Social Accounting Matrices

A Basis for Planning

edited by
Graham Pyatt
Jeffery I. Round

A World Bank Symposium

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Preface

The conference in Cambridge, England, that was the origin of papers in this volume has been described as a meeting of a subculture. This character was recognized before the event and little occurred to alter the perspective. Many, but not all, of the participants were well known to at least some of the others, so there is a particular debt to those who were unfamiliar with the fraternity that otherwise defined the group. We would here like to make special mention of C. P. Ezeife, who throughout the proceedings contributed much to the focus of discussion and always stood firmly for a measured practicality at points where one individual or another was bent on pursuing some esoteric irrelevance. Both the spirit and content of his participation were greatly appreciated.

The full list of conference participants follows this preface. Unfortunately, some others who we hoped could attend were unable to do so. This was a pity, not least because social accounting as practiced by many of the present authors had been developing rapidly during the 1970s, and it was thought to be time that their ideas and achievements were exposed to a wider and experienced audience. This is one reason the World Bank External Research Program was prepared to finance the conference and is also a reason for publishing this volume based on the proceedings. What started as a small and speculative exercise in Iran has now developed a life of its own. At the same time, we are conscious of legitimate complaints over lack of documentation on what social accounting matrices (SAMs) are, what they can do, and how one (or preferably a team) sets about their construction.

The conference and this volume are one response. We hope the papers will not encourage a stultifying conformity in future efforts, since the challenge of defining one's own SAM framework, in order to capture the main macroeconomic and planning issues to be faced in a particular country, is perhaps one reason SAMs have attracted so many enterprising and creative spirits.

Of course, SAMs have roots, and Sir Richard Stone traces these to eighteenth-century France and Quesnay's Tableau Economique. Others at the conference would be largely content to go back only as far as Stone's personal contributions to national accounting. There are important contributions by others, especially in the interwar years, which should be acknowledged. But Stone is the great architect of SAMs, not only as national accounting frameworks but also in relation to macroeconomic planning models. Our individual personal and intellectual debts to him have been yet further increased by his lively and authoritative contributions to the conference and this volume.

A further debt is to Benjamin B. King, who has helped at various stages from inception of the proposal to hold a conference through to completion of the editorial tasks. As one of the few nonmembers of the SAM subculture at the conference, he has been willing to write an introductory chapter from the outsider's point of view under the daunting title, "What Is a SAM?" His willingness to do so has considerably eased our task as editors.

Anne McKenna organized the Cambridge conference and the production of this volume through its early drafts. Beyond these essential contributions, her advice often extended into more subjective areas. Nancy Ribeiro also helped in many ways to administer the volume through the latter stages. We are greatly indebted to them both. Our sincere thanks also go to Cathy Bau, who painstakingly undertook some of the editing work, and to Ann Van Aken and Ann Robeson, who assisted in the production of the final text.

We would like to thank the conference participants and regret that it is not possible to include all their papers in this volume. To many we also owe a debt of friendship forged in particular research studies that could not have been achieved without the bond of a shared enthusiasm. We hope that these friends gain some satisfaction from seeing the sum total of past efforts—to the extent that this volume is able to capture it. One friend in particular, Harry Fell, merits special mention. We hope he will accept the dedication of this volume to his example.

Finally, we must thank the editors of the Review of Income and Wealth, the Economic Journal, and the Pakistan Development Review for permission to reproduce previously published material in chapters 2, 9, and 11, and disclaim any responsibility of the institutions to which we and other authors of papers in this volume are affiliated for the views expressed.

Graham Pyatt
Jeffery I. Round

Participants

The affiliations shown are those at the time of the conference, April 16–21, 1978.

Terence Barker, University of Cambridge
Clive Bell, The World Bank, Washington, D.C.
Alan Brown, University of Oxford
Ross Bull, Institute of Social Studies, The Hague
Colin Dunn, Coopers and Lybrand Limited, U.K.
C. P. Ezeife, Central Planning Office, Nigeria
Harry Fell, retired from the Overseas Development Ministry, U.K.
K. Gnasegarah, Department of Statistics, Malaysia
Colin Greenfield, Overseas Development Ministry, U.K.
Carol Hayden, University of Warwick
Benjamin B. King, The World Bank, Washington, D.C.
Robert Lindley, University of Warwick
Frank Lysy, The Johns Hopkins University
S. Narapalasingam, Ministry of Finance and Planning, Sri Lanka
Graham Pyatt, The World Bank, Washington, D.C.
Gerry Rodgers, International Labour Office, Geneva
Alan R. Roe, University of Warwick
Jeffery I. Round, University of Warwick
Sir Richard and Lady Stone, University of Cambridge
Erik Thorbecke, Cornell University
Michael Ward, Institute of Development Studies, University of Sussex
Stanley Webster, Coopers and Lybrand Limited, U.K.
Donald Wilkes, Coopers and Lybrand Limited, U.K.

Introduction

The data base for macroeconomic policy and planning is hardly a fashionable topic among economists. The subject has received relatively little attention since the publication of The Social Framework (Hicks, 1942), and subsequent efforts from the same era to establish concepts and standards for national income accounting. Such accounts provide the information needed for macroeconomic analysis, especially the short-term analysis of demand management, and for the longer-term, post-Keynesian, dynamics of the Harrod-Domar model and the two-gap model of Chenery and Strout (Chenery and Strout, 1966). To go further calls for a richer source of information, and the main extension has been in interindustry economics, with particular emphasis on the Leontief input-output model. This has led to much sophistication in the construction of models, as illustrated by the many applications of activity analysis to development planning, by Tinbergen's semi-input-output analysis (Tinbergen, 1966), and by the extensive application of the Balassa-Corden formalizations of effective protection (Balassa and associates, 1971, and Corden, 1966). Beyond these are many more extensive models of growth and development in particular economies, of which the Stone and Brown Cambridge growth model is a primary example (Cambridge University, Department of Applied Economics, 1962–74 and 1975–). In all cases, the starting point is a view of the economy that sees aggregate production broken down into component activities. These activities are interdependent, since each requires inputs of raw materials which have to be purchased from some other activity. They also require imports to the extent that necessary raw materials are not available domestically. Since the rest of the world is typically an alternative source of supply for many of the goods that the domestic economy is capable of producing, the domestic activities are also in competition with imports. It follows that domestic production structures and patterns of trade are intimately connected. Detailed accounting of these connections can enrich analysis of aggregate demand effects on output levels and the balance of payments. Research in recent years has led to some considerable progress in our understanding of these matters. At the same time, the results have been unsatisfactory in an important respect. Development is about raising the living standards of people. Accordingly, the framework for data and models must recognize the central importance of people, not commodities, if it is to serve best the interests of policy design.

Development economists have always recognized that their main concern is the improvement of living standards. It has not always been recognized, however, that this objective might call for the adoption of policies which differ from those that would maximize the rate of output growth. Today, while most would agree that output growth is a necessary condition for sustained improvement in living standards, it is also generally recognized that economic policy must simultaneously concern the distribution of benefits arising from growth, to the point where faster growth overall might be sacrificed for the sake of faster growth in the living standards of particular groups, especially poverty groups. This perception of economic development provides an underlying philosophy for many of the papers in this volume. Ultimately it calls for developments in the theory of economic and social change which would embrace both the traditional concerns of growth economics and the agenda of issues that follows from a focus on income distribution, employment, and poverty alleviation. How this might best be done remains a priority for research. Meanwhile, pragmatists may be more concerned with the facts of the matter and will want to know how living standards for different groups actually change in the

process of economic development, even though some of the reasons for change are as yet unresolved. Indeed, such an approach can be seen as a useful first step toward an understanding of those reasons.

The social accounting approach illustrated in the volume records particular attempts at meeting this practical need within the limitations of (a) currently available statistics, and (b) current perceptions as to the best way of assembling them. Beyond this, a number of the papers discuss uses of data once they have been arranged in a social accounting format. These uses inevitably involve an imposition of behavioral and technical assumptions on the data themselves. To that extent such applications of the data cannot proceed without theory. But the concern here is not with the theory itself. Rather it is to show how the data base provided by a social accounting matrix (SAM) can be taken as a statement of initial conditions in an economy and how theoretical analysis can proceed from this starting point. Not least, the approach serves to emphasize the fact that the distribution of employment opportunities and living standards in a society is inextricably interwoven with the structure of production and the distribution of resources.

The eleven papers in this volume have been grouped into three sets. The first four papers, which compose part I of the volume, illustrate the methodology of social accounting as a discipline within economic statistics. Part II then records some country experience in the construction and use of social accounts and is followed, in part III, by a final set of four papers illustrating the step from data systems to models in a SAM context.

THE METHODOLOGY OF SOCIAL ACCOUNTING

The first of the four papers in part I, by Benjamin B. King, addresses the question "What is a SAM?" without assuming anything more of the reader than a rudimentary knowledge of national income accounting and a willingness to entertain the psychological novelty of having such accounts presented in an unusual format. Starting with a very simple formulation, he presents, step by step, many of the technical complexities that feature more prominently in subsequent contributions. This, then, is an introduction to the subject.

The next paper, by ourselves, was written some time before the conference, although it featured in the discussion. The paper is included here because it contains relevant background concerning not only the nature and importance of SAMs, but also the early evolution of their practical application in addressing development problems, beginning with a SAM for Iran (in 1970), and subsequent studies of Sri Lanka (also in 1970) and Swaziland (in 1971–72). The paper readily admits to the process of learning by doing, which was involved in these successive studies, and it begins by setting out the reasons for embarking on them. Prominent among these reasons is a concern to answer the question "Who gets what, and how much, as a result of the economic process of income generation?" This question is set in the context of conventional national income accounts and input-output analysis, with data displayed in the single entry matrix format, which is essential to a SAM and distinguishes it from the more traditional form of double entry bookkeeping. The innovation is to obtain a disaggregation of the household sector within this format so that income distribution is captured as differences between the incomes of various socioeconomic groups, in much the same way that the structure of production can be captured by disaggregation of productive activity into output levels for each of a number of different industries. This paper also includes discussion of some technical problems that arise in attempting to construct a social accounting matrix when both the production sector and the household sector are disaggregated. In the production and household sectors, some disaggregations are much more difficult to achieve than others. But it is also the case that some disaggregations are much more interesting than others. Accordingly, the paper ends with comment

on appropriate criteria for disaggregation in a context of equal concern for "who gets what?" and "what and how much of it is being produced and consumed?"

The studies of Iran, Sri Lanka, and Swaziland had the limited ambition of disaggregating the current account for households simultaneously with production. The next obvious step is to disaggregate capital accounts and hence to integrate balance sheets and flow of funds with data on the flows within the real economy. Alternative ways of disaggregating capital accounts are discussed in the third chapter on SAM methodology, by Alan Roe. His contribution draws on specific experience in Botswana to illustrate both conceptual and empirical issues that can arise, depending on the format adopted. Roe then discusses current analytic uses of such flow-of-funds data in planning and in macromonetary models. This discussion accordingly illustrates the links between data systems and models. And insofar as Roe's argument leads him to conclude that the current generation of planning models fails to capture some of the crucial monetary issues of development, he is led automatically to a discussion of the data that are needed on flow of funds, that is, to the classification that would be required to capture the essential role of the financial sector in stimulating savings and allocating their use. Roe argues that market segmentation should be the basis of classifications in the financial accounts. His paper therefore serves to push forward an area for SAM development which is in its early stages, yet seems to depend on considerations that are comparable to those that have arisen earlier in analysis of the real economy.

Flow-of-funds accounts are of considerable interest in their own right. To have a set of such accounts fully integrated with the real flows captured in previous SAMs adds to their value by forging the link between the real and monetary aspects of the economy. But it may be worth stressing that there is some virtue in obtaining a SAM without flow of funds as a first step; to then make the extra effort not only facilitates the flow-of-funds compilation, but also potentially improves the data on the real economy, not least insofar as they refer to savings.

To set this point in perspective it is worthwhile to consider the basic steps by which national accounts and SAMs are compiled. For national accounts, the best procedure is to work with a balance equation for demand and supply of each commodity. Total supplies comprise imports plus domestic production. Total demand is final demand—exports, investment, and domestic consumption—plus intermediate demand or raw material requirements. The latter can be reconciled with domestic production by using input-output computations. Hence, if the supply side details are known, consistent figures for the demand side can be obtained by treating some component of demand (such as the stock change component of investment) as a residual balancing item or, more generally, by adjusting the data for each commodity so that a balance is struck between demand and supply. That balance should be consistent, to the extent possible, with available data sources and commonsense relationships such as the input-output formulation of raw material requirements.

This approach is as much as is usually attempted to secure consistency. It produces the major aggregates needed for national accounting purposes, and these aggregates will satisfy the obvious accounting constraints, notably that total value added for all activities (defined as gross outputs minus intermediate demands) will be equal to aggregate final demand. Moreover, the approach implies a particular value added figure for each activity and a particular final demand figure for the goods that each activity produces. These details are consistent in aggregate, and in principle they are consistent for each activity. But are they?

By disaggregating the accounts for factors and institutions the SAM approach embodies a further check. In the Sri Lanka study, for example, the factor disaggregation requires that the value added figures from national accounts must be broken down into payments to different types of labor, capital, and, in principle, natural resources. Adding up these details across activities produces a breakdown of total value added into its factoral distribution.

Next, the SAM approach requires that the factor incomes be paid out to institutions according to the factor services they supply: the wages of particular types of labor go to the households

which supply the corresponding labor services; corporate profits go to the private corporate sector or to government if the enterprise is state owned. In this way total value added maps into the disposable income of each institution—that is, each type of household, company, and branch of government—before transfers. Current transfers between these institutions must then be estimated, thus leading to the distribution across various institutions of actual disposable income.

To carry out these calculations requires data on incomes by source for various institutions. The main requirement is for household survey information on the relevant flows. Often this information is judged unreliable, so that the household data are adjusted to be consistent, for example, with national accounts data on the wage component of value added in each sector. This adjustment may be appropriate, although the evidence is growing that household survey data on income by source, and national accounts data on value added payments by activity, are seemingly unrelated in many, if not most, cases. In taking the national accounts figures as the firmer estimates, the authors of SAM studies may well have misplaced their trust, and data on the incomes of different institutions may have been adjusted too severely so as to permit the control totals provided by the national accounts to be retained.

Be this as it may, the national accounts figures are directly challenged at the next step in SAM compilation. Having arrived at disposable income for each institution, the next step is to allocate these incomes (net of the current transfers already determined) either to current expenditures or to savings. But the current expenditure element of this process has already been determined to the extent that national income estimation has already required an estimation of consumption by commodity groups. This has to be reconciled, one way or another, with the consumption expenditures of government and the various household types whose disposable income was previously estimated. Household surveys provide a real check here to the extent that their consumption figures are generally thought to be more reliable.

Suppose that the national accounts survive this check, that is, that observed discrepancies can be removed by adjustments elsewhere in the matrix which seem sensible and, at the same time, allow the national income figures to be retained at their original value. Then much of the weight of adjustment falls inevitably on the remaining elements of disposable income, namely, savings. In aggregate savings must be equal to investment. But in detail there is no control up to this point of the distribution of savings across institutions.

Foreign savings, government savings, and corporate savings may all be known to some extent. If so, the burden of adjustment falls on household savings. The typical experience is that the figures initially obtained are so obviously worthless that there has to be some backtracking over the sequence of calculations which lead to this point so as to provide a reasonably sensible set of savings estimates for different types of households. Of course, what is reasonable and sensible is a subjective matter, and SAM studies have shown much courage and some ingenuity in coming up with answers. They have also typically left an uncomfortable feeling that, at some point, the principle of maintaining previously computed national income estimates should have been abandoned.

Forging ahead into the flow of funds imposes yet a further round of consistency checks and a potentially firm basis for evaluating SAM estimates of savings by each institution. Depending on the quality of financial data, this check would be most valuable if there were some reasonably rigid structure to the flow of funds, comparable to that for input-output analysis. But in fact many financial flows are highly volatile, so that data problems, derived from the timing of payments and discordance of the financial year between institutions, weaken the feedback that the financial data could have in pointing up inconsistencies in previous estimates for the real economy. While these data problems are a pity, they should not detract from the value of the data in their own right, nor from the fact that there is some feedback. Just how much depends partly on the classifications adopted, and it is interesting to note in this context that an extremely rigid structure to the flow of funds may be justified, as in the formulation of Ahluwalia and

Chenery (1974), if the classification of institutions within the capital accounts can match that which is adopted for the current accounts also.

In his foreword to Pyatt, Roe, and associates (1977) Stone pointed to the ultimately subjective nature of the numerous adjustments which have to be made to different data sets in developing a SAM or, for that matter, the national accounts. He refers to a much earlier paper by Stone, Champernowne, and Meade (1942), which proposed the application to social accounting of the well-known technique for the adjustment of conditional observations by the method of least squares based on a subjectively estimated covariance matrix of the errors. A little later a general formal statement of the problem was provided by Durbin but never published. At that time the state of the art of numerical analysis, together with the capacity limitations of computers, precluded the practical application of formal methods, but the subject was kept alive by Stone, who included a series of small constructed examples in a number of his papers. But times have changed, and more recently Byron (1978) has reformulated the problem in terms of a quadratic loss function and shown that, by using the conjugate gradient algorithm, even very large SAMs can be adjusted without great difficulty.

The Byron method has in fact been applied in one of the studies reported in this volume (see chapter 11), although generally the authors have favored what have come to be known as RAS (or biproportional matrix transformation) procedures applied either to sub-blocks of the SAM or to the matrix as a whole, as in the Botswana case. The choice involves various issues which lie outside the scope of this volume. Although these issues are mainly technical, they also include the desire, especially among model builders, to obtain a data set that is purged of the "residual error" categories which some national income statisticians regard as the hallmark of their integrity. The choice of methods is also expanding, and a linear programming approach has much in its favor over constrained least squares, not least with regard to the greater control over results and the "zeroing-in" on a final solution which it facilitates. This approach is strengthened by the work of von Saleski (1977), who shows that the network specialization of linear programming allows much of its flexibility to be retained, yet with considerable savings in computational costs.

The development of formal techniques for data reconciliation is clearly a subject for the future.[1] At present we have little experience in producing the national accounts from scratch as part of a more general SAM estimation. However, there are other areas in which progress has been made, and the final paper in this section addresses the conceptual problems that arise in constructing a multiregional SAM (in this case two regions) so as to capture the various flows that take place interregionally. The paper, by ourselves, is drawn from a more extensive study of Malaysia which is reported elsewhere (see Chander and others, 1980).

COUNTRY STUDIES

For developing countries, perhaps the first studies to have been undertaken with a simultaneous focus on income distribution and production structure were those for Iran and Sri Lanka, which have been referred to previously. Both arose from the activities of the World Employment Programme, sponsored by the International Labour Office (ILO). The third study, which dealt with Swaziland, was sponsored by the Overseas Development Ministry, London, which subsequently launched a program of work in collaboration with Warwick University. This program has involved a series of exercises in Botswana and work in both Kenya and Fiji.

1. Van der Ploeg (1982) and others are developing more efficient computational procedures for tackling essentially the same class of adjustment problems.

Increasingly, other countries have undertaken SAM investigations, so that by 1984 there were SAMs for Cyprus, the Arab Republic of Egypt, Indonesia, Malaysia, the Philippines, Saudi Arabia, the Republic of Korea, Thailand, and Turkey. This list notably excludes any Latin American countries, but studies are now under way in Brazil and Mexico.

To illustrate all this activity, and because of their pioneering nature, the three country studies which are discussed in this volume are those for Sri Lanka, Swaziland, and Botswana. Together they provide the primary materials for much of the discussion in part I of this volume and, together with the Iran study, may be regarded as the basis for work subsequent to the foundations laid by Stone and his associates on the Cambridge Growth Project.

The Sri Lanka study has been fully documented in book form (Pyatt, Roe, and associates, 1977). Given this documentation and the material drawn from it in part I of this volume, the discussion of Sri Lanka in part II is a retrospective view by S. Narapalasingam, who was a member of the original study team. As a former deputy secretary, Ministry of Finance and Planning, in Sri Lanka, Narapalasingam reflects on the usefulness of the study for policy issues and ways in which the data base provided by the SAM could be improved from this perspective. He therefore builds on the essential notion that the purpose of social accounting is to inform current policy debates and that the construction of a SAM is not a once-and-for-all effort. Rather, it requires continuous updating to reflect changes in both economic structure and its environment, and because of shifts in policy emphasis. In Sri Lanka the SAM for 1970 has not been maintained, while the focus of policy has shifted somewhat as the development problems of that country have hardened. The initial effort has contributed little that is now useful, beyond the demonstration of what could be done.[2] The theme of Narapalasingam's paper is therefore one of regret that previous capital has been allowed to depreciate. At the same time, he points to a number of respects in which a new effort could represent an improvement for policy purposes. He also suggests a number of organizational and administrative changes with respect to primary data requirements that would be necessary to set up and maintain a data base for planning, which could also serve the needs of policy.

In chapter 6, S. J. Webster presents a brief but comprehensive view of the Swaziland SAM, in terms of actual achievements and the motivations behind this particular study. He begins with a sketch of the country, and accordingly invites the reader to go through the subsequent discussion of compilations and data problems keeping one eye on the issues and perspectives that the statistical exercise was to capture. Next, a definition of classifications—for households, factors, and production activities—allows the salient features of Swaziland to be manifest. Some novelty is involved here, reflecting the particular socioeconomic structure of the country. It is to be noted that this study, in particular, expresses the view that in systems of classification and other respects social accounting should reflect the circumstances of the country it is designed to serve and not adhere to extraneous norms for the sake of an ultimately illusive comparability.

Inevitably, desirable classifications have to be compromised by the limitations of available data. Webster discusses data limitations both from this perspective and with regard to timeliness. He argues, on the basis of Swaziland experience in particular, that much can be done in a small country even with relatively limited resources. The proof he offers is mainly in terms of the SAM actually implemented, some work on its updating, and the consequent perspective on development issues and strategies that emerged from the study.

Finally, as Narapalasingam has done, Webster addresses some administrative and organizational questions. The Swaziland SAM, like the Sri Lanka SAM, has been allowed for the most part to lie dormant over subsequent years. Webster expresses concern over this and rehearses

2. We understand that moves are under way to resurrect the earlier work.

some of the possible causes. He makes explicitly a point that is implicit in much of what Narapalasingam has written, to the effect that a SAM approach to macroeconomic data is potentially a lively and constructive link between statisticians and economic planners. The SAM approach therefore offers relevance and dialogue to a relationship between two professional groups which is all too often observed to be muted.

The next country study is of Botswana and was undertaken in 1977 by a team under the leadership of Colin Greenfield. His paper, chapter 7, covers a number of the topics previously discussed by Narapalasingam and Webster but adds new dimensions, which derive partly from the accumulating experience on which the Botswana study was able to draw and partly from the fresh perspective introduced by Greenfield himself and others for whom the Botswana SAM represented an initial involvement in the SAM approach.

Beyond these fresh perspectives on issues of classification and data problems, Greenfield introduces three new elements of considerable interest. One of these is a highly technical matter, concerning the choice of price systems for recording commodity flows in a SAM. The discussion of this is largely contained in the second appendix of his paper, but it is in fact quite central. Secondly, Greenfield organizes much of his early discussion of the Botswana SAM around a comparison of how it differs as a conceptual framework from that recommended in the United Nations System of National Accounts (known as the UN SNA). Hence, the question is directly posed as to how the SAM approach illustrated by the studies of Sri Lanka, Swaziland, and especially Botswana differs from the framework currently recommended to developing countries by the United Nations Statistical Commission (United Nations Statistical Office, 1968). Stripped of qualifications, Greenfield's answer is that SAMs are simpler, and hence have a better chance of being "generally understood by economists and others concerned with planning the economy." He goes on to express a sentiment that most who attended the Cambridge conference would also want to emphasize: "It would be wrong, however, to conclude with an impression that one has nothing but criticism for the SNA format. Quite the reverse—one has nothing but admiration for the pioneering and meticulous work recorded in the SNA which provided an invaluable guide and source of reference in preparing the Botswana SAM." The conflict, if there is one, can be traced back to the common root previously identified, namely, the Cambridge Growth Project. The UN SNA has emerged from this project through the social accounting matrix developed in Cambridge as the counterpart of a growth model for the United Kingdom. Data systems and models are inseparable, and the SAM studies recorded here simply reflect a different, albeit implicit, model of what the issues are in a developing country, while retaining the same essential principles of macroeconomic accounting. The differences, of both issues and practicalities, argue for a simpler framework and for some greater attention to classifications within the framework. A single household sector will not do if we are concerned about who benefits from development; thus the Botswana SAM follows the priorities of policy in having nine different types of household, with the differences corresponding to real socioeconomic distinctions: periurban households; urban households (split by density of housing area and with residents of servants' quarters as a separate category); three types of rural households (defined with respect to their ownership of cattle); and finally, migrant workers abroad. The same spirit is reflected in the disaggregations chosen for the corporate sector and production activities. But the SNA principles and, not least, the matrix approach are rigorously adhered to throughout the Botswana SAM. Ultimately there is no conflict. The issues essentially concern only the route to be followed from the existing data base toward improved macroeconomic accounts.

While previous SAMs had all attempted some disaggregation of the current account for institutions, that is, for households, companies, and government, they had made little or no effort to disaggregate the corresponding capital accounts and thereby capture details of the flow of funds. The third striking feature of the Botswana SAM, directly prompted by the priorities of the decisionmaking process, was to include no less than seven separate capital accounts for

institutions, together with thirteen accounts for financial claims. Greenfield discusses this aspect of the Botswana SAM in some detail, which is justified by its importance. Inevitably, the innovation led the team into a new set of issues of classification and data reconciliation. Perhaps the main points to emphasize here are that many of the problems were overcome and that the value of the SAM to policymakers in Botswana was considerably enhanced as a result.[3] This is not surprising, given the well-recognized need for such a development, which was expressed by Narapalasingam in his comments on the limitations of the Sri Lanka study.

At various points during discussion at the Cambridge conference, questions were raised and opinions expressed about the merits and limitations of the SAM approach to national economic statistics, not just as a research or planning exercise, but as a thematic, organizing framework that governments might choose to establish on a permanent basis. Harry Fell and Colin Greenfield, in particular, made some interesting points in this context, drawing on their specific experience with SAMs in Swaziland, Botswana, and Saudi Arabia and their many years of experience as practicing statisticians in numerous countries. It was instructive, therefore, to hear their views on the SAM approach as a highly effective method of making the best use of "dirty" and "gappy" data. Too bad that the data are not perfect; they never will be, and the only answer is to learn to live with this fact while always pressing for better primary sources. They also point to the various levels of sophistication of a SAM, each appropriate to its purpose, and come close to expressing the view of Pyatt and Thorbecke (1976) that the SAM approach is ultimately based on a philosophy of quantitative analysis that is open and honest in trying to establish the facts and then cautious in moving toward analysis and projections from this basis. More than anything else, a SAM is a generator of agenda for decisions: about what the facts are, about the priorities for improved information, and about the repercussions that a particular course of action might have. In this sense an underlying dynamic for change emerges from the static matrix of numbers. This, in itself, is a reason for not worrying too much about how bad the basic data are since, as Fell and Greenfield point out, either the SAM will not be used or the process of using it will create the forces for improvement.

Experience also shows that whether a SAM is used depends in part on whether a country can move beyond an initial effort for some base date to the creation of a continuing capability to generate and maintain future SAMs, so that up-to-date information is available. Equally, however, such a development is unlikely unless the SAM is used. Thus data and analysis are mutually dependent. It is therefore encouraging to learn of instances in which SAMs are proving to be practical aids to policy formulation. Such instances seem more likely to occur when SAMs have been perceived at an early stage as a meeting ground for statisticians and planners to their mutual advantage.

MULTIPLIERS AND SAM-BASED MODELS

The relationship between SAMs and models is twofold. On the one hand, modeling is a major area of application of SAMs, and the four papers in part III of this volume illustrate the point. On the other hand, models are important as a formalization of particular conceptual frameworks. Without such frameworks, data gathering is largely an empty exercise. The early work on SAMs in the Cambridge Growth Project was guided by the needs of a particular planning model, and later developments in the form of the UN SNA were similarly conditioned by a somewhat less complete framework of analysis, namely, input-output. In the same spirit, the

3. A brief discussion of various uses to which the SAM has been put in analyzing some policy issues in Botswana can be found in Hayden and Round (1982).

1972 SAM for Iran was conceived as the data base for a planning model that solved simultaneously for incomes and production levels. Subsequent SAM work has been directed essentially to the task of facilitating more sophisticated modeling treatment of this and other issues. Analysis, if not formal modeling, is therefore the ultimate driving force.

This general position on the relationship between SAMs and modeling underlies the four papers presented here. The first of these, by Sir Richard Stone, provides a ready link from the country studies in part II to the subsequent contributions in part III.

Stone is the primary architect not only of the UN SNA but also of the System of Social and Demographic Statistics (SSDS). The treatment of income distribution questions in the latter is conceptually consistent with the treatment of the household sector in the former. The SAMs discussed in this volume can be seen as an extension of the SNA by disaggregation of the household sector, and it is this perspective that Stone has adopted. The first part of his paper carefully enumerates the conceptual differences between the SNA definition of households and the narrower, everyday use of the term. (The former includes nonprofit institutions, foreign visitors, and certain aspect of life insurance, or mutual benefit, societies.) He then illustrates how disaggregated accounts for households proper—he uses seven groupings according to income levels—can be integrated into a SAM for the United Kingdom for 1968 which otherwise stays close to the established SNA format.

Next Stone asks, "What became of the multiplier?" He proceeds, after a short history of the concept, to apply and extend a set of computations which we ourselves initiated in chapter 4 of Pyatt, Roe, and associates (1977) and applied to the Sri Lanka SAM. Stone's application is to the U. K. SAM previously derived, and the extension is to provide an additive version of a previously multiplicative decomposition of $(I - A)^{-1}$. But here $(I - A)^{-1}$ does not refer to the familiar Leontief inverse: that is only a part of it. Rather $(I - A)^{-1}$ in the present context is a multiplier matrix which links all endogenous income levels in a SAM to exogenous injections. Hence, if the endogenous incomes include those of factors, institutions, and activities, then $(I - A)^{-1}$ embraces not only what happens within these broad groups of accounts (for example, the interindustry transactions among production activities), but also what goes on between them, not least the full circular flow of income around the familiar macroeconomic loop of demands on activities, leading to demands for factors, hence to the incomes of institutions, and from there back to demands on activities. Stone provides an extensive set of tables for his illustration which, together with the textual commentary, provide a full exposition of a method for manipulating the data in a SAM so as to make explicit many of the structural characteristics that might otherwise be missed.

Finally Stone asks, "Where do we go from here?" and points to the obvious step of more sophisticated modeling of economic structure. Beyond such a step, he focuses on various aspects of the household sector which ultimately require further elucidation: the dynamics of household formation and demise; the role that households play as producing units, especially in developing countries, and the imputation of incomes from asset ownership; and, finally, the need for further research on household consumption behavior and the integration of household balance sheets into the SAM framework. This ambitious list is additional evidence of the tendency for each stage of SAM development to suggest an agenda for further progress.

"It seems to me that of all the interesting and useful things that could be done to improve the national accounts, the one most worthy of consideration is the disaggregation of the household sector." This is Stone's main conclusion and, in large measure, it is what the Cambridge conference was all about.

In a short appendix to his paper, Stone demonstrates that Quesnay's Tableau Economique belongs to the class of SAMs that focus on links between the structure of production and the distribution of income. He applies multiplier decomposition analysis to the Tableau, providing a set of calculations which incidentally were made the weekend before the conference in prep-

aration for it. The final sentence of this appendix is worth noting: "Short of providing an initial stimulus to artisans, the next best method of helping them is to stimulate (nonagricultural) activities. This will do less for landlords, farmers, the state, and the church than a stimulus of the same size applied to any of the other accounts." So much for the economic structure of France in the 1750s. One is reminded by this of some conclusions, similarly based on a simple SAM and multiplier analysis, which emerged from the Iran study referred to in chapter 2: "Undoubtedly our most important conclusion regarding economic policy in Iran relates to the performance of the livestock and agricultural sectors . . . the potential contribution of agriculture to the general development of the economy is very great . . . for Iran to ignore these sectors could be disastrous" (Pyatt and others, 1972). It would seem, then, that SAMs and their associated multipliers have relevance to political economy in recent times as they did in the eighteenth century.

Chapter 9, again by ourselves, takes our earlier work on multipliers a stage further and adopts Stone's additive version of multiplier decomposition. The data used refer to Sri Lanka. The extension here is to contrast the accounting multipliers that can be obtained directly from a SAM with the incremental multipliers that can be obtained from a fixed price model. The link is thus made from accounting structures to simple models, and the different results in the two cases are shown to depend on income effects in those instances where income or expenditure elasticities differ from unity. Because the SAM recognizes separate accounts for urban, rural, and estate households, the multiplier analysis serves to point up the extent to which the estate sector in Sri Lanka is isolated from the rest of the economy. More generally, the multiplier decomposition confirms an observation made by Stone, yet in an obviously different economic environment. The decomposition of multiplier effects distinguishes the first- and second-round implications of an injection from the third- and higher-order effects which depend on the complete cycle of circular income flows. The observation is that the distribution of these higher-order effects across households of different types is essentially independent of where in the economy the initial injection takes place. It follows that a changed pattern of injections will change income distribution to the extent that different groups are the immediate beneficiaries. But to the extent that there is a multiplier effect, so that income increases exceed the size of initial injections, the distribution of benefits is rather rigidly determined. In other words, the distribution of income is insensitive to a degree with respect to the pattern of injections: what matters ultimately is the pattern of skill endowments across household types, the role of government, and the distribution of wealth.

The threshold from accounting to simple models having been crossed, chapter 10, by Erik Thorbecke, takes us deeply into macromodel applications. His long and valuable paper is presented in four sections. The first gives a general exposition of the relationship between SAMs and macromodels. At one level, a SAM is a static picture of numerical structure at some base date. It provides the initial facts, and hence much of the information that a model must be calibrated to reproduce if it is to replicate the base period accurately. In addition, the SAM can be seen as a modular conceptual framework, with different blocks of the SAM representing the different modular components which, together, can describe how the economy will move in response to exogenous change or as otherwise dictated by its own internal dynamic. It is this second aspect to which Thorbecke particularly applies his pedagogic skills, and it sets the scene for the two sections which follow.

The next sections describe six macroeconomic models, each set in a SAM framework, and each therefore an illustration of the dictum that every economic model has an accounting framework. Thorbecke splits the six models into two groups of three and refers to them as first- and second-generation models. The distinction is that for the first-generation models, the SAM as a data framework can equally be interpreted as the reduced form relationships of the model structure: the behavioral relationships have an essentially linear relationship to the accounting

structure. This is not so for second-generation models, which are nonlinearly related to the corresponding SAMs.

The three first-generation models are (a) the Iran model by Pyatt, in association with Bharier, Lindley, Mabro, and Sabalo; (b) Thorbecke's joint work with Sengupta on a model for Colombia; and (c) a model by Ng for the Philippines. Since Ng was a student of Thorbecke's, and since the Pyatt-Thorbecke collaboration over several years is well known, the selection of material may, perhaps, be questioned. It might be useful therefore to record that the first two papers have a common root in the ILO World Employment Programme, and that it was an awareness of each other's individual and independent responses to the issues for macroeconomic planning, which this program raised, that fostered the Pyatt-Thorbecke collaborative relationship. Beyond that, we are not aware of any earlier work that has attempted a simultaneous determination of income distribution, production structure, and economic development in quite the same way.[4]

Both these first two models assume fixed prices, while prices are endogenous in the Ng model. By assuming that technology can be adequately explained in terms of generalized Cobb-Douglas models, Ng's model has much in common with the pioneering contribution to development planning of Johansen (1960). In contrast, the second-generation models are known in the jargon as CES-CGE models: CES indicating that constant elasticities of substitution (not necessarily equal to unity) are assumed to characterize production relations; and CGE because these are computable general equilibrium models in which prices adjust so that markets are cleared, essentially according to Walras' law. The three second-generation models are (a) Adelman and Robinson's model of the Republic of Korea; (b) the Lysy and Taylor model of Brazil; and (c) the Ahluwalia-Lysy model of Malaysia. All three models have been developed as part of the World Bank's research program, which also sponsored the Cambridge conference as previously noted.

Thorbecke's discussion of these six models will probably be found invaluable by those who wish to absorb trends in macromodeling for development planning and to form a perspective on the state of the art. His synthesis is admirable from this perspective, and his final summing up is an equally admirable, low-key commentary on some of the misgivings that others have expressed less temperately on the usefulness of the second-generation developments. One perspective is this: the first-generation models make no claim to ultimate realism. They can be based explicitly on a SAM, which is openly available for comment and improvement. They then perform some sensible calculations in the spirit that the assumptions made are strong simplifications. Hence they arrive at suggestive conclusions which are a starting point for policy debate. The second-generation models, in contrast, are way down the spectrum toward the black-box end. If one is really concerned about living standards and development, the art of macromodeling has some way to go before it can be trusted on these issues. For the present, the simpler approaches may be the best, and inspired research is urgently needed.

More recent developments in the modeling arena tend to confirm the views and perspectives expressed in Thorbecke's paper. The literature on CGE models has become extensive, although much of it has now been consolidated in the book by Dervis, de Melo, and Robinson (1982). Nevertheless, such models remain black boxes to many potential users and, moreover, can be costly to develop within developing countries. As a result, current research is being directed toward alleviating these problems. For instance, the transactions values, or TV, approach can easily accommodate a range of behavioral relationships between economic agents selected by the user (see Drud, Grais, and Pyatt, 1983, and Grais, 1982). But because it is explicitly a SAM-based system, it has the virtue that it is highly "user-friendly."

Finally, a paper by Clive Bell and Shantayanan Devarajan reflects work subsequent to the Cambridge conference at which Bell presented earlier results that he and associates have obtained in tracking the early SAM macroeconomic studies in an extensive study of a large irrigation

4. The nearest precedent we have been able to identify is Desai (1961).

Table I.1. King's "Scheme of the Income and Expense of the Several Families of England Calculated for the Year 1688"
(in pounds sterling)

Number of families	Ranks, degrees, titles and qualifications	Heads per family	Number of persons	Yearly Income per family	Total of the estates or income	Yearly income per head	Expense per head	Increase per head	Total increase per annum
160	Temporal lords	40	6,400	2,800	448,00	70	60	10	64,000
26	Spiritual lords	20	520	1,300	33,800	65	55	10	5,200
800	Baronets	16	12,800	880	704,000	55	51	4	51,200
600	Knights	13	7,800	650	390,000	50	46	4	31,200
3,000	Esquires	10	30,000	450	1,200,000	45	42	3	90,000
12,000	Gentlemen	8	96,000	280	2,880,000	35	32 10	2 10 ..	240,000
5,000	Persons in offices	8	40,000	240	1,200,000	30	27	3	120,000
5,000	Persons in offices	6	30,000	120	600,000	20	18	2	60,000
2,000	Merchants and traders by sea	8	16,000	400	800,000	50	40	10	160,000
8,000	Merchants and traders by sea	6	48,000	200	1,600,000	33	28	5	240,000
10,000	Persons in the law	7	70,000	140	1,400,000	20	17	3	210,000
2,000	Clergymen	6	12,000	60	120,000	10	9	1	12,000
8,000	Clergymen	5	40,000	45	360,000	9	8	1	40,000
40,000	Freeholders	7	280,000	84	3,3650,000	12	11	1	280,000
140,000	Freeholders	5	700,000	50	7,000,00	10	9 10	.. 10 ..	350,000
150,000	Farmers	5	750,000	44	6,600,000	8 15	8 10	.. 5 ..	187,500
16,000	Persons in sciences and liberal arts	5	80,000	60	960,000	12	11 10	1 10 ..	40,000
40,000	Shopkeepers and tradesmen	4-1/2	180,000	45	1,800,000	10	9 10	.. 10 ..	90,000
60,000	Artisans and handicrafts	4	240,000	40	2,400,000	10	9 10	.. 10 ..	120,000
5,000	Naval officiers	4	20,000	80	400,000	20	18 ..	2	40,000
4,000	Military officers	4	16,000	60	240.000	15	14 ..	1	16,000
511,586		5-1/4	2,675,520	67	34,495,800	12 18	12 ..	.. 18 ..	2,447,100
									Decrease
50,000	Common seamen	3	150,000	20	1,000,000	7 ..	7 10	.. 10 ..	75,000
364,000	Labouring people and outservants	3-1/2	1,275,000	15	5,460,000	4 10	4 12	.. 2 ..	127,500
400,000	Cottagers and paupers	3-1/4	1,300,000	6 10	2,000,000	2 ..	2 5	.. 5 ..	325,000
35,000	Common soldiers	2	70,000	14	490,000	7 ..	7 10	.. 10 ..	35,000
849,000		3-1/4	2,795,000	10 10	8,950,000	3 5	3 9	.. 4 ..	562,000
.....	Vagrants	.....	30,000	.. ..	60,000	2 ..	3 ..	1	60,000
849,000		3-1/4	2,825,000	10 10	9,010,000	3 3	3 7 6	.. 4 6	622,000
				So the General Account is:					
511,586	Increasing the wealth of the Kingdom	5-1/4	2,675,520	67	34,495,800	12 18	12	.. 18 ..	2,447,100
849,000	Decreasing the wealth of the Kingdom	3-1/4	2,825,000	10 10	9,010,000	3 3	3 7 6.	.. 4 6	622,000
1,360,586	Net totals	4-1/4	5,500,520	32	43,505,800	7 18	7 11 3	.. 6 9	1,825,100

Source: Gregory King (1696).

project in the Muda region of Malaysia. The paper included here develops a model framework that began with a standard multiplier analysis and proceeded to a more elaborate cost-benefit formulation. Similarities between the approach and Tinbergen's semi-input-output framework were discussed in Cambridge. These similarities are explicit in the paper presented here, which goes a long way toward a synthesis of Tinbergen's primal approach to cost-benefit analysis and the dual (shadow-price) approach of Little and Mirrlees (1974). The model is SAM-based in the sense used by Thorbecke, as well as with respect to its data base. Accordingly, it furthers the direct application of SAMs to regional projects as explored by Round in relation to a project in Swaziland, referred to by Webster in chapter 6.

SOME CONCLUDING COMMENTS

It has unfortunately not been possible to include in this volume all of the papers presented in Cambridge. However, the selection and supplementary material assembled here will give a fair impression of the work discussed and, more generally, of the SAM approach as it has been developing over the years. In many respects it should be left to the reader to draw conclusions on what has been achieved and the fruitfulness of the SAM approach to the issues that have been addressed. However, it may be worth recording here that there was a consensus among the conference participants on a number of issues which others might like to entertain in reaching their own evaluation. Four of the major points are set out below.

First, incomplete data of variable quality inevitably face the quantitative analyst. A SAM is an invaluable tool in bringing together whatever data there are and in helping to fashion a quantitative description of the initial position in an economy. Those who have tried it doubt whether those who have not can appreciate fully the extent and nature of SAM's advantages in these terms. The method is so superior that other approaches are even suspect, both because they imply inferior data (accounting constraints reduce the variance on estimates, given reasonable luck and judgment) and because it is most unlikely that a comparable sense of the data limitations can be developed and documented in any other way. Documentation of SAMs has not featured in the papers in this volume, mainly because it is a highly specialized and somewhat tedious business. But, to the best of our knowledge, such detailed documentation has been written up for all the SAM studies discussed in the various papers. It leads to an immediate sense of priorities for future developments in statistics and the opportunity to test how new information changes results.

Second, the emphasis in the present set of SAMs is toward disaggregation of the institutional accounts but otherwise to simplify the SNA guidelines to national statistical authorities. The feeling is that little is lost by the simplifications, while much is gained in making the results more intelligible to nonspecialists. To this gain can be added the increased interest which follows from a disaggregation of the household sector, especially when the disaggregation is according to socioeconomic criteria. Those concerned with policy are much more likely to be intrigued by such a SAM than they are by conventional national accounts, and this increased possibility for communication should not be dismissed lightly. More broadly, the concern to put "people" at the center of national accounting is a theme which has already been addressed. But, oddly, since none of the papers makes reference to it, the fact that national accounts had such an orientation at their inception can be noted by reproducing in table I.1 the national income of England in 1688 as set out by Gregory King.

The third point to be emphasized in this final summing up is that taxonomies matter. A SAM is not a model; however, accounting constraints are part of a model and typically an important part. Moreover, the classifications adopted within a SAM are really quite crucial. The choice of classifications is potentially much more important than the choice, say, of a consumer demand

system, especially when it is recognized that the adding-up criterion must be satisfied by the latter because the accounting framework dictates this. Market imperfections or behavioral differences can only be captured if classifications and disaggregations are suitably defined. All too often the responsibility of a model builder to define and justify his choice of classifications is honored in the breach. The SAM approach makes this breach less likely, according to the evidence of these papers.

Finally, while SAMs are not models, they are clearly a stepping-stone in that direction. Much remains to be done in the development of model frameworks at both national and regional levels; many problems exist in model formulation as well as in SAM construction. The question for policy analysis and planning that is raised here is whether or not the SAM approach to such matters is a useful line to pursue.

PART I

The Methodology of Social Accounting

1

What Is a SAM?

Benjamin B. King

A social accounting matrix, familiarly known as SAM to the limited fraternity familiar with it, has two principal objectives. The first is concerned with the organization of information, usually information about the economic and social structure of a country in a particular year, though it could as well be about a region in a country, a city, or any other unit one is interested in; the unit of time, though convenient, is arbitrary. Complaints about the inconsistency and unreliability of economic and social data in developing countries have reached the point of being trite. Although there is justification for these complaints, they are not the whole story. There is often information, dispersed or fragmentary, which is not used for lack of a framework to make the maximum use of the available information and to pinpoint with greater accuracy and specificity the salient gaps and inconsistencies.

Once the data in a particular country for a particular year have been organized in the form of a SAM, they present a static image which can reveal much about the country's economic structure. Even so, the image is only a "snapshot." In order to analyze how the economy works and to predict the effects of policy interventions, more is needed than just a static image. A model of the economy has to be created which can simulate, for example, the effects of interventions. This is the second objective of a SAM: to provide the statistical basis for the creation of a plausible model.

The principle of a SAM is really nothing more than that of double entry bookkeeping in accounting. A SAM is a series of accounts in each of which incomings and outgoings (or income and expenditure in many cases) must balance. What is "incoming" into one account must be "outgoing" from another account. In this respect, a SAM resembles traditional national accounts. In fact, as will be demonstrated later, a SAM embodies the information normally included in national accounts and much more. In a SAM the double entries are achieved by only a single entry in a matrix which resembles an oversized chessboard. Each account consists of one row across the board and one column down it; both are identically numbered. We shall explain how this works shortly.

How large the matrix is depends on the limitations of the available data and the motivation one has for constructing it. In principle, there is no limit to the fineness of detail. In practice, both the data and the effort available for constructing the SAM impose limitations. One of the original motivations for the elaboration of SAMs has been the growing interest in issues of poverty and basic needs. If one wishes to show how different activities affect or are affected by different socioeconomic groups in society, the amount of detail must correspond to the differentiation one wishes to make.

This paper does not attempt to examine the problems arising in the construction of SAMs or the methods of economic analysis which use the assembled data. It is not addressed to specialists but to the broader audience of those who need an introduction to SAMs. In the rest of the paper we shall proceed with simplified examples of SAMs, based on more elaborate ones published elsewhere. We shall start at the simplest level with a purely imaginary economy and proceed by increasing the size and the complexity with examples of SAMs worked out for real economies, Sri Lanka and Botswana. The reason for using two different vehicles, rather than

Table 1.1. The SAM for Robinson Crusoe

			Expenditures					Total
			1	2	3	4	5	6
Receipts	1	Income				1,000		1,000
	2	Demand	1,000					1,000
	3	.....						
	4	Production		1,000				1,000
	5	.....						
	6	Total	1,000	1,000		1,000		

carrying the reader nonstop on one, is that they illustrate the fact that SAMs may be constructed in different ways—or, more properly, with different accents—for different purposes. Some points of interest may occur in one and others in another.

A PRIMITIVE EXAMPLE: THE ROBINSON CRUSOE ECONOMY

As an expository device, the Robinson Crusoe economy has perhaps become rather shopworn. Nevertheless, for want of something better, we shall use it again as a point of entry into the description of SAMs. We shall assume that Robinson Crusoe engages in only one production activity, the picking of coconuts. In some given period, he picks 1,000 coconuts. This represents at the same time the level of production, the level of his income, and the level of his demand for products (sometimes called "wants"). All three are equal, as they must be in such an economy.

The structure of this economy is set out in table 1.1, in which two columns and rows have been left blank because they are not being used for the time being. The final column and row around the border show the total of each row or column. Within the border there are three entries, each of them equal to 1,000. These constitute the SAM for Robinson Crusoe.

In a SAM the rows represent incomings and the columns outgoings. For example, row 1, which is labeled "income," receives 1,000 from column 4, labeled "production." In other words, Robinson Crusoe's income derives from production and equals 1,000. Now, turning to column 1, we see the corresponding entry 1,000 which represents the outgoings of income in row 2, which is labeled "demand." Column/row 1, in effect, describes Robinson Crusoe's role as an income earner.

In column/row 2, we look at him as a consumer. His demand arising from income in row 2 is balanced by what he spends on production in column 2 (row 4). The third leg of this process is in row 4 and column 4, where he turns up a third time as producer: his demand for production is 1,000 and income arising from production is also 1,000. These various identities could be set out in the form of double entry accounts, but, although not so apparent yet, the matrix is more economical since it requires one entry for each item, whereas conventional accounts require two.

It will be noted that there is a circular process. If one put the three entries in the table in coordinate form with the row first and column second, they would appear like this: (1, 4); (4, 2); and (2, 1). Thus, the matrix illustrates the circular process of demand leading to production leading to income, which in turn leads back to demand.

Of course, this rather complicated way of setting out the trivial structure of the Robinson Crusoe economy might well be considered much ado about nothing. We present it this way, however, because it is so self-evident and can serve as an introduction to the more complex relationships in an actual economy. In real life, Robinson Crusoe as a member of a society may, indeed, fill all three roles—as income earner, consumer, and producer—but he would do so as a member of different sorts of units or subdivisions, according to his function. In the accounts for a whole society, income may be subdivided into many different categories, among which income to labor and income to capital are only the first tier. That income accrues to a variety of domestic institutions, which are the source of demand: households with different characteristics, firms, and government (central or local). The outgoings or expenditures of these institutions are spread over a variety of products, as indeed Robinson Crusoe's must have been; production thus can be divided into as many sectors or subsectors as is desirable or practical. In the next section, we turn to a description of a SAM which has been worked out for an actual economy. Although progressive complexities are brought in, the fundamentals remain the same.

Table 1.2. An Initial Aggregate SAM for Sri Lanka, 1970
(in millions of rupees)

			Expenditures					Total
			1	2	3	4	5	6
Receipts	1	Factors of production				11,473		11,473
	2	Institutions	11,360			885	97	12,342
	3	Surplus or deficit		-425			425	
	4	Production		11,312			2,113	13,425
	5	Rest of the World	113	1,455		1,067		2,635
	6	Total	11,473	12,342	0	13,425	2,635	

SRI LANKA 1970

Among the first SAMs constructed was that for Sri Lanka. Sri Lanka is a country with a low average income per capita, but an unusually equitable distribution of income and high standards in meeting "basic needs." Having successfully achieved a high quality of life for such a low income, Sri Lanka's need for more rapid growth of income and reduction of unemployment implied structural change; it also implied better understanding of the existing economic structure.

All the data used in this section are taken or adapted from one of the earliest publications documenting the construction of a SAM (Pyatt and Thorbecke, 1976). We start with a highly aggregated and simplified version, shown in table 1.2. In this table all six pairs of rows and columns are used, although one of them (3) has no entry in the column. Apart from the border totals, there are now eleven entries. Two of the titles used in the Robinson Crusoe economy were not the conventional ones used in SAMs, because in such a primitive economy they would have sounded rather fatuous. Column/row 1 is now called "factors of production" and column/row 2, "institutions." A word of explanation is in order about these two fundamental ingredients of a SAM. Factors of production consist primarily of the labor and capital that are used in the process of production and receive income from it. But the production process draws these factors from where it can, without being overly concerned with the entities to which their owners belong. It is these entities that constitute the "institutions" in column/row 2. Foremost among them are households, which we may wish to study in different categories. Households may supply labor and capital through one or more of their members but act as a unit when it comes to spending the income from it. Other institutions are firms or corporations, both public and private, which provide capital. A third type of institution is government, central or local. It, too, may provide capital, but it has another important role in the production process—at least in the determination of the value of production—namely, the levying of indirect taxes. (It will be noted that these are all domestic institutions.)

The two new accounts 3 and 5 (that is, the pairs of row and column) are there for different reasons. The account for the "rest of the world" (5) is necessary because Sri Lanka, though an island, is not an isolated one like Robinson Crusoe's, but has many transactions with the rest of the world. The "surplus or deficit" (3) is a direct consequence of these transactions; the transactions are normally not equal and must be balanced by borrowing or lending, or by the use of reserves. How these two new accounts fit in will be explained in a tour of the matrix.

We shall start with the production account (4). In the row are the "incomings": the proceeds of sales, at producers' prices, of 11,312 to institutions within Sri Lanka in column 2 and of exports of 2,113 to the rest of the world in column 5. These are exactly balanced by the "outgoings" or the cost of production in column 4: in row 5 payments of 1,067 for imports of materials going into production; in row 2 payments of 885 made to institutions during the production process, which are in fact indirect taxes on intermediate goods or imported materials; and finally, the value added by factors of production of 11,473 in row 1. (All figures in this section are in millions of Sri Lankan rupees.)

If we move to the income account (1), the 11,473 just referred to is now interpreted as income to factors of production (again not differentiated as yet). In column 1 we see the disposition of this income to factors of production, consisting mainly of income of 11,360 accruing to institutions in Sri Lanka and the small balance of 113 to the rest of the world.

Moving now to the third main account—the one for institutions—we have in row 2 two incoming items already mentioned: income from factors of production (11,360) in column 1 and indirect taxes (885) in column 4. There is one additional receipt—transfers from the rest of the world (97) in column 5. The components of this will be described later.

Column 2 shows how the receipts of institutions are spent. In rows 4 and 5 there are goods

Table 1.3. A Revised Aggregate SAM for Sri Lanka, 1970
(in millions of rupees)

			Expenditures					Total
			1	2	3	4	5	6
Receipts	1	Factors of Production				11,473		11,473
	2	Institutions	11,360	2,441		885	97	14,783
	3	Surplus or Deficit		-425			425	0
	4	Production		11,312		4,660	2,113	18,085
	5	Rest of the World	113	1,455		1,067		2,635
	6	Total	11,473	14,783	0	18,085	2,635	

and services purchased: 11,312 being the value of goods produced in Sri Lanka, and 1,455, the value of goods imported in final form as opposed to those used as materials in the course of production. In addition, in row 3, the deficit of −425 is due to the fact that expenditure by institutions in Sri Lanka exceeds their receipts.

In the course of this brief tour, we have now referred to every item in the two new accounts, 3 and 5, with one exception. This is the surplus of 425 in row 3 of the account of the rest of the world (5). The latter's total income in the row exceeds its expenditure in the column by this amount; the rest of the world's surplus exactly balances Sri Lanka's deficit. Consequently, Sri Lanka had to borrow or use its reserves to cover its deficit of 425 with the rest of the world.

It is worth noting that the three largest entries in the matrix, by a wide margin, are in boxes (2, 1), (1, 4), and (4, 2); these were the only entries in the Robinson Crusoe SAM. The core of the matrix is still the circular process of demand (2), production (4), and income (1). Most of the remainder are required by the existence of the rest of the world. The circular process is dual in nature. One can move round a circle clockwise or counterclockwise. If we go in the counterclockwise direction, corresponding to the order just given, we are implicitly following the flow of money. In (1, 4), factors of production, such as labor, receive money from production; in (2, 1), institutions, such as households, receive money from factors of production; and in (4, 2), production receives money from institutions. We may think of the other direction as the supply of goods or services: factors of production to the production process, production to institutions, and institutions (by a slight stretch of the meaning) to factors of production.

We can now give an example of how the SAM could be set up in the form of double entry accounts, of which there would be five. For example, the production account shows:

Revenue (row)		Expenditure (column)	
Domestic sales	11,312	Payments to factors of production	11,473
Exports	2,113	Indirect taxes (on production)	885
		Imported materials	1,067
Total	13,425	Total	13,425

This is more or less the form of traditional national accounts. The complete accounts are fully articulated in this double entry form in the sense that each item in one account appears on the opposite side of another account. It can be readily appreciated that, as the number of accounts is multiplied, their interconnections can become rather hard to follow. A SAM is more economical in that it has only half as many entries as a series of double entry acccounts, and the interconnections between accounts are obvious.

Diagonal Entries

There are two modifications to table 1.2 in the next version—table 1.3. Both are diagonal entries: one at (2, 2) and the other at (4, 4). Nothing else in the table has been changed except, of course, the totals for rows/columns 2 and 4, which are each increased by the amount of the corresponding diagonal entries.

What meaning is attached to a diagonal entry, which appears both as a revenue and as an expenditure to a particular account? It clearly can only mean that, in one case, institutions make certain payments to themselves or, in the other case, production units do the same. If we were only concerned with institutions or production units as a group, this would not serve much purpose. But that is not the case. In fact, we shall in due course split both accounts into several subaccounts. The diagonal elements represent the total of transactions among these subaccounts plus new diagonal elements within the subaccounts themselves, if they too are aggregations.

By including diagonal entries, we have changed the meaning of the totals. In table 1.2, the total of column 4 was the total value of all goods and services (value added in Sri Lanka plus

Table 1.4. Further Development of the Aggregate SAM for Sri Lanka, 1970
(in millions of rupees)

			Expenditures						Total
			1	2abc	2d	3	4	5	6
Receipts	1	Factors of production					11,473		11,473
	2abc	Institutions	11,360	2,052	1,368			3	14,783
	2d	Indirect taxes		389			885	94	1,368
	3	Surplus or deficit		-425				425	0
	4	Production		11,312			4,660	2,113	18,085
	5	Rest of the World	113	1,455			1,067		2,635
	6	Total	11,473	14,783	1,368		18,085	2,635	

import content) produced in Sri Lanka without duplication. In table 1.3, it represents the sum of the outputs of all production units. There is duplication in this sum to the extent that one production unit sells to another; the diagonal entry is the amount of this duplication. Similarly, the diagonal amount of 2,441 in row/column 2 represents moneys paid from one institution to another. Such transfers are a part of total incomes and total expenditures.

Indirect Taxes

In table 1.4 we have made an initial split in the institutional account (2). Instead of one line, there are now two: 2abc (foreshadowing further splits into 2a, 2b, and 2c), which we have given, rather lamely, the same title as before; and 2d, which is labeled indirect taxes. Part or all of each of the entries in the old line 2 have been extracted and entered on line 2d. Thus in column 2abc the original figure of 2,441 has been split into two entries, 2,052 and 389; in column 4 the old entry of 885 is now on line 2d; and the old entry in column 5 has similarly been split up. The amounts so extracted from row 2 have been replaced by a single figure equal to the sum of the parts extracted—1,368 in column 2d. Consequently, the total for row (and column) 2abc is the same as before.

Why do we need a separate account for indirect taxes? The main reason is that they should be distinguished from direct taxes. The latter are extracted from the income stream and, therefore, constitute a transfer to the government from other institutions. Indirect taxes, on the other hand, are levied on the expenditure of the final purchaser of goods and services or, earlier in the production chain, on intermediate goods purchased by producers. In column 2 of table 1.3, the total cost of goods purchased at home (11,312) and abroad (1,455) is not what the buyer pays. Indirect taxes (or their opposite, subsidies) must be added in (or subtracted). The same is true for exports in column 5. The symmetry with column 4, where indirect taxes on intermediate goods or materials are clearly separated, should be evident.

At the same time indirect taxes, which appear as an expenditure in columns 2, 4, and 5, are also a source of revenue to the government (one of the institutions of Sri Lanka) and so appear in column 2d on the appropriate row (2abc).

Of course, indirect taxes are not an "institution" in any reasonable sense. But separating them out has sufficient advantage in understanding the structure to justify a separate subaccount. The logic of the matrix is in no way altered. The total still appears as part of the revenue of the government, while the parts are allocated to the relevant types of expenditure. This is an illustration of the flexibility of a SAM. (And here it can be noted that another way of dealing with indirect taxes, which may be preferable in some contexts, is to insert all of them into the production process, column 4.)

Savings and Investment

Before proceeding to a subdivision of the various accounts, we will make one more change. In column 2 (or 2abc) expenditure so far has included all kinds of goods and services, whether for consumption or investment. The change introduced in table 1.5, in effect, separates consumption from investment goods. Column 2abc now becomes a true current account for institutions and has been so labeled.

The initial change is a reallocation between columns 2abc and 3. We extract the investment goods in rows 4 and 5 from column 2abc and enter them in column 3, renamed "combined capital account." For example, in row 4, the entries in columns 2abc and 2d—9,350 (consumption goods) and 1,962 (investment goods)—correspond to the total 11,312 in row 4 of table 1.4. The related indirect taxes similarly shift on row 2d. There is also a small shift on row 2abc

Table 1.5. A Final Aggregate SAM for Sri Lanka, 1970
(in millions of rupees)

			Expenditures						Total
			1	2abc	2d	3	4	5	6
Receipts	1	Factors of Production					11,473		11,473
	2abc	Institutions: Current	11,360	2,009	1,368	43		3	14,783
	2d	Indirect taxes		119		270	885	94	1,368
	3	Combined Capital		2,214				425	2,639
	4	Production		9,350		1,962	4,660	2,113	18,085
	5	Rest of the World Current	113	1,091		364	1,067		2,635
6		Total	11,473	14,783	1,368	2,639	18,085	2,635	

for institutional reasons which are specific to Sri Lanka and do not merit detailed explanation here.[1]

The total of all these changes in column 3 is equal to expenditure on investment—namely 2,639. Expenditure in column 2abc is now reduced by this amount. The balance of −425, which formerly appeared on line 3, is altered accordingly by the amount spent on investment: −425 + 2,639 = 2,214. This is now the difference between income and current expenditure or consumption rather than income and total expenditure. It constitutes the savings of domestic institutions. Total savings derive from domestic sources (2,214) and foreign sources (425). These together finance investments (account number 3). In double entry form, the combined capital account is:

Revenue (row)		Expenditure (column)	
Domestic savings	2,214	Domestic investment goods	1,962
Foreign savings	425	Foreign investment goods	364
		Indirect taxes	270
		Other payments	43
Total	2,639	Total	2,639

A General Framework

In table 1.6 we have divided two accounts (1 and 2) into subaccounts. The account for factors of production (1) is divided according to the two main factors: labor (1a) and capital (1b). In account number 2, the three main sets of institutions have been distinguished: households (2a), corporations (2b), and government (2c). Indirect taxes (2d) had already been separated in table 1.4.

There is little to say about the subaccounts for factors of production, which show income to labor and capital separately. Income to capital is more than half the total, but, as will be seen from column 1b, the greater part of it accrues directly to households. This consists largely of income from small enterprises including farms, plus a substantial element of imputed income from housing.

The entries in the "box" bounded by rows and columns 2a, 2b, and 2c are in the aggregate equal to the diagonal entry (2, 2) in table 1.5. Payments among institutional sectors all fall into the category of transfer, since they do not constitute income directly received from production. Payments arise from a variety of causes: ownership of certain assets (such as debt or equity investment in firms), direct taxation or government subsidies to households (not related to goods or services), or even voluntary transfers. Payments to the government include, of course, direct taxes by both households and corporations, but they also include social security contributions, pension fund contributions (actual or imputed), and dividends and the like from corporations (mainly public ones in Sri Lanka). Payments by the government include pensions, interest on the public debt, and a substantial amount of direct transfers to public corporations. The large payments from corporations to households (2a, 2b) are mainly payments to owners of capital (debt or equity), although they include some private corporate pensions.

It will be noted in this table that, on line 4, there is no entry for consumption in column 2b (corporations). Following standard national accounting practice, only households and the government consume. Goods and services used by firms as inputs in the course of production are included in the final value of output; they are only consumed when the final output is consumed. Firms may invest, but their investments are included in column 3.

Some observations are in order about some of the other accounts. We can see why account 3

1. They have to do with the system of Foreign Exchange Entitlement Certificates (FEECs), a system granting or charging a premium for foreign exchange, here applied to debt payments.

Table 1.6. A Partially Disaggregated SAM for Sri Lanka, 1970
(in millions of rupees)

			Expenditures									Total
			1a	1b	2a	2b	2c	2d	3	4	5	6
Receipts	1a	Income to Labor								5569		5569
	1b	Income to Capital								5904		5904
	2a	Household Current	5569	4216		644	248				18	10695
	2b	Corporations Current		1575			294				-15	1854
	2c	Government Current			447	376		1368	43			2234
	2d	Indirect taxes			119				270	885	94	1368
	3	Combined Capital			1337	834	43				425	2639
	4	Production			7701		1649		1962	4660	2113	18085
	5	Rest of the World		113	1091				364	1067		2635
	6	Total	5569	5904	10695	1854	2234	1368	2639	18085	2635	

is now labeled "combined capital account." It combines the capital accounts of households, corporations, government, and the rest of the world. In principle, there is no reason why each institution should not have a capital account of its own. In practice, this was not possible in this case because of data limitations. Later, we will show an example of a disaggregated capital account in another SAM.

The production account (4) has not yet been subdivided. The blank lines suggest, correctly, that it will follow in the next table. The principal reason for not dividing it at this stage is that we do not wish to make too many changes at once. There is also another reason. The SAM in its present form gives all the information necessary to compile the "Consolidated Accounts for the Nation" as outlined under the UN SNA system (United Nations Statistical Office, 1968, p. 29). The accounts in this form are set out in table 1.7. They do not contain any information that is not already included in table 1.6. The latter is therefore a more compact form in which to present these consolidated accounts. It also, perhaps, is more useful insofar as the interconnections among accounts are more obvious in table 1.6 than they are in the double entry format.

Each of the consolidated accounts can be identified with either a single column or row in table 1.6, or a combination of both. The two accounts which correspond to a single column/row can easily be compared. The capital account (c) corresponds to column/row 3; the rest of the world account (d) corresponds to column/row 5. Outgoings in the consolidated accounts correspond to columns and the incomings to rows. The other two accounts are less easy to identify, since they correspond to combinations. The reader who is not interested in the details of the identification is advised to skip the next five paragraphs.

The "domestic product and expenditure" account (a) corresponds to SAM accounts 2d and 4 combined, with two adjustments. In order to show the correspondence, we have reproduced in table 1.8 rows/columns 2d and 4 of table 1.6 and added the implications of making the adjustments, as described below.

First, the elements common to both row combination and column combination have been omitted; these are the figures 885 in row 2d and 4,660 in row 4 of column 4 in table 1.6. They can be left out because, when accounts 2d and 4 are combined, as they need be to form the domestic product and expenditure account, all transactions between accounts 2d and 4 become both a receipt and an expenditure of the combined account. They therefore do not affect the balance of receipts and expenditures for the domestic product and expenditure account.

Second, we have added an extra row and column, 7, which does not appear as such in table 1.6. The row corresponds to direct imports for final consumption and for investment. (The figures 1,091 and 364 appear in row 5 in table 1.6.) The column has the total 1,455 required to balance the account.

Row 8 in table 1.8 is the sum of the combined entries in rows 2d, 4, and 7. This row corresponds to the incomings, or the left side of consolidated account (a), except for the imports, which have in effect been transferred, changing the sign, from the opposite side. Column 8 includes these imports and the outgoings, or the right side of account (a).

The "national disposable income and outlay" account (b) corresponds to SAM accounts 2a, 2b, and 2c. Table 1.6 has been reproduced with only these rows and columns in table 1.9, but the diagonal transfer elements between them have been eliminated. Here we represent the totals by two rows and columns, 8a and 8b, instead of one, because, in several cases, the simple addition of the elements in a particular combination does not correspond to an entry in the consolidated account (c). For example, income to capital in column 1b appears not as the sum of 4,216 and 1,575 (5,791) but as the difference between total capital income (5,904) and capital income to the rest of the world (113); that the two are the same is obvious from column 1b in table 1.6. In column 8b, the three elements of private consumption marked by an asterisk appear combined in consolidated account (b) of table 1.7: indirect taxes (119), domestic production (7,701), and imports (1,091), making a total of 8,911. Once one has performed these

Table 1.7. Consolidated National Accounts for Sri Lanka, 1970
(in millions of rupees)

A. Domestic Product and Expenditure

Incomings		Outgoings	
Government consumption	1,649	Income to labor	5,569
Private consumption	8,911	Income to capital	5,904
Investment	2,596	Indirect taxes	1,368
Exports	2,207		
Less Imports	-2,522		
	12,841		12,841

B. National Disposable Income and Outlay

Incomings		Outgoings	
Income to labor	5,569	Government consumption	1,649
Income to capital	5,904	Private consumption	8,911
Indirect taxes	1,368	Savings	2,214
Current transfers from abroad	3		
Transfers from capital a/c	43		
Less property income transferred abroad	-113		
	12,774		12,774

C. Capital Account

Incomings		Outgoings	
Savings	2,214	Capital formation	2,596
Less transfers from capital a/c	-43		
Foreign borrowing	425		
	2,596		2,596

D. Rest of the World Account

Incomings		Outgoings	
Imports	2,522	Exports	2,207
Property income transferred abroad	113	Transfers	3
		Surplus (of ROW)	425
	2,635		2,635

Note: ROW signifies rest of world

Table 1.8. Reconciliation Table for Sri Lanka, 1970
(in millions of rupees)

		1a	1b	2a	2b	2c	2d	3	4	5	7	8
1a	Incomes of Labor								5569			5569
1b	Income to Capital								5904			5904
2a	Household Current											
2b	Corporations Current											
2c	Government Current						1368					1368
2d	Indirect Taxes			119				270		94		
3	Combined Capital											
4	Production			7701		1649		1962		2113		
5	Rest of the World								1067		1455	2522
7	Final Imports			1091				364				
8	Subtotal			8911		1649		2596		2207		15363

Note: Column 8 is the total of columns 2d, 4, and 7. Row 8 is the total of rows 2d, 4, and 7.

Table 1.9. Revised Reconciliation Table for Sri Lanka, 1970
(in millions of rupees)

		1a	1b	2a	2b	2c	2d	3	4	5	8a	8b
1a	Incomes to Labor											
1b	Income to Capital											
2a	Household Current	5569	4216							18		
2b	Corporations Current		1575							-15		
2c	Government Current						1368	43				
2d	Indirect taxes			119								119*
3	Combined Capital			1337	834	43					2214	
4	Production			7701		1649					1649	7701*
5	Rest of the World			1091								1091*
8a		5569	5904				1368	43		3		
8b				-113							(12774)	

Note: Columns 8a and 8b together equal the total of columns 2a, 2b, and 2c. Rows 8a and 8b together equal the total of rows 2a, 2b, and 2c.

*The total of these three equals 8,911 (private consumption).

arithmetic tricks, the elements in the row again correspond to the consolidated account incomings and the column to outgoings.

An Input-Output Matrix

The final step in this exposition of the Sri Lanka table is to subdivide the production account (4) into six sectors; these are listed in table 1.10 in rows 4a to 4f. The "box" formed by these rows and their equivalent columns constitutes the core of what is commonly known as an input-output matrix. The accounts of each sector follow essentially the same logic as before.

For example, if we take the agricultural sector (4a), the column in total is equal to gross output at producers' prices (which exclude sales taxes and the like). This total of 5,903 includes not only value added (in rows 1a and 1b), taxes on intermediates (in row 2d), and imported materials (in row 5), but also inputs from other sectors. The largest volume of inputs is on the diagonal (4a, 4a) and consists of internal purchases and sales within the sector; in fact, it is largely paddy (one subsector) sold to ricemills (another subsector).

Just as column 4a shows the sources of gross output to which payments are made, row 4a shows the destinations of gross output from which the production units derive their revenue: in column 2a the amounts going to consumption; in column 3 to investment; in columns 4a to 4f as intermediate goods to other sectors; and in column 5 to exports.

Table 1.10, with eighty-five entries in it, is a long way from the pristine simplicity of the Robinson Crusoe economy. The circularity of the process of production-income-expenditure is no longer so evident. But this fundamental attribute of the SAM is still there, and it can be illustrated by reference to the input-output tables. Table 1.11 shows an input-output table with six sectors corresponding to those in table 1.7. Table 1.11 is the same as table 1.10, with two exceptions. The first, which is trivial in substance, is that it has been rearranged. Columns and rows 4a to 4f in table 1.10, which were in the lower right corner, occupy the top left corner in table 1.11; columns and rows 1, 2, and 3 are now below or to the right of them. The substantial difference is that the lower right corner of table 1.11 is blank. The input-output table captures only the relationships between the production accounts and the other accounts (factors of production, institutions, capital accounts, and rest of the world). Interrelationships among these accounts, most of which are in the top left corner of table 1.10, are not there.

If we were to specify a new set of final demands different from those in table 1.11, techniques, based on specific assumptions about intersectoral relationships, exist for deriving the implied pattern of production in each subsector. That implied pattern, of course, will include income to factors of production (rows 1 and 2 in table 1.10). The results, however, give no guarantee that there is any relationship between incomes generated and the ensuing demand. The complete SAM, in principle, provides the missing link—or at least the data to establish it.

Table 1.10 is as far as we shall go here in subdividing the accounts. In the original source, much greater detail is shown. In one complete matrix, the following appear:

- Three labor groups (urban, rural, and estate)
- Three capital groups (public, private, and housing)
- Three household groups (urban, rural, and estate)
- Two kinds of corporations (private and state)
- Eleven production sectors.

However, still more detail lies behind that matrix. For example, the production account is based on detailed accounts for forty-eight subsectors. Household data are based on information for six income brackets within each group.

This completes the first part of this introduction to the exposition of social accounting matrices. For those who may, unexpectedly, have been titillated by the subject, we have added one more section on a SAM for a different country, Botswana. That example illustrates an attempt to

Table 1.10. A Complete Disaggregated SAM for Sri Lanka, 1970
(in millions of rupees)

			Expenditures													Total
			1a	1b	2a	2b	2c	2d	3	4a	4b	4c	4d	4e	4f	5	6
Receipts	1a	Income to Labor								2015	561	245	909	564	1275		5569
	1b	Income to Capital								2009	909	734	1423	829			5904
	2a	Household Current	5569	4216		644	248									18	10,695
	2b	Corporations Current		1575			294									-15	1854
	2c	Government Current			447	376		1368	43								2234
	2d	Indirect taxes			119				270	80	504	66	130	76	29	94	1368
	3	Combined Capital			1337	834	43									425	2639
	4a	Agriculture			2861				104	1191	354	3		62	40	1288	5903
	4b	Industry			1824				109	254	815	417	172	66	74	335	4066
	4c	Construction							1595		1		7	50	92		1745
	4d	Trade and Transport			1606				154	135	344	206	96	42	59	203	2845
	4e	Private Services			1410					37	4	9	38	55	37	287	1877
	4f	Government Services					1649										1649
	5	Rest of the World		113	1091				364	182	574	65	70	133	43		2635
	6	Total	5569	5904	10,695	1854	2234	1368	2639	5903	4066	1745	2845	1877	1649	2635	

Table 1.11. Input-Output Matrix for Sri Lanka, 1970
(in millions of rupees)

	Sectors						Sub-Total	Final Demand				Total
	Agr.	Ind.	Constr.	Trade & Transp.	Priv. Services	Govt. Services		Cons.	Inv.	Gov't.	Exports	
Agriculture	1,191	354	3		62	40	1,650	2,861	104		1,288	5,903
Industry	254	815	417	172	66	74	1,798	1,824	109		335	4,066
Construction		1		7	50	92	150		1,595			1,745
Trade & Transport	135	344	206	96	42	59	882	1,606	154		203	2,845
Priv. Services	37	4	9	38	55	37	180	1,410			287	1,877
Govt. Services							0			1,649		1,649
Subtotal	1,617	1,518	635	313	275	302	4,660	7,601	1,962	1,649	2,113	18,085
Value added (labor)	2,015	561	245	909	564	1,275	5,569					
Value added (capital)	2,009	909	734	1,432	829		5,904					
Indirect taxes	80	504	66	130	76	29	885					
Imports	182	574	65	70	133	43	1,067					
Total	5,903	4,066	1,745	2,845	1,877	1,649	18,085					

Table 1.12. An Aggregate SAM for Botswana, 1974–75
(in millions of pulas)

			Expenditures							Total
			1	2	3	4	5	6	7	8
Receipts	1	Factors of production		29.2	171.4	23.0			0.7	224.3
	2	Institutions Current Account	220.7	80.6	4.5	18.3	4.6		2.0	330.7
	3	Production Account		78.0	82.8	117.9	68.4		2.7	349.8
	4	ROW Current Account	3.8	87.2	91.4		37.0		9.2	147.7
	5	Combined Capital Account		55.4		69.4			-8.3	116.5
	6	.....								
	7	Errors and Omissions	-0.2	0.3	-0.3		6.5			6.3
	8	Total	224.3	330.7	349.8	228.6	116.5		6.3	

Note: ROW signifies rest of world.

bring into the framework of the accounts not only the various transactions already described but also the financial counterpart of these real transactions and the flow of capital funds into investment. In some ways this is one of the most intriguing uses of a SAM, because it brings together two related aspects of development, the real and the financial. The parsimonious use of financial data and the neglect of its relationship with the real economy have often been noted (see chapter 3).

BOTSWANA 1974–75: THE FLOW OF FUNDS

Our purpose at this point is to illustrate how to introduce financial transactions into a SAM. The example we use is taken from a report on a SAM constructed for Botswana (United Kingdom, Ministry of Overseas Development, 1977). (All figures in this section are in millions of pulas.)

The Botswana SAM, shown as table 1.12, is conceptually the same as table 1.5 for Sri Lanka, except for three differences:

- There is no separate line for indirect taxes; for simplicity, they have been included with the central government, which is itself included under institutions (row/column 2).
- The combined capital account has been moved down to row/column 5 and the two accounts previously on lines 4 and 5 have been promoted to 3 and 4, respectively.
- New lines 6 and 7 have been added. One of them has been left blank for the moment. The other consists of errors and omissions. Totals are now shown in rows and columns 8.

The reason for not having a separate line for indirect taxes is to avoid unnecessary clutter. Having made the point once, we do not need to repeat it.

The change in order is not a change in substance, as there is no magic in any particular order. The best order is the one that follows a reasonable logic and makes the SAM intelligible to the reader; thus there can be differences. The order here conforms rather closely to the original, more detailed version of the SAM.

The account for errors and omissions (7) is present for two quite different reasons. The first set of errors is attributable entirely to rounding. Many individual figures in the original table have been added together to form subaggregates; this process inevitably involves rounding errors. There are, however, several large specific errors, which appear as such in the original SAM, mainly in rows/columns 4 and 5. These errors are akin to residual errors often left in the balance of payments or national accounts. All SAMs have such errors at some stage of their construction. How these particular errors arose and why they were left in are explained in detail in chapter 7.

Purchase and Sale of Assets

The main change in table 1.13 from table 1.12 is that row/column 6 has been labeled "financial account" with one entry each in the column and the row. In addition, there is a new diagonal element in row/column 5. These are basically the only differences.

All previous tables, whether on Sri Lanka or Botswana, have dealt with the consequences of current activity during the year: the production-income-expenditure cycle. Savings are savings out of current income, and the investment they finance encompasses only new investment. However, this does not exhaust the totality of transactions. Institutions may buy or sell existing physical assets, particularly land and buildings. They also lend or borrow, thereby creating financial assets or liabilities. The new entries are intended to acknowledge these facts.

The diagonal element of 30.3 in row/column 5 expresses the fact that institutions bought existing assets of that amount and also that they sold them. Obviously, the two must balance. When looked at as an entry in the column, the transaction appears as a purchase; when looked at as an entry in the row, it appears as a sale.

Table 1.13. Introduction of a Financial Account into the Aggregate SAM for Botswana, 1974–75
(in millions of pulas)

			Expenditures							Total
			1	2	3	4	5	6	7	8
Receipts	1	Factors of production		29.2	171.4	23.0			0.7	224.3
	2	Institutions Current Account	220.7	80.6	4.5	18.3	4.6		2.0	330.7
	3	Production Account		78.0	82.8	117.9	68.4		2.7	349.8
	4	ROW Current Account	3.8	87.2	91.4		37.0		9.2	228.6
	5	Combined Capital Account		55.4		69.4	30.3	127.3	-8.9	273.5
	6	Financial Account					126.6		0.6	127.2
	7	Errors and Omissions	-0.2	0.3	-0.3		6.6	-0.1		6.3
	8	Total	224.3	330.7	349.8	228.6	273.5	127.2	6.3	

Note: ROW signifies rest of world.

The new account (6) reflects all financial activities on capital account, such as borrowing and lending. Most, but not all, of these are carried out by banks and financial enterprises. Current activities and new physical investments of these enterprises are already included as part of the accounts of institutions. The two new entries, at the intersection of row 5 and column 6 (127.3) and the intersection of row 6 and column 5 (126.6), are identical except for the errors and omissions. In principle they must be. They express the fact that institutions incur financial liabilities to the financial sector (for example, by borrowing) and also acquire financial assets from that sector (such as currency or bank deposits). These two must balance, because a liability automatically creates a corresponding asset. They must balance in the aggregate, but, as we shall see, they need not balance for any individual subset of institutions.

We can now set out the capital account implied by the entries in row/column 5 in the familiar double entry form as follows:

Incomings (row)		Outgoings (column)	
Domestic savings	55.4	New investments (rows 2–4)	110.0
Foreign savings	69.4	Purchase of existing assets	30.3
Sale of existing assets	30.3	Acquisition of financial assets	126.6
Financial liabilities incurred	127.3	Errors and omissions	6.6
Errors and omissions	−8.9		
Total	273.5	Total	273.5

Decomposition of the Capital Account

In table 1.14 we have divided row/column 5 into three parts. The first element is labeled 5abc and includes the group of institutions identified in Sri Lanka, namely, households, enterprises (or corporations), and government; the fact that it has an "abc" at the end implies that it will be broken down still further at a later stage. The second element, labeled 5d, consists of a new category of financial enterprises, such as banks, which loom quite small in the production processes we have considered so far, but loom much larger in the financial transactions that we are considering now. They do, in fact, represent the capital and money markets through which most of the financial transactions take place. The final element in row/column 5e is the capital account of the rest of the world (ROW).

The sales of existing physical assets are now identified (5abc, 5e) mainly as sales by institutions in Botswana to the rest of the world and, to a smaller extent, vice versa. The latter transactions are explained by the interest of foreign corporations in mining enterprises in Botswana.

We see that individual accounts do not have to balance in their financial transactions. Those who save may put their savings into real or financial assets. Investors in real assets may borrow in order to finance them. This is the purpose of a capital market.

For example, we can set out the capital account of domestic institutions other than financial enterprises to illustrate this point:

Incomings (row)		Outgoings (column)	
Savings	53.9	New investment (rows 2–4)	108.6
Sale of physical assets	23.8	Purchase of existing assets	6.8
Financial liabilities incurred	90.7	Acquisition of financial assets	53.7
Errors and omissions	0.5	Errors and omissions	−0.2
Total	168.9	Total	168.9

A similar account could be made for financial enterprises (5d). It would include rather modest amounts for savings and new investment (1.5 and 1.4, respectively). The principal elements in this account would be the entries in row/column 6, that is, the sale or purchase of financial assets. In practice, these are bound to balance, except for the minor difference between savings

Table 1.14. A SAM with Disaggregated Capital Accounts for Botswana, 1974–75
(in millions of pulas)

				Expenditures									
				Current Accounts				Capital Accounts					Total
				1	2	3	4	5abc	5d	5e	6	7	8
Receipts	Current Accounts	1	Factors		29.2	171.4	23.0					0.7	224.3
		2	Institutions	220.7	80.6	4.5	18.3	4.6				2.0	330.7
		3	Production		78.0	82.8	117.9	67.5	0.9			2.7	349.8
		4	ROW	3.8	87.2	91.4		36.5	0.5			9.2	228.6
	Capital Accounts	5abc	Institutions		53.9			0.3		23.5	90.7	0.5	168.9
		5d	Financial enterprises		1.5						31.8	-9.6	23.7
		5e	ROW				69.4	6.5			4.8	0.2	80.9
		6	Financial Transactions					53.7	15.4	57.5		0.6	127.2
		7	Errors and Omissions	-0.2	0.3	-0.3		-0.2	6.9	-0.1	-0.1		6.3
		8	Total	224.3	330.7	349.8	228.6	168.9	23.7	80.9	127.2	6.3	

Note: ROW signifies rest of world.

and new investment, but, in the table, balancing is achieved through the errors and omissions row/column. This arises, for example, because occasionally in the year-end accounts of a borrower and a lender, a liability and its corresponding asset may be valued differently (see chapter 7).

Decomposition of the Financial Transactions

The account for financial transactions (6) in table 1.14 has been broken down further in table 1.15 into four different categories: domestic currency,[2] bank deposits, and the like; domestic borrowing or lending; and foreign borrowing or lending. These are identified by rows/columns 6a through 6d.

As might be expected, institutions acquire additional resources (row 5abc) by incurring liabilities through domestic or foreign borrowing (columns 6c and 6d). To the extent that they do not spend these resources on physical assets (old or new), they retain them for the most part in the form of financial assets: either currency or deposits (rows 6a and 6b in column 5abc).

The account of financial enterprises (5d) in table 1.14 is of particular interest here. In presenting it in the usual form of outgoings and incomings, we make a minor modification by changing titles to "change in assets" and "change in liabilities," respectively. We could do the same for other capital accounts, but the change in this case brings out more clearly the nature of outgoings (acquisition of assets) and of incomings (incurring of liabilities). The account thus reads:

Change in liabilities (row)		Change in assets (column)	
Physical assets	1.4	Savings	1.5
Currency	0.4	Deposits received	22.9
Deposits made	0.5	Domestic borrowing	3.2
Domestic lending	14.5	Foreign borrowing	5.7
Errors and omissions	6.9	Errors and omissions	−9.6
Total	23.7	Total	23.7

Two items appear on both sides of the account: deposits and domestic lending or borrowing. There are at least two reasons for this. First, financial enterprises cover more than commercial banks. Some of them make deposits in commercial banks. These deposits appear as a liability to the banks, but an asset to the depositing enterprises. Second, financial enterprises may both borrow on the market and lend to their customers. They therefore increase their assets by lending and their liabilities by borrowing.

The account is, in fact, analogous to the change in an enterprise's balance sheet from one year to the next, except that it applies to a set of enterprises. Savings here correspond to the increase in equity investment attributable to retained earnings.

Decomposition of Institutions

In table 1.16, the final one for Botswana, institutions have been broken down into the same three constituent parts as for Sri Lanka: households, enterprises (or corporations), and central government. This has been done both for the current account (2) and the capital account (5abc).

Except for the greater amount of institutional detail, there is no change in principle from table 1.15. However, these new data now show how each set of institutions contributes to the flow of capital funds through the system. This information shows, for each of the three sets of

2. Actually, at the time there was no independent Botswana currency; the currency then circulating was the South African rand.

Table 1.15. Extension of the SAM for Botswana to Include Separate Accounts for Financial Assets, 1974–75
(in millions of pulas)

				Expenditures										
				Current Accounts				Capital Accounts			Financial Accounts				Errors	Total
				1	2	3	4	5abc	5d	5e	6a	6b	6c	6d	7	8
Receipts	Current Accounts	1	Factors of Production		29.2	171.4	23.0								0.7	224.3
		2	Institutions	220.7	80.6	4.5	18.3	4.6							2.0	330.7
		3	Production		78.0	82.8	117.9	67.5	0.9						2.7	349.8
		4	Rest of World	3.8	87.2	91.4		36.5	0.5						9.2	228.6
	Capital Accounts	5abc	Institutions		53.9			0.3		23.5			38.8	51.9	.5	168.9
		5d	Banks & financial enterprises		1.5							22.9	3.2	5.7	-9.6	23.7
		5e	Rest of World				69.4	6.5			5.4			-0.6	.2	80.9
	Financial Accounts	6a	Domestic Currency					5.0	0.4							5.4
		6b	Bank deposits					22.2	0.5						.2	22.9
		6c	Bank advances & other domestic borrowing					27.2	14.5						.3	42.0
		6d	Foreign borrowing					-0.7		57.5					.1	56.9
		7	Errors	-.2	.3	-.3		-.2	6.9	-.1				-.1		6.3
		8	Total	224.3	330.7	349.8	228.6	168.9	23.7	80.9	5.4	22.9	42.0	56.9	6.3	

Table 1.16. A Final SAM for Botswana, 1974–75
(in millions of pulas)

				Expenditures															
				Current Accounts						Capital Accounts					Financial Accounts				Errors	Total
				1	2a	2b	2c	3	4	5a	5b	5c	5d	5e	6a	6b	6c	6d	7	8
Receipts	Current Accounts	1a	Factors of Production			7.3	21.9	171.4	23.0										0.7	224.3
		2a	Inst. Households	181.5	11.2	9.3													.7	202.7
		2b	Enterprises	37.4	5.2	8.1	6.5	.4	5.4										.4	63.4
		2c	Cent. Govt.	1.8	15.7	24.6		4.1	12.9	.2	3.9	0.5							.9	64.6
		3	Production		67.2	.6	10.2	82.8	117.9	14.1	32.5	20.9	0.9						2.7	349.8
		4	Rest of World	3.8	79.9	.3	7.0	91.4		1.4	31.3	3.8	0.5						9.2	228.6
	Capital Accounts	5a	Households		23.1						0.1						1.7		.2	25.1
		5b	Enterprises			11.7											35.3	41.2	1.7	89.9
		5c	Cent. Govt.				19.1			0.1	0.1			23.5			1.8	10.7	-1.4	53.9
		5d	Banks & fin. ent.			1.5										22.9	3.2	5.7	-9.6	23.7
		5c	Rest of World						69.4		6.5				5.4			-0.6	.2	80.9
	Financial Accounts	6a	Domestic Currency							4.5	0.5		0.4							5.4
		6b	Banks & other deposits							6.3	3.0	12.9	0.5						.2	22.9
		6c	Bank advances & other domestic borrowing							0.4	6.2	20.6	14.5						.3	42.0
		6d	Foreign borrowing							-1.7	5.7	-4.7		57.5					.1	56.9
		7	Errors	-.2	.4		-.1	-.3		-.2	.1	-.1	6.9	-.1				-.1	6.3	
		8	Total	224.3	202.7	63.4	64.6	349.8	228.6	25.1	89.9	53.9	23.7	80.9	5.4	22.9	42.0	56.9	6.3	

Table 1.17. Changes in Assets and Liabilities of Households, Enterprises, and Government in Botswana, 1974–75
(in millions of pulas)

	Households	Enterprises	Government	Total
Change in Assets (column)				
Physical assets (new)	15.7	67.7	25.2	108.6
Physical assets (existing) a/	-	6.7	-23.7	-17.0
Financial assets	9.5	15.4	28.8	53.7
Errors and Omissions	-0.2	0.1	-0.1	-0.2
Total	25.0	89.9	30.2	145.1
Change in Liabilities (row)				
Savings	23.1	11.7	19.1	53.9
Financial liabilities	1.7	76.5	12.5	90.7
Errors and Omissions	0.2	1.7	-1.4	0.5
Total	25.0	89.9	30.2	145.1

a. Sales of existing assets have been brought over from the "liability" side as a negative item. This is a net figure.

institutions and for the total, the changes in assets and liabilities. In an alternative format, it can be presented as shown in table 1.17.

Households, as is often the case, saved more than they invested in physical assets and, consequently, put the difference into financial assets. Enterprises were the principal investors in physical assets and, since their savings (or equity participation) were small relatively, most of their investments had to be financed by borrowing. In this particular year (1974–75), the role of the government was unusual; it financed most of its new investment by the sale of existing assets.

THE USES OF A SAM

The effort required to put together a SAM is not trivial. Data must be ferreted out, wherever they may be available. Conflicting sources must somehow be reconciled. Rows and columns do not conveniently come to the same total in the first instance.[3] What does one get out of it all except a rather complicated and impressively tidy collection of numbers?

Because social accounting matrices have not been in existence for long and there are not many of them, to say what they are useful for is partly an exercise in conjecture. Nonetheless, there seems to be sufficient foundation to make a few plausible suggestions. In the first place, a SAM is clearly a step forward in the upgrading of statistics. Recent comparisons of microeconomic information obtained from household surveys with national accounts have shown that the discrepancies between these two sources of information can be very large. How do we

3. Techniques exist for making adjustments to achieve balance at a minimum cost in terms of variation from the original; and new or improved techniques are being worked on.

choose between them? Or, should we choose between them? While construction of a SAM is certainly not going to reveal the ultimate truth, at least it forces attention on inconsistencies in a way that brings one closer to the root of their cause. Judgment, to be sure, has to be used in imposing ultimate consistency, but it can be done in such a way as to keep adjustments within plausible limits and so avoid a purely Procrustean process of fitting one set of data to the dictates of another.

The concept of a SAM goes further than the improvement of statistics for their own sake. It could be said to be the common ground of economic planners or development economists, on the one hand, and statisticians, on the other. A SAM is cast in a form that, given the fineness of detail with which it is constructed, makes the most of existing information. Economic models of an economy, which may be designed for particular purposes, nevertheless imply the existence of an underlying SAM. Parts of this implied SAM may be aggregated and parts highly disaggregated, but it is, nevertheless, a SAM. The existence of an actual SAM, against which to test the behavioral assumptions of a model and the SAM they imply, is, on the face of it, a useful way of testing the model's validity. Much has been and could be said about the relationship between models and SAMs. Examples from the growing literature are de Melo, 1979, and Dervis and Robinson, 1978. Here we shall only touch on some of the simpler applications of a SAM to the understanding of the way in which an economy works.

The uses of a SAM fall into two categories: those in which the whole corpus of information in the SAM is used and those in which only a part is used. Of course, in the latter case, it is not necessary to have the complete SAM. But the construction of the complete articulated SAM means that one has at one's disposal a multipurpose tool and does not have to construct separate subsets of accounts for each purpose. An illustration of the use of part of a SAM has been documented in the case of the Sri Lanka SAM that we have described in aggregate terms. The purpose of the exercise in question was to establish the order of magnitude of the total fiscal incentives for exporting in various sectors (see Pyatt, Roe, and associates, 1977, ch. 6). At the time (in 1970) substantial direct fiscal incentives were given to encourage nontraditional exports. At the same time, many industrial subsectors in Sri Lanka, among which, it might have been expected, would be found some potential exporters, received fairly high nominal protection. The input-output matrix within the Sri Lanka SAM was used to convert nominal protection rates into effective protection rates to these industries; in most cases, these were substantially higher than the nominal protection rates. The incentives in the tariff system that implicitly encouraged production for the domestic market could then be compared with the export incentives. In many cases, they greatly outweighed the export incentives and, in other cases, reduced them to fairly small proportions. These findings, which were unexpected, could have been reached without a SAM; its existence, however, made the task easier.

One of the principal ways in which the whole corpus of information in a SAM can be brought to bear is through multiplier analysis, which shows how changes in one or more elements of a SAM generate changes elsewhere in the matrix. Here we will only consider a simple example to illustrate the approach.

The starting point is to assume a simple economy and a highly aggregated SAM which has accounts only for the private sector, government production, the rest of the world, and a combined capital account. To keep things even simpler, it is assumed that only the private sector buys goods from the rest of the world. Corresponding to this simple economy, we assume we have a SAM for some base period, and we ask the question, "What would happen if demands on production activities were increased by increasing government expenditure (by an amount i_g), investment (by an amount i_z), and exports (by an amount i_e)?" Without loss of generality we can put the sum of the i's equal to one.

The first part of the answer to this question is that whatever the processes of consequential changes might be, the end result will be a new SAM for our simple economy. Moreover, those

Table 1.18. Multiplier Effects in the Form of an Incremental SAM

			Expenditures					Total
			1	2	3	4	5	6
Receipts	1	Private Sector				M		M
	2	Government	Mp_2					Mp_2
	3	Capital Account	Mp_3	$Mp_2 - i_2$			$Mp_5 - i_5$	i_3
	4	Production	Mp_4	i_2	i_3		i_5	M
	5	Rest of World	Mp_5					Mp_5
	6	Total	M	Mp_2	i_3	M	Mp_5	

Note: $M(1 - p_4) = \Sigma p = 1 = \Sigma i$

p_2 = marginal propensity to tax
p_3 = marginal propensity to save
p_4 = marginal propensity to consume (domestic)
p_5 = marginal propensity to import
M = multiplier
i_2 = impulse from increased government expenditure
i_3 = impulse from increased investment
i_5 = impulse from increased exports

elements of the initial SAM that are zero by definition will remain zero. Because our model assumes that only the private sector buys goods from abroad, the purchases of such goods by the government, for example, will remain zero.

Given the accounting rules and model assumptions, the difference between the new SAM and the original one will imply an incremental SAM in which many cells have zero entries. This incremental SAM is shown in table 1.18. At this stage we know the items i_2, i_3, and i_5, because these are the changes that we have exogenously postulated. We also know that the blank entries in the table are zeros, because these follow from our model and accounting conventions. The question then is, "What can be said about the nonzero entries apart from i_2, i_3, and i_5?"

Not much can be said about these nonzero entries without making further assumptions about what will happen, for example, to prices, monetary policy, and how people choose to spend any extra income. We will assume, for simplicity, that private sector income goes up by an amount M, and then explore what the incremental SAM in table 1.18 can say about the relationships between M and the i's.

Because in this simple model the private sector gets all its income from production activities and because these activities pay all value added to the private sector, row 1 and column 4 of the incremental SAM are very simple and contain zeros apart from the entry in row 1, column 4, which is M.

The increase in private income (row 1) must match the increase in private expenditures in column 1. The latter must now be spread over the different components of private expenditures. This spread is assumed to take place in the proportions p_2, p_3, p_4, and p_5, which can be referred to as the marginal expenditure propensities of the private sector. Because all the extra income M must be spent or saved, the accounting balance for row/column 1 implies that

$$p_2 + p_3 + p_4 + p_5 = 1.$$

We might also be prepared to assume that these propensities are constant. But if we do, then this is clearly a behavioral assumption, not an accounting rule.

Because Mp_2 is the only increase in income for the government, row/column 2 of table 1.18 must have sums Mp_2. From column 2, this implies that the entry in row 3, column 2—the increase in government savings—must be $Mp_2 - i_2$.

For now, we skip over the details of accounts 3 and 4 and move to the rest of the world account (5). Here, the only increase in receipts is Mp_5 because only the private sector imports in this model. This then implies that the entry in row 3, column 5, must be $Mp_5 - i_5$. This entry measures the extent to which foreign savings, or a reduction in domestic reserves of foreign exchange, finances the increased investment, i_3.

Returning now to account 4, the fact that row and column sums must be equal implies that

$$M = Mp_4 + i_2 + i_3 + i_5 = Mp_4 + 1,$$

or

$$M = 1/(1 - p_4).$$

In other words, the value-added M must be equal to the aggregate increases in government expenditure, investment, and exports, inflated by the factor $1/(1 - p_4)$. This factor is the familiar expenditure multiplier; it is the reciprocal of the complement of the marginal propensity to consume domestic goods. Hence, while the SAM does not tell us what value to give to M or to p_4, it does show that once one value is fixed, the other is also fixed; and in that sense it defines the relationship between the initial increments in expenditure (the i's) and the increase in total value added (the M).

At this stage we have discussed the balancing of four of the five accounts of the incremental SAM. That is all that is necessary, because it is always true that within a SAM the last account

will balance if all the others balance. To illustrate this point, the rule requires that, for our account 3,

$$i_3 = Mp_3 + (Mp_2 - i_2) + (Mp_5 - i_5),$$

or

$$i_2 + i_3 + i_5 = (p_2 + p_3 + p_5)\,M.$$

Since the sum of the i's and the sum of the p's are each equal to one, this can be written as:

$$1 = (1 - p_4)\,M.$$

Hence the condition for account 3 to balance is the same as that for account 4, that is to say:

$$M = 1/(1 - p_4).$$

This result simply repeats that obtained previously. If all but one account are balanced, then all accounts are balanced, and the story of the incremental SAM shown as table 1.18 is thus completed.

The application of multiplier analysis with a complete SAM is little different in principle, though it is far more complex. It takes into account all the interactions within each step of the process of linkages among incomes, expenditures, and production. The linkages could include, for example, the effects on other industries of expansion within a particular industry. There is, however, no longer a single multiplier, but an entire matrix of multipliers, which potentially shows the effect of expansion in one cell of the original SAM on any other cell. How these effects are to be interpreted must always be approached with care because the effect of one variable on another ultimately depends on economic behavior and not just on accounting constraints. However, the approach has some value in distinguishing accounts or subaccounts that are likely to be affected from those that are likely to be bypassed. This distinction may well have importance in considering the effect of exogenous changes on the distribution of income. The analysis may also serve to identify the important elements that result in changes in government accounts or in the balance of payments.

Several different applications of this type of analysis have been made using the Botswana SAM. In such applications the SAM relationships can trace the complex interactions inherent in the circular process. If initial changes in prices or wages are involved, the analysis can show—at least in orders of magnitude—how the initial changes affect the prices in different industrial sectors and the consumption patterns of different household groups; if interindustry relations are complex and if, as is more than likely, household consumption patterns are very different, the resulting pattern may be difficult to predict. Such analysis, however, is based in the first instance on the assumption that patterns of production and consumption are unaffected by price changes. Adaptation to take into account assumed responses can, however, be introduced. This adaptation, in fact, is essential in modeling an economy.

In a small open economy or a region, interindustry relations tend to be weak and leakages in the multiplier process large. SAMs have been constructed in each of these contexts: for example, for Swaziland and for the Muda Valley in Malaysia. (See chapter 6 for a discussion of the Swaziland SAM and Bell, Hazell, and Slade, 1982, for the Muda Valley SAM.)

The construction of accounts for a region, as opposed to a country, is likely to reveal features of the regional economy that were little appreciated before. This is obviously so because regions do not possess "national" accounts and other data normally associated with an economy as a whole. The construction of the SAM for the Muda Valley is a good illustration. In this region a large irrigation project had more or less doubled the output of rice, the main crop. Several "downstream" effects of the resultant increase in farmers' incomes are of interest. Perhaps the main one is the very large outflow of capital from the region to the rest of Malaysia. This fact

and other data in the SAM are consistent with the theory that the principal downstream effect was to increase the incomes of nonfarm households, such as traders, who were in effect "importers" from the rest of Malaysia. Leakages from the regional economy were thus substantial. It is perhaps significant that there was still a substantial number of poor landless laborers. Although the SAM may have been constructed too soon after the completion of the irrigation system to allow for opportunities for reinvestment in the region, it is, nevertheless, a clear reminder that downstream effects can simply not be taken for granted.

Clearly, no SAM can ever be constructed to answer questions except in the broadest sense. Specialists in any particular subject may have a much better idea of specific consequences, based on their accumulation of intimate knowledge, than a SAM alone could provide. But no one since Thomas Jefferson and his contemporaries can be a specialist in everything. A SAM can be used to bring out what is likely to be important in any given context and, therefore, to order the consultation of specialist knowledge to the occasion. A highly disaggregated SAM, such as that reported in Pyatt, Roe, and associates (1977) for Sri Lanka, would, of course, be physically difficult to reproduce on one sheet of paper. Even if it were possible to do so, the result would be comprehensible only to a very limited group. The great advantage of a SAM is that one can select for any occasion those parts of it to be aggregated and those parts where detail is to be preserved.

LEARNING BY DOING

There are more detailed accounts of the SAMs used in this paper, which the reader can consult. But, while further reading may give the reader a fuller taste of what a SAM is all about, there is probably no substitute for learning by doing. A do-it-yourself SAM does not have to be on the scale of the SAMs described in this paper. National accounts, balance of payments, and financial data (such as the central bank's balance sheets and consolidated statistics for commercial banks) are often readily accessible and are sufficient to start the construction of a rudimentary SAM or even a series of SAMs for different years. The data, at first, may appear inconsistent or inadequate even to this task, or other questions may crop up. But once one starts asking questions about the data, one will begin to appreciate some of the reasons it is useful to adopt a SAM framework for the numbers.

Data of this kind can often be found in the appendices of World Bank reports. The example shown in table 1.19 is taken from a report on the Yemen Arab Republic. The SAM itself is only a first cut using eight tables in the appendix for basic information and two others to make very crude estimates of the allocation of indirect taxes (line 2b) and imports (line 4) to the two production sectors (columns 3a and 3b) (World Bank, 1979; tables 2.1, 2.3, 2.4, 3.1, 3.8, 5.1, 6.1, and 6.3 were used for the basic data, and 3.4 and 3.5 were used to make the crude estimates). Anyone with access to the original data could easily improve on the SAM. The point here is to show how even a limited exercise can throw up questions of substance and consistency for further investigation.

There are forty entries in the core of the SAM and fifteen totals (each appearing twice); of these, twenty-six, including the rough estimates, could be directly entered in the core of the SAM, and ten could be entered in the totals. The rest followed easily by simple addition or subtraction, making, it is true, some arbitrary assumptions about the location of small residuals; there was one independent check on the outcome.

A special feature of the table is the row/column 1b devoted to remittances. A large part of the Yemeni labor force was working in Saudi Arabia and the Gulf states at that time. In the year in question, gross remittances (there was also some reverse flow) were equal to nearly 50 percent of factor income. The proportions were changing extremely rapidly; the corresponding

Table 1.19. A Simple SAM for the Yemen Arab Republic, 1975–76
(in millions of rials)

			Expenditures														Total
			Current Accounts							Capital Accounts					Financial Accounts			
			1a	1b	2a	2b	3a	3b	4	5	6a	6b	7a	7b	8	9	10	11
Receipts	Current Accounts	1a Factor Income					4220	508	100									4828
		1b Remittances							2363									2363
		2a Private Sector	4789	2057														6846
		2b Public Sector	39		72		338	115										564
		3a Production (consumption)			4900	681			293									5874
		3b Production (capital)								814	262	94						1170
		4 Rest of World		306			1316	547										2169
	Capital Accounts	5 Private Sector			1874								-11	121		178		2162
		6a Public Sector(budget)				-117								15			609	507
		6b Public Sector (other)													9	-15	103	97
		7a Rest of World (BOP)							-587						1288			701
		7b Rest of World (other)													-45	181		136
	Financial Accounts	8 Central Bank								886	258					108		1252
		9 Commercial Banks								462	-13	3						452
		10 Foreign Borrowing															712	712
		Total	4828	2363	6846	564	5874	1170	2169	2162	507	97	701	136	1252	452	712	

Note: BOP signifies balance of payments.

figure in the previous year was less than 25 percent and in the following year over 75 percent. The response of the private sector to this rapid increase in resources was to save more than 25 percent (column 2a). Of these savings, less than half was invested in physical assets; the rest, plus a substantial amount of borrowing, was retained in the form of currency and deposits with commercial banks (column 5). At the same time, the government was borrowing abroad, more than enough to finance its investment. (It, too, accumulated funds in the central bank, row 8, column 6a.)

Two other features of the SAM are the consequence of the form in which the data were available. The public sector capital account has been split into budgetary and "other" transactions (rows/columns 6a and 6b). Government expenditure (investment plus consumption) in the national accounts exceeded expenditure in the budget. Similarly, official loans or grants in the balance of payments exceeded borrowing recorded in the government budget. There were evidently "government transactions" outside the budget, a large part of which must have been due to investment in public enterprises. The division is intended to draw attention to this point; there is some gratification to be had from the fact that the adjustments required to balance the line and column were trivial.

Similarly, there are two subdivisions of the rest of the world capital account. One is for the official balance of payments. Again, however, there were additional transactions, as is evident from the increase in foreign assets (row 7b) over the officially recorded reserves in the central bank (row 7a). This increase has been balanced by a corresponding inflow of capital, here allocated mainly to the private sector. One residual in the table is the intersection of row 8 and column 9. This represents an increase in deposits of the commercial banks with the central bank. Obviously, there should be little difficulty in checking this figure, but our purpose here has simply been to present what can be done with a particular set of information rather than going beyond it.

The time invested was not large, about half a day of uninterrupted time. (The compiler, moreover, had no previous familiarity with the country concerned.) Yet this was sufficient for the preparation of SAMs for six successive years. It seems a small price to pay for an articulated set of accounts which reveals, at least in order of magnitude, the salient features of the economy. It is arguable that six successive matrices of this kind give a better appreciation of change—in this case kaleidoscopic change—than do individual tables of the traditional kind. If this final example strikes a mundane note on which to finish, that may not be inappropriate. The SAM approach is a flexible tool which can be deployed with varying degrees of sophistication and for a variety of purposes, once an initial investment has been made to learn how. Although economists have long since understood that their analyses can each be set within a framework of accounts, this aspect has not usually been developed. The general point is that an economist who understands SAMs will probably be better equipped to tackle a variety of problems than one who does not.

2

Social Accounting Matrices for Development Planning

Graham Pyatt and Jeffery I. Round

It is well known that accounts for transactions within an economy can be presented in matrix as well as double entry format. Such a matrix is known as a social accounting matrix (SAM) and must be square.[1] Within it each row records the details of receipts by each particular account while the columns (which follow the same ordering as the rows) record the corresponding expenditures. Thus the entry in row i, column j, represents receipts by account i from account j or, alternatively, expenditures by account j that are paid to account i. Within such a general schema, SAMs can take a wide variety of forms, depending on how the constituent accounts are defined. A particular and most important variant is provided by the United Nations System of National Accounts (SNA), which has set down guidelines for deriving national income statistics as part of a more comprehensive social accounting matrix approach (United Nations Statistical Office, 1968). It is noteworthy, however, that only a small part of the text of the SNA is directed toward the specific needs of the developing countries, and even then the discussion is downgraded to "suggestions" rather than "guidelines" for implementation. A full implementation of the SNA has frequently been questioned as a statistical priority, as has the need for a SAM approach to macroeconomic information systems. Our view is that the underlying philosophy of the SNA and the SAM approach is thoroughly appropriate to statistical systems for developing countries, but that some flexibility and a less mechanistic approach are needed for its actual implementation. In particular, we consider detailed disaggregation of factor and household accounts—implying, for example, separate accounts for different types of labor and for different types of household—as a priority. This position is developed in the course of this paper. Meanwhile, there are not many examples in which the SAM approach has been applied to developing countries, and our main purpose here is to outline and compare the results of three studies with which we have been associated. These have led to SAMs for Iran in 1970, for Sri Lanka, also in 1970, and for Swaziland in 1971–72, all of which attempt disaggregation of households or factors in one form or another. (References to sources and methods used in these studies are provided as part of the discussion of each.) Tables 2.1, 2.2, and 2.4 give a preliminary impression of the results that these studies have yielded. Further detail of each of the studies is provided in the third, fourth, and fifth sections of this paper, where some of the practical difficulties encountered in our work are described.

Before coming to these studies, we discuss in the next section some of the reasons for undertaking this work. This is necessary for a number of reasons. One is the contention that the need for data systems derives from concern for quantitative advice on policy and that the characteristics of such systems feed back onto the nature of advice that can be offered. Such considerations explain why our studies depart from SNA recommendations in some respects. Specifically, the motivation of our work has been the need for an information system to advise on the issues of employment opportunities and income distribution, which have challenged the conventional emphasis in macroeconomics on growth alone. This need has been clearly iden-

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1. Nonsquare formats can be defined, but these are always derived, conceptually at least, from a square matrix, which is the basic format.

tified by the International Labour Office, World Employment Programme (ILO WEP), and implies the view that economic growth is inadequate as a policy objective unless its content, in terms of the living standards of different groups within society, is spelled out (International Labour Office, 1976). Acceptance of this position implies that conventional data systems which derive from a preoccupation with aggregate growth or average living standards must also be judged inadequate. Accordingly, we greatly regret the separation of the UN SNA from the System of Social and Demographic Statistics (United Nations Statistical Office, 1975) and have made a start in our work toward the integration of the two. Thus in a narrow sense the SNA is inadequate for our purpose.[2] This point, however, is subsidiary to the fact that developments or modifications of the system, such as we have explored, are greatly helped by the underlying philosophy, that is, by the SAM approach. If the SNA is interpreted as having championed this approach, rather than in its specific detail, then we would see it as having a great deal to offer developing countries, which they may ill afford to be without. Meanwhile our three case studies illustrate the feasibility of making progress in this direction.

BACKGROUND TO THE STUDIES

The historical origins of the SNA, going back 300 years, are set out briefly by Stone in his foreword to Pyatt, Roe, and associates (1977). Our discussion can start from a more recent event, namely, the inception in 1960 of work on the Cambridge Growth Project, which was initiated by Stone in association with Brown. This work produced the first SAM,[3] as we now know it, as the information system counterpart of early versions of the Cambridge growth model (see Cambridge University, Department of Applied Economics, 1962–74 and 1975). At this time the structure of the welfare state in the United Kingdom was well established, so that questions of employment opportunities and care of the needy were not pressing. The issues that caused most concern were those of economic growth, or rather a comparative lack of it. The focus of the work was therefore on industrial structure. To carry it through called for various developments on standard input-output analysis so that contributions were forthcoming, such as the RAS method of updating technology matrices and the use of "make matrices" to supplement commodity-by-industry specifications of technology.[4] The latter especially is now firmly established in the SNA recommendations.

It is important to emphasize this link between policy, data, and models because it is essential and permeates our own work. In the SNA the link between data and models is fully explicit, and both aspects build on the earlier Cambridge work. Unfortunately, it is in the nature of affairs that the policy applications of the SNA have to be taken largely as read. Much of the complication of the revised SNA seems hardly worthwhile if the purpose is simply to get better estimates of national income. At least some criticisms of it might be muted if it is realized that the purpose is to describe an economy in detail with a view to changes, or to make sure it remains on course. In this view the heart of the SNA is the model that the data serve to calibrate, in much the same way that the economics of Keynes is the rationale of conventional national accounts.[5]

2. It is noteworthy, however, that the draft report "Complementary Systems of Statistics of the Distribution of Income, Consumption, and Accumulation," adopted by the UN Statistical Commission in 1972, proposes ways of integrating household income distribution data and the SNA.

3. We are advised that there are antecedents from work in Norway and the Netherlands dating back to the 1930s and 1940s.

4. See Cambridge University, Department of Applied Economics (1962–74), vols. 1 and 3, for early references on these subjects. The RAS method was subsequently developed by Bacharach (1970). The project has pioneered a number of other contributions. Those cited, however, are the ones that have become most firmly established in statistical—as opposed to modeling—work.

5. The economics of Karl Marx leads to the net material product concept, as opposed to national income.

The links between policy, models, and data in our own work explain its special characteristics. The ILO WEP sent a comprehensive employment strategy mission to Colombia in 1970, under the leadership of Seers. The report of this mission (International Labour Office, 1970) raised the question of whether its recommendation and those of other such missions could be set in a comprehensive consistency framework.[6] The next WEP mission—this time to Sri Lanka and again with Seers as its leader—provided an interesting opportunity to pursue the issues for two reasons. One was the fact that Seers has been a pioneer in this field for many years and his national accounts for Zambia, for example, are a fascinating and unconventional attempt to address the data requirements of a developing country and to reconcile them with what is possible (see Frank, 1967, for a discussion of Seers's approach). From his subsequent writings (Seers, 1975), it may be fair to classify Seers as a critic, if not an opponent, of the SNA. His unconventional system for Zambia, however, can in fact be rearranged to be a more or less conventional SAM, while his criticisms of the SNA can all be embraced by it in its SAM incarnation.

The second factor to make the choice of Sri Lanka propitious for the issues under discussion was that a considerable amount of time and energy had been spent in deriving a credible series of national accounts, as part of an earlier planning project by the UN Development Programme (UNDP). These were complemented by an input-output table estimated by Narapalasingam, who subsequently used these data to build a planning model of Sri Lanka along the lines of the Cambridge growth model (see Narapalasingam, 1970). A particular feature of this work involved experimentation with the effects of income redistribution. As such it was a pioneering effort. The case study of Sri Lanka discussed in the fourth section of this paper was undertaken as part of WEP research to resolve some of the issues that this earlier mission had raised. In the interim, however, there was another WEP country mission, to Iran.

The respective economic circumstances of Sri Lanka and Iran imply that the issues of growth, employment, poverty, and income distribution arise in quite different settings. In Iran a crucial question concerned the extent to which policies for growth might need to be modified in order to do more for the poor, especially in rural areas. The modeling of income distribution questions was therefore important, and a data system that embraced them was needed accordingly. Narapalasingam had been able to avoid this need because his model of Sri Lanka looked only at how a change in income distribution influenced consumer demand, and hence the structure of production. He did not consider how production structure influenced factor payments and hence income distribution. In this sense his model was incomplete. In the case of Iran, both directions of causality were thought to be crucial. The model and data system were therefore designed to capture them both, otherwise building on earlier work in Sri Lanka.[7]

The need to introduce income distribution into models and social accounts has meant going beyond the realm of the SNA into the province of the UN System of Social and Demographic Statistics (SSDS). This has raised a number of questions, some of which are touched on in what follows. Meanwhile we have already mentioned our regret that this development of economic and social statistics should be separate from the SNA. Our work indicates that it is relatively straightforward to integrate aspects of both systems at the conceptual level, which is perhaps not surprising since Stone is the prime architect of the SSDS as well as the SNA.[8] This facility is illustrated with respect to income distribution by the case studies discussed in the next

6. One early response to this question has been a paper by Thorbecke and Sengupta (1972). Subsequently, Thorbecke has set out his views as part of the evaluation of the first five WEP comprehensive employment strategy missions. See International Labour Office (1973b).

7. Apart from the Narapalasingam study some modeling work was undertaken as part of the mission in Sri Lanka. Some of this is reported in International Labour Office (1971), vol. 2, technical appendix 4.

8. Stone's early thoughts on what eventually became the SSDS were presented as the Radcliffe lectures at Warwick University in 1973.

section. In other areas, such as housing, nutrition, education, and wealth, we have no empirical results as yet. But much thought has been given to the issues, and a preliminary report is available (Pyatt and Thorbecke, 1976; see also United Nations Statistical Office, 1972). Essentially our view is that the integration must go ahead if the data system is to serve the current policy debates on these questions. Sen (1973) has made reference to the problems for economists of abandoning the welfare principles of Pareto and incorporating income distribution questions into their thinking. But there is no intellectual problem in integrating the income distribution component of the SSDS into the SNA. Our experience is that the SAM framework is an invaluable aid through the empirical problems of doing so. It is also our experience that the end product is widely perceived to be relevant in a way that the standard SNA is not. Indeed our Swaziland case study derives directly from interest among individuals of the Overseas Development Ministry, London, in the replicability of the Sri Lanka study.

THE IRAN CASE STUDY

The case study of Iran resulted in the smallest and most confused of the SAMs presented here—some learning by doing has been involved through successive studies. The basic framework of accounts and estimates for 1970 are given in table 2.1, which is extracted from the original source (Pyatt and others, 1972). The table resembles a conventional input-output transactions matrix; the first twelve rows and columns relate to the incomings and outgoings of a set of production activities. The remaining rows and columns record receipts and expenditures for other accounts in the system (à la SNA) and show relationships between domestic and foreign institutions, as well as relationships between these institutions and production activities.

In the usual way, the first twelve columns show the outgoings of twelve domestic activities. These consist of raw material purchases, payments to institutions of value added, imports of raw materials, and indirect taxes on inputs. The revenue of production activities derives from the intermediate sale of commodities, plus institutions' current expenditure, exports, and sales of capital goods. Four institutions are distinguished: three types of households and government. Value added is shown as a direct accrual to these institutions, so that company profit is included as income distributed to households and government. This feature is important for comparison with other case studies. Apart from value added payments arising out of production activities, incomes are also created by households in purchasing domestic services and by government through wage and salary payments for public administration. Gross national product at market prices—771.2 billion rials, as shown in cell (18, 26)—comprises these elements of value added, together with net income from abroad, and indirect taxes; this is shown in column 26, distributed over the four institutions, as total incomings to their current accounts. Outgoing values from these accounts appear in columns 14 through 17. Expenditures of the institutions on domestic commodity outputs and on imports, and on payments of indirect and direct taxes are shown.[9] Separate company accounts, however, are not shown, and company profits are recorded as an ultimate receipt by households and governments. It follows that households and governments are deemed to make investment expenditures on behalf of the companies they own.

A feature of this framework is the distinction drawn between three categories of households. Rural households consist of all people in the rural areas, which in turn are defined in the population census as places with less than 5,000 inhabitants. The urban population is divided into two groups: households in the top 30 percent of the urban expenditure distribution are

9. For the government, direct taxes are a negative outgoing (a receipt of taxes from households) since they are a transfer between institutions.

Table 2.1. A Social Accounting Matrix for Iran, 1970

(in billions of rials)

Receipts				Expenditures																						
				1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26
				Production Activities													Current Accounts									Capital Accounts			
																	Households												
				Livestock	Other Agriculture	Mining	Resident Oil	Traditional Manufacturing	Modern Manufacturing	Utilities	Transport and Communication	Non-domestic Services	Trade	Construction	Ownership of Dwellings	∑ 1 to 12	Rural	Urban I	Urban II	Government	∑ 14 to 17	Rest of World	Indirect Taxes	∑ 13 + 18 + 19 + 20	Direct Taxes	Households	Government	Rest of World	∑ 21 to 25
	1	Production Activities	Livestock	4.4	7.8	0	0	6.2	0	0	0	0	0	0	0	18.4	21.7	19.3	28.0	4.4	73.4	1.2	0	93.0	0	0	0	0	93.0
	2		Other Agriculture	3.0	12.0	0	0	32.9	0	0	0	0	0	0.3	0	48.2	41.1	15.2	19.6	0	75.9	5.9	0	130.0	0	0	0	0	130.0
	3		Mining	0	0	0	0	0.6	1.6	0	0	0	0	1.0	0	3.2	1.8	0.4	0.5	0	2.7	1.1	0	7.0	0	0	0	0	7.0
	4		Resident Oil	0	2.0	0	21.4	12.9	2.4	0.3	8.8	0.1	0.2	3.0	0	51.2	3.9	3.4	8.0	3.2	18.5	0.3	0	70.0	0	0	0	0	70.0
	5		Traditional Manufacturing	4.0	1.7	0	0.6	33.3	0.8	0	0.1	0.2	0.2	7.4	0	48.3	46.2	41.5	61.1	24.3	173.1	6.2	0	227.6	0	0.1	0.1	0	227.8
	6		Modern Manufacturing	0	0.8	0.4	0.1	2.1	0.5	0	0.1	0	0	8.4	0	12.5	6.4	7.4	22.6	7.2	43.6	1.0	0	57.1	0	21.4	12.5	0	91.0
	7		Utilities	0	0.3	0	0	5.5	0.7	0	0.1	0.1	2.5	0	0	9.1	0.4	2.7	4.0	2.8	9.9	0	0	19.0	0	0	0	0	19.0
	8		Transport and Communication	5.1	2.6	0.3	0.1	16.0	0.4	0	0.2	0	4.0	12.3	0	41.1	2.3	2.8	4.0	4.1	13.2	1.0	0	55.3	0	1.2	1.5	0	58.0
	9		Non-domestic Services	2.8	2.0	0	0	19.0	7.9	2.6	3.0	4.2	5.8	3.0	0	50.3	1.5	2.7	6.5	4.0	14.7	0	0	65.0	0	0	0	0	65.0
	10		Trade	7.0	7.3	1.0	0.1	8.7	0.1	0	3.6	0.1	8.6	8.0	0	44.6	3.5	10.0	22.6	0	36.1	4.3	0	85.0	0	1.9	2.1	0	89.0
	11		Construction	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	38.3	66.6	0	104.9
	12		Ownership of Dwellings	0	0	0	0	0	0	0	0	0	0	0	0	0	8.7	5.9	24.3	0	38.8	0	0	38.8	0	0	0	0	38.8
	13		∑ 1 to 12	26.3	36.4	1.7	22.3	137.2	14.5	3.0	16.0	4.8	21.3	43.4	0	326.9	137.5	111.3	201.1	50.0	499.9	21.0	0	847.8	0	62.9	82.8	0	993.5
	14	Current Accounts	Households: Rural	53.7	59.5	0.8	0	6.6	0	0.5	3.5	5.0	8.0	3.0	5.7	146.3	1.0	0	2.0	7.2	10.2	0	0	156.5	0	0	0	0	456.5
	15		Households: Urban I	4.6	6.0	0.2	5.0	15.2	6.3	4.5	9.0	11.5	17.0	8.0	2.0	89.3	0	1.0	5.0	36.0	42.0	0	0	131.3	0	0	0	0	131.3
	16		Households: Urban II	7.6	25.5	4.0	21.6	47.5	23.7	8.2	20.7	42.5	38.9	28.1	31.1	299.4	0	0	1.0	42.6	43.6	-59.7	53.0	336.3	0	0	0	0	336.3
	17		Government	0.5	0.5	0.2	17.6	1.2	1.0	2.8	2.0	0	0	0	0	25.8	0	0	0	0	0	0	121.3	147.1	0	0	0	0	147.1
	18		∑ 14 to 17	66.4	91.5	5.2	44.2	70.5	31.0	16.0	35.2	59.0	63.9	39.1	38.8	560.8	1.0	1.0	8.0	85.8	95.8	-59.7	174.3	771.2	0	0	0	0	771.2
	19		Rest of World	0.3	1.7	0.1	3.5	16.9	39.8	0	1.0	1.0	1.1	15.4	0	80.8	3.2	2.1	10.1	1.0	16.4	0	0	97.2	0	14.5	15.1	0	126.8
	20		Indirect Taxes	0	0.4	0	0	3.2	5.7	0	5.8	0.2	2.7	7.0	0	25.0	5.5	3.4	6.5	4.4	19.8	129.5	0	174.3	0	0	0	0	174.3
	21		∑ 13 + 18 + 19 + 20	93.0	130.0	7.0	70.0	227.8	91.0	19.0	58.0	65.0	89.0	104.9	38.8	993.5	147.2	117.8	225.7	141.2	631.9	90.8	174.3	1,890.5	0	77.4	97.9	0	2,065.8
	22		Direct Taxes	0	0	0	0	0	0	0	0	0	0	0	0	0	1.5	3.0	26.6	-31.1	0	0	0	0	0	0	0	0	0
	23	Capital Accounts	Households	0	0	0	0	0	0	0	0	0	0	0	0	0	7.8	10.5	84.0	0	102.3	0	0	102.3	0	0	0	16.7	119.0
	24		Government	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	37.0	37.0	0	0	37.0	0	41.6	0	19.3	97.0
	25		Rest of World	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	36.0	0	36.0	0	0	0	0	36.0
	26		∑ 21 to 25	93.0	130.0	7.0	70.0	227.8	91.0	19.0	58.0	65.0	89.0	104.9	38.8	993.5	156.5	131.3	336.3	147.1	771.2	126.8	174.3	2,065.8	0	119.0	97.9	36.0	2,318.7

classified as Urban II, and those remaining, as Urban I. In other respects the SAM is fairly aggregative; for instance, only twelve production sectors are distinguished. However, these sectors are chosen on a wider set of criteria than simply homogeneity or similarity of products. The level of technology (modern or traditional manufacturing) and ownership (resident or nonresident oil sectors) are also taken into account.[10]

The payment of factor income directly into institution accounts raised several difficulties. Although data on aggregate value added by activity were available from published sources, the allocation of these sums directly to the three household types and to government had to be subjectively estimated within constraints set by the classifications themselves (for example, rural wages had to accrue predominantly to rural households) and by controls on total incomes from all sources which were known or could be estimated.

On the expenditure side of the institution accounts, separate commodity expenditures are shown for three types of household and for government. The allocation of private consumption between Rural, Urban I, and Urban II households was made on the basis of a family budget survey for 1965 carried out by the central bank. An important point to note is that after allowing for indirect and direct taxes and for imports, the difference between household expenditures and gross household incomes yields household savings. Government savings are similarly derived.

The capital accounts are highly aggregative. The three household accounts are consolidated, so that three savings figures are shown as incomings to a single capital account. In consequence, the flow of funds, shown in the three penultimate rows and columns of the SAM (23 to 25), has a very simple structure. The balance of payments deficit (36.0 billion rials in 1970) is financed by capital transfers to households (16.7 billion rials) and to government (19.3 billion rials). Domestic savings are supplemented by these capital transfers from abroad to finance domestic investment. Financing of the private and public components of domestic investment is facilitated by a capital transfer from households to government of 41.6 billion rials.

The resulting SAM for Iran is a very simple design. It is worth noting, however, that it was produced in a matter of days, rather than weeks, by two people on the basis of (a) considerable relevant knowledge of a generalized kind; (b) reliance on published sources almost entirely; and (c) work in association with others.[11] The feasibility of the exercise depended crucially on the rigors imposed by the accounting constraints in a SAM, since only in this way could the better data be fully exploited to support the weaker and more doubtful figures. Of course, better data would have been used if available. In this sense table 2.1 presents the best that could be obtained for Iran in 1970 without new primary information. Its quality owes much to the discipline of working in the context of a SAM, and it was judged adequate to support a modeling exercise for Iran which considered the two-way links between production structure and income distribution referred to earlier. Aspects of the model used in conjunction with table 2.1 and some of its analytic properties are discussed in the original source and elsewhere (see Blitzer, Clark, and Taylor, 1975, and chapter 10). These need not concern us here beyond noting that the "single entry" accounting that characterizes a SAM requires that the treatment of items as a receipt be consistent with their treatment as an expenditure. In a model context this means that the effects of income distribution on production must be consistent with the effects of production on income distribution if the results of the model are to be expressed as a new SAM in the format of table 2.1.

10. The nonresident oil sector is excluded from the production activities distinguished in the table. Its contribution to national product is treated as an indirect tax receipt on exports, that is, in row 20, column 19.

11. The prime calibrators of the Iran matrix were Julian Bharier and Robert Mabro. Other members of the team were Robert Lindley, Graham Pyatt, and Yves Sabolo. The team report (Pyatt and others, 1972) discusses sources and methods in detail. That such an approach was worth trying emerged from a preliminary reconnaissance of the issues with Abdul Meguid, who had previously constructed a more conventional input-output model not available to us.

Table 2.2. A Social Accounting Matrix for Sri Lanka, 1970

(in millions of rupees)

Receipts					Expenditures 1 Factors of Production: Labor: Urban	Labor: Rural	Labor: Estate	Other: Housing	Other: Other Private	Other: Public	2 Institutions: Households: Urban	Households: Rural	Households: Estate	3 Institutions: Private Corporations	State Corporations	4 Government	5 Combined Capital Account	6 Production Activities: Tea	Rubber	Coconuts	Rice	Other Agriculture	Food and Drink	Other Industry	Construction	Trade and Transport	Private Services	Government Services	7 Rest of the World	Total
	1	Factors of Production	Labor	Urban														5	5	9	25	75	46	182	81	414	276	555		1673
				Rural														43	158	67	706	247	68	259	159	487	276	715		3185
				Estate														526	133	11		5	4	2	5	8	12	5		711
			Other	Housing																							633		633
				Other Private														13	24	442	282	1259	184	604	742	1424	123		-113	4984
				Public																		-11	12	109	-8	-1	73			174
	2	Institutions	Current Accounts	Households: Urban	1673			137	662					434		91													6	3003
				Households: Rural		3185		330	3026					203		151													6	6901
				Households: Estate			711	31	30					7		6													6	791
	3			Private Corporations				135	1266							57													-15	1443
				State Corporations						174						237														411
	4			Government							368	194	4	272	104		313	33	4	14	10	19	288	216	66	130	76	29	94	2234
	5			Combined Capital Account							519	807	11	527	307	43													425	2639
	6	Production Activities		Tea							14	55	7				-55										2	2	839	864
				Rubber													25							8					341	374
				Coconuts							54	208	27				29						239	8			6	4	2	577
				Rice							158	760	102				105				1082			2			15	18		2242
				Other Agriculture							357	980	139					11	1		2	95	63	34	3		39	16	106	1846
				Food and Drink							253	541	82				37				9	11	24	188			29	8	94	1276
				Other Industry							258	621	69				72	97	24	9	35	69	49	554	417	172	37	66	241	2790
				Construction													1595							1		7	50	92		1745
				Trade and Transport							410	1074	122				154	50	10	8	44	23	95	249	206	96	42	59	203	2845
				Private Services							405	920	85					11	3	7	15	1		4	9	38	55	37	287	1877
				Government Services												1649														1649
	7	Rest of the World									207	741	143				364	75	12	10	32	53	204	370	65	70	133	43		2522
		Total			1673	3185	711	633	4984	174	3003	6901	791	1443	411	2234	2639	864	374	577	2242	1846	1276	2790	1745	2845	1877	1649	2522	

Note: This SAM is an early version of the results published in Pyatt, Roe, and associates (1977).

THE SRI LANKA CASE STUDY

The experience of the Iran study indicated that data requirements, and not modeling, were the initial obstacle to progress with planning techniques that embrace employment and distribution questions. Accordingly, our subsequent efforts have focused in this direction.

The SAM for Sri Lanka shown in table 2.2 indicates some of the innovations achieved in this study. First, it is immediately apparent that there is a new set of accounts, not included in the Iran matrix, relating to factors of production. Second, the accounts have been rearranged so that, for example, the factor accounts lead in the rows and columns. A third difference, not readily apparent from the table, relates to the compilation of accounts. Each of these will be discussed in turn below. But first it needs to be emphasized that the study in Sri Lanka was a much larger exercise than that in Iran. Hence table 2.2 is only a summary of results for the latter, while table 2.1 is more exhaustive of the output of the Iran study. (The Iran study also involved an estimated SAM for 1972 and detailed analysis of labor statistics, as well as the modeling work previously referred to.) This difference in order of magnitude is discussed later. Meanwhile, further comments on each of the three points referred to is in order.

The factor accounts in table 2.2 are in addition to the production and institution accounts shown hitherto. Their main purpose is easily stated: it is to receive factor payments, from both domestic production activities and from the rest of the world. These in turn are mapped into the household and other institutions accounts, thereby recording the factor income component of the gross income receipts of institutions. Nonfactor incomes, such as current transfers between institutions and transfers from the rest of the world, augment factor incomes to yield gross incomes of institutions.

The distinction between factor and institutions accounts serves two important purposes. In the first place, a clear distinction can be made between factor income and nonfactor income that arises from the redistributive process within the economy. These redistributive forces are likely to be a centerpiece of policy and planning strategy, and therefore need to be captured in this way. In the second place, the classification of factors can be entirely divorced from institutional classifications. The latter can be determined by a range of socioeconomic considerations; for households these may include location and socioethnic factors as well as income level; for other institutions "ownership" or "purpose" might be appropriate. The Sri Lankan institutions shown in table 2.2 are in fact an aggregation of more detailed accounts. Thus in the full study each of the three household classes is further subdivided into six income groups, and the government accounts are disaggregated into ten categories for income receipts and nineteen heads (or accounts) for expenditure. Similarly, in the full study the factors are classified according to the kinds of economic agents employed by production activities and thereby receiving factor returns. In table 2.2 only six factors are shown, but this is a more aggregated version of the classification that was in fact utilized. For example, three kinds of labor are distinguished in table 2.2 (urban, rural, and estate labor), although a disaggregation of labor income by nine occupational groups was also achieved. Three nonlabor factor accounts are distinguished: the factor "housing" simply receives imputed rents on owner-occupied housing, while all other returns are divided between private and public ownership of capital. Each of the six factor accounts has a row sum which accumulates all domestically generated factor incomes, together with net factor income from abroad which is shown to accrue to the factor "other private capital." The total of all factoral row sums conveniently shows gross national income (GNI) at factor cost (Rs. 11,360 million in 1970), while the arrangement of the table puts the individual factor accounts first, so that the decomposition of GNI into its factoral distribution is also given prominence.

The arrangement of accounts in the table is a conscious attempt to capture the circular flow of income—from income generated by activities to factors; from factors to the institutions that provide factor services; and from the expenditure of income by institutions to demand on activities, and hence income generation. It is also an attempt to give prominence within the SAM to the things that matter most. For us, these are employment and income distribution questions set in a framework of the level and structure of activity. Thus our accounts start with factor incomes and move to the incomes of households and other institutions in the economy. These, not the structure of production, are our primary concerns.

A third innovation in our Sri Lanka study concerns the practical procedures for compilation of the SAM. In many ways the data base for Sri Lanka differed from the situation encountered for Iran, although the basic notion that the SAM imposes a discipline for data consistency was sustained. Some details of the methods used to construct the Sri Lanka SAM may be of particular interest, since these involve several novel features for social accounting in developing countries. (The most recent national accounts for Malaysia make use of the basic approach described herein; see Malaysia, Department of Statistics, 1975.)

In close correspondence with SNA guidelines, our Sri Lanka SAM is built up from data on the supply and disposition of commodities, traced through the rows and columns of the production accounts. Using a 1965 input-output matrix to depict the approximate structure of production, the commodity balances for Sri Lanka in 1970 were achieved in a systematic, yet nontrivial way. The complicating factors were not only incomplete or uncertain data, but also multiple estimates of some elements. We were faced, for example, with two (or more) estimates of most value added components—one from Ceylon, Department of Census and Statistics (1973), the other from Ceylon, Central Bank (1971). Furthermore, available figures on gross outputs were recognized to be subject to a substantial degree of error. The final use components of commodity requirements (household and government expenditures, fixed capital formation and exports) were more reliable, except for the vector of changes in commodity stocks, and this was used as a residual in the commodity balance calculation.

The derivation of a set of commodity balances was achieved in four stages. The first set of commodities considered were those which make no sales whatsoever on intermediate account: in Sri Lanka these sectors were tea, bread, other bakery products, and tobacco manufacturing. These were investigated first because final sales must also be equal to gross sales and gross output for these sectors. On the input side, with gross outputs thus ascertained, the input technology (determined principally by the 1965 input-output matrix) gives some value added estimates as well as estimates of intermediate input requirements. Alongside these four sectors were those known to have few sectors to which intermediate sales were made: rubber and fishing, for example. The second group of sectors to be investigated were those belonging to what we term "process loops." The coconut group is one example. There is a linkage between the three sectors: coconut; dessicated coconut and copra; and coconut fiber and yarn. For these sectors intermediate sales and purchases exist but are largely confined within the process loop. These intermediate sales can easily be estimated from the final demand estimates, given some knowledge of the nature of the interaction between various sectors within a loop. The gross output of the sector of coconut fiber and yarn, for example, can be set equal to its final demand entry since it has almost no intermediate sales. Working through the backward linkages in the loop, we found it possible to iterate to feasible (though, admittedly, not unique) solutions for the gross output, value added, and intermediate transactions of each of the sectors involved.[12]

The third stage of the commodity balance procedure was to investigate the remaining sectors.

12. Sectors belonging to a process loop form a natural aggregate sector, of course, but it is convenient on occasions to distinguish between them, as when, for example, the outputs serve different export markets as well as further stages in the product process.

Clearly some intermediate sales had been determined from the first two stages, which limited the problem. This knowledge allowed sectors to be ordered so that those with relatively few undetermined intermediate transactions would be considered first. The fourth and final stage was to review the feasibility of the initial estimates of value added, gross output, and intermediate transactions. Inevitably this stage revealed some anomalies, and it proved necessary to repeat the first three stages, in an iterative manner, eventually converging to an overall feasible matrix that was not unacceptable on the basis of the facts.[13]

The balanced production accounts determined a consistent set of value added estimates for the forty-eight production activities in the study. The way in which they were derived took full cognizance of the various prior estimates of value added. Changes were made to the firmest of these estimates if there occurred even firmer estimates of commodity supplies and dispositions not consistent with the value added data. It is perhaps worth noting that in this regard our experience is at variance with the contention that estimates and "guesstimates" should not be placed side by side (Barkay, 1975). The SAM consistency framework forces a confrontation between various data sources, which can never reasonably be expected to be of equal quality. Reconciliation of data of varying qualities is therefore unavoidable. Moreover, unless data are literally useless they can add something to SAM calibration. There is no sensible alternative to setting all sources (with prior judgment regarding their relative reliability) alongside one another and executing an "optimum" balance. One consequence of doing so is that the SAM approach teaches a great deal about statistical priorities for new information.

After the production accounts, the next step was to obtain a balance of all the institution and factor accounts. From several standpoints the government accounts and the accounts governing transactions with the rest of the world were the firmest. They therefore formed a basis for this part of the matrix. We were particularly fortunate in being able to utilize a socioeconomic survey, or SES (Ceylon, Department of Census and Statistics, 1971), which enabled us to obtain disaggregations of household expenditures according to urban, rural, and estate subdivisions. Not surprisingly, SES estimates of household (and factor) incomes implied negative savings in all household groups, confirming our expectations of underrecording of incomes in household surveys. In this situation, assumptions about the economywide capital/output ratio, the relationship between business investment and retained profits, and the implicit constraints of the SAM were all utilized to obtain a feasible solution to the remaining cell entries, including revised estimates of household incomes and savings.

The complete table has eighty-seven rows and ninety-six columns, as shown in table 2.3, which gives listings of the detailed accounts in the full study. Justification for these and the full results are set out in Pyatt, Roe, and associates (1977), which attempts to record the man-year of work that went into the study.[14] It can be noted, however, that this man-year was in fact collapsed into a period of less than three months, with the team involved averaging some six people through this period.[15]

There are two further comments to be made on the Sri Lanka study. First, it will be recalled that the purpose of the exercise was not to build a model as such, but rather to push forward

13. In his foreword to Pyatt, Roe, and associates (1977), Stone has suggested that more formal techniques of data reconciliation may have advantages. He refers in particular to statistical techniques that iteratively balance the accounts subject to initial estimates and sets of constraints, both of which may be subject to uncertainty. This issue is the subject of continuing research in the Development Research Center, World Bank. Some initial results are given in Byron (1978).

14. The 87 × 96 matrix was estimated in full detail subject to one caveat. This caveat arises because estimates of current transfers between institutions could not be obtained at the level of detail of table 2.3 but only at the more aggregate level of table 2.2. Otherwise the 87 × 96 matrix was estimated in full. Thus at the full level of detail only the eighteen household current accounts are incomplete, but full accounts for three aggregate household types, and therefore for a 72 × 81 matrix, were obtained.

15. The team comprised S. Narapalasingam and Neil Karunaratne, respectively from the Ministry of Planning and Employment and the Industrial Development Board, Sri Lanka; Alan Brown and Robert Mabro from Oxford University; and Robert Lindley and Alan Roe, in addition to ourselves, from the University of Warwick.

Table 2.3. Summary of the Extent of Disaggregation of the Full Sri Lanka SAM

Aggregate Accounts as in Table 2		Number and Nature of Component Accounts Shown in the Rows	Number and Nature of Component Accounts Shown in the Columns
(1) Factors of Production		6 (three accounts for different employment statuses and three accounts for the factor of production, capital)*	6
(2) Firms	Current	3 (Private, Public Financial Institution, Other Public Companies)	3
(3) Households	Current	18 (Urban, Rural and Estate and within each of these, six income classes)	18
(4) Government	Current	10 (seven categories of tax, one account for current transfers, one account for Local Government and a summary account)	19 (eight accounts for expenditure on goods and services, nine accounts for transfer payments, one account for Local Government and one summary account)
(5) Consolidated Capital Account		1	1
(6) Production Activities		48	48
(7) Rest of World - Current		1	1
TOTAL		87	96

Note: Alternative factor accounts were also produced showing nine categories of skill as well as capital.

the possibilities for modeling by resolving some of the problems of data system design and availability. However, Pyatt, Roe, and associates (1977) include a number of empirical exercises using the data and showing its immediate relevance for policy issues. These exercises include a description of the economy with reference to income distribution; the output, income, and employment multipliers in the economy; an analysis of export incentives and of effective protection; and a study of the structure of household expenditure in Sri Lanka focusing on its sensitivity to the income distribution. These, then, are some of the products that can be obtained short of a full-scale model once data has been set up consistently in a SAM framework.

The second and final comment on Sri Lanka is that increasingly, as countries come to adopt the SNA (and hence the commodity balance approach), the preceding discussion of the way we were able to implement such an approach may be of interest. The methods that proved successful in Sri Lanka were nonetheless challenged by the subsequent study in Swaziland. Comment on these methods is reserved, therefore, until after the description of our work in Swaziland.

THE SWAZILAND CASE STUDY

Interest in the replicability of the Sri Lanka case study led to the formation of a group of similar size to spend six weeks in Swaziland and about the same time subsequently in an attempt to set the major economic statistics in a SAM context.[16] As in the Sri Lanka case, there was no initial intention to undertake modeling work immediately, and the focus was an endeavor to contribute directly to policy discussion on the basis of an understanding of the economy, for which the SAM exercise was to be the catalyst.

In several respects Swaziland offered the opposite of Sri Lanka in available data. Not least, the SAM framework which we intended to estimate, and which was broadly comparable with the Sri Lanka matrix in its dimensions, was not fully determined by available data. Although the details of achieving SAM estimates differed markedly between Sri Lanka and Swaziland, it is interesting to note that a common approach was sustained, and the discipline underlying the SAM was revealed to be of unquestionable value in deriving estimates.

Table 2.4 sets out aggregate accounts for Swaziland for the year 1971–72. These are aggregative in the sense that more detailed estimates were obtained corresponding to disaggregations of some of the accounts shown. Thus, although the nine factor accounts and the seventeen institution accounts of the study are shown in full detail, table 2.4 consolidates into one account each of the forty-four commodity and twenty-five production activity accounts that were distinguished. The distinction of activity accounts from accounts for the commodities that they produce is one of the main differences between the Swaziland and the Sri Lanka matrices. This distinction is, of course, very much in line with the SNA guidelines, and we found that it afforded a conceptual flexibility in the definition of activities and commodities which was also advantageous in the estimation of the matrix elements. Before considering the commodity/activity distinction and the determination of the commodity balances for Swaziland, we must mention several of the classifications embodied within the factor and institution accounts.

The nine factor accounts, distinguished in the first nine rows and columns of the matrix in table 2.4, are novel in several respects. It should first be understood that the organizational aspects of the supply of agricultural factor services within Swaziland are complex: part of the land is held by the Swazi nation, and the remainder is still owned by individuals—often non-Swazi—and is generally farmed according to modern agricultural technology. Within the Swazi

16. The group was financed by the Economic and Social Committee on Research (ESCOR) of the Overseas Development Ministry (ODM), London. It comprised Harry Fell and Stanley Webster, on secondment from the ODM; Graham Jones and Malcolm Walmsley from the Swaziland Department of Statistics, Ministry of Finance and Planning, Mbabane; and the same four Warwick colleagues who undertook the Sri Lanka study, plus Paul Stoneman, also from Warwick.

Table 2.4. A Social Accounting Matrix for Swaziland, 1971-72
(in millions of emalangeni)

		Expenditures																																			
		1									2						3		4			5											6		7	8	9	
		Factors of Production									Institutions																											
											Current Account																						Capital Accounts					
											Households								Corporations			Government																
											Traditional		I.T.F.		Urban							Customs Union																
No.	Receipts	Swazi Nation: Non-R.D.A.	Swazi Nation: R.D.A.	Individual Tenure Farms	Other Land and Natural Resources	Employee Compensation	Self Employment n.e.s.	Other Housing	Other Capital - Swazi	Other Capital - Non-Swazi	Not R.D.A.	R.D.A.	High Income	Low Income	High Income	Low Income	Non-Profit Bodies	Swazi National Council	Public	Private Small	Private Large	Direct	Indirect	Consolidated	Other Indirect Taxes	Direct Taxes	Other Government Revenue	Consolidated Revenue	Public Debt	Education	Health	Other Government	Fixed Capital Formation	Increase in Stocks	Commodities	Production Activities	Combined Rest of World Accounts	Totals
1	Factors of Production: Swazi Nation: Non-R.D.A.																																			9.26		9.26
	Swazi Nation: R.D.A.																																			0.93		0.93
	Individual Tenure Farms																																			1.15		1.15
	Other Land and Nat. Resources																																			0.56		0.56
	Employee Compensation												0.18		1.22																	4.81				32.80		39.01
	Self Employment n.e.s.																																			1.83		1.83
	Other Housing																																			3.91		3.91
	Other Capital - Swazi																																			9.67		9.67
	Other Capital - Non-Swazi																																			20.35		20.35
2	Institutions, Current Account, Households, Traditional: Not R.D.A.	9.26				2.19	0.39	0.01									0.06													0.03							0.36	12.30
	Traditional: R.D.A.		0.93			0.25	0.04																							0.02							0.04	1.28
	I.T.F.: High Income			1.12	0.22	4.33	0.12	0.57												0.15										0.02								6.53
	I.T.F.: Low Income					4.24	0.02	0.46									0.06													0.02								4.80
	Urban: High Income			0.03	0.08	20.04	1.20	2.27												0.95										0.25								24.82
	Urban: Low Income					7.96	0.06	0.70									0.06													0.05		0.02						8.85
3	Non-Profit Bodies																													0.05	0.13							0.18
	Swazi National Council				0.11																0.29											0.23						0.63
4	Corporations: Public								2.01																													2.01
	Private Small				0.07			-0.16	7.66	8.04										1.81	0.29																0.22	17.93
	Private Large				0.08			-0.21		12.31																			0.09								0.27	12.54
5	Government, Customs Union: Direct																																			0.18		0.18
	Indirect										←		2.84			→														0.06	0.03	0.08	0.52	0.07		2.60		6.20
	Consolidated																					0.18	6.20														2.14	8.52
	Other Indirect Taxes										←		0.17			→																				1.21		1.38
	Direct Taxes										←		1.89			→				0.94	2.99																	5.82
	Other Government Revenue							0.27			←		0.21			→					0.76											0.22				0.33		1.79
	Consolidated Revenue																							8.52	1.38	5.82	1.79		-0.62	-3.93	-1.46	-9.09						2.41
6	Combined Capital Account										←		7.84			→		0.63	1.05	12.26	1.85							2.41					-18.29	-2.69			-5.06	-
7	Commodities										←		44.23			→														2.94	1.30	3.65	17.77	2.62		63.25	67.39	203.15
8	Production Activities																																		148.03			148.03
9	Combined Rest of World Account																		0.96	1.82	6.36								0.53	0.49		0.08			56.12			65.36
	Totals	9.26	0.93	1.15	0.56	39.01	1.83	3.91	9.67	20.35	12.30	1.28	6.53	4.80	24.82	8.85	0.18	0.63	2.01	17.93	12.54	0.18	6.20	8.52	1.38	5.82	1.79	2.41	-	-	-	-	-	-	203.15	148.03	65.36	

nation land, rural development area (RDA) schemes are currently being introduced and represent a significant break from traditional methods.[17] To avoid an arbitrary division of the returns to land and labor of the self-employed in the agricultural sector, we defined a composite factor for each of these three types of land: Swazi nation (traditional), Swazi nation (RDA), and individual tenure farms. Labor receiving employee compensation is shown as a separate category, as is self-employment income from nonagricultural activities. It is also worth noting that in the Swazi context one individual may be supplying his services in the form of two factors in the course of a normal year. For example, he may be working on a rural homestead, thus accruing factor income of the first kind, and may also be receiving employee compensation for casual work in urban areas. More typical is the instance in which members of a rural homestead (household) will be supplying a variety of factor services in both rural and urban districts. In such situations the importance of distinguishing factors from institutions and carefully choosing the classifications for each of them is obvious. Finally, returns to other capital (that is, capital other than land) are distinguished as Swazi and non-Swazi controlled, a distinction which is of considerable importance in the policy context.

The first two institution accounts relate to two forms of traditional Swazi households: those outside and those within the RDAs. Each household receives the major part of its gross income from the factor income derived from its traditional agricultural activity, although typically this is supplemented by employee compensation and self-employment incomes. The main sources of the supplementation are employment on Swazi nation land, in small traders' establishments, and in rural education and health services. Note that teachers, for example, who teach in schools and live on Swazi nation land are included in this part of the rural sector. Households on individual tenure farms and in urban areas are further subdivided into high- and low-income groups according to whether their aggregate income is greater or less than E600 a year. (E is the standard reference for the currency unit, the emalangeni.) The remaining institutions are nonhousehold institutions. We attributed separate categories to nonprofit bodies (which receive transfer income from government expenditures on health and education) and the Swazi National Council (which essentially receives income in the form of rent and mineral royalties). Three corporate categories were distinguished, which allowed separate accounts for large and small corporations.

The merit of the distinction within a SAM between factors and institutions is more clearly seen in Swaziland than in our other studies. At the same time, flexibility is important since the distinction is most informative (and useful for modeling applications) when the classifications are chosen to reflect the particular structure and organization of each country. Accordingly, we are against stereotypes for the detailed classifications. The classifications appropriate for the Swazi economy are only approximately replicated in other developing countries. In particular, the Swazi nation is a unique organizational form, and while it is important to reflect this aspect in the national accounting system for Swaziland, there may be no analogue for other countries.

The data base was constructed from a variety of detailed sources. The national accounts statistics were a crucial input, but, unlike the Sri Lanka situation, there were relatively few instances in which multiple estimates were available for the major elements. For the most part, however, value added payments by production activities (in aggregate) were readily obtained. An important exception was the difficulty of making a distinction between RDA and non-RDA factors and households. Simply, the level of activity of RDAs was globally estimated to be 10 percent of other traditional agriculture, and this percentage was applied throughout the accounts in order to distinguish RDA from non-RDA classes. This was the most arbitrary of the assumptions made and would have been avoided had it not been considered important in demonstrating

17. For 1971–72 this distinction within Swazi nation land is not of great significance, but for monitoring progress within RDAs it is ultimately a distinction of considerable policy interest.

how a SAM could be designed to monitor the future progress of RDAs when independent data become available.

The derivation of the commodity balances differed substantially between Swaziland and Sri Lanka in several respects. Nonetheless, these balances still proved to be a useful starting point for the framework and probably provided some of the firmest estimates in the accounts as a whole. Without a previously derived input-output table, it was necessary to construct matrices showing the intermediate requirements of commodities by activities (absorption matrix) and the domestic supply of commodities by activities (make matrix) from the available evidence. This included detailed statistics of the commodity inputs and outputs of manufacturing sectors, together with much detail on commodity imports.[18] At the present stage of development, Swaziland has a very simple commodity output mix, so the buildup of an absorption matrix took the form of commencing with the structure based on imports, and then allocating the domestic supplies along its rows. The whole operation was tentative because total intermediate inputs, obtained by netting value added from gross outputs, provided a set of constraints. Since imports of consumer goods and capital goods were distinguishable, the only major problem was identifying the stock elements of each purchase. As in the Sri Lanka case study, the vector of increases in stocks tended to be derived as a residual of unallocable items.

The detailed procedure for allocating domestic supplies by both sector and use followed a theme similar to that of the Sri Lanka study. That is, many commodities could be readily identified as being produced essentially for final use (usually as exports) or as part of particular process loops. This considerably aided what otherwise might have been a formidable task. Our experience also showed that a high degree of commodity detail helped us identify the using sectors more easily.

Swaziland has not carried out a household income-expenditure survey comparable to that of Sri Lanka. Consequently it proved impossible to derive disaggregations of household expenditure on commodities, except for an overall urban/rural distinction and separate treatment of high-income individual tenure farmers. Even this disaggregation was only possible by "borrowing" a set of expenditure coefficients from a rural household expenditure survey undertaken in nearby Lesotho. A further consequence of this lacuna is that no detail could be obtained on the savings propensities of the various household groups, although corporate savings and consolidated government savings were defined more explicitly.

Thus the Swaziland study serves not only to endorse the advantages of an approach that starts with commodity balances, but also to underline the importance of multipurpose household surveys in seeking to obtain an integrated set of accounts. As it is, the table was not completed. Nonetheless, it is interesting to note that the table was available before the national accounts for the same year.

A final point on Swaziland is that the data base has been used subsequently for some model work. This use arose from the need to consider some specific investments, which were nonmarginal to the economy. The evaluation took the form of a project appraisal based on a macroeconomic model. This was new ground which, experience suggests, was well prepared by the SAM approach.

CONCLUDING COMMENTS

Our work has raised a number of issues that are barely touched in the preceding discussion but that we would like to suggest as avenues for future work. We begin by summarizing the main points of that discussion.

18. The need for import data arose mainly because of the need to estimate Swaziland's revenue entitlement from the Southern African Customs Union.

First, the SAM approach has proved in our experience to be a practical working tool of considerable merit in making the best use of available data and in providing a quantitative basis for analysis. It inevitably involves using data of variable qualities and calls for skills in data reconciliation which have not required the same emphasis in the past. It would undoubtedly be of value (and also of comfort) to have available formal techniques for pooling data. Meanwhile the informal methods must suffice, and the exercise of reconciliation gives a valuable focus to discussion of statistical priorities.

Second, the SNA recommendation that SAMs should be approached through commodity balances has served us well. Furthermore, the refinement of having separate commodity and activity accounts is valuable both for implementation of a SAM and as an aspect of subsequent modeling.

Next, we have concluded not only that it is possible to disaggregate the household sector, and hence to build income distribution into the macroeconomic picture, but also that it is desirable. At one level this is simply a matter of classifications—in this case, of institutions. But in taking the step from national accounts to a SAM some extra effort is obviously needed. At the same time policymakers are concerned about income distribution, and considerable effort is therefore going into data collection in this field. In our approach there is no conflict between the two competing claims: the extra costs of bringing income distribution into the major macroeconomic statistical picture are relatively small, and there seems to be a much wider interest in the product when households are disaggregated, rather than treated as a single sector.

Our Swaziland study makes the fairly obvious point that it is not easy to include a disaggregated household sector unless a multipurpose household survey—covering income received as well as expenditures—is available. Even then, the problems of data reconciliation are considerable in our experience, and this is confirmed by the work of Altimir (1975). Do the problems exposed imply margins of error hitherto unsuspected in survey research or in national accounts? Regardless of the answer, the interests of better data are well served by the discipline of trying to reconcile household surveys and national accounts.

It is not entirely adequate to resolve this question in favor of national accounts data on the grounds that the savings behavior measured by household surveys often implies that the rich dissave. In none of the case studies that we have conducted is there even approximate empirical support for the logical certainty that savings equals investment. This implied inaccuracy of data is not a trivial matter. As Ahluwalia and Chenery have emphasized (1974), savings behavior plays a crucial role in both growth and redistribution. There is no escaping the fact that this sensitive area has hardly begun to be charted by statisticians in developing countries. Meanwhile, since policy never waits, a SAM approach at least forces guesses to be consistent with whatever macroeconomic data are more precisely known.

While we realize that reference to guesstimates is unpopular in government statistical circles, the need to accept them as a part of macroeconomic statistics is unavoidable. This point goes beyond the early arguments in favor of using data from all sources to calibrate a SAM framework. As applications of our Swaziland study demonstrate, economic planning in developing countries is largely about structural change. Our view of a SAM is as concerned with the picture of future economies that might exist as it is with the initial position in which any particular economy might be. Accordingly, if statistical effort is to focus on reducing the standard errors on forecasts relating to policy alternatives, it is not at all clear that scarce resources should be devoted to more accurate estimation of the historical position. To us, not least of the virtues of the SAM approach is its ability to make the best use of those primary sources that might happen to exist. If these need to be filled out for the time being by guesstimates, there is nothing new in doing so that is attributable to the SNA except, perhaps, the relevance of the statisticians' work to the policy model.

None of this is intended to detract from the importance of good basic data. The fact is that the SAM framework is not just a statistical tool: it is also a framework for economic analysis. The essential point, therefore, is that SAMs are not the preserve of the statistician but a potential

bond in common with the economist. This potential, then, is the fullest implication of our earlier suggestion that the heart of the SNA is an economic model. Appreciation of SNA origins in the Cambridge growth model makes this point rather obvious.

One further point which should be exposed in the present context is the importance of classifications. It can be rehearsed in relation to production activities, although it extends throughout the SAM framework. The literature of development has always seen duality in production techniques as an essential element of economics. More recently the question of vintage of technology has been found to be a powerful element of economic theorizing. We have already referred to the link between development planning and structural change. Is it not plausible, then, that this technological dimension of production units is just as important as the goods they produce? Indeed the SNA already recognizes that separate commodity and activity accounts are needed. Once this separation is accepted it is simply inefficient not to ask what the most informative classification of production might be. An answer in terms of principal products does not seem to be self-evident and requires some justification. Making the best use of data by choosing appropriate classifications is also important and provides another avenue for enhancing the value of what limited resources are capable of producing.

In conclusion, it should be emphasized that we do not consider any of the three SAMs discussed here to represent a best data framework for the countries in question or even the best use of the available data. And there are important omissions from the discussion, such as the treatment of imputed transactions, and the virtues of trying to obtain complete data for a SAM given that this will involve time and effort in estimation of some details that may be essentially irrelevant. With respect to imputed transactions, the narrow answer is that we have simply followed national conventions throughout, since our concern has been to fill out existing national accounts rather than to produce new figures. But the broader answer, and the answer to questions concerning the best SAM design for a particular country, is that such questions cannot be answered without reference to a model: only a model of the economy can define the correct basis for imputation, facilitate the distinction between what is important detail and what is not, and suggest the best data system to serve the needs of policy and planning. Thus in our view questions concerning the design and implementation of a data system cannot be divorced from the model such systems are intended to serve.

We would prefer such models to be explicit, but that may not be essential, and a data system may need to serve more than one model. Accordingly, there may be disagreement over what is relevant detail. But, meanwhile, we do not see model construction as the primary task, even though the model (or models) is ultimately preeminent. In our view progress is to be made by iterative—or better, simultaneous—attention to a priori or model considerations, on the one hand, and empirical measurement and calibration, on the other. Enough has been written in the literature of development economics on the importance of institutional structure and dualities to justify the view that an examination of data systems in the light of such considerations may be timely. And if this point is not conceded, then it must surely be agreed that recent concern for distributional issues is sufficient justification for an attempt to measure some aspects of this dimension of an economy consistent with other continuing concerns, such as the balance of payments or the rate of investment.

Although we lack a full articulated model of how all these different dimensions come into play in determining the actual path of development, we know enough to be sure that consistency is not, of itself, enough and that an integrated picture of interdependence in the different dimensions is required. Hence we have attempted, on the empirical side, to integrate detailed accounts for factors and households into an otherwise conventional SAM framework. Within this framework we have views about preferred classifications, which have been touched on in the text. But our empirical work has been circumscribed on two counts. First, it has been necessary to work largely with secondary sources that tabulate data on the basis of classifi-

cations in current use. These may or may not be ideal, which points to the second limitation, namely, the lack of a model to resolve such outstanding issues. Differences in the existing data base, as well as the effects of learning by doing, explain the differences in the three country studies reported here. We have not yet reached the point of wanting to prescribe what data ought to be collected in the future and how it ought to be arranged. Thus potential conflicts between country data systems and international standards for comparability are not resolved in our perspective. Simply, this paper attempts to set out details of the directions in which our research has been leading and to demonstrate the empirical feasibility of going beyond existing national accounts in three specific cases toward something more interesting and useful for policy purposes.

3

The Flow of Funds as a Tool of Analysis in Developing Countries

Alan R. Roe

The preparation of relatively detailed flow-of-funds accounts for developing countries is becoming common. Long series of such accounts are now available for India, Korea, and other countries, and partial exercises are available for several more. This comprehensive format of financial information is being used both in descriptive work on financial questions and in the calculation of financial implications of development policies. The work, however, is often compartmentalized and kept substantially separate from statistical and analytical work on the real economy.

We begin with a few remarks about the methodology of constructing flow-of-funds accounts and about the narrowly statistical advantages of their integration with SAM data proper. Our main purpose is to explore the possible analytical uses of flow-of-funds data for developing countries and to form a view about how well the existing data serve these functions. A central conclusion is that substantial improvements are needed in both sectorization and disaggregation of claims, in order to obtain quantitative insights about the role of finance in the development process.

THE STATISTICAL FORMAT

A statistical format for the flow of funds, which is most general and corresponds closely with that used in the SNA, is set out in table 3.1. The format is that used in Stone (1966). Note that subscripts refer to the order of matrices and vectors shown as entries in the table.

This structure has two elements that link it back to the real economy in a purely statistical sense, namely, the savings vector (including the balance of payments deficit) and the real investment vector. This linkage involves certain difficulties. For example, the sectoral savings of table 3.1 ought to include the capital gains/losses of each sector even though these would normally be excluded from the national income accounts. Similarly, the real investment of table 3.1 ought to include the second-hand purchases/sales of each sector even though these would normally be excluded from the national accounts. If these problems can be overcome, the structure of table 3.1 provides an additional set of accounting identities that can contribute a good deal to the identification and elimination of inconsistencies between different data sources. For example, from the explicit identities of table 3.1, we can derive the following:

$$s_j = a_j - L_{jk}i_k, \tag{3.1}$$

that is, sectoral saving is identically equal to the total of assets acquired by the sector less the liabilities issued, and

$$z_j = l_j - A_{jk}i_k, \tag{3.2}$$

that is, sectoral real investment is identically equal to the total sources of each sector less the financial assets acquired.

Since, in all SAM exercises reported so far, the estimation of sectoral saving as the residual of income and expenditure accounts is recognized as an extremely inaccurate procedure, the

Table 3.1. The Structure of the Flow-of-Funds System

	Savings	Institutions	Financial Claims (liabilities)	Total Liabilities
Real Investment		z_j		
Institutions	s_j		L_{jk}	$l_j = s_j + L_{jk}i_k$
Financial Claims (assets)		A_{jk}		a_k
Total Assets		$a_j = z_j + A_{jk}i_k$	l_k	

Note: $a_j = l_j$
$l_k = a_k$
s_j = the vector of savings of the j sectors
z_j = the vector of real investment of the j sectors
L_{jk} = the matrix of new issues of liabilities (of the k types) by the j sectors
A_{jk} = the matrix of financial assets (of the k types) purchased by the j sectors
a_j = total asset purchases (real and financial) of the j sectors (that is, total uses)
l_j = total financial issues plus savings (that is, total sources)
l_k = total issues of claims of the k types
a_k = total purchases of claims of the k types.

supplementary information provided by equation (3.1) and the associated financial data are clearly of potential value. In the Overseas Development Ministry and University of Warwick social accounting exercise in Botswana, for example, the flow-of-funds data, while themselves full of difficulties, proved of value in identifying certain initial errors in the estimation of items in the income and expenditure accounts of the SAM and in providing a subsequent basis for an upward adjustment of household income (see chapter 7). This advantage to appending a flow-of-funds element to the SAM structure illustrates a general proposition: the more identity constraints that can be brought to bear upon a particular element of the structure, the smaller will become the confidence interval surrounding the estimation of that element.

The obvious qualification that needs to be attached to this proposition concerns the accuracy with which the additional constraint can itself be specified. More specifically, we have to ask whether the flow of funds for a "typical" developing country can be estimated with sufficient accuracy to service the functions that our preliminary estimates discharged in the Botswana exercise. The answer is probably country specific, but a few remarks about the situation as it was encountered in Botswana may nevertheless be of interest.

Botswana is a small and institutionally simple economy, and it was therefore a relatively straightforward task to extract full balance sheet information for all of the public corporations,

banks, other financial institutions, and major mining corporations. First differencing of adjacent balance sheets (in the absence of any significant asset revaluations) yielded information about the financial flows of our 1974–75 data period. The second stage of the exercise involved identification of the other party to all financial transactions taken directly from balance sheets. This was possible by virtue of (a) direct information (for example, the balance sheets of the banks specify the sector to which loans are made and from whom deposits are received) and (b) some knowledge of individual sector-to-sector relationships (for example, the public corporations only receive loans from central government). In a residual, but small, number of cases, the second party to each directly observed transaction had to be deduced by a combination of assumptions and guesswork.

The third stage of the estimation involved completion of sectoral accounts for households, including unincorporated enterprises; nonmining and nonpublic corporations; and the central government. The procedure simply entailed identifying those transactions that were obviously important but had not been captured by the previous two stages and then constructing the best possible estimate of their magnitude. For the central government this procedure was relatively straightforward. For households and nonmining and nonpublic corporations it was extremely speculative.

The overall impression was that, since the first two stages of this procedure could be completed with a reasonably high degree of accuracy, and since the really difficult residual items were relatively few in number, our final estimates of sectoral saving as deduced through equation (3.1) were probably more accurate for some sectors than estimates derived from income and expenditure accounts.

The method we have outlined seems, in broad terms, to be the one used in flow-of-funds estimation in other country contexts (see Venkatachalam and Sarma, 1977), with households, unincorporated enterprises, and all but the very large corporate enterprises generating all the serious estimation difficulties. It can easily be replicated in countries for which no flow-of-funds data currently exist and can be done at relatively modest cost. However, it is a methodology clearly capable of providing statistical feedback to the rest of the SAM only in the simpler economies. In more complex cases, the residual estimation problems associated with the flow-of-funds system may not permit it to define narrow, and therefore useful, constraints on the estimation of the rest of the SAM.

The final point on the purely statistical side concerns the layout of the flow-of-funds information. There are two possible alternatives to what might be termed the sector-claim format of table 3.1. The first is the sources-uses table in which both sector and claim detail is retained but in columnar form (a sources and uses column for each sector), rather than in the A and L matrices of table 3.1. The sources-uses approach essentially rearranges the A and L matrices of table 3.1 in such a way that any sale of an asset, or acquisition of a liability, by a sector is shown in the sources column for that sector, while any purchase of an asset or repayment of a liability is shown in its uses column. In effect, both the set of sources columns and the set of uses columns are matrices (having the dimensions sectors times type of claim), but the normal practice is to arrange the sources and uses columns of each sector next to each other so that these two matrices are interwoven into one.

The advantage of this procedure is that the full picture of any sector's capital transactions is easily seen. The main disadvantage is that some of the interesting aggregates that are obtainable from the format shown in table 3.1 (for example, a_{ik} and l_{ij}) are lost. However, since both formats cross-classify the available information by sector and type of claim, one can normally be constructed from the other with minimal difficulty.

The third approach, in contrast, completely suppresses the financial claims dimension of the presentation and shows a matrix of lender-borrower flows; the lending sectors are shown as columns of the matrix and the borrowing sector as rows. (A good example of this form of

presentation is given in Bhatt, 1969.) Thus, if a sector issues, say, three types of financial claim—currency, securities, and savings bonds in the case of government—then any sector acquiring any one or more of these would be shown as lending to government the amount of the acquisition. No detail regarding the type of claim through which this lending was channeled would be provided. In the Botswana case, we were able to demonstrate that the sector/claim format could be translated into a lender/borrower format with little difficulty since most claims in issue were associated with just one sector. Thus, for example, the knowledge that the household sector was accumulating rand currency in 1974–75 indicated that the sector was, in effect, lending to the rest of the world.

The snags with the lender/borrower format are, first, that it cannot be used to infer anything about the channels and instruments through which these funds are flowing and therefore about the manner in which the flows might be influenced by changes in the conditions attached to certain instruments. Second, this format provides no link whatsoever with sectoral portfolio structure and with the sectoral behavior patterns that influence flows of funds. Any analysis based on it has to be largely mechanistic. Finally, it is impossible to move from it to either of the two alternatives.

PREVAILING ANALYTICAL USES

Although pioneering work on flow-of-funds data began nearly four decades ago, far more effort is still devoted to the data than to the analysis. However, analytical uses are becoming relatively common in the developing countries, and in this section we focus on three of the most important.

First, comprehensive flow-of-funds data are increasingly used as the framework for historical descriptions of the evolution of an economy's financial system and for comparative analysis of financial developments in different countries. (An IBRD financial sector mission to the Ivory Coast, for example, has used the flow of funds as its descriptive framework.) It is, of course, interesting to know something about differences in the rate of creation of financial assets either through time or across countries, about the changing relative importance of different instruments in the total of financial assets, and about the manner in which a given structure of real investments was financed. In organizing these and other pieces of financial information, historical flow-of-funds data serve an extremely useful purpose.

What is invariably lacking in such studies, however, is a consistent theory concerning the manner in which the financial events have interacted with the production, consumption, and income creation in the real economy. In particular, such studies rarely provide insights into how production, levels of income, and other real economic variables would have been affected if the financial flows had evolved differently.[1] Lacking the theory to make connections for historical periods,[2] descriptive flow-of-funds work also provides relatively little policy guidance for those who would attempt to intervene in the evolution of the financial systems of the developing countries.

The second common application is in the broad area of financial planning, particularly in

1. There are, of course, notable exceptions to this as a general statement about the analysis of the contribution of the financial sector to economic development. See, for example, Patrick (1966).

2. This statement should not be interpreted to mean that no attempts have been made to establish these connections. Goldsmith, in particular, has done prodigious amounts of work in this area but without arriving at any really general conclusions. For example, his book, Financial Structure and Development, ends with the statement "... The question [does finance make a difference?] certainly cannot be settled before the theory of finance is developed much further in the direction of analyzing the process of financial development and its relation to economic growth in operational testable terms and before we possess a substantial number of intensive case studies for different representative countries and periods that use the framework of such a financial theory" (Goldsmith, 1969).

calculations of the sectoral financing implications of medium-term development plans. This work has traditionally been carried out on a rather ad hoc basis with particular attention directed at the manner of financing government deficits. There is, however, an increasing interest in a more comprehensive and a more formal approach to the problem.

A good example of this approach is work conducted by Venkatachalam, Bhat, and others at the Reserve Bank of India (see, for example, Bhat, 1972). Their procedure develops the original idea of Stone (1966), in which an exogenous vector of sectoral investment is applied to coefficient matrices constructed from the A and L matrices of table 3.1. Assuming constancy of all elements of the coefficient matrices and enforcing all the identities implicit in table 3.1, Stone's procedure generates the vector of sectoral saving that is consistent with the exogenous investment and the portfolio composition indicated by the coefficient matrices. The interesting elaboration injected by the researchers of the Reserve Bank of India is estimation of marginal portfolio coefficients based on time trends and their use, rather than the average coefficients, in the coefficient versions of the A and L matrices. Applying the procedure to the investment targets of the Fourth Indian Plan, they compute consistent sectoral savings figures, as well as the implied increase in the amounts outstanding of each major financial claim. By comparing their derived savings vector with the target savings vector from the plan, they are able to identify the trends that are necessary to ensure the attainment of these targets.

A similar procedure, based on a lender-borrower format of the flow-of-funds system, is described in the papers by Bhatt (1969) and Divatia (1969). Divatia's paper is more formal and takes as constant the coefficients constructed by relating the elements of the lender/borrower matrix to their row totals (or column totals). With either sectoral saving (or investment) taken as exogenous, he generates the consistent sectoral pattern of investment (or saving). Bhatt's approach is similar in structure, but he incorporates additional information to avoid the assumption that the coefficients of the lender/borrower matrix will remain constant at their historically estimated values. These papers are valuable in identifying possible inconsistencies between the sectoral savings and investment targets of the Indian plan, which they analyze. Indeed, the work was used to modify the initial estimates of the investment targets of that plan. A similar exercise, but for another continent, is described in a paper by Bhatia and Engstrom (1972) on the Second Nigerian Plan.

These papers are valuable in extending the consistency analysis of development plans to their financial dimensions. There is still a need for more explicit procedures whereby inconsistencies, once uncovered, can be eliminated. There is little doubt, however, that the comprehensive flow-of-funds approach to the problem represents a considerable improvement over the partial equilibrium approaches emphasizing government.

These first two analytical uses of flow-of-funds information potentially involve the full gamut of financial claim and sectoral detail. A third example is rather different in that it draws on certain key elements of the flow-of-funds picture. We refer to the burgeoning literature concerned with the empirical formulation for developing countries of monetary models of the balance of payments. In this literature, the central sectoral flows are those of the commercial and central banks shown in simplified form in table 3.2.

Consolidation of these two flow accounts, the netting out of central bank borrowing from government (that is, government deposits) against its loans to government, and the netting out of the currency held by the banks against amounts issued, yields the following identity:

(3.3) $$\Delta \text{ Currency held outside banks} + \Delta \text{ Commercial bank deposits} = \Delta \text{ Loans and advances to government} + \Delta \text{ Loans and advances to private sector} + \Delta \text{ Foreign reserves}$$

which is equivalent to:

(3.4) $$\Delta \text{ Money supply} = \Delta \text{ Domestic credit} + \Delta \text{ Foreign reserves.}$$

Table 3.2. Flow of Funds of Commercial and Central Banks

A. Commercial banks

Changes in Liabilities	Changes in Assets
Private Deposits	Currency
Government Deposits	Balances with Central Banks
	Loans and Advances to Government and Private Sector
Total = X_1	Total = X_1

B. Central bank

Changes in Liabilities	Changes in Assets
Currency in Circulation	Loans and Advances to Government
Government Deposits	Loans and Advances to Private Sector
Balances of Commercial Banks	Foreign Reserves
Total = X_2	Total = X_2

Since the majority of developing countries are highly open to trade, the change in the money supply is taken to be strongly endogenous in the sense that an expansion in domestic credit, to the extent that it stimulates aggregate expenditure, will generate an increase in imports and a fall in reserves. Thus the two terms on the right side of (3.4) will partly offset each other and so reduce the final money supply expansion associated with any given initial change. The recent monetary models for the developing countries have mostly been concerned with specifying, elaborating, and testing this basic insight in order to form a view as to the nature of the interaction between monetary and credit factors, on the one hand, and income levels, prices, and the balance of payments, on the other.

The original model along these lines for developing countries was developed by Polak (1957) and involved the endogeneity of nominal income, imports, and the money supply. The income velocity of circulation of money was rigidly constant in the classical manner; exports, capital inflows, and domestic credit were all exogenous; and real income was held constant through a full employment assumption. Subsequent work has introduced greater endogeneity into the model by relaxing many of the rigid classical assumptions and thus providing fuller insights into the division of monetary effects between real and inflationary consequences. A brief summary of the additions to the basic Polak structure introduced by five papers in this area is given in table 3.3. A couple of examples will suffice to indicate the sort of insights that these models can provide.

Table 3.3. Summary of Characteristics of Five Macromonetary Models

	Price Sensitivity of Imports	Price Sensitivity of Exports	Short-term Capital Flows Endogenized	Rate of Interest Involved	Rate of Interest Endogenized	Some Links from Nominal to Real Magnitudes	Inflation Rate Endogenous	Supply Determination Explicitly Specified	Government: Private Sectorization
Aghevli (1977) INDONESIA	✓	(a) ✓	X	✓	X	X	✓	X	(b) ✓
Khan (1974) VENEZUELA	✓	X	✓	✓	✓	X	X	X	✓
Aghevli and Khan (1977) INDONESIA	Whole of balance of payments is exogenous			X	X	X	✓	X	✓
Otani and Park (1976) KOREA	✓	X	X	✓	X	✓	✓	(c) ✓	X
Otani (1975) PHILIPPINES	✓	X	X	X	X	(e) X	✓	(d) X	X

Notes: ✓ = a characteristic that is included.
X = a characteristic that is not included.

a. Applies to non-oil exports only.
b. Sectorization only in the sense that government revenues and expenditures appear explicitly.
c. Nonprimary sector only; the primary sector is exogenous.
d. A trend value of supply confronts monetarily determined demand to generate price and inflation effects.
e. Real income is endogenous.

In a joint paper by Aghevli and Khan (1977) on Indonesia, the authors argue that inflation itself feeds the growth of the money supply (as well as being fed by it) by causing government expenditure to rise faster than revenues, thereby generating the need for increasing amounts of deficit financing. To focus attention on this central point they simplify the basic Polak structure by regarding the balance of payments as exogenous, so that the only endogenous influence on the money supply is the government deficit. Given the exogeneity of real income and the absence of any interest rate term in the demand for money function, an initial rise in the money supply can only be matched by a change in demand to the extent that the domestic price level is increased (thereby reducing the excess of real money balances). However, the rise in price stimulates a larger increase in nominal government expenditure than taxes and increases both the government deficit and the monetary base. That generates a second round of monetary expansion, the effects of which are exacerbated by the adaptive adjustment of inflationary expectations and the resulting fall in the equilibrium holdings of real money balances.

Similarly, in the Otani and Park (1976) model for Korea, the initial response to a monetary expansion is a rise in the domestic price level to clear the money market. However, in their model this response stimulates imports, which also appear as an explicit input in the production function of the nonagricultural sector. Thus the real output of that sector rises. This rise causes an increase in the nominal demand for money which moderates the earlier price increase, as does the reduction in the money supply associated with the deteriorating balance of payments. Thus output, monetary variables, prices, and the balance of payments are inextricably woven together.

The models just described are not flow-of-funds models in the conventional sense; they do not involve a full specification of the intersectoral flow of funds and do not enforce all the financial accounting identities implicit in table 3.1. Thus they commit some of the sins of implicit specification discussed at length by Brainard and Tobin (1968). The models can also be criticized because the strong link between aggregate demand and imports (that is, the openness assumption), the central element in most of them, is of dubious validity when the import demand of so many "open" developing economies is in fact heavily dictated by direct central controls.[3] Finally, their presumption that there is a real possibility for developing countries to have "pure" monetary policy—that is, a change in the money supply that does not require changes in government expenditure or taxation—either flies in the face of reality or misleadingly applies the label "monetary" to something that, with equal validity, might be regarded as "fiscal."

THE ROLE OF THE FINANCIAL SYSTEM IN ECONOMIC DEVELOPMENT

Clearly, all the applications we have just discussed are extremely useful in their own different ways, and it would be quite wrong to argue otherwise. Of themselves they justify the continuing effort to produce flow-of-funds data for a wider range of countries and to use the classifications and the methodologies already established. However, if we take either the view that the financial sector is a potentially important and independent source of dynamic in a country's economic development or the view that inappropriate financial policies can, of themselves, damage a dynamic established by innovation in some other sector, then a somewhat more critical standpoint might emerge. In the rest of the paper we explore the implications of these viewpoints and conclude that if we wish to quantitatively analyze the innovative (or repressive) influences of financial policies, then we need to think harder about what sort of flow-of-funds data will be most appropriate.

We begin with the view that the financial system of a developing country at any time is a

3. I am grateful to William Dellalfar for this point.

part of its inherited technology in the same way that the production systems of its factories are part of that technology. The financial technology services two essential functions, namely, the facilitation of the movement of funds from surplus to deficit sectors and the provision of incentives to stimulate future as opposed to present consumption and so help move society closer to some "optimum" mix of these two quantities. In other words, its functions are to stimulate and allocate savings. Now it is clear that the financial technology of a typical developing country services these two functions extremely imperfectly. This imperfection is not so much because the resources available to existing financial institutions do not work to good effect; rather it reflects certain barriers to the expansion of these institutions to anything like an optimal scale of operation. Furthermore, these barriers may be inherent in the nature of a developing economy or erected by some form of government intervention.

If this can be accepted as a starting point, we can easily move on to two important propositions. The first is that beneficial developments in the real economy (for example, a technological breakthrough in agricultural production) may be completely frustrated or have their benefits moderated by imperfections of the financial markets. The second is that innovations in the financial markets, to the extent that they reduce the inefficiencies of these markets, can generate independent benefits in the real economy. In either case, the financial system is important to understanding the behavior of the real economy. But the nature of that importance can only be understood by first acquiring a clear comprehension of the causes and consequences of the imperfections of the financial markets and the manner in which these might be overcome. (This point is clearly ignored by most of the literature that attempts to incorporate a monetary asset into standard growth models.)

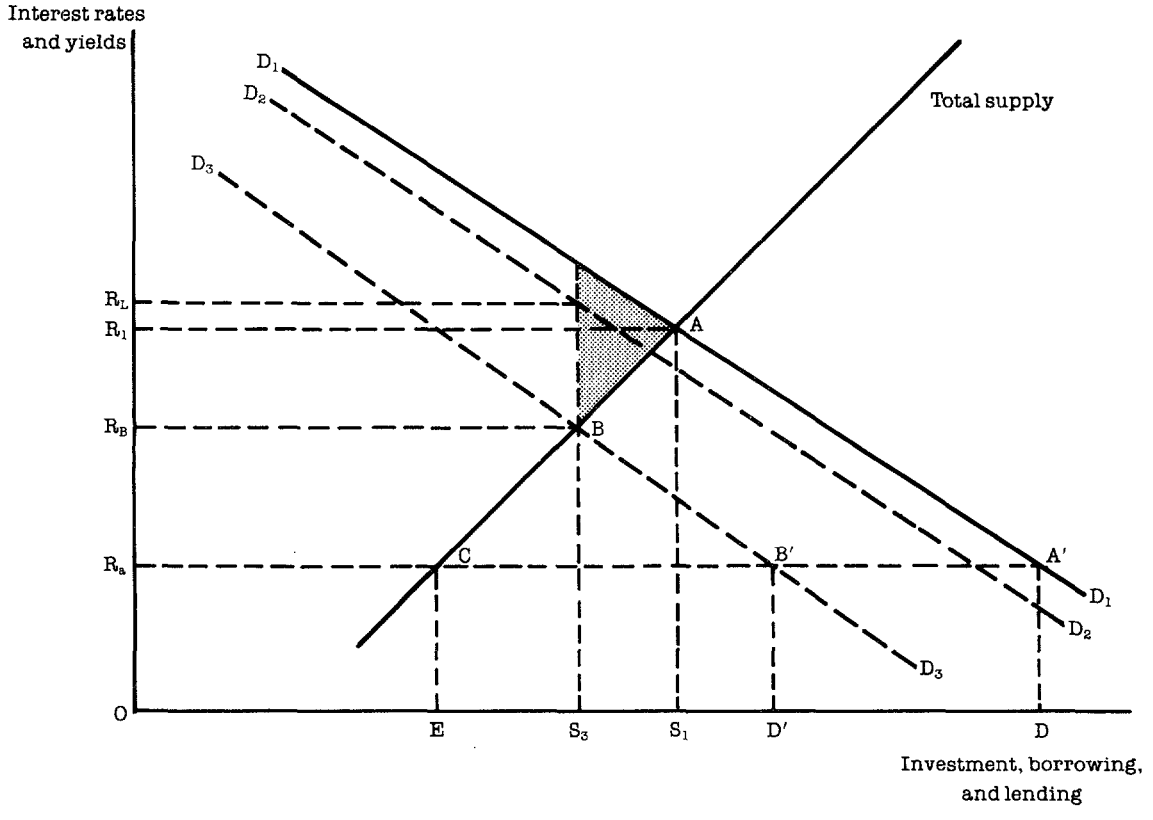
Most sources of capital market imperfections in developing countries can be summarized under two main headings: interest rate restrictions (including restrictions on the terms of lending and borrowing other than the interest rate) and transaction costs. The first speaks for itself, but the second needs elucidation.

Financial transactions, by definition, involve the intercession of time (for example, time between borrowing and repayment dates), as well as the contractual interlinking of persons unknown to each other to varying degrees. Thus both uncertainty and imperfect information arise to drive a wedge between the demand price of real capital assets and the price at which funds can be borrowed to finance their acquisition. This is in addition to the wedge between these two prices arising from the operating costs, including profits, of the financial institutions. Since imperfect information only arises as a problem in an economy having transaction costs (otherwise borrowers and lenders could spend infinite time in gathering the information to make correct borrowing and lending decisions), we can theoretically represent the effect of any given imperfection of information by the amount of transaction costs needed to overcome it. Similarly, uncertainty can be represented as a transaction cost (for example, the uncertainty of the lender might be represented as his evaluation of the probability of default of the borrower, multiplied by the amount of the proposed loan). Finally, recognizing that there are transaction costs in the broad sense incurred by both borrowers and lenders, we can construct a catalog of elements that form total transaction costs, and thereby contribute to capital market imperfections. The elements are as follows:

Borrower (or demand) side of the market

1. The administrative costs and opportunity costs of the borrower (for example, traveling time to geographically distant banks).
2. The borrower's risk as evaluated by the borrower, that is, the difference between the expected marginal efficiency of an investment project and the rate at which the borrower is prepared to borrow funds to finance it.

Figure 3.1. The Effects of Transaction Costs



Lender (or supply) side of the market

3. The administrative costs of the lending institution (for example, wages and profits).
4. The interest premium that the lender requires as compensation for his evaluation (correct or otherwise) of the riskiness of the loan or the absence of conventional security.

The effects of these sources of inefficiency can be seen very simply in figure 3.1.[4] The demand curve D_1D_1 represents the marginal efficiency of capital schedule, while the first downward shift of this curve, D_2D_2, represents its adjustment for borrower transaction costs, and the final shift, to D_3D_3, represents its adjustment for borrower and lender transaction costs.

In the absence of transaction costs, the economy will attain an equilibrium at point A, with total lending equal to OS_1 and the borrowing and lending interest rate equated at R_1. With allowance for transaction costs, the equilibrium moves to point B, total lending falls to OS_3, and the lending and borrowing rates of the financial institutions ("banks") diverge by the distance R_LR_B. Above all, the transaction costs impose a loss of surplus on the economy equal to the shaded area in the figure, in addition to certain dynamic losses associated with a lower level of real investment. Equally it is clear that a reduction in transaction costs associated with greater efficiency in capital market transactions in any of the four senses identified in the classification given above will provide the economy with real gains in income and output.

4. In this exposition, we are ignoring the possible effects of monopoly power in the hands of the financial institutions. Such a monopoly would have effects similar to those of the four sources of inefficiency that we do consider.

This much is clear and probably fairly obvious. The story becomes more interesting when we allow for some sectorization based upon the differential transaction costs of borrowing and lending of different sectors. For purposes of exposition imagine a "traditional" sector that has relatively high transaction costs and a "modern" sector that has relatively low transaction costs. Through an extension of figure 3.1, it is a relatively simple matter to demonstrate the following propositions (see Roe, 1978):

1. In the absence of transaction costs the marginal efficiency of capital is equated in the two sectors.
2. Transaction costs impose a larger fall of lending, and of surplus, on the traditional sector than on the modern.
3. If the banks are allowed to discriminate by price, transaction costs will result in their charging a higher interest rate to the traditional sector than to the modern.
4. If price discrimination is not allowed, the same effect will probably be achieved by imposing more stringent nonprice conditions on lending to the traditional sector.

In short, as well as imposing an aggregate economywide reduction in welfare, transaction costs will cause a disproportionate reduction in lending to the traditional sector and consequently a reduction in that sector's investment, its income, and the output that it produces. Thus, just as economywide analysis would clearly wish to specify the effects of taxes and the effects of removal of taxes having uneven incidence, so ought such an analysis to specify the effects of differential sectoral transaction costs in financial intermediation. There is no theoretical reason to expect these effects to be trivial or sectorally neutral.

The second source of capital market inefficiency, namely, the administering of the interest rate, is also easily analyzed using figure 3.1. Assume that both lending and borrowing rates are fixed at a level R_a, moving the quasi equilibrium of the economy to B′ when there are transaction costs and to A′ when there are not. In fact, this "equilibrium" will be characterized by excess demand of ED′ when there are transaction costs, and ED when there are not. Since the excess of ED over ED′ depends only on transaction costs, it is clear that in this situation the salutary effects of an improvement in the financial technology will lead to an increase in excess demand only and not to any improvement in social welfare. In this same situation, any upward shift in the schedule of the marginal efficiency of capital (because of a green revolution, for example) is likely to have its beneficial effects on the economy moderated by the inelasticity of the supply of funds with respect to the new lending opportunities. Thus, whether a technological improvement is in the financial sphere or elsewhere, one condition for its full benefits to be realized would seem to be the absence of any initial excess demand in financial markets.

Two final issues need to be considered before we attempt to draw out the data implications of this line of reasoning. They both concern the nature of the supply schedule of figure 3.1.

If we conceive of this schedule as representing the supply of funds to the formal (or organized) financial markets, then our analysis rather begs the question of the role of the informal (or unorganized) financial markets of developing countries. We take the view that these markets have two fundamental distinguishing characteristics. First, their transaction costs of borrowing and lending are far lower than those of formal sector institutions serving the same clientele. This difference is partly because they lack expensive infrastructure, but largely because they operate on a narrow local basis and therefore have far lower costs of information. The second characteristic is that they are successful, either by law or by practice, in avoiding administrative restraints on lending and borrowing rates. In short, the informal institutions are distinguished by their comparative advantage in relation to both sources of capital market inefficiency referred to earlier.

What this means in practical terms can be seen by referring back to figure 3.1. In the case in which the interest rate is administered at R_a, the informal sector, to the extent that it can

tap into the part of the supply of funds denied to the formal sector by the interest rate restriction, will move the equilibrium of the economy away from point C and toward point B. It will thereby enable the economy to recapture some of the surplus lost because the interest rate is controlled. Furthermore, since the credit rationing associated with an administered interest rate will almost certainly impinge disproportionately on disadvantaged sectors (the traditional sector in our analysis), the intercession of the informal sector may moderate that distributional effect. However, although it provides these obvious aggregative and distributional benefits, the informal sector may have such a large gap between its lending and borrowing rates that it appears exploitive.

Similarly, if we consider an initial equilibrium at B, then the lower transaction costs of the informal sector will enable it to tap into the supply of funds to the right of B and move the equilibrium nearer to A. Again this confers an aggregate social benefit and provides certain distributional benefits in that the informal sector lending will undo part of the disadvantage of our traditional sector arising from differential transaction costs.

The social functions of the unorganized financial markets are thus clear: they restore part of the social welfare lost by virtue of the two capital market imperfections referred to earlier, and they redistribute income in favor of the traditional sector. If they could discharge these second-best functions perfectly, then we would have no cause to concern ourselves with the imperfections of the formal markets. Unfortunately, the informal markets are themselves defective, most seriously because they are heavily localized in their spheres of operation. This severely restricts their access to the economywide supply of funds, as well as their ability to allocate the funds they do raise in the most efficient manner.

The second issue concerning the supply schedule of figure 3.1 relates to the distinction between aggregate savings and financialized savings (that is, savings mobilized through the financial system). The supply schedule of figure 3.1 would be controversial if it was interpreted as referring to aggregate saving as the supply concept, because the empirical evidence on the interest elasticity of saving is inconclusive (see Saito, 1977). We prefer, therefore, to interpret it as referring only to financialized saving, which implies that the upward slope of that schedule relies upon a diversion of saving away from nonfinancial assets. This diversion is far easier to demonstrate empirically than interest elasticity of saving (see Roe, 1978).

The alternatives to putting savings into financial assets differ for different groups in an economy, but some of these alternatives will be directly productive of real income. Thus the reduction of social welfare associated with the shaded area of figure 3.1 is potentially overstated to the extent that the downward move along the supply schedule from A to B may permit increased direct investment of savings in tangible and productive form, and thus offset the reduced real investment associated with reduced financialized saving. At the risk of some oversimplification, the most important alternatives to the financialization of saving for different groups of a "typical" developing country are the following.

1. For rural households and small businesses: unproductive items such as precious metals, jewelry, and inventories of their own output in excess of consumption needs; productive items such as land, agricultural and handicraft tools, and livestock.
2. For urban households: real estate and various consumer durables.
3. For government: public sector investment projects and overseas investments.
4. For modern sector companies: corporate real capital and overseas investments.

Even a casual inspection of this list reveals that some items will certainly not substitute for financialized saving in the sense that the income and output to which they will give rise will equal those arising from the real investments that financialized saving makes possible. Other items on the list are ambiguous in this respect. However, it follows from the earlier analysis that improvements in relation to either or both forms of capital market inefficiency will move

the economy upward along the supply schedule of figure 3.1. Whether this movement will produce the potential benefits referred to earlier depends on both the source from which the financialized savings are diverted and the output and income forgone by virtue of the reduced direct investment associated with that diversion.

THE IMPLICATIONS FOR FLOW-OF-FUNDS DATA SYSTEMS

The previous section has attempted to identify some aspects of the role that the financial system can play in the process of economic development. We also hope to have identified some of the critical changes in the flow of funds which accompany this development. In this section we attempt to identify some of the implications for data systems which would arise from attempts to do empirical work based on our essentially theoretical argument. We do not begin this task with an expectation that many of our suggestions will be implemented, at least not in the near future. We proceed rather with the view that it is legitimate for a coherent theory to define a data requirement which, if met, could significantly improve knowledge of how particular financial changes might improve economic well-being.

If we accept the proposition that finance is part of an economy's technology, we require classifications that reflect this proposition. In particular, we need a classification of borrowing institutions which reflects the institutions' differential advantages or disadvantages that arise from the transaction cost source of inefficiency. The analogy between these costs and a tax has already been made: we need to be able to identify any group that would receive a disproportionate advantage from the lowering of such a tax. The traditional/modern distinction in our example was not necessarily intended to imply an analogy with the traditional and modern sector of conventional usage. However, it is clear that in many developing countries the small-scale, traditionally organized businesses do suffer a transaction cost disadvantage, and it would seem appropriate, as an initial step, to try to separate this group for flow-of-funds purposes. To develop this classification, we need fuller documentation of the nature and magnitude of the transaction costs faced by each group in the classification. This is a difficult task since only some of these are tangible financial costs. As indicated in the classification presented earlier, certain of these costs involve subjective evaluation on the part of the borrower, the lender, or both and are not readily quantifiable.

In practice, flow-of-funds estimation falls far short of the sectoral detail that the proposal of the previous paragraph implies. Indeed, it has often proved difficult to produce separate accounts for the household and the corporate part of the private sector, let alone any finer disaggregation of these two elements. Where separate household accounts are available they normally depend disproportionately on a residual approach to estimation and incorporate substantial elements of unincorporated business activity. So long as no finer sectorization can be achieved from the data, analyses based on those data seem certain to miss much of the fundamental importance of financial processes.

A second point relates to the portfolio choices that flow-of-funds data reflect. In most applications the ex post measures are wholly concerned with formal sector financial assets and have little to say about (a) informal sector assets and liabilities, and (b) tangible assets that appear in portfolios. Given our theoretical judgment as to the fundamental importance of the informal financial sector in a situation characterized by capital market imperfections, it is critically important that we have some information about how this sector intercedes in the borrowing and lending transactions of different groups. We need to know much more about the portfolios and the potential portfolio choices of those who lend to informal sector financial institutions and about the categories of transactors to which these funds are ultimately made available. Without such information we have no real hope of quantifying the consequences of the imper-

fections in formal capital markets or the consequences of eliminating such imperfections. In particular, we have a quite inadequate basis for analyzing the effects of ending the administration of interest rates at subequilibrium levels.

Similarly, flow-of-funds information needs to give far more attention to the tangible assets that appear in the portfolios of the various sectors. If, as the argument of the previous section implied, the move along the supply schedule of figure 3.1 is merely a diversion of funds from tangible assets to financial assets, then it is important to know something about the nature of tangible assets in each sector and the scope for substitution away from them. In particular, we need some information about the quantities and types of tangible assets that are productive of output, relative to those that are not, in each sector. The standard flow-of-funds practice of incorporating only one catch-all category of tangible asset permits no analysis of this problem.

Clearly nothing can be done about these particular recommendations unless the raw data are available in the appropriate form. Since this will normally not be the case, the first step toward implementing the recommendations is likely to be the elaboration of a survey program directed at households and small-scale businesses, to provide a systematic documentation of the financial aspects of their operations. This chapter has tried to pinpoint the questions that ought to be asked and the analytical uses to which the answers might be put.

CONCLUSIONS

Several of the arguments in this chapter are worth highlighting. First, there is a strong statistical case for fully integrating the flow-of-funds system within a SAM. While this approach is not likely to improve the overall accuracy of every SAM, it will do so in many cases. Second, our partial survey of analytical uses of flow-of-funds data suggests several established uses but notes two fundamental weaknesses as well: either the analyses fail to provide any explicit mechanism whereby the financial system can affect real economic events, or they fail to reflect any of the important distinguishing characteristics of the financial systems in the developing economies, or both.

We have attempted to identify these distinguishing characteristics and, in that light, to examine the possible beneficial effects of an improved financial system on the real economy. The view we take is that these effects are potentially large, both in aggregate social welfare and in distributional benefits. This is the third conclusion we wish to underline.

The fourth and final conclusion is that data required to quantify the potential effects of financial improvement are not provided by the standard flow-of-funds tables available for developing countries. This is largely due to the statistical difficulties of measuring these flows and implementing the sectorizations needed to properly analyze the effects of an evolving financial system. A clear conception of the importance of the financial system to economic growth is needed as a starting point for addressing these statistical problems. Some of the ideas in this chapter may be a small contribution toward the development of such a conception.

4

Regional Accounts in a SAM Framework

Graham Pyatt and Jeffery I. Round

There have been many attempts to identify, as well as to solve, the special problems of social accounting at the regional level. To the extent that only a single region is involved, whether it is part of a nation (a subnational region) or a group of nations (a supranational region), the conceptual problems are not really very different from those arising at the national level. This is not to understate the practical problems, which are often severe and derive largely from the fact that regions do not enjoy the statistical advantages that are by-products of the existence of well-defined national boundaries, such as customs controls or currency areas. The point is rather that a multiregion system poses a different range of problems, and these extend beyond those normally encountered for a single region system. This paper will consider some extensions of the SAM framework as it applies to a two-region system. The particular study used for illustration concerns East and West Malaysia, but the conclusions are applicable to other regional systems. Not least, the approach to a two-region system can readily be generalized to the many-region case.

By way of background, the east-west split of the Malaysian economy is one that arises quite naturally. The Federation contains twelve states, of which two—Sabah and Sarawak—make up East Malaysia. Historically, they are the most recent members of the federation, joining the other states in 1963; geographically, they are separated from the peninsular (West Malaysian) states by some 500 miles of sea. The regional distinction is easy to make statistically, since the sources for West Malaysia are independent and, incidentally, are also substantially better than those for East Malaysia, both in coverage and in quality of data. For example, national accounts have been estimated for West Malaysia for some years, while those for East Malaysia have, until relatively recently, been nonexistent. Our underlying concern has been to integrate the social accounts for Malaysia as a whole, while retaining the regional detail. In the first instance, this involves a disaggregation of the external transactions for each region into transactions between East and West Malaysia (interregional transactions) and transactions by each region with other parts of the world. Such disaggregation of external transactions is of some general interest. Many countries are already developing their balance of payments statistics toward showing separately the links with different international trading or financing partners, since there are obvious policy implications to be drawn from differences in the pattern of external transactions with different currency areas, countries in different stages of development, or different economic or political blocs.

It should also be noted that the situation as it exists between the two regions of Malaysia is complicated by the position of Singapore as an entrepôt for a variety of commercial activities. A good deal of merchandise trade between East and West Malaysia is still routed through Singapore, while its position as a financial and commercial center means that many nonmerchandise transactions and monetary transfers are cleared through financial intermediaries in Singapore. In consequence, there are very real difficulties in distinguishing actual east-west flows as opposed to those that involve the intermediation of Singapore. In general, the existence of entrepôts in regional systems is not unusual; in our particular case, we are perhaps fortunate that the entrepôt is a single location and that the trade flows through it have previously been identified for us by the Malaysian Department of Statistics, Kuala Lumpur.

Before embarking on the intricacies of the regional accounting scheme we shall first briefly describe the structure of the Malaysian SAM. As already noted the estimation of separate accounts for West and East Malaysia actually preceded the derivation of a SAM for the whole of Malaysia. Nevertheless, the aggregate All Malaysia SAM will provide a useful basis for describing the basic structure of the accounts upon which subsequent discussion will revolve.

AN AGGREGATE MALAYSIA SAM IN OUTLINE

The aggregate structure of the framework underlying the full Malaysia SAM is shown in table 4.1.[1] Table 4.1 shows the SAM for Malaysia in schematic form: its entries simply describe the nature of the transactions that take place between the various accounts. With the same framework is shown our estimates of the aggregate transactions for Malaysia in 1970. The eleven sets of accounts contain seven broad groups of accounts as follows: wants (account 1), factors (account 2), domestic institutions current accounts (accounts 3–5), a consolidated capital account for domestic institutions (account 6), rest of the world (accounts 7 and 8), production (accounts 9 and 10), and indirect taxes (account 11).

The wants accounts are designed to focus on the fact that development policy objectives ultimately reduce to the welfare of individuals (subject to the need to supply public goods to provide for the national interest), and that these are met by the provision of "wants" or needs. Ideally such wants might include items that go beyond those normally included within an estimate of private consumption expenditure in the national accounts. However, such imputations were not attempted, so the first row of table 4.1 has only one entry, showing receipts from the supply of wants defined as categories of private consumption expenditures to households. The corresponding numerical entry in the table shows the aggregate level of consumer expenditure to be 7,528. (Amounts are all in millions of Malaysian dollars.)

The second row and column of table 4.1 refer to a set of factor accounts which receive factor incomes (domestically generated by production activities and those received from abroad) along the rows and pay these out down the columns to domestic institutions (households, companies, and government) and abroad. The incomes of institutions can be seen to comprise factor and nonfactor (that is, transfer) receipts. As with the wants accounts, in the most disaggregated form of the SAM many factor and household accounts are distinguished. In contrast, the current accounts for companies and government and the combined domestic institutions capital account are maintained in consolidated form throughout.

The current and capital accounts for the rest of the world are shown as accounts 7 and 8. In accordance with normal practice, the balance of payments current account deficit, from the point of view of Malaysia, is shown as a transfer of 39 from current to capital account (that is, a rest of the world "saving" of 39). Overall balance in the rest of the world account for 1970 is achieved via net lending abroad of −39 (that is, a reduction of assets held abroad by Malaysia of 39), which arises out of net disinvestment abroad of 124, plus net capital transfers from abroad of −85.

Our treatment of the production accounts follows SNA practice in recognizing separate sets of accounts for commodities and activities. Although only aggregative flows relating to commodities and activities are shown in table 4.1, our most detailed SAM involves substantial disaggregations of these accounts for fifty-nine commodities and thirty activities. One feature of the SAM accounts is especially worth noting given our concern in this paper for a proper recording of regional and international commodity trade and regional transactions in general. It relates

1. A more detailed summary description based on this table is presented in Chander and others (1980). Full detail is to be found in Pyatt and Round (1978).

Table 4.1. A SAM for Malaysia, 1970

(in millions of Malaysian dollars)

RECEIPTS				EXPENDITURES											
				1	2	3	4	5	6	7	8	9	10	11	12
				Wants	Factors	Institutions' Current Accounts			Consolidated Capital Account for Domestic Institutions	Rest of World		Production		Indirect Taxes	TOTAL
						Households	Companies	Government		Current	Capital	Commodities	Activities		
	1	Wants				Want acquisitions by households 7528									Total want acquisitions 7528
	2	Factors								Factor incomes rec'd from abroad 232			Valued added payments to factors 10601		Total factor incomes 10833
	3	Institutions' Current	Households		Wages & unincorporated business income 8696	Inter-household transfers 476	Distributed profits 109	Government transfers to households 196		Current transfers from abroad 16					Total household incomes 9493
	4		Companies		Operating surpluses of companies 1551			Government transfers to companies 134		Current transfers from abroad 15					Total company incomes 1700
	5		Government			Direct taxes 388	Direct taxes 992			Current transfers from abroad 15				Net indirect taxes 1802	Total government income 3197
	6	Consolidated Capital Account for Domestic Institutions				Household savings 1101	Company savings 369	Government savings 855			Capital transfers from abroad -85				Total capital receipts 2240
	7	Rest of World	Current		Factor incomes paid abroad 586	Household transfers abroad	Company transfers abroad 230	Government transfers abroad 27				Imports 4798			Total current payments abroad 5641
	8		Capital						Net investment abroad -124	Balance of payments current deficit 39					Total capital payments abroad -85
	9	Production	Commodities	Conversion of wants into commodities 7528				Government current expenditure 1985	Gross fixed capital formation & stock increases 2364	Exports 5324			Intermediate commodity demands 9311		Total commodity demands 26512
	10		Activities									Domestic commodity supplies 20403			Gross outputs 20403
	11	Indirect Taxes										Commodity indirect taxes net of subsidies 1311	Non commodity indirect taxes 491		Total net indirect taxes 1802
	12	TOTAL		Total want acquisitions 7528	Total factor payments 10833	Total household expenditures 9493	Total company expenditure 1700	Total Government expenditure 3197	Total investment 2240	Total current receipts from abroad 5641	Total capital receipts from abroad -85	Total commodity supplies 26512	Gross inputs 20403	Total net indirect taxes 1802	

Source: Pyatt and Round (1978).

to the valuation of the commodity balances. In the Malaysia SAM commodity transactions are recorded at market prices. In the SNA they are valued at basic prices. Such prices are essentially factor costs (that is, market prices net of indirect taxes on sales) less trade and transport margins on sales of output. However, for certain conceptual and practical reasons discussed elsewhere (see Pyatt and Round, 1978, and Chander and others, 1980), rather than follow this route a market price valuation is retained throughout. Its relevance to the issues addressed in this paper is obvious: the margins for trade and transportation include the costs of moving goods between producer and user locations. This means, for example, that the want acquisitions in row 1 of table 4.1 represent consumer expenditures of 7,528 at market prices. Much of the difference between this convention and the use of basic prices is not apparent at this aggregate level of the SAM, but it is seen more readily at a disaggregated level where accounts for trade and transportation services are separated from those of other commodities.

The next section of this paper shows how the SAM framework can be applied to the regional accounts for Malaysia. The system will continue to be viewed in a fairly aggregate way. In a final section we shall focus more explicitly on the particular conceptual difficulties concerning the treatment of interregional commodity trade.

AGGREGATE REGIONAL ACCOUNTS IN A SAM FRAMEWORK

The development of a regional account system may be approached from two standpoints. One approach is to disaggregate a SAM for the economy, taken as a whole, into its constituent regional components. The alternative approach is to combine SAMs for two (or more) regions into an integrated system. As already indicated, our starting point has been separate SAMs for East and West Malaysia, which we have then articulated into a system for Malaysia as a whole. At the aggregate level of accounts, this combination of separate regional SAMs requires only one major conceptual step, namely, that the external accounts for each region have to be disaggregated so as to show interregional and true international transactions (and transfers) separately. As will be seen more clearly at the disaggregated level, this step involves problems beyond those of obtaining a consistent set of data from alternative initial estimates for each of the regions.

There are several alternative formats for the presentation of regional accounts, corresponding to more or less exacting demands for primary data. Table 4.2 shows one arrangement, which is among the least demanding in its data requirements.

The accounts within table 4.2 can be viewed as comprising three principal blocks. One block relates to East Malaysia; the second to West Malaysia; and the third to the rest of the world. Each of the blocks for East and West Malaysia contains nine accounts, which are the nine domestic accounts in the basic eleven-account SAM. The numerical ordering of the eleven-account SAM is retained, so that the external accounts for each region (accounts 7 and 8) are excluded. Transactions between each region and the rest of the world are shown in accounts 7* and 8* which are labeled as such in recognition of the fact that they are true international transactions and exclude those that take place between regions.

One consequence of representing the accounts in the format shown in table 4.2 is that transactions between the domestic accounts for East Malaysia, on the one hand, and West Malaysia, on the other (that is, the interregional flows), appear as diagonal entries in the off-diagonal partitions of the table. This simply illustrates the fact that interregional transfers are simultaneously an outgoing from an account in one region and an incoming to the same account in the other region.

Not all of these accounts have interregional transfers associated with them, however, and for those that do the actual transactions may be zero. Definitional and actual zeros are distin-

Table 4.2. Aggregate Regional Accounts for East and West Malaysia, 1970
(in millions of Malaysian dollars)

Incomes				Expenditures: East Malaysia										Expenditures: West Malaysia										Expenditures: Rest of World		
						Institutions' Current										Institutions' Current										
				Wants	Factors	Households	Companies	Government	Combined Capital	Commodities	Activities	Indirect Taxes	Wants	Factors	Households	Companies	Government	Combined Capital	Commodities	Activities	Indirect Taxes	Current	Capital	Total
				1	2	3	4	5	6	9	10	11	1	2	3	4	5	6	9	10	11	7*	8*	
East Malaysia	Wants		1			1179.0																		1179.0
	Factors		2								1563.0			0								12.8		1575.8
	Institutions'	Households	3		1376.0	74.2	10.9	25.0							0									1486.1
		Companies	4		149.0			7.8								0						3.2		160.0
		Government	5			36.1	32.5					253.0					226.6					2.2		550.4
	Consolidated Capital		6			196.8	106.6	56.8										93.8						434.0
	Commodities		9	1179.0				243.0	349.0		1421.9								98.1			1211.8		4502.8
	Activities		10							3108.7														3108.7
	Indirect Taxes		11							129.2	123.8													253.0
West Malaysia	Wants		1												6349.2									6349.2
	Factors		2		0															9038.1		219.4		9257.5
	Institutions'	Households	3			0								7319.7	401.7	98.0	171.2					16.0		8006.6
		Companies	4				0							1401.9			125.9					11.9		1539.7
		Government	5					235.0							351.9	959.1					1549.0	12.9		3107.9
	Consolidated Capital		6						0						903.8	262.5	818.6						-85.0	1899.9
	Commodities		9							218.2			6349.2				1742.0	2014.9		7891.3		4111.8		22327.4
	Activities		10																17296.1					17296.1
	Indirect Taxes		11																1182.3	366.7				1549.0
Rest of World	Current		7*		50.8		10.0	2.8		1046.7				535.9		220.1	23.6		3750.9					5640.8
	Capital		8*						85.0									-208.8				38.8		-85.0
Total				1179.0	1575.8	1486.1	160.0	550.4	434.0	4502.8	3108.7	253.0	6349.2	9257.5	8006.6	1539.7	3107.9	1899.9	22327.4	17296.1	1549.0	5640.8	-85.0	

guished in table 4.2 by blanks and zero entries, respectively. Thus, for instance, the interregional transfers for three accounts are definitionally zero. The wants accounts (account 1) simply define a mapping between household requirements and the commodities that they implicitly demand; this mapping has no geographical dimension. The appropriate vehicles for trade in goods and services are the commodity accounts. By a similar reasoning neither activities nor indirect taxes (accounts 10 and 11) can have any interregional transfers: the sole function of activities is to produce commodities; similarly, the indirect tax accounts serve only to collect such taxes and eventually pay them to government. For some other accounts there appear to be zero interregional transfers, such as those between factors or households. While it is perhaps unlikely that flows actually were zero in all these instances, they accord with estimates provided to us by the Department of Statistics, and can be interpreted as being negligible.

An important feature of the regional SAM depicted in table 4.2 is the distinction that we have made between functional flows and geographical (interregional) flows. All transactions between accounts are shown as taking place within each region. This is not to deny the possibility of some intraaccount transfers occurring within a region (such as household-to-household transfers in West Malaysia of 401.7), which are still functional flows in our sense. Interregional transfers simply augment the receipts of an account in one region and simultaneously deplete the same account in the other region. Clearly, since gross flows are being represented, it is possible for an east-west transaction to take place at the same time as a west-east flow. All of this implies, of course, that when interregional transactions are aggregated with corresponding flows to the rest of the world, the totals obtained give the aggregate external transactions for each region separately.

An interesting permutation of the scheme shown in table 4.2 is to order the accounts initially by functional type rather than by geographical region. This has the effect of showing each cell of the eleven-account structure as a 2×2 submatrix, with the two rows and columns relating to East and West Malaysia, respectively. With this approach, all such submatrices would necessarily be diagonal for transactions between accounts i and j for $i, j = 1, \ldots, 11$; $i \neq j$. Only in the diagonal block of submatrices (account i to account i) can off-diagonal elements appear with this arrangement, and these would represent the interregional transactions. The approach has the advantage of showing even more explicitly than table 4.2 that the interregional transactions are transfer payments between accounts of the same type. And as transfer payments, these interregional transactions would be netted out if the regional accounts for East and West Malaysia were consolidated back into a SAM for Malaysia as a whole.

THE TREATMENT OF INTERREGIONAL COMMODITY TRADE

The aggregate structure of regional accounts as in table 4.2 clearly shows that regional interdependence involves transactions between a number of accounts. There are few conceptual difficulties involved in identifying these flows, even though the practical difficulties may be substantial. One exception to this general rule, however, is the treatment of interregional commodity trade.

In general terms, imports of commodities are portrayed in the SAM framework as augmenting "domestic" commodity supplies. At a disaggregated level commodities may be distinguished by qualitative differences or even by price differences if the incidence of commodity taxes or distribution margins lead to a variation in user price. It should be recalled that commodity purchases are valued at market prices in our Malaysia SAM framework. This means that commodity transactions are valued at the prices that prevail at the location of the user, rather than the location of the producer. It follows that, on the supply side of the commodity accounts, the value of total commodity supplies comprises the following elements. First, there are domestic commod-

Table 4.3. Definitions for Components of Imports and Exports

Item	Exports of goods and services originating in East Malaysia to West Malaysia (f.o.b.)	Exports of goods and services originating in West Malaysia to East Malaysia (f.o.b.)	Imports of goods and services originating in West Malaysia to East Malaysia (c.i.f.)	Imports of goods and services originating in East Malaysia to West Malaysia (c.i.f.)	Imports from Rest of World to East Malaysia (c.i.f.)	Imports from Rest of World to West Malaysia (c.i.f.)
Definition	$x(E \rightarrow W)$ + $e(E \rightarrow W)$ + $e(W \rightarrow E)$	$x(W \rightarrow E)$ + $w(W \rightarrow E)$ + $w(E \rightarrow W)$	$x(W \rightarrow E)$ + $e(W \rightarrow E)$ + $w(W \rightarrow E)$ + $r(W \rightarrow E)$	$x(E \rightarrow W)$ + $e(E \rightarrow W)$ + $w(E \rightarrow W)$ + $r(E \rightarrow W)$	$r(W \rightarrow E)$ + Imports of goods and services originating in Rest of World to East Malaysia (c.i.f.)	$r(E \rightarrow W)$ + Imports of goods and services originating in Rest of World to West Malaysia (c.i.f.)

ity outputs supplied by production activities, which are valued at basic, or ex-factory, prices. Second, and also part of the "activity to commodity" matrix (the so-called make or mix matrix), are the margins supplied by the trade and transport activities that are required to deliver commodities from the point of production to the point of consumption. In our SAM system, we view these margins as components, supplied by trade and transport activities, of commodity outputs, rather than as the supply of a separate trade and transport commodity. This is because trade and transport margins are an intrinsic part of the value of a commodity when considered from the user's perspective. The third component is the commodity tax element, which is specific to each commodity account and which must be included in the market price valuation. The final component is that of imports c.i.f. (cost, insurance, and freight), the implication being that c.i.f. prices are equivalent to ex-factory costs from the user's point of view, so that when appropriate components of domestic distribution margins and commodity taxes are added, imports are revalued from prices at the point of entry (c.i.f.) to those actually paid by the user, namely, market prices (see Pyatt and Round, 1978, ch. 5).

The conceptual problems of interregional commodity trade concern the treatment of insurance and freight margins on commodity flows, which are simultaneously recorded as a part of one region's exports (at f.o.b., or free on board, prices) and of the other region's imports (at c.i.f. prices). To accommodate these within a SAM framework, the insurance and freight services that are required to move commodities from the market in one region to that in the other need to be distinguished according to who supplies them; that is, the distinction must be made as to whether these services are supplied by East or West Malaysia or by the rest of the world. The notation $E \rightarrow W$ will be used for the flow of goods from East Malaysia to West Malaysia; and $W \rightarrow E$ for flows in the opposite direction. The notation $x(E \rightarrow W)$ is then used to denote the value of goods shipped from east to west, with the valuation being in terms of the market prices at the point of dispatch, East Malaysia in this case. By the time these same goods arrive in West Malaysia, their value will be increased to the extent of the freight and insurance charges involved in shipment. Such charges for the flow of goods from east to west will be denoted by $e(E \rightarrow W)$, $w(E \rightarrow W)$, and $r(E \rightarrow W)$, depending on whether the required shipment services are provided by East Malaysia, West Malaysia, or the rest of the world. Similar notation $x(W \rightarrow E)$, $e(W \rightarrow E)$, $w(W \rightarrow E)$, and $r(W \rightarrow E)$ can be defined to cover the parallel movement of goods from West Malaysia to East Malaysia. With this notation, various magnitudes can be defined so as to recognize that, in our SAM compilations, exports of goods are valued f.o.b. while imports are valued c.i.f.[2] Table 4.3 sets out the definitions needed.

The first four columns of table 4.3 decompose the imports and exports for East and West Malaysia that originate in, or are destined for, the other region. One problem that immediately arises is the question of the appropriate treatment of the elements $e(W \rightarrow E)$ and $w(E \rightarrow W)$. As we have seen, these refer to freight and insurance services on imports when their services are supplied by the importing region. In the balance of payments statistics, in order to maintain imports strictly at c.i.f. values, the convention is to include these elements both in the imports and the exports of a region. It is as though these services are exported and simultaneously reimported. This convention is reflected in table 4.3 where the element $e(W \rightarrow E)$ appears in columns 1 and 3, and likewise, element $w(E \rightarrow W)$ appears in columns 2 and 4. In other respects, freight and insurance charges appear in the exports of one region and the imports of the other region just as one would expect. For example, $x(E \rightarrow W)$ is shown in column 1 (as an export)

2. Purists will notice that we have not captured all possibilities, having excluded the East or West Malaysian supply of shipping services on goods imported from or exported to the rest of the world: $e(R \rightarrow W)$, $w(E \rightarrow R)$, and so forth. These elements can easily be handled by considering the accounts for a closed, three-region system: east, west, and the rest of the world. We limit ourselves to an open, two-region system basically because our focus is on Malaysia rather than the world as a whole. We are grateful to Ann Harrison for raising this point.

Table 4.4. Final Interregional and External Commodity Flow Matrix

		Commodity Accounts		Rest of World	Total
		East Malaysia	West Malaysia		
Commodity Accounts	East Malaysia	Domestic commodity transactions in East Malaysia + e(W → E)	x(E → W) + e(E → W)	Exports of goods and services originating in East Malaysia to Rest of World (f.o.b.)	Total commodity requirements in East Malaysia
	West Malaysia	x(W → E) + w(W → E)	Domestic commodity transactions in West Malaysia + w(E → W)	Exports of goods and services originating in West Malaysia to Rest of World (f.o.b.)	Total commodity requirements in West Malaysia
Rest of World		Imports of goods and services originating in Rest of World to East Malaysia (c.i.f.) + r(W → E)	Imports of goods and services originating in Rest of World to West Malaysia (c.i.f.) + r(E → W)		
Total		Total commodity supplies in East Malaysia	Total commodity supplies in West Malaysia		

and column 4 (as an import). Even freight and insurance services provided by the exporting region, such as e(E → W), are consistently classified in this way, although (and this is a second problem to be dealt with) from the point of view of the exporting region they are an export of a service, while from the view of the importing region they are embodied as part of the c.i.f. values of individual goods.

Table 4.4 displays these same component items within and between the commodity markets of East and West Malaysia in a matrix format. It emphasizes interregional and external flows of the commodity accounts, showing commodity requirements along the rows and commodity supplies down the columns. The basic SAM rule of full articulation of the accounts is clearly captured in table 4.4. It means that the exports (f.o.b.) from East to West Malaysia [x(E → W) + e(E → W)] are the true interregional flow from East to West; while from the importing region's point of view the insurance and freight charges not included, that is, w(E → W) and r(E → W), must be handled separately. Of these additional freight and insurance items, table 4.4 shows quite clearly that r(E → W) is an amount that is imported from the rest of the world.

The item w(E → W), which represents West Malaysia's freight services on its own imports, is both a receipt and an expenditure of the external accounts to West Malaysia when East Malaysia and the rest of the world are treated in aggregate. But when these are distinguished, as in table 4.4, the SAM rule that each transaction should be recorded only once comes into force. Accordingly, w(E → W) becomes a diagonal element in this format. West Malaysian commodity accounts receive income for providing services in shipping goods from East Malaysia to West Malaysia, and this income is also a cost of the West Malaysian commodity accounts because it is part of the amount that must be paid for the supply of goods and services available in West Malaysia.

By way of a check on this treatment of interregional trade, it is useful to consider the effect of aggregation across regions and the resulting consolidation of regional accounts. If the East and West Malaysian accounts were consolidated, then the interregional transfer of commodities would be netted out, since they appear on both the credit side of one region's commodity accounts and the debit side of the commodity accounts for the other region. This is not the case, however, with the items e(W → E) and w(E → W), which would not net out through the consolidated process, since they are not an interregional transfer.

Table 4.5 shows estimates of the interregional and external commodity flows for Malaysia, and it illustrates numerically the schemes we have just discussed. It broadly corresponds to table 4.4 in its entries; the exceptions are the elements corresponding to intraregional commodity flows. In table 4.5 these only include the elements e(W → E) and w(E → W), which amount to 0.1 and 2.0, respectively, all other "domestic" commodity transactions being netted out. This means that row and column sums for each in table 4.5 have a direct interpretation. The row sums represent total exports f.o.b., so that exports from East Malaysia (f.o.b.) are 1,310.0. The column sums equal total imports c.i.f. into each region, which for East Malaysia amount to 1,265.0.

The commodity trade flows between each region and the rest of the world could be decomposed in an analogous way. Such decompositions, however, are only important in seeking a consistent treatment of trade flows in a system of two or more interacting regions, that is, when imports of one region are being matched against the exports of another. In general, the rest of the world is not treated in the same way as the domestic economy, and the decompositions discussed above are not usually warranted. Moreover, it should also be noted that the balance of trade for either region with the rest of the world is unaffected by the treatment of trade flows we have proposed. A region's earnings in providing freight and insurance services on its own imports have been deducted from both total exports and total imports as normally recorded, so the difference between them is unchanged.

Having noted a certain amount of rearrangement of the decomposition of trade flows, and in

Table 4.5. Interregional and External Commodity Flows for Malaysia, 1970
(in millions of Malaysian dollars)

		Commodity Accounts		Rest of World	Total
		East Malaysia	West Malaysia		
Commodity Accounts	East Malaysia	0.1 (a)	98.1	1211.8	1310.0
	West Malaysia	218.2	2.0 (a)	4111.8	4332.0
Rest of World		1046.7	3750.9		4797.6
Total		1265.0	3851.0	5323.6	

a. These items refer only to a region's earnings in providing freight and insurance services in bringing imports into the region from the other region.

particular the extraction of freight and insurance services supplied by an importing region from the apparent interregional trade flows, it remains to discuss in more detail the way in which disaggregated interregional commodity flows can be formalized within a SAM framework. Commodity trade between two regions is represented in the SAM framework as a transaction between the commodity accounts of one region and those of the other region. Therefore, the general representation is by two matrices $X(E \rightarrow W)$ and $X(W \rightarrow E)$, where, for example, the former is a matrix whose rows represent the commodity accounts of East Malaysia and whose columns are the commodity accounts of West Malaysia. Now consider the structure of $X(E \rightarrow W)$ and suppose for simplicity that all freight and insurance services are supplied by the exporting region; we thus assume $w(E \rightarrow W)$ and $r(E \rightarrow W)$ are zero. The element $x(E \rightarrow W)$ is the total amount of goods exported from east to west. At a disaggregated level, the individual commodity exports at f.o.b. prices, which sum to $x(E \rightarrow W)$, would comprise diagonal elements of $X(E \rightarrow W)$, otherwise the diagonal would be zero. From the point of view of the importing region (West Malaysia in this case), these goods should include elements of freight and insurance margins. This can be shown in the matrix $X(E \rightarrow W)$ in the following way. From the point of view of East Malaysia, freight and insurance services are a commodity export. The situation is therefore

analogous to the treatment of distribution margins in the SAM framework that was referred to earlier. These services have to be allocated across the East Malaysia rows of the commodities "freight and insurance services" to the whole range of West Malaysia commodity accounts columns according to the respective c.i.f. markup. The matrix $X(E \rightarrow W)$ has the following properties. The row sums of $X(E \rightarrow W)$ would be a vector of exports from East Malaysia, f.o.b., written $x(E \rightarrow W)$.

$$[X(E \rightarrow W)]i = x(E \rightarrow W) \tag{4.1}$$

where $x(E \rightarrow W)$ contains as one (or more) commodities the total exports of freight and insurance services to West Malaysia. The column sums of $X(E \rightarrow W)$ are elements of a vector of the same commodity trade, but shown as imports into West Malaysia, c.i.f., written $m(E \rightarrow W)$.

$$[X(E \rightarrow W)]'i = m(E \rightarrow W) \tag{4.2}$$

where the freight and insurance margins are now embodied within the c.i.f. value of the commodity imports.

The difficulties that are often encountered in matching trade statistics, and which especially manifest themselves in multiregional analysis, can therefore be accommodated in the SAM framework in a way that is entirely consistent with the distinction of basic prices, factor prices, and market prices. The proposed convention amounts to using the trade matrices $X(E \rightarrow W)$ and $X(W \rightarrow E)$ to transform commodities defined at the border prices of the exporting region into commodities defined at the border prices of the importing region. Moreover, the conceptual structure of these trade matrices is relatively easy to put into practice with recourse to available data.

PART II

Country Studies

5

A Social Accounting Matrix for Sri Lanka, 1970

S. Narapalasingam

The most disaggregated SAM currently available for Sri Lanka relates to the year 1970. Some details of it have been discussed in chapter 2, and a full description is available in Pyatt, Roe, and associates (1977). In this chapter, I shall comment on conceptual problems that are somewhat peculiar to Sri Lanka's national accounts. My focus will be on the paramount need to improve existing social accounting methods and strengthen the data base, so as to make the SAM an effective tool in development planning. I shall also, in the wake of the social and economic changes in Sri Lanka since 1970, draw attention to those aspects of the SAM that need to be expanded further to provide empirical answers to questions of current interest to policymakers in Sri Lanka. In doing so, I shall touch upon the question of how to determine a frame for the SAM, because the usefulness of the SAM in development planning hinges on the choice of the frame.[1] This leads me into a discussion of the statistical needs of the SAM.

Greater disaggregation of the SAM obviously places increased demands on the statistical system, and this aspect cannot be ignored. Because there are usually constraints on the quality of available data, greater disaggregation implies greater effort in reconciling different accounts. Obviously, there is a point beyond which disaggregation proves to be meaningless, unless the statistical system has developed to an extent that justifies greater reliance on the basic estimates themselves. Statistical techniques that iteratively balance the different accounts are meaningful only in the context of a strong data base. These are some of the fundamental problems that I wish to address. To motivate the discussion, I need to provide a brief introduction to the current policy emphasis in Sri Lanka, and I have set out my perception of the general context in which the need for a SAM arises as a schematic flow diagram, shown as figure 5.1.

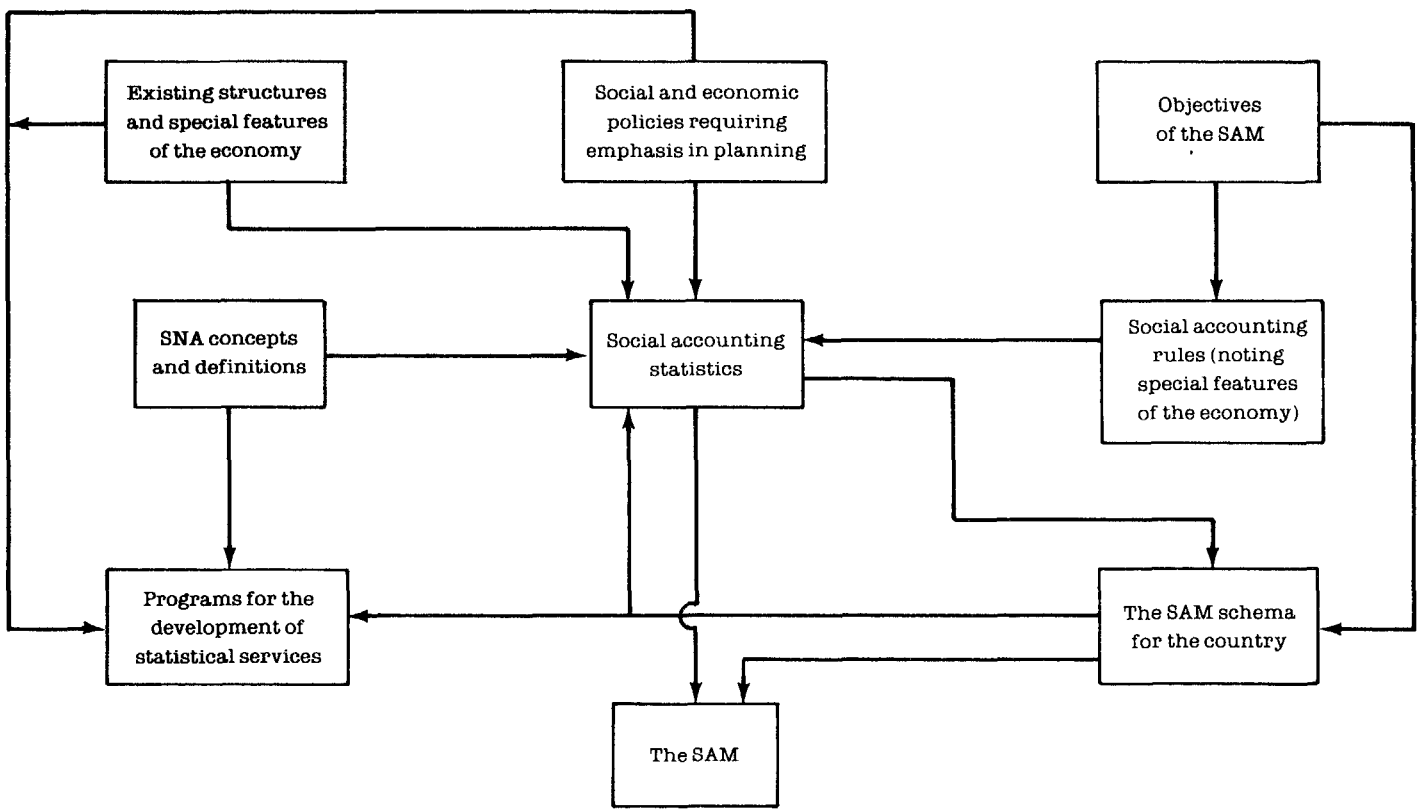
THE CURRENT POLICY EMPHASIS

Over the years, Sri Lanka has achieved major advances in income distribution, health, education, mortality, and fertility comparable to those achieved by more developed countries. It is estimated that Sri Lanka has about one and a half times the life expectancy, about three times the literacy, a quarter the infant mortality, and half the fertility that would be expected at its per capita level of income. There have also been similar gains in income distribution: the Gini coefficient has declined from 0.45 in 1963 to 0.35 in 1973, according to the best available estimates. In the Overseas Development Council's index of the physical quality of life, Sri Lanka occupies a place among the developed countries, securing as high as 83 points out of a possible 100. This compares with an index of 75 for Mexico, 68 for Brazil, 80 for Korea, 41 for India, 42 for Algeria, and 16 for Ethiopia.

Nonetheless, Sri Lanka's per capita income of around $150 a year is one of the lowest in the world. The most severe problem currently facing Sri Lanka is unemployment. The unemployment rate (about 20 percent) is high by any standard and has been accentuated in recent years by a mismatch between the high aspirations of educated new entrants to the labor force and the types of jobs available. An explanation for the increase in unemployment is found not only

1. This point is dealt with in greater detail by Pyatt and Thorbecke (1976).

Figure 5.1. The Determinants of a SAM Schema for a Developing Country



in inadequate resource mobilization for economic development, but also in misallocation of scarce resources. The allocation of limited resources in favor of consumption, as against investment, has not only increased unemployment, but has also made it impossible to sustain the various social welfare programs that were initiated after independence and that enabled Sri Lanka to achieve the impressive gains already mentioned.[2]

The need to change the pattern of allocation of resources away from consumption and toward investment—in order to provide solutions to unemployment and economic growth problems—has been recognized by government. Changes to the food subsidy scheme enabled the government to divert substantial resources from consumption to investment in the 1978 budget. Until the beginning of 1978, almost the entire population was entitled to the food subsidy. Thereafter coverage was restricted, and the current beneficiaries of the food subsidy are those families (comprising about half the population of Sri Lanka) with incomes less than Rs. 3,600 a year (about US$20 a month).

As a result of the nationalization of tea, rubber, and coconut estates of more than 50 acres under the Land Reform Programme and the establishment of new corporations in the public sector since 1970, 30 percent of the value added in total gross domestic production in 1975 came from the public sector, which also provided nearly one-quarter of total employment. More than two-thirds of the tea industry profits and one-third of the rubber industry profits now accrue to the public sector. The principal capital asset owned by the public sector, after the implementation of the Land Reform Programme, is in agriculture, including almost a million acres of land. The physical assets of the public sector in agriculture and industry have the potential to yield much greater returns than in the recent past, when efficiently and fully utilized.

However, performance of the public sector in the recent past has been very disappointing. Many corporations have consistently failed to make any profits, so that nearly all capital expenditures by the public corporations have had to be financed by transfers from the government. Because the government's net current accounts position has been in deficit in recent years, not only all of the public sector's investment, but also part of its current expenses, have had to be financed by domestic and foreign borrowings. Even if the public corporations incurring operational losses are omitted, the rate of return on capital employed in public corporations was below 10 percent—much less than private capital would have yielded. This is because public corporations have been used as instruments of pricing and employment policies, in disregard of some basic commercial principles. The point to be emphasized is that at least some of the decisions that have previously aggravated Sri Lanka's financial problems and adversely affected the long-term growth prospects could have been avoided had the implications been formally studied. The political will might not have permitted alternative decisions, but this is not the immediate concern of planners. What is at issue here is how all the implications concerning income distribution, employment, and pricing policies could have been studied, so that sound advice could have been given to the authorities. Ronnie del Mel, minister of finance and planning, remarked in his budget speech of November 15, 1977: "Since 1956 we have been experimenting with piecemeal, patchwork, ad hoc solutions to our economic problems. The age of cosmetic solutions to economic problems is over, and this Government is determined to offer real and long-term solutions for the problems of our nation."

Sri Lanka has paid dearly by not developing further the planning foundations laid in the late 1960s with the assistance of the United Nations Development Programme (UNDP), which subsequently contributed to the compilation of the 1970 SAM. The framework suggested for economic statistics in that SAM, though still relevant in the present stage of development of the economy, requires further disaggregation to take account of institutional and structural

2. "A static redistribution of income through consumption transfers, for example, would not alter the structure of production and resources in the initial period and, therefore, could not lead to any sustainable changes in the generation of incomes over time." See Pyatt and Thorbecke (1976).

changes since 1970. Moreover, the estimates provided in the 1970 SAM are now outdated; work on the compilation of a fresh SAM needs to be initiated.

In this regard, the new emphasis given to employment generation and the need to reallocate resources from consumption to investment and to improve the financial viability of the public sector as a whole (including public corporations) have to be noted. Thus more disaggregated accounts are required in the new SAM. The traditional small-scale sector should be separated from the modern sector, since the former tends to be more labor intensive. Public sector accounts need to be disaggregated further, identifying separately (a) public corporations, (b) public enterprises, and (c) government departments. Similarly, separate capital accounts are needed for households, private businesses, public corporations, government, public enterprises, and financial institutions, so as to identify the sources of funds for financing investment by public corporations and by government.

All these developments call for a pioneering effort to set up detailed flow-of-funds accounts for Sri Lanka.[3] In the 1970 SAM, there was only one consolidated capital account (including the rest of the world), and public corporations were grouped under the respective production activities, along with private firms. Today, public corporations assume greater importance in Sri Lanka because of the dominance of the public sector in all major industrial activities. The distinction between public and private corporations is important for another reason. The efficiency of capital employed in the two sectors differs considerably. If performance in public corporations is to be monitored closely, with a view toward improving capital and production efficiencies, disaggregation will be essential. The 1970 SAM identified nine distinct occupational groups for compiling the manpower matrix. The usefulness of this matrix would be enhanced if technical skills were further disaggregated to distinguish engineers, welders, fitters, carpenters, bricklayers, and similar jobs that have become critical in recent years because of large-scale migration to the Middle East.

THE DATA BASE

Given the present state of statistics in Sri Lanka, the framework suggested for social accounting is undoubtedly ambitious. It is also a great pity that, over the years, there has been a deterioration in the flow of information needed to update the estimates contained in the SAM. The quality of statistics on national income and components of national expenditure has not improved either. Moreover, the methodology used to compile the available estimates has remained the same, despite changes in the intersectoral dependencies, cost structures, and final demand patterns. In the estimation of gross domestic product (GDP), less than one-quarter of value added is estimated directly, while the rest either is assumed to grow at a trend rate or is estimated on the basis of circumstantial evidence. Value added in construction is calculated as a multiple of the value of certain materials inputs (local and foreign), while investment is derived largely as the value of output of construction plus a multiple of the c.i.f. value of imported machinery and equipment (that is, the value including cost, insurance, and freight). Even estimates of output of major crops and industries are suspect, because reliable estimates of acreage planted are not available for tea, rubber, and coconut crops; and the coverage of industries varies from year to year depending on the response to questionnaires that are sent out. In several instances, domestic consumption in real terms is derived from estimates of constant per capita consumption obtained several years earlier, despite significant increases in the prices of consumer

3. It is inadequate to treat savings and investment as a mere overall accounting identity. The level of investment made by a given sector of the economy depends not only on its own surplus generated within, but also on the volume of investible funds made available by other sectors either directly or through credit institutions. Again, see Pyatt and Thorbecke (1976) and chapter 3 of this volume.

commodities over the years. Estimates of the changes in inventories are simply not available for most commodities. Despite the overwhelming concern with unemployment and the cost of living, statistics on employment and consumer prices are unfortunately dubious.

Among the several papers that have pinpointed the deficiencies of the statistical system in Sri Lanka, the most comprehensive is a report prepared by Petter Jacob Bjerve, statistical adviser to an ILO World Employment Programme mission to Sri Lanka in 1971 (International Labour Office, 1971). Bjerve examined the availability, adequacy, and timeliness of the statistical data and outlined a program for the development of statistical services in Sri Lanka. The recommendations contained in his report continue to be relevant, notwithstanding what Dudley Seers, the chief of the mission, wrote at that time: "To govern in Ceylon, given the present state of its statistics and the present structure crisis, is like driving a racing car without headlights along a winding road at night" (p. 153).

The data used in the 1970 SAM were not obtained from any one source: the more disaggregated the SAM, the wider the range of information sources is likely to be. It follows that, where there is some lack of comparability between concepts, definitions, sampling methods, and valuations used in the different sources, reconciliation becomes difficult. This indeed was the experience in the compilation of Sri Lanka's SAM. There was also the added problem of adjusting data to account for price changes, because the surveys from which estimates were obtained were carried out in different years. The control totals for the 1970 SAM were the national income statistics compiled by the central bank. In a few instances, the control figures were rejected in preference to survey estimates. This is not surprising, since national income statistics compiled without reference to a SAM conceptual framework are unlikely to prove internally consistent when individual components of incomes and expenditures are compared.

If different surveys are conceived and planned within a SAM framework, the prospects for achieving overall consistency in concepts and definitions are enhanced. What Sri Lanka and possibly many other developing countries lack is a commitment to the implementation of statistical programs covering a medium term of four to five years. In Sri Lanka's case, such a commitment on the part of the authorities is of paramount importance in expanding and strengthening the data base, so that a SAM could be used as an effective tool in development planning.

There is a yawning gap in Sri Lanka between data supply and requirements for the compilation of a SAM. To fill the gap, I strongly recommend the preparation of plans for a medium-term statistical program, which will ensure that adequate funds are allocated annually for statistical work. (In fact, the lack of funds has been one of the major factors contributing to the deterioration in the supply of data useful for the compilation of a SAM.) Such plans would also ensure that surveys are designed to deploy available manpower resources optimally; that all data requirements are studied in advance, within a SAM framework, to avoid duplication; that the financial resources allocated for data collection are used efficiently; and, above all, that the SAM is kept "alive" by feeding in new information.

Ideally, statistical services must improve at a faster rate than the development of planning techniques. But if the former are allowed to stagnate, no useful purpose would be served by increasing the degree of sophistication of the latter. It has been argued that improvements in planning techniques will stimulate the expansion of the data base and the quality of data supplied. From Sri Lanka's experience this certainly has not been the case.

SOME CONCEPTUAL PROBLEMS

The new System of National Accounts (SNA) recommends the disaggregation of imports into two types: competitive and complementary. The latter are goods that cannot be obtained

locally. In the 1970 SAM, all imports were treated as primary inputs and hence as complementary imports and were valued c.i.f. The need to distinguish between protective and other import duties, as recommended in the SNA, therefore did not arise. Nevertheless, if the (current) input-output matrix contained in the SAM is to be used to forecast the outputs of different industries corresponding to a given level of final demand, a distinction must be made between competitive and complementary imports. If the objective is simply to obtain insight into interdependencies that existed in the past such a distinction may not be that important. However, for many developing countries, the scope for increasing incomes and employment (at least for several years) lies more in the area of import substitution than in export promotion. The import classification can therefore be crucial in economic forecasting and development planning. Thus import classifications raise a basic issue regarding the use of a SAM in development planning.

Sri Lanka had a dual exchange rate regime from 1968 to 1977. The rates were unified from November 15, 1977, and then allowed to float on the basis of underlying market forces. Before this turning point, except for a few selected items (such as rice, flour, drugs, books, fertilizer, and some condiments), most goods were imported at the higher rate. Similarly, exports, except for tea, rubber, and coconut products (copra, coconut oil, and dessicated coconuts), were also valued at the higher rate. In the 1970 SAM, the premiums paid on imports were treated as indirect taxes (that is, as import duties) and those received by exporters of nontraditional products were regarded as export subsidies. In the rest of the world (current) account of the 1970 SAM, imports and exports were both recorded at the lower rate of exchange.

These valuations of the external transactions raise two problems, given that the Sri Lanka rupee (at the official, lower rate) was overvalued in relation to other currencies in 1970. First, domestic savings are overstated to the extent that the conventional rest-of-the-world current account deficit failed to reflect the magnitude of the true deficit. The true deficit in 1970 would have been higher on the basis of the weighted average exchange rate. Domestic savings were derived by subtracting the balance of payments deficit (obtained by valuing all transactions at the lower rate) from estimated gross domestic capital formation and were therefore overstated. Moreover, the estimate of gross capital formation used in this calculation was valued at market prices. It therefore included the premium exchange payment made for imports of capital goods and accentuated the overestimation of savings. Furthermore, in the absence of independent estimates of savings in different parts of the economy, there was no way of checking the overall savings estimate.

Second, the principle of homogeneous pricing in a SAM is sacrificed if the exchange rate used is at variance with the valuation of a competitive commodity produced locally. This problem is not peculiar to Sri Lanka alone but would arise in all countries that have multiple exchange rates.

The SNA does not explicitly deal with problems arising from the use of multiple exchange rates. The problem, insofar as residual estimation of domestic savings is concerned, stems mainly from the use of different exchange rates for capital goods imports as against other current transactions in the external account.

The dual exchange rate problem affects not only the estimation of domestic savings, but also the current account position of the government. The inclusion of the entire premium on foreign exchange in current receipts, including those generated by public debt amortization and the government's purchases of capital goods, leads either to an overstatement of the surplus or to an understatement of the deficit.

Price distortions have been pervasive throughout the Sri Lankan economy, because of the previously prevailing dual exchange rates, government-administered prices, and price controls. Under these conditions, the task of ensuring homogeneity in prices in the valuations of the several entries in the SAM is formidable. Two different producer prices were available for rice—

depending on whether the farmer sold his produce to the government or to the private trader (middleman). The effective price used in the SAM is the weighted average of the two prices. Likewise, the same commodity sold in different markets (at most there were three: the "official" market, the open market, and the black market) fetches different prices. This price differential poses a problem in regard to accounting prices. If the basic accounting principle of valuing private consumption at market prices rather than at artificial prices is accepted, then, when the government sells goods and services below open market prices, the question arises of whether there has been a transfer from the government to households of resources that would otherwise have been available for alternative use. In Sri Lanka's case, several examples can be found of goods that have been sold below market prices. The SAM has not captured these as transfers, because it did not use market prices for valuing goods that entered into private consumption. This is in fact a weakness in Sri Lankan national accounts, and the 1970 SAM has simply followed the practice. The loss incurred by the government in selling food, for example, either free of charge or at subsidized prices has been treated as a negative indirect tax, in line with the practice followed by the Sri Lankan authorities responsible for compiling the national accounts. It is more correct to treat this amount as a current transfer from government to households, since the food subsidy is not strictly a producer subsidy. It can be noted here that in the IMF format for presenting government accounts, the food subsidy is in fact treated as a current transfer item.

If market prices are used instead of subsidized or cost prices to value consumption of commodities sold below market prices, the estimate of the implied transfer from government to households will increase. This can be illustrated by an example. Let us take rice distributed free of charge to consumers and for simplicity assume that consumers purchase the balance of their requirements of rice in the open market. According to the present way of estimating the food subsidy on rice, the value of the subsidy will be exactly equal to the total cost incurred by the food commissioner in purchasing local and foreign rice and distributing it to consumers. Let us say this amounts to Rs x. Under the suggested valuation procedure, the income transfer from government to households will be Rs (x + y), where Rs y is the value of the margin that the food commissioner would have received had he sold the rice at the average open market price of rice. In other words, Rs (x + y) represents the market value of rice given away free of charge by the government. The upshot of this imputation is that the food commissioner's department would be construed as a government trading enterprise, and the margin (Rs y) realized on the distribution of rice would be charged to revenue of the government accounts. On the debit side of the income and outlay account of the government, an identical entry has to be made to increase the value of transfers to households to Rs (x + y). Thus the estimate of government saving remains unaffected by explicitly providing for the relevant entries in the SAM. These revisions would also entail adjustments to factor accounts. The food commissioner's margins (Rs y) should be reflected in the value added for wholesale and retail trade. This approach to valuation of private consumption would ensure that the estimates are comparable from year to year. If, for example, one assumed that the free rice was eliminated altogether and no other change occurred, the estimate of private consumption expenditure would remain unaffected by this change. The difference will show up only in the amount of current transfers received by households from the government. Besides, as already mentioned, the SAM would reveal more accurately the extent of the transfer involved in selling goods below market prices. All these imputations, though not necessary for balancing the different accounts, are useful to policymakers and planners and may be shown explicitly in the SAM.

Where open market prices are nonexistent, cost prices can be used to estimate the value of current transfers from the government to the household sector. In Sri Lanka's case, educational, health, and even passenger transport services are provided by the government either free of charge or at highly subsidized rates. These subsidies help to reduce the inequalities in income

distribution.[4] However, the 1970 SAM for Sri Lanka does not show these subsidies explicitly as current transfers; the total value of the services at cost prices is shown as a current expenditure incurred by the government (institution accounts) in purchasing government services (production activities). This line of argument reflects the view that "the provision of free services of health and education should be allowed for in the calculation of living standards" (Pyatt and Thorbecke, 1976).

It is claimed that in the 1970 SAM pensions are treated as a current transfer to households rather than as expenditures on goods and services. However, this is not borne out by the entries made in the relevant rows and columns of the SAM. The reason for this apparent anomaly in the treatment of pensions is that in Sri Lanka there is no separate fund to which contributions are made and out of which pensions are paid, because the pension plan is noncontributory (except for the Widow and Orphans Pension Scheme, or W & OP, where contributions by employees are compulsory). The government annually meets almost all the liabilities on account of pensions from its revenue (except some small amounts coming in as W & OP contributions from the employees only).

As recommended in the SNA (paragraph 7.17), in Sri Lanka's case, contributions to social security must be imputed. If the assumption is made that the wages paid to employees currently in service are hypothetically higher by the imputed value of their contributions to social security and that the payments to pensioners are made from this matching contribution, both GDP and the value of government consumption (current expenditure on goods and services excluding transfers) are increased by an amount equal to the pension payments. In order to show pensions as distinct from wages and salaries in a SAM, current transfers from households to government should be increased to reflect the imputed value of the contributions made by employees to social security. Since a corresponding entry of the same magnitude must also be made on the expenditure side of government accounts (that is, a current transfer from government to households), the imputations do not alter the current account position of the government.

SUMMARY AND CONCLUSIONS

The 1970 SAM for Sri Lanka, with the amendments suggested in this chapter, provides a comprehensive and detailed framework for the systematic and integrated recording of flows and stocks. (See also the final SAM scheme suggested by Pyatt and Thorbecke, 1976.) The amendments suggested will certainly help to obtain a better understanding of the hidden and hitherto unrecorded flows, which are important to planners and policymakers. The framework itself will help to improve the quality of Sri Lanka's national income and expenditure statistics, provided a commitment is made to collect economic statistics with reference to this framework. Such a commitment will require a high degree of coordination and planning in the preparation of statistical programs that can be implemented over the medium term.

Finally, the suggested disaggregation of certain accounts in the SAM falls in line with priorities that have emerged since 1970 in the wake of institutional, social, and economic changes that have taken place in Sri Lanka. The disaggregation will require vast improvements in the supply of statistics, particularly in priority areas. The framework underlying a SAM depends ultimately on the availability of statistics for the year chosen; hence, emphasis should be given to the

4. See the appendix by Jayawadena in Chenery and others (1974). Although in Sri Lanka's case, it was assumed, for lack of detailed data, that the entire population irrespective of their income classes benefited from these measures, the Gini coefficient showed a decline from that obtained by ignoring the distribution of educational, health and public passenger transport services in the calculations. It is reasonable to assume that the chief beneficiaries of these services provided by the government are those in the lower income groups.

collection of economic statistics useful for compilation. Attention should also be drawn to the problem of reconciling different accounts in the SAM, because of the wide range of sources that must necessarily be used to compile the matrix. The gravity of these problems varies from country to country, depending on the quality and supply of statistics. In the Sri Lanka SAM, the control figures were taken from official statistics on the components of national income and expenditure, which in some cases were deficient in regard to concepts and methodology used in their estimation. The reconciliation problem would be mitigated by a well-articulated series of sample surveys conducted at regular intervals by a powerful central authority. That authority would be responsible for coordinating economic statistics on all aspects of the country's social accounts.

The other specific suggestions made to enhance the usefulness of a SAM in development planning and economic analysis in Sri Lanka briefly are:

- Use of proper accounting rules and prices to show explicitly the hidden transfers from the government to other sectors
- Adoption of the SNA's concepts and definitions in Sri Lanka's national income and expenditure estimates
- Disaggregation of current and capital accounts to separate public corporations and enterprises from the private sector
- Differentiation of traditional and modern sectors of the economy
- Disaggregation of the capital account to reveal the variations in capital cost structures among different industries and between public and private sectors
- Expansion of the manpower matrix to identify the supply of specific skills that are known to be critical in the development process
- Compilation of a flow-of-funds matrix
- Aggregation of household income classes into two or three categories, while retaining the urban-rural classification
- Disaggregation of imports into competitive and complementary categories to obtain current input-output coefficients for use in forecasting.

6

A Social Accounting Matrix for Swaziland, 1971–72

S. J. Webster

A team of economists and statisticians drawn from the University of Warwick and the Ministry of Overseas Development, London, visited Swaziland in the summer of 1974.[1] Our objective was to examine Swaziland's economic situation and prospects through the medium of a social accounting matrix which we would construct. The matrix was intended to quantitatively describe the structure of the Swazi economy as it was then and to provide a consistent data framework within which the implications of different future development strategies and major economic events could be explored, especially with respect to employment and income distribution. By trying to construct a SAM for a country in the early stages of developing its administrative capacity we were consciously challenging the frequently heard assertion that data limitations preclude useful quantitative analysis of development problems at the macroeconomic level, even where policymakers are willing and able to make use of it. We were also hoping to demonstrate that the social accounting matrix presents a better framework for such analysis than the standard national accounts tables compiled by most developing countries.

This chapter provides a brief description of the Swaziland scene as we found it, sets out the matrix we designed, and discusses some of the conceptual issues we had to resolve. It also recounts the major difficulties we faced in using available information to fill in our framework and explains the solutions we adopted. The finished matrix is presented together with some of the analysis it stimulated and a discussion of its usefulness. The final section discusses the lessons of the Swaziland experiment for introducing social accounting as a working tool. Although the work was conceived as a research project, we had hoped to leave behind a usable tool that could be maintained and improved by others. That this did not happen may be seen as a challenge to our initial assertion that the approach is practical for developing countries; nonetheless, those of us who visited Swaziland believe that the problems can be overcome. In closing, I refer to subsequent work, and to work elsewhere, which is turning out to have been more successful in this respect, perhaps with the benefit of experience gained in Swaziland.

It will be clear from the foregoing that the Swaziland experiment should not be viewed in isolation. The nucleus of the team had already used social accounting as the framework for studying development problems in Iran and in Sri Lanka. Various members have since been heavily involved with similar work in Saudi Arabia, Malaysia, and Botswana, and still further work is planned. On each occasion different aspects have come to the fore. The Swaziland experiment should therefore be seen simply as one contribution to the growing body of experience on some, but by no means all, of the issues involved. In particular, the experiment focused on the data framework, and no attempt at carrying the work a stage further into macroeconomic modeling was made.[2]

1. The team consisted of Graham Pyatt, Robert Lindley, Alan Roe, Jeffery Round, and Paul Stoneman, all from the University of Warwick, and Harry Fell and myself, both, at that time, at the Ministry of Overseas Development, London.

2. This remark relates to the mission itself. On a subsequent mission (discussed later) Jeffery Round constructed a simple model.

THE SWAZILAND SCENE IN 1974

Swaziland is a compact, landlocked country of about 6,700 square miles. Its eastern border lies at the nearest point some forty miles from the Mozambique port of Maputo. (In 1974 Mozambique had not attained independence and Maputo was still called Lourenco Marques.) The administrative capital of Mbabane lies about fourteen miles from the western border with the South African province of Transvaal, which also encloses the country to the north and south. Despite its small size, the country has four geographically distinct regions and is relatively well endowed with minerals, perennial rivers, and land suitable for agriculture. The climate varies from the temperate highveld, with a mean annual rainfall of around fifty inches, to the semiarid, subtropical lowveld, where the rainfall is sometimes insufficient to support the traditional subsistence crop of maize. A surge in primary economic activity took place between 1960 and 1964, and by 1974 there had been some additional development of light manufacturing activity, mainly around the commercial center of Manzini, and a very marked increase in the development of the Ezulwini valley (the Mbabane-Manzini corridor) as a tourist center, catering mainly to South Africans from the Johannesburg area. Mbabane itself had seen a considerable expansion in retail and wholesale distribution facilities.

This brief description of the range of economic activity perhaps hides the extreme dualism of the economy. For a very large proportion of the population of around 400,000 the way of life in 1974 was a traditional peasant agriculture based on maize and cattle herding, although a few cash crops, notably cotton and tobacco, had made inroads in some areas. This dualism was reflected in a twin system of land tenure and government. At the beginning of this century, European settlers were confirmed by the British administration in freehold title to large areas, including some of the best agricultural land and what became the modern towns. In 1974, six years after political independence, there was and still is a sizable community of European farmers; and it is on the freeheld land that most of the commercial agriculture takes place, with the larger farms now being operated by companies which in some cases also control processing plants, in particular a pulp mill, sawmills, two sugar refineries, and a fruit canning factory. The rest of the land is held under the traditional Swazi system by the nation in trust for the people, and arable land is allocated to individuals by chiefs who also have the power to reallocate it. The Swazis, a single tribe forming about 97 percent of the 1974 population, settled the area in the seventeenth and eighteenth centuries. Their settlements consist of individual homesteads rather than villages, with each homestead traditionally supplying most of its own material wants, although for many years individuals have sought employment outside, including temporary emigration to the South African mines, without surrendering their links with traditional household responsibilities such as ploughing and harvesting. Maize and sorghum are the most important arable crops, although the national cattle herd is large, much of it being in Swazi ownership and grazing on common land. As is often the case in Africa, the ownership of cattle has a significance beyond the mere provision of food.

After political independence in 1968 the country had a complete Westminster-style government with the familiar ministries and a parliament in which, however, only the royalist Imbokodvo movement gained any seats in the preindependence elections. This government ran side by side with the traditional system of chiefs, the senior of whom formed the Swazi National Council. The two systems met in the person of King Sobhuza II who was, by a long way, the longest-reigning monarch in the world. In 1972 Parliament was disbanded, without much disturbance, but the civil service and the ministries continued to function as before in most respects, with ministers reporting to the King-in-Council.

Inevitably, Swaziland has close economic links with South Africa. Since 1910 these had been embodied in a formal customs union, and in addition South African currency was used in

Swaziland. In 1969 a new customs union agreement was signed between South Africa and the three newly independent states of Botswana, Lesotho, and Swaziland. This related revenue shares to imports and vastly increased the revenue of the smaller countries to the extent that British budgetary assistance ceased. The provisions of the customs union, of course, have a marked effect on Swaziland's development, and part of the increased revenue was meant to compensate the country for the disadvantages of being in union with a more developed neighbor which was building up industry behind a tariff wall. South Africa is thus by far the most important source of imports for Swaziland, but it is much less important as a market for Swaziland's exports. Sugar, iron ore, asbestos, wood pulp, beef, citrus fruit, and coal were all exported beyond the region. In 1974 negotiations with South Africa to formalize the monetary arrangements were concluded. The Swaziland Monetary Authority came into being, and the lilangeni (plural: emalangeni) replaced the South African rand in general circulation, although the two currencies were closely linked and Swaziland did not aspire to full monetary independence.

The postindependence development strategy of the Swaziland government was expressed in a plan that contained little macroeconomic analysis and was largely a statement of public sector projects and recent economic history. The mining developments and the main agriculture-based industries had existed before independence, and although there was some renegotiation with their foreign owners which gave the Swazis (through the Swazi National Council) a greater share in profits, the general attitude of the government was to create a climate that would encourage further industrial development by foreign companies. Some success was achieved, but the additional employment created was far too small to absorb the rapidly growing labor force. Similarly, although tourism grew spectacularly, the industry had little impact on the welfare of the ordinary Swazi. The Ministry of Agriculture, however, continued its preindependence policy of trying to raise the standards of the Swazi farmer in both crop growing and cattle rearing. Rural Development Areas were set up in which these efforts would be concentrated, and infrastructure was provided through the development budget. In 1974, the RDA program was just beginning to be implemented.

Apart from the question of general development strategy, the Swaziland government faced a number of major issues. The sugar industry was booming at the time under the impact of record world prices and there were plans for expansion, but the iron ore mine which provided the next most important export after sugar was coming to the end of its profitable life. There were largely unexploited coal reserves in the lowveld, and some studies had been made of the feasibility of building a thermal power station to export electricity to South Africa as a means of using the coal. In addition, there was political uncertainty as to the future of Lourenco Marques, through which iron ore and most other exports passed on a railway for which Swaziland was still paying out of the returns from the iron ore mine. Finally, the growth of government expenditure on the civil service was beginning to outstrip the revenue from the customs agreement, and there was little prospect of continuing to absorb a high proportion of qualified school leavers into government employment as had been the case in the five years following independence, when the civil service was being built up and localized.

THE SAM: STRUCTURE, CLASSIFICATIONS, AND CONCEPTUAL ISSUES

The social accounting matrix we designed is presented in table 6.1 (This matrix shows different disaggregations of the accounts from the version of the Swaziland SAM shown as table 2.4 in chapter 2.) This section discusses first its structure and then the classifications through which we hoped to present a picture of the Swaziland economy at work.

Structure of the Matrix

The first block of rows shows the factoral distribution of income generated in production activities, government employment, and domestic service. In the first block of columns this income is transferred to the institutions that own the factors—households of various types, business enterprises, and government. Something of the structure of factor ownership is thereby revealed.

The second block of rows continues the process of collecting the receipts of institutions, which consist of transfers among themselves, including dividends, interest and taxes, and transfers from abroad. The government also receives indirect taxes from production activities. Thus all the sources of income for each type of institution are displayed. However, there is no direct mapping from production activities to household types, so that the activities on which particular households depend for their livelihood are not directly available from the matrix except by inference through the factor accounts. Apart from farming households, where the main activities are obvious in any case, this omission may be said to reflect the view that labor is more mobile among activities than among skill levels, so it is the type of labor rather than the activity in which it is employed at present on which we concentrate.

The second block of columns views the institutions as spenders and savers of the incomes received in the rows. Consumer expenditure and government expenditure are shown by commodity and the balance, after providing for the interinstitutional transfers already discussed and transfers abroad, appear as savings at the intersection with the combined capital account. The contribution of each type of institution to domestic savings is therefore directly available.

The combined capital account of the nation forms the third block, in this case a single row and column. No attempt was made to disaggregate the capital transactions of different institutions except in the case of savings, as already explained. Although considerable efforts had been made to document current transactions, capital transactions had received little attention. Nevertheless, the combined capital account column is able to show real investment by commodity. Domestic investment turned out to be less than domestic savings, and thus the capital account column is completed by an entry in the rest of the world account to reflect Swaziland's current balance of payments surplus. We knew in advance that data on the corresponding capital outflow was too scarce to justify an attempt to present it in the matrix, although we did attempt to complete the balance of payments in a separate table. Had our investigations revealed a deficit on current balance of payments, then the entry would of course have appeared along with savings in the combined capital account row as another source of finance for domestic investment.

Our representation of income generation, distribution, expenditure, saving, and investment is thus complete, and we have the pattern of final demands for commodities which the process creates. These are shown in the fourth block of rows, together with the requirements of production activities for commodities as intermediate consumption. The fourth block of columns shows the breakdown of the supply of each commodity among domestic production activities and as between domestic production and imports. The pattern of demand for imports by commodity is, therefore, directly related to the structure of production and the distribution of income.

The matrix as presented above displays what we saw as the most important mappings of transactions between decisionmaking units for analysis which was to focus on questions of income distribution and employment generation. Clearly, however, not all the tabulations which are potentially of interest to the administrator are available directly from the matrix. For example, even if we had disaggregated the capital account, we should have been able to show only the purchases of capital goods by institutions and not the use made of them in different production activities. Therefore, the matrix should not be regarded as replacing the need for

Table 6.1. Swaziland SAM, 1971–72

(in tens of thousands of rand)

			Factors								Institutions (Current Accounts)														Capital
											Households			Corporations				Government								
			1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	Health	Educ.	Other	21
Factors	Swazi nation land (& labor)	1																							
	Freehold farmers (& land)	2																							
	Other land & natural resources	3																							
	Self-employment, n.e.s.	4																							
	Employment	5										40												481	
	Housing	6																							
	Other domestic capital	7																							
	Other foreign capital	8																							
Institutions (Current Accounts) — Households	Swazi nation land	9	1019			43	244	1						6										5		
	Upper income	10		115	30	132	2437	284								110								27		
	Lower income	11				8	1220	116						12										7	2	
Institutions (Current Accounts) — Corporations	Private nonprofit	12																				13		5		
	Large private, for profit	13			8			–21		1231															9	
	Other private, for profit	14			7			–16	766	804					29	181										
	Public	15							201																	
Institutions (Current Accounts) — Government	Swazi National Council	16			11										29										23	
	Customs union	17									12	180	92										3	6	8	59
	Direct taxes	18									1	166	24		299	94										
	Other revenue raising	19						27			6	44	11		76										22	
	Consolidated revenue	20																	852	584	315		–146	–393	–981	
Combined Capital Account		21									339	418	40		185	1226	106	63				231				–2098
Commodities	Maize	22									314	99	182													7
	Other fresh food	23									249	178	210													30
	Other agric. produce	24																							3	23
	Minerals	25										1														62
	Petrol & oils	26										57	25												28	3
	Electricity & water	27										27	8												9	
	Buildings & works	28																								704
	Semi-finished manufactures	29																							5	31
	Processed food, drink	30									136	213	149												37	31
	Machinery & vehicles	31										170													37	990
	Other finished manufactures	32									81	376	233												85	58
	Dwelling services	33									39	333	75												36	
	Other personal services	34									62	338	66										130	294		
	Transport & communications	35									22	63	37												135	
	Distributive & bus. services	36									98	332	212													100
Production Activities	Traditional activities	37																								
	Other farming & forestry	38																								
	Mining	39																								
	Processing agric. products	40																								
	Other manufacturing	41																								
	Construction	42																								
	Public utilities	43																								
	Hotels & restaurants	44																								
	Other trade & transport	45																								
	Other services activities	46																								
Rest of the World		47													636	182	96							49	61	
Total		48	1019	115	56	183	3901	391	967	2035	1359	3135	1365	18	1254	1793	201	63	852	584	315	231	0	0	0	0

			Commodities															Production Activities										ROW	Total
			22	23	24	25	26	27	28	29	30	31	32	33	34	35	36	37	38	39	40	41	42	43	44	45	46	47	48
Factors		Swazi nation land (& labor) 1																1019											1019
		Freehold farmers (& land) 2																	115										115
		Other land & natural resources 3																	46	7	2					1	1		56
		Self-employment, n.e.s. 4																	1			2	8		4	133	35		183
		Employment 5																15	759	316	494	94	257	55	90	466	734		3901
		Housing 6																									391		391
		Other domestic capital 7																	597			3	19	33	81	150	84		967
		Other foreign capital 8																	344	515	781	47		68		227	3		2035
Institutions (Current Accounts)	Households	Swazi nation land 9																										40	1359
		Upper income 10																											3136
		Lower income 11																											1366
	Corporations	Private nonprofit 12																											18
		Large private, for profit 13																										27	1254
		Other private, for profit 14																										22	1793
		Public 15																											201
	Government	Swazi National Council 16																											63
		Customs union 17																	48	33	52	48	24	1	12	20	40	214	852
		Direct taxes 18																											584
		Other revenue raising 19																-4	10	27	13	11	2	1	7	44	17	1	315
		Consolidated revenue 20																											231
Combined Capital Account		21																										-609	0
Commodities		Maize 22																			21								623
		Other fresh food 23																			42				57			881	1647
		Other agric. produce 24																6	165	1	1793	3	13					370	2377
		Minerals 25																			1	1	17			8		1217	1307
		Petrol & oils 26																	30	13	67	4	14	4	4	24	11		284
		Electricity & water 27																	25	34	99	7	1	6	6	7	4		233
		Buildings & works 28																								50	91		845
		Semi-finished manufactures 29																	38	28	17	15	99			1		1307	1541
		Processed food, drink 30																			7	94			47		9	1951	2665
		Machinery & vehicles 31																	68	99	40	11	12	2		224	102	30	1784
		Other finished manufactures 32																11	444	119	150	93	138	5	38	32	125	169	2157
		Dwelling services 33																											483
		Other personal services 34																										449	1339
		Transport & communications 35																	108	2	191	30	1			386	70	362	1407
		Distributive & bus. services 36																3	171	155	132	63	110	15	22	131	34	6	1584
Production Activities		Traditional activities 37	420	300	169				51		110																		1050
		Other farming & forestry 38	53	999	1966																								3018
		Mining 39				1289		14	3								43												1349
		Processing agric. products 40	32	253	196			36	32	1358	1900	10	27	1		9	49												3902
		Other manufacturing 41							5		283		233				5												526
		Construction 42							697			16					2												715
		Public utilities 43						184	6																				190
		Hotels & restaurants 44													368														368
		Other trade & transport 45							1						10	922	971												1904
		Other services activities 46												482	961		308												1751
Rest of the World		47	118	95	46	18	284		50	183	382	1758	1897			475	208												6536
Total		48	623	1647	2377	1307	284	233	845	1541	2665	1784	2157	483	1339	1407	1884	1050	3018	1349	3902	526	715	190	368	1904	1751	6536	

Note: ROW signifies rest of world; n.e.s. signifies not elsewhere specified.

standard tabulations. Rather it is a means of focusing attention on the main interrelationships in the economy and thus encouraging analytical use of economic statistics which we find requires a much greater effort of imagination when they are presented separately. Naturally, greater or lesser disaggregation of the accounts shown would be suitable for different purposes, and we turn now to the most detailed classifications that we produced in our attempt to provide a suitable framework for analysis of the situation in Swaziland.

Classifications in the Matrix

The full set of classifications used is presented in table 6.2. Rather than going through each account in detail, this section aims to discuss the main issues faced in arriving at the final classifications. To some extent it interacts with the data problems discussed in the next section.

Institutions. Whether they are households, business enterprises, or government departments, institutions represent people collected together into the real decisionmaking units of the economic system. They are the owners of factors of production, the source of entrepreneurship, and the consumers of commodities produced. For this reason it seems more appropriate to give them first consideration than to follow the traditional pattern of beginning with the production account, and hence focusing on industries or factors. Since the final aim is to improve the living standards of the population, especially the poorest groups, it is to the classification of households that we turn first of all.

By far the most numerous household type was the traditional Swazi homestead on Swazi nation land. These were clearly to be our first group and there was a possible subdivision by location since RDAs had been designated and it would be interesting in the future to compare the progress of households living in RDAs with that of other traditional households. We did not attempt any further subdivisions, although given adequate data there would have been enough regional disparities produced by the geography of Swaziland and the historical pattern of communications to justify a regional breakdown. Apart from this we came to the view that the way of life of traditional households was sufficiently standard to deal with them as a single group, despite the difference in income and wealth which the traditional system itself generates. This may reflect a further view that policies designed to act directly on the traditional system would stand little chance of success.

The wholly different way of life of households living in urban areas reflects the dual nature of the economy. Here, subdivisions were clearly necessary and partly because of the general scarcity of data we opted in the end for a very simple classification into high income and low income. We thus ignored divisions that might have been based on race, location within urban areas, type of dwelling, or the occupational or educational level of the household head. By doing this we showed directly the proportion of total income going to the poor and, of course, we could compare the average income of poor urban households with that of households living in the traditional manner in rural areas. We were not, however, able to point to any useful subgroups in the population which had features in common other than their level of income, except such as would be revealed through the factors from which their income was derived. This is largely a reflection of the fact that Swaziland's population has little of the complicated ethnic and tribal structure that characterizes many African countries. Furthermore, urban areas throughout the country are fairly similar despite the fact that certain "towns" are owned and operated by companies for their employees. Since we could find no readily identifiable social grouping that had special access to higher occupations or educational facilities and none of significant size which was excluded from them (except by living in rural areas too far away), the remaining possible classifications for urban households were merely correlates of income, and only worthy of consideration if they had any particular advantage with regard to data availability or if we had been asked to consider them for policy reasons. As it is, we did not even find it necessary

Table 6.2. Classification of the Accounts in the Swaziland SAM

Main Account	Detailed Accounts	Notes
Factor Accounts	Swazi nation land—traditional Swazi nation land—Rural Development Areas Freehold farmers Other land and natural resources Self-employment (not elsewhere specified) Employee compensation (including housing subsidy) Other housing Other capital—Swazi controlled Other capital—non-Swazi controlled	Accounts for Swazi nation land and freehold farmers include land and labor. Freehold farms are also referred to as individual tenure farms.
Households (Current Accounts)	Traditional Swazi households Rural Development Area households Freehold farm households, high-income Freehold farm households, low-income Urban households, high-income Urban households, low-income	Full detail at this level of disaggregation is available only on the income side of the accounts. Household expenditures are estimated at a more aggregate level.
Companies (Current Accounts)	Private nonprofit organizations Public corporations Large private companies Small private companies	The account for public corporations comprises five public corporations. The account for large private companies comprises five companies.
Government (Current Accounts)	Swazi National Council Customs union account Direct taxes Other revenue raising Consolidated revenue account Health expenditure account Education expenditure account Other expenditure account	
Capital Account	Consolidated capital account	
Commodities Account	Commodity accounts	Aggregated into 15 accounts in table 6.1
Production Activities Account	Activity accounts	Aggregated into 10 accounts in table 6.1
Rest of the World Account	Combined current and capital account for the rest of the world	

to separate urban European households (whether expatriate or citizens of Swaziland) from their African counterparts in the upper income group. They resembled each other quite closely in lifestyle, and with localization proceeding in both public and private sectors, interest in European households from the macroeconomic standpoint was dwindling along with their numbers.

We were, however, uneasy with the sharpness of the distinction we had made between Swazi households living in the urban areas and those living in the rural areas. Such is the strength of the household tie in African societies, that we knew them to be quite capable of spanning the rural/urban distinction in their capacity of decisionmakers. Furthermore, we had little hope that the data would allow us to capture most of the interhousehold transactions which arise by separating family members living in towns from the rural homestead. Because the urban

areas of Swaziland have only a short history as true centers for most of the present population, and thus few separate, entirely urban-based families exist, it is difficult to evaluate the impact of employment generation in the modern urban sector on the country as a whole. Nevertheless, although there are few urban families without strong rural links, there are enough rural families who as yet have few if any urban links to justify our analysis.

Having covered the traditional rural areas and the urban areas, we were left with households living on freehold farmland. Apart from the farmers (mainly European or colored and, in Swaziland terms, in the upper income bracket), these included the households of their regular employees and other households that provided a pool of casual labor but otherwise lived in the traditional fashion, often on farms where the owner was absent and carried on no farming activities. Again, a simple subdivision by income was sufficient to separate the groups.

We felt that the classification presented above gave a reasonable picture of the household types in Swaziland in 1974 with which Swaziland's administrators would be concerned. Certainly, even this broad classification stretched the available data to their limits and beyond. We believed, however, that enough reasonable assumptions could be made and tested later by fresh data collection to put the matrix together on this basis.

After households, the second institutional group we distinguished was the private corporate sector. There is a very marked gap in the size distribution of private corporations operating in Swaziland. Certain enterprises in mining, agriculture and forestry and agricultural processing activities are very large, relative to the economy as a whole. These giants, all of which are essentially foreign controlled, clearly required a separate category from the general run of private business enterprises, because they would be affected by and react to economic events and changes in public policy in quite a different way. Which criterion of size we used did not matter, and the task of separating out the giants was quite straightforward. Other private corporate enterprises were left as a single group. Most appeared to have a high degree of foreign ownership in any case, and further subdivision by size or type of technology did not seem likely to yield any groupings that would be interesting for policy purposes, given the data and time available.

Our third institutional category was the public sector. The Swazi National Council, as an institution that made certain crucial decisions as to the use of Swaziland's natural resources and that had recently become a shareholder in enterprises exploiting them, clearly deserved separate treatment, although we knew in advance that data would be hard to come by. Beyond this distinction, and a separate class for public corporations such as the Swaziland Electricity Board, the main issue was how to classify the revenue-raising activities of the "modern" government. Revenue from the customs union was of such importance and was generated so differently from other revenue that we decided on a separate customs union account. On the expenditure side, we chose to show health and education separately from other government expenditures, partly for their intrinsic interest and partly because private institutions as well as government were engaged in providing health and education services.

Factors of production. We started from the usual view of factors as consisting of land, labor of various types, and reproducible capital assets. Very soon, however, we realized that it was fruitless to try to separate the returns to the labor of the traditional Swazi household from the returns to its land, especially given the use of common grazing and the system of allocating arable land to individuals by the chiefs. We therefore identified a single composite factor of production consisting of the land, labor, and capital operated by a traditional household. In some respects this decision begs important questions, because it creates a one-to-one relationship between the factor and institution accounts and precludes, for example, analysis of the difference in returns to those traditional farmers who have received some measure of training or exposure to extension services. However, the decision reflected the fact that the household in traditional Swazi society operates as a producer—in fact, an entrepreneur—as well as a

consumer. Furthermore, the household can and does sell some of its labor to production activities which it does not control, and thus the matrix is able to show what proportion of income is derived from wages and what proportion from self-organized efforts. This seemed a much more interesting division than estimating the "pure" returns to land, labor, and capital.

We chose to take a similar course with freehold farmers, although since there was a market in freehold land, we could in principle have imputed a rent for land farmed by its owners. In our view this calculation would not have justified the effort of making it. Land other than that farmed by its owners or its occupants under the traditional system was classified with other natural resources as a single factor of production.

Apart from the labor factors included above and in other self-employment, we hoped to classify labor by level of skill. This we found to be available by production activity from employment surveys, but data on which to map labor incomes by level of skill into households by type was almost nonexistent. Hence the discussion of employment by level of skill took place in a separate analysis outside the main matrix. The way we used the data on labor incomes by skill in the household accounts is described in the next section on data problems.

We had some difficulty in deciding how to treat the "income" of employees in the form of subsidized accommodation. Since some important employers spanned several production activities and provided a whole range of facilities amounting to a complete township we decided to show the benefits as a transfer from the corporate institution involved to the relevant household group, rather than as factor income.

Capital as a factor of production was divided into other capital, Swazi-controlled, and non-Swazi controlled. This last was clearly a desirable distinction although, equally clearly, establishing the true pattern of ownership and control of enterprises takes much careful investigation. Nevertheless, the Central Statistical Office (CSO) had classified firms according to whether the majority of shares were held by residents of Swaziland, and we followed them in this.

Commodities and production activities. Our final classification had forty-four separate commodities and twenty-six production activities. The classification followed the lines of standard international practice, except we tried to expand the parts that seemed important and contract those that were less so. It is the number of classes, rather than the scheme of classification, which requires comment. For an economy the size of Swaziland and in its stage of development in 1974, a smaller number of classes in each case would have resulted in a more manageable matrix, and hence in a matrix more likely to be used. Aggregation is, however, always possible, and we had good reasons for starting with a disaggregated list. Although the CSO carried out several Industrial and Agricultural Production Censuses, and also surveyed other sectors in the process of compiling national accounts, the reports contained very little commodity detail, and the industrial classification was inhibited by the need to preserve confidentiality in publications. There had been no attempt at producing commodity balances or input-output tables. In contrast, import statistics were collected in a fair degree of commodity detail by surveys of the importers, there being no customs control within the region, and it seemed to us that this accident of the customs union arrangements could be exploited to provide a much more detailed picture and a far better check on the macroeconomic aggregates that were being estimated than had so far been available. What we did is described in the section on data problems, but the point here is that it required us to work at a very detailed level. We decided that our results should remain in detail for the benefit of those we hoped would follow.

DATA PROBLEMS AND SOLUTIONS

The data provided to us by the CSO covered a great deal of the necessary ground. It fell short, however, in certain specific areas and in a number of general respects. Of the latter, timeliness

was probably the most important, and the second half of this section is devoted to what we did about that. First, we turn to the basic data with which we were presented.

The national accounts which were prepared each year contained estimates of gross domestic product by origin and expenditure on GDP, but did not attempt a capital finance account, and the external transactions account was incomplete even as regards the current account. The accounts were, however, based on surveys of various aspects of the economy to which there had been reasonable response. The most important of these for our purposes are:

- Surveys of importers
- Survey of agriculture on Swazi nation land
- Census of individual tenure farms
- Census of industrial production
- Survey of employment and wages
- Rural household survey
- Survey of income and rent in Msundusa (a poor area of Mbabane).

In addition, we had the government accounts and a great deal of incidental information from the Annual Statistical Bulletin. The list above is not atypical for a small statistics office and represents the fruits of several years of hard work by successive statisticians. Only one item requires special comment. Import statistics were not collected as an administrative by-product of the Customs Department for the simple reason that most imports came from South Africa, and in terms of the customs union agreement there were no customs formalities between the two countries. However, the value of Swaziland's imports is the most important single determinant of its revenue under that agreement, and consequently much ingenuity had been expended in designing surveys to measure it. In particular, each modern sector business received a quarterly questionnaire asking it to report the value of direct purchases from South Africa and elsewhere. To assist respondents in the classification of commodities, a guide was issued which corresponded roughly to the three-digit level of the Standard International Trade Classification (SITC). Separate arrangements were made for small Swazi traders, personal shoppers, and postal imports. Since a very high proportion of expenditure went to imports, the fact that we were able to classify them by the production activity of the importer proved critically important when we came to build up input-output tables. The commodity detail also gave us a reasonable guide to end use.

The main defect of the list of sources presented above is that an urban consumption survey was lacking. In the national accounts private consumption was estimated as a residual, and it was only through careful analysis of the import data and comparisons with consumption patterns revealed by surveys undertaken in South Africa and Lesotho that we were able to build up a vector of expenditures by households on commodities that we could enter in the matrix. We could not, in fact, sustain the division of households into the five categories that had proved feasible when examining incomes, and we were reduced to three categories—traditional, high-income nontraditional, and low-income nontraditional—for the expenditure entries. Some may question the usefulness of a matrix that contains guesswork of this sort. We would justify the exercise in two ways. First, it makes explicit assumptions which have to be made informally in considering policy options, and the results of such consideration at a broad level are often insensitive to the accuracy of the detailed data that underlie them. Second, we did not (and do not) view the construction of the first SAM for a country as anything more than the start of a process by which the coverage and consistency of its statistics are gradually improved. If the first attempt reveals that certain areas are very weak, then these are the areas on which subsequent data collection should be concentrated.

The other defect of the sources from our point of view was that each stood independently as a survey of a particular area, and the mappings from one to another, which lie at the heart of

the concept of a social accounting matrix, did not exist. Thus, for example, while the employment and wages survey had a perfectly good classification by level of skill, information on skills had not been collected in the household surveys. Similarly, no input-output work of any kind had been attempted. The analysis of imports by importer led us to the solution of that problem, since it gave far more detail on the use of commodities by industry than was available from the Census of Industrial Production. Because domestic interindustry transactions were relatively few, and we could identify the main ones separately, this information proved all that was necessary. The problem of skill classifications we solved by using the information on earnings by skill from the employment and wages survey to separate household incomes according to the categories we had defined, although in doing so we lost the ability to show more than one category of labor as a factor of production. This limitation is certainly a serious defect for analysis using the matrix and would have to be remedied by further data collection.

We turn now to the problem of timeliness. When we arrived in Swaziland in July 1974, the National Accounts for 1971–72 were still in draft, and there was no hope of selecting a later year as our base. So much had happened both internally and externally between 1972 and 1974 that we felt it essential to try and fill the gap as best we could and so provide a foundation on which the updating of our matrix could be built. It was out of the question to generate in a short time a model that was capable of updating the whole matrix with any degree of reliability, and so we chose instead to tackle the problem piecemeal, using the 1971–72 matrix as a framework. The understanding we had gained of the economy through completing the matrix gave us more confidence in this process than we would have had otherwise for the following reasons.

First, we knew that a great proportion of economic transactions had as one party the government, one of the few giant private enterprises, or one of a similarly limited number of institutions handling the export or processing of agricultural products. Thus we were able to draw up a list of key institutions and arrange a program of visits to be carried out by members of the team, working in pairs. These visits served other purposes as well, in that they enabled us to discuss our interpretation of the basic statistics already available and future prospects for the enterprises concerned. They gave us solid information on virtually all the exports of the country, and since this accounted for a high proportion of activity other than subsistence farming, they also gave us a base on which to build an estimate of the change in production.

Second, with only two commercial banks operating in Swaziland at the time, it was possible to gain a great deal of useful information as to the general growth in commercial activity by talking to their managers, who proved most helpful without breaching the confidence of their individual clients.

Third, import statistics were reasonably up-to-date because of their importance in determining customs revenue. Having carried out a very thorough analysis of 1971–72 imports in the process of putting together the production and commodity accounts, we were able to make much use of later figures to estimate change in expenditure. Furthermore, since such a high proportion of imports came from South Africa, the South African price indices, coupled with information on transport costs, could be used as a supplement to Swaziland's own price indices to provide estimates of real change or to convert volume indicators of change into values.

Fourth, having already covered the marketed output of traditional farmers through our visits to processing and marketing institutions, we found that the size of the maize crop and the net increase in the cattle herd were by far the most important remaining items for general welfare. Although the Department of Agriculture relied on the CSO for surveys to establish the former, their extension workers could make informed comments, and we could supplement these with information from the commercial milling company, which saw the success or failure of the traditional crop reflected in the amount of maize coming to them as a surplus or being bought from them for consumption in the rural areas. In the process of this investigation we were

able to show that the CSO's surveys, as then constituted, gave very poor estimates of change, a fact that would have been noticed long before had the data actually been used.

Finally, there were several statistical series available, such as electricity sales and installations by class of consumer and registrations of new motor vehicles, which were very up to date. Normally, they were used by the CSO only in the Annual Abstract of Statistics, but we found that, with the other information we had pieced together, they helped us bring our macroeconomic picture more or less up to date.

The conclusion we reached after going through this process was that, given sufficient incentive and a good framework within which to view the separate pieces of information, it would be possible for even the small statistical office to provide a much more up-to-date service than had been the case. Furthermore, as experience in using different indicators developed and was compared with more formal survey information, the results could be expected to increase in reliability.

A SOCIAL ACCOUNTING VIEW OF SWAZILAND'S PROSPECTS

A condensed version of the SAM we produced for Swaziland in 1971–72 has previously been presented in table 6.1. In order for it to fit within the confines of this book, production activities have been reduced from twenty-six to ten, and commodities from forty-four to fifteen, but the broad outlines of the economy mostly remain clear. Detailed analysis naturally requires the full matrix, but this section will concentrate on the broader issues and uses to which the matrix can be put.

First, the matrix shown in table 6.1 provides a very convenient source of data for writing a quantitative description of the economy. For example in the top right corner, the factoral distribution of income generated by different production activities is displayed and the activities can be compared. The two major activities of mining and processing agricultural products are each seen to depend heavily on foreign-controlled capital, in each case to the extent that about 62 percent of the year's value added goes as a return to such capital. Proper interpretation of income from employment naturally requires knowledge of the numbers involved and these are presented by skill level together with incomes similarly distributed in tables 6.3 and 6.4. By the same token full understanding of the household distribution of income shown in the second block of rows requires knowledge of the population in each household group. Swaziland's population census was eight years old at the time we did our work and of course did not contain any usable data on income. We did, however, have projections of population living on Swazi nation land, on individual tenure farms, and in urban areas. These are presented in table 6.5. With the aid of this additional information it can be seen that there are strong inequalities in the income distribution and that households living on Swazi nation land were participating only to a minor extent in the employment market. The block of columns in table 6.1 devoted to households shows how income was disposed of, in particular who bore the taxes and how the pattern of consumption varied between household groups. From the next block of columns it can be seen to what extent the government was successful in collecting tax revenue from the corporations, how much was retained by them to finance further investment, and in the final entries how much of the income flowed abroad. Government activities are depicted in the next block and capital formation by commodity in the central column. Where the rows for commodities intersect with the columns for production activities there is embedded a matrix of the technical requirements of each domestic production activity followed by a vector showing exports by commodity. The converse of these entries to complete the commodity balance is the make matrix and vector of imports shown in the last block of rows.

We would argue that presenting the information in a matrix format like this, rather than in

Table 6.3. Payment of Employee Compensation in Swaziland, by Occupation and Industry, 1971–72
(in thousands of rand)

	Production Activities	Administrative and Technical	Clerical	Skilled	Semi-skilled	Unskilled	Total
1	Traditional Swazi households	—	—	—	—	144	144
2	RDA activities	—	—	—	—	14	14
3	Individual tenure farms	1,389	—	348	544	4,601	6,882
4	Forestry	360	48	82	265	894	1,649
5	Maize milling	80	58	—	3	39	170
6	Sugar milling	777	152	688	73	893	2,583
7	Cotton ginning	31	8	6	4	22	71
8	Timber pulping	438	49	659	412	267	1,925
9	Timber sawing	110	29	118	94	251	602
10	Meat packing	23	5	43	12	78	161
11	Fruit canning	119	40	46	60	163	428
12	Iron ore mining	211	70	135	320	209	945
13	Asbestos mining	521	78	373	679	632	2,283
14	Coal mining	49	9	9	15	133	215
15	Other mining	16	3	3	7	54	83
16	Other manufacturing	252	73	107	158	363	953
17	Utilities (electricity & water)	230	51	68	106	129	584
18	Construction	204	57	838	712	760	2,571
19	Transport	562	153	481	532	615	2,343
20	Posts and telecommunications	136	129	38	9	20	332
21	Hotels, restaurants, and bars	135	115	133	213	319	915
22	Wholesale trade and modern retail	796	243	112	175	954	2,280
23	Small Swazi traders	—	—	—	—	43	43
24	Education and health	4,184	123	70	189	302	4,869
25	Other service activities	1,311	540	274	142	250	2,515
	Total	11,932	2,130	4,627	4,724	12,149	35,562

separate tables, has the great advantage that the inevitable inconsistencies that economic data contain have necessarily had to be removed by deliberate judgment and that what remains is not only a complete macroeconomic picture but also a consistent one.

Useful as an overall picture of the economy may be, it is by no means the sole object of the exercise. A full planning model was beyond the scope of our Swaziland experiment, but some discussion of the problems of development strategy can take place simply by reference to the matrix itself, while in other cases the matrix suggests a line of approach for further analysis using data more specific to the task in hand. In fact, the latter aspect probably predominated in the report we presented to the Swaziland government, in which major issues such as the evolving employment situation, the customs union, financial matters, and the distribution of income were all analyzed in considerably more detail than that in which they could be treated in the matrix.

Turning to the general questions of development strategy, which the matrix throws into relief, we can note that the domestic market is much too small for import substitution to be a viable major aim. Furthermore, if the object is to raise the living standards of the rural poor, more development of industry along existing lines is unlikely to have much impact. For one thing, the number of jobs that could possibly be created is far smaller than the number that would be required to make more than a tiny dent in the situation; and this, coupled with membership of the customs union, which has overriding advantages in providing an assured

Table 6.4. Paid Employment in Swaziland, 1971–72
(in thousands of workers)

Production Activities	Administrative and Technical	Clerical	Skilled	Semi-skilled	Unskilled	Total
Individual tenure farms	480	—	213	1,105	16,383	18,181
Forestry	80	39	42	459	3,152	3,772
Maize milling	12	33	—	4	160	209
Sugar milling	113	64	99	72	1,152	1,500
Cotton ginning	5	5	1	4	60	75
Timber pulping	73	78	172	312	561	1,196
Timber sawing	40	37	55	176	1,040	1,348
Meat packing and canning	4	5	13	7	183	212
Fruit canning	14	16	9	40	260	339
Iron ore mining	27	34	22	180	256	519
Asbestos mining	78	62	54	545	1,050	1,789
Coal mining	11	9	2	26	323	371
Other mining	4	4	3	9	157	177
Other manufacturing	72	83	47	276	730	1,208
Utilities (electricity and water)	44	48	35	115	289	531
Construction	41	49	229	632	2,133	3,084
Transport	131	114	114	383	844	1,586
Posts and telecommunications	56	117	23	12	79	347
Hotels, restaurants, bars	50	53	36	273	899	1,311
Wholesale trade and modern retail	217	190	53	213	1,860	2,533
Small Swazi traders	—	—	—	—	360	360
Education and health	2,821	133	64	260	1,242	4,520
Other service activities	200	232	82	184	700	1,398
Total	4,573	1,465	1,368	5,287	33,873	46,566

source of government revenue at virtually no cost in scarce administrative resources (but which places most industries located in Swaziland at a disadvantage compared with similar industries located nearer the large population centers of South Africa), probably means that the general policy of seeking to attract industry by providing sites and tax advantages could not achieve the desired results.

We can also note, although not so clearly from the compressed matrix, that the tourist industry may be a useful minor source of government revenue, but its contribution to the general economic well-being of the country is relatively small. Although it creates a few jobs, they are mostly at rather a low level, and surprisingly it places few demands on domestic industry. Most of its requirements are imported, including fresh meat and vegetables which Swaziland could easily supply. It seemed to us that further development as a tourist economy was probably not in the country's long-term interest, particularly given the costs that providing for tourists imposes on a small country in social terms.

The mining industry—iron ore and asbestos, but with the opportunity of developing much

Table 6.5. Population and Income in Swaziland, by Household Type, 1971–72

Household Type	Population	Income (millions of rand)	Average Annual Income per Capita (rand)
Traditional	295,597	13.57	45.90
Individual tenure farms	81,467	10.89	133.67
Urban	72,295	32.21	445.54

bigger coal mines than existed when we worked—has clearly been an important source of government revenue either directly or through the customs revenues entailed in its relatively heavy imports of plant and equipment. Also, the need to build a railway to get the iron ore to Lourenco Marques (Maputo) provided Swaziland with an important route to the coast for other export products and an alternative to the expensive route through South Africa for bringing in imports bought on the world market. Equally clearly, however, Swaziland is unlikely to become a mining economy in the sense that the mines could not provide incomes for a sizable proportion of its people, which might then generate more domestic activity in the course of being spent. The high propensity to import and the lack of viable import substitution opportunities seem to ensure this outcome. Furthermore, the direct domestic linkages of the mining industry are naturally very small.

There was, of course, no opportunity to look at one of the government's other strategies in quantitative terms, in that the RDA program was in its infancy when we worked. Its effects could be seen through the matrix if the proper data collection were organized and the matrix reestimated for later years. However, it links quite neatly with what seems to be, on first inspection, a favorable strategy for the government to pursue. This would be to expand the processing of agricultural products either by taking existing processing a stage further or by starting to process things that were being exported in a raw state. There seem to be several advantages in this approach. First, it provides a market and a focus for attempts to introduce more cash crops into the rural areas. Second, as a fertile, well-watered country, Swaziland competes well with others if the products are exported in a form or to markets where transport costs do not provide a barrier. Third, while processing's main domestic link is clearly to agriculture, it provides at least as much opportunity for other domestic industries to grow up by providing the processing industries with inputs as by any other strategy we could envisage. We were encouraged to note, in fact, that Swaziland already had a small factory making cardboard cartons, which were used to export the citrus crop. Fourth, it goes some way to satisfying the aspirations of the government and the people to create an economy in which there are opportunities for wage employment and urban living, as well as peasant farming in the rural areas. There are, of course, difficulties, but at least such a strategy seems feasible when examined in the broad terms allowed by the matrix, while several other strategies do not.

A third use can be made of the information in examining the impact of major economic events or development projects. In fact, Jeffery Round, the team member primarily responsible for the production accounts of the system, returned to Swaziland some eight months after the initial work was completed to evaluate a proposal to build a large thermal power station and thus convert the coal resources into a commodity that could profitably be exported to South Africa through their electricity grid network. Similar studies could be made of the impact on various aspects of economic life of events such as the closure of the iron ore mine or a dramatic fall in the price of sugar. The advantage we see in having a SAM for this work, rather than merely using a set of input-output tables together with some supporting economic statistics, is that, apart from consistency, the matrix functions as a checklist to ensure that important aspects are not overlooked. In particular, it helps ensure that aspects such as employment generation and income distribution, which are central to the government's stated policy objectives, are kept to the fore.

ISSUES OF ADMINISTRATION AND ORGANIZATION

The process of constructing the SAM and discussing it with Swaziland's administrators brought us into close contact with the administrative as well as the technical problems of providing quantitative advice in a developing country. In fact, part of the initial interest which the civil servants of the team had in the experiment was our belief that the approach might offer a

means of bringing statisticians and economists into closer contact and thus improving their joint contribution to solving administrative problems.

It had been our experience across many countries that little use was made in government of the work done in statistics offices, apart from a formal chapter in the development plan and transmission of data to international organizations for inclusion in their publications. Statisticians often felt cut off from the process of giving policy advice, while some economists complained of lack of hard data on which to base their judgments, not only in planning but also in reacting to major economic events. I do not propose to offer a full discussion of the reasons for this state of affairs, either in Swaziland in particular or for all countries in general. However, it seems clear that in many cases the statistics collected were either not those wanted by economists or they were classified in a way unsuitable for economic analysis. In addition, statistical reports were often three or more years out of date by the time they left the statistics offices and even then there could be serious doubts about their reliability. Some economists argued that, even if reliable, up-to-date macroeconomic statistics were available, they would be of little use in project appraisal which formed the bulk of their work and for which highly specific data on particular organizations is usually required.

Although many of the criticisms of the work of statistics offices are valid, we did not share the view that the economist concerned with project appraisal could afford to ignore the macroeconomic picture. It may be reasonable to ignore the indirect effects of particular small projects on the grounds that the indirect effects of all small projects on an economy are broadly similar. However, this is scarcely true of a relatively large project such as the thermal power station and the development of the coal field in Swaziland. Furthermore, the assumptions that underlie the appraisal of even small projects seem to require a view of general development strategy if, for example, sensible shadow prices are to be used. This in turn requires a clear picture of the resources available and their present uses; and, as aid donors have become increasingly concerned with trying to improve the lot of the poorest people in the poorest countries, it has become more important when seeking aid to know who gets what, out of what activities. It also seems likely to me that in evaluating the uses of general economic statistics too much stress is placed on formal planning applications. Many of those who are cynical about planning are thereby enabled to question the worth of investing in comprehensive data frameworks. However, it is a feature of developing countries that single, unplanned events can have a dramatic impact on their welfare—world price movements, new trading arrangements, epidemics affecting crops and cattle, the actions of a powerful neighbor—and, even where domestic policy options are shown to be insufficient to deal with the problem, the country is in a much better position to seek help if the probable total effects can be anticipated early in quantitative terms.

It is true that informed guesses can sometimes be made by experienced economists, but even these will benefit from being made within a consistent framework. There are enough examples of important mistakes to support the view that a reliable macroeconomic data framework represents a worthwhile undertaking if it can be achieved.

We found nothing in our Swaziland experiment to alter the views expressed above. We showed that the resources needed to make a start are not out of the reach of most countries with technical assistance agreements, given the information that is already available in national accounts, and I have tried to demonstrate in the previous section that the SAM is a worthwhile development of such accounts. I would argue that it is worth organizing a sufficiently large input to put the first SAM together quickly, or the effort is likely to be overtaken by events and never brought into profitable use. For the same reason, I would counsel against waiting until the statistics office has produced a complete range of surveys before beginning. The SAM, like the national accounts to a lesser extent, provides a useful indication of where the most serious data deficiencies lie. Furthermore, survey data are never perfect and often one set will benefit from being seen in the context of other available information.

However, it became clear from our experience in Swaziland that the mere provision of a completed SAM for a base year with some ideas on updating and recommendations as to the future pattern of statistical work by a team of outsiders was not in itself sufficient to stimulate the development in data collection and the application of economic analysis which we thought desirable. Since the social accounting approach is intended as a practical aid to improve capacity, careful thought will have to be given to integrate social accounting into the work of planning and statistics offices against the background of extreme pressure on skilled resources.

Since the Swaziland experiment was completed, some members of the team have returned to southern Africa to help the government of Botswana construct a SAM. With British government assistance, a special post of "research statistician" has been established in the CSO and its occupant works closely with a macroeconomic unit in the Department of Economic Affairs in Gaborone. It remains to be seen whether this alternative approach will succeed, although the early indications are very encouraging. In the end, much will depend on whether aid donors give adequate continuous support to countries that are trying to improve their administrative capacity this way. In turn, whether countries are willing to make such an effort will depend to a great extent on whether they themselves can see any return for the expenditure of scarce resources. No one, however, should underestimate the distance still to be traveled in spite of the substantial step forward by the experience in Swaziland and SAM studies like it.

7

A Social Accounting Matrix for Botswana, 1974–75

C. C. Greenfield

Botswana is a landlocked country about the size of France but with a population of only 700,000. More than two-thirds of the land surface is covered with Kgalagadi sand, of which a large part is the Kgalagadi desert. Together with Lesotho, South Africa, and Swaziland, Botswana is a member of the Southern African Customs Union (SACUA) and, before 1976, used the rand as its currency. The Bank of Botswana was established in July 1975 as a full central bank and a year later introduced the country's own currency, known as the pula, in place of the rand. The economy is open and relatively simple; cattle farming is the major traditional economic activity. The discovery and mining of copper and nickel and diamond deposits, coupled with high international prices for beef, have brought rapid economic growth in recent years.

These developments have meant that economic planning in Botswana can no longer concentrate on sector and project issues, but must increasingly consider macroeconomic issues as well. This broader approach, together with the government's goal that all citizens should benefit from development, accounts for the desire to produce a SAM for Botswana. The particular features of the matrix that was produced are in part a result of the particular circumstances of the country.

THE MATRIX AND ITS BROAD FEATURES

The Botswana SAM for 1974–75 was constructed in 1977 by a small team working in close association with officials of the government of Botswana.[1] The date of the SAM was chosen to include the latest year for which national income estimates were available at the time this study was undertaken. Appendix A, at the end of this chapter, sets out some logistic details of the exercise, while table 7.1 presents a version of the final matrix. The major features of the matrix will be discussed here by comparing it with table 2.1 of the United Nations System of National Accounts (SNA) (see United Nations Statistical Office, 1968). The latter is the format that has been most widely publicized and recommended internationally. The comparison is facilitated by table 7.2, which summarizes the principal features of the Botswana SAM and the SNA format.

It is apparent from table 7.2 that the Botswana SAM represents a considerable condensation, and a simplification, of SNA table 2.1. In certain cases this result arose from a lack of data, but mainly it arose by choice. Lack of data specifically precluded incorporation of opening and closing assets and revaluations. Although in principle one would wish to include these, the possibility of obtaining sufficiently reliable data, particularly for tangible assets, would seem to represent an unattainable goal in most, if not all, countries.

The remaining differences arose by choice, the most striking of these being the current account in the Botswana SAM, which can be compared with the production, consumption, and rest of the world current transactions accounts of the SNA table. In the latter, production is subdivided

1. The production of the Botswana SAM was a team effort and thanks are due to all who participated. Particular thanks go to Harry Fell for his contribution to the design of the matrix.

into commodities and activities, so that a "make" matrix, showing industrial production by commodity, and an "absorption" matrix, showing the use of commodities by industries, are both separately estimated, with imports shown classified by commodity. In order to produce an input-output table from these matrices, the conventional method would be to assume either a commodity-based technology or an industry-based technology, and more exceptionally a mixture of the two, and thereafter to combine the make and absorption matrices into a single input-output table through mechanical algebraic manipulation.

In table 7.1, however, there is only an input-output table, located at the intersection of the production activities rows and columns. This input-output table was estimated directly without first producing make and absorption matrices. It was possible to do this in Botswana because of the relatively simple nature of the economy, with only a few large business enterprises for which one can obtain individual estimates of expenditure associated with noncharacteristic production. For the remaining small enterprises, noncharacteristic production was trivial, particularly given the high degree of aggregation used (only seventeen groups of production activities were identified, condensed into fifteen in table 7.1). Although this approach might not be possible in more complex and developed economies, there is merit in employing it whenever possible. The size of the SAM is appreciably reduced in consequence, and ease of interpretation is thereby improved.

Other differences in the current account are equally substantial. In the SNA table 2.1, consumption is subdivided into expenditure and income and outlay. Expenditure is subdivided by purpose—for households, government, and private nonprofit bodies—while income and outlay are divided into the subheadings of value added, institutional sector of origin, form of income, and institutional sector of receipt. It would take too long to describe the logic of all the flows arising from these classifications, but let us trace value added through them as an example. Value added is shown as being derived from commodities (protective duties), commodity taxes, industries, and so forth. It is then paid to the institutional sector of origin, which in turn pays its incomings to the form of income account. Form of income then pays to accounts for the institutional sector of receipt and the rest of the world. And finally, institutional sector of receipt pays for its incomings to the consumption expenditure, form of income, and capital finance (savings) accounts. This is hardly a picture that one would visualize as describing the flow of value added through an economy, largely because of the inclusion of the form of income accounts, which in part duplicate and in part disaggregate the value added accounts.

In the case of the Botswana SAM, all of the above accounts have been replaced by accounts for factors and institutions. The logic of the flows is that factors receive income from hiring their services to production activities, government, and the other accounts. This income is then channeled to the institutions owning the factors, namely, households, enterprises, government, and the rest of the world. Transfers between domestic institutions then occur, such as payments of interest, dividends, and direct taxes, and are shown in the institution-by-institution submatrix. The resulting income of institutions is then spent on domestic production, imports, and other payments to the rest of the world, and the balance is saved, as shown at the intersection of the institution capital account rows with the institution current account columns. While some detail has been lost in this presentation as against that of SNA table 2.1, it is suggested that the gain in simplicity, with a description of flows that is intuitively clear, more than compensates for the minor loss of detail.

The differences in presentation of the capital account, apart from necessary omissions in the Botswana SAM already mentioned, are more a matter of detail than principle. Thus gross capital formation has been presented in the Botswana SAM at the intersection of the institutions columns with the rows for production activities and the rest of the world. Capital transfers are shown in the institution-by-institution capital account submatrix. The treatment of financial claims is essentially the same as that in table 2.1 of the SNA, and the basic identity—that

Table 7.1. A SAM for Botswana, 1974–75

(in millions of pulas)

				Current Account																	
				Factors								Institutions									
				01	02	03	04	05	06	07	08	09	10	11	12	13	14	15	16	17	18
Current Account	Factors	Admin. & prof. employees	Local 01																		
			Expat. 02																		
		Skilled manual & clerical employees	Local 03																		
			Expat. 04																		
		Unskilled employees	05																		
		Self-employed	06																		
		Operating surplus	07																		
		Depreciation	08																		
	Institutions: Households	Periurban households	09	0.1		0.5		9.7	0.2								0.2	0.2			
		Urban hhs., high-density housing	10	0.2		8.2		13.5	0.9								0.2	0.2	0.1	0.3	
		Urban hhs., servants' quarters	11			0.3		3.6										0.1			
		Urban hhs., med.-density housing	12	0.5	0.9	4.2	3.5	4.1													
		Urban hhs., low-density housing	13	0.3	11.7	1.3	5.4	0.4													
		Rural hhs., <10 cattle	14	2.5	0.1	5.7	0.4	3.1	16.3	0.3	2.4	0.8	1.5	0.3	1.0	0.2				1.5	
		Rural hhs., 10–80 cattle	15	2.0		3.2		0.7	29.5	2.2	2.5	0.7	1.2	0.3	1.0	0.2				1.0	
		Rural hhs., >80 cattle	16	0.6		0.9			6.6	9.0	1.0		0.2								
		Migrant workers abroad	17			18.6		4.4													
	Institutions: Entrp.'s	Major mining enterprises	18							2.1	7.8										
		Other private enterprises	19							11.8	5.9	0.1			0.3	0.1			0.3		0.8
		Parastatal enterprises	20							7.7	1.4										
		Private nonprofit & local govt.	21							0.3	0.4	0.1	0.4		0.6	0.5	1.6	0.6	0.6		
	Central Government	Transfers	22a							0.1	1.7	0.1	0.2		0.6	2.0	0.1	0.1	0.1		12.9
		Sales	22b										0.3		0.9	0.7		0.4	0.4		
		Indirect taxes	22c												0.1	0.1		0.1	0.2		
	Production Activities	Freehold farms	23																0.3		
		Traditional farms—livestock	24														4.0	9.0	2.1		
		Traditional farms—crops	25										0.1				2.3	3.4	0.5		
		Traditional farms—other activ.	26										0.2		0.2		3.5	1.6	0.5		
		Mining (diamond, copper, other)	27																		
		Botswana Meat Commission	28																		
		Other manufacturing	29									0.4	1.2	0.2	0.4	0.1	3.1	2.3	0.8		
		Water & electricity	30									0.1	0.2		0.1	0.3		0.1	0.5		
		Construction	31																		
		Wholesale & retail trade	32									1.5	3.3	0.6	0.8	1.0	3.4	2.0	1.0		
		Hotels, bars, restaurants	33												0.2	0.2		0.1	0.3		
		Rail transport	34									0.1	0.1		0.1		0.1	0.1			
		Other transport & communications	35									0.1	0.1		0.1	0.2	0.1	0.2	0.2		
		Services, n.e.s. (incl. dwellings)	36										0.6		0.9	1.3	2.9	2.2	0.9		
		Personal & household services	37									0.1	0.4		0.1	0.5	0.3	0.7	1.2		
	Price Effects		38									0.9	1.9	0.4	0.6	0.9	1.8	1.8	1.6		
			39									0.1	0.1		0.2	0.2	0.2	0.4	0.2		
	ROW	Goods & nonfactor services	40									5.7	11.1	2.1	3.7	4.5	10.7	10.9	9.6	15.6	0.7
		Factor services & transfers	41		0.7		3.1								0.6	5.4					-9.3
Capital Account	ROW	Capital transactions	42																		
	Institutions	Households	43									0.2	0.4	0.1	0.8	1.3	2.2	8.0	5.5	4.6	
		Major mining enterprises	44																		5.9
		Other private nonfinan. & local govt.	45																		
		Nonfinan. parastatal enterprises	46																		
		Banks	47																		
		Other enterprises, incl. BDC	48																		
		Central government	49																		
	Financial Claims (Assets)	Domestic currency	50																		
		Bank deposits	51																		
		Other domestic deposits	52																		
		Treasury bills	53																		
		Bank advances	54																		
		Other domestic lending & borrowing: Short term	55																		
		Other domestic lending & borrowing: Long term	56																		
		Common customs area account	57																		
		Other foreign lending & borrowing: Short term	58																		
		Other foreign lending & borrowing: LT from govts.	59																		
		Other foreign lending & borrowing: LT from orgs.	60																		
		Other foreign lending & borrowing: LT from private	61																		
		Official reserves	62																		
		Unallocated	63																		
		Errors & omissions	64																		
Total			65	6.2	13.3	42.6	12.5	39.5	53.6	33.4	23.2	10.9	23.6	4.0	13.4	19.8	36.3	44.6	27.1	23.0	11.0

Note: ROW signifies rest of world; n.e.s. signifies not elsewhere specified; BDC is Botswana Development Corporation.

Current Account																							Capital Account						
				Production Activities															Price Effects		ROW		ROW	Institutions						
19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36	37	38	39	40	41	42	43	44	45	46	47	48	49
		1.7	3.1	0.1				0.1	0.1	0.1		0.1	0.3			0.1		0.5												
		1.0	3.8	0.1				1.2	0.4	0.4	0.9	0.9	0.5	0.1		1.8	1.8	0.4												
		2.2	11.0	0.7	1.6	0.1		1.4	0.3	0.8	0.8	1.0	1.8	0.2		0.4	1.7	0.1			18.6									
		0.2	1.9	0.4				2.7	0.1	1.1	0.3	3.1	0.9	0.1	0.8	0.5	0.4	0.2												
		1.7	1.4	1.3	1.8	0.1		3.6	1.4	3.4	0.4	9.4	4.3	0.5	0.8	0.4	0.8	3.6			4.4									
				1.3	26.9	5.2	6.1			2.9		0.8	7.9	0.3		0.1		2.0												
		0.1		3.7	9.8			0.4	3.4	0.2	3.4	4.6	4.7	0.1	-1.9	0.6	4.1													
		0.4	0.7	0.7	1.2	0.1		7.9	0.5	0.7	1.0	2.0	1.0	0.2	0.5	1.4	4.4	0.4												
0.1																														
0.6																														
8.6																														
0.1																					0.9									
5.9	0.3		1.2																		3.6									
0.8	0.2																				0.2									
			5.3						0.1				0.2					0.1			0.7									
4.3	7.4																				12.9									
					0.1			0.2						0.1		0.1														
				0.1	0.1			0.1	0.5				0.5			0.1	0.2	0.2	16.4											
									10.5	0.4										0.3	0.1			0.9			0.3			
									15.7	0.3										0.1				13.0						
										0.7											1.0			-1.9						
								1.2			0.5	0.6								0.9	51.0				3.0					
				0.2	0.2															1.1	32.1						2.7			
			0.4					5.5				0.1		0.2						0.3	9.9					0.5				
			0.9					5.8	0.6	0.1		0.5	0.2	0.2	0.1	0.2	0.2	0.1		0.1										0.5
								6.2												0.6				1.8	5.5	8.9	7.4	0.8	0.1	19.7
		0.1	0.3	0.5	0.3			1.3	1.1	2.6	0.8	4.8		0.3	0.4	0.9	0.3	0.5		1.3	0.7			0.2	0.8	1.7	0.2			0.4
		0.2	0.7														0.3				1.3					0.1				
			0.2	0.2	0.3	0.1		0.9		0.6	0.1	0.1	1.1			0.5	0.1			0.2	14.9					0.5				
		0.2	7.0	0.1	0.2	0.1		0.6				0.1	0.5				1.4			0.3	1.1									
		0.1	0.5	0.1	0.3	0.1		1.1		0.4	0.1	1.5	1.9	0.1		0.1				0.5	1.8					0.3				
				0.4	0.6	0.2		0.5		0.6		1.1	0.7	0.1		0.7				0.3	2.0					0.2				
				0.2				0.5	0.1	0.2	0.1	0.4	0.1		0.2	0.1	0.1							0.2	1.1	2.5	0.3			0.5
			0.2					0.3	0.4	0.1		0.2	0.1			0.1					2.2			0.1	0.2	0.2	0.2			0.3
1.2	0.5	0.9	5.6	2.7	1.1	0.2		16.2	1.4	10.1	3.0	19.9	7.1	1.3	19.7	4.7	1.7	2.3					-80.9	1.4	15.2	14.1	2.0	0.1	0.4	3.8
6.1	0.2		1.4																											
																					-11.5				6.5					
																										0.1				
1.6		2.7																												
	1.5																													
1.0																														
0.3	0.2																													
			19.1																				23.5	0.1			0.1			
																								4.5	0.1	0.4		0.4		
																								3.5	1.9	1.0	0.1		0.5	12.9
																								2.8						
																												0.6		
																												10.9		
																								0.4	2.1	0.9	2.5			
																									-0.1	0.6	0.2		3.1	20.6
																														-6.2
																							11.7	-1.7	6.2		0.5			1.6
																							6.0							
																							4.6							
																							35.2							
																												4.4	2.4	
30.5	10.3	11.6	64.6	12.9	44.4	6.2	6.1	57.4	36.5	25.5	11.1	51.2	33.6	3.6	20.5	12.6	17.6	10.6	16.4	6.2	147.7		1	25.1	41.4	32.0	16.5	17.2	6.5	53.9

(Table continues on the following page.)

Table 7.1. (Continued)

					Capital Account														Unallocated	Errors & omissions	Total
					Financial Claims																
					50	51	52	53	54	55	56	57	58	59	60	61	62		63	64	65
Current Account	Factors	Admin. & prof. employees	Local	01																	6.2
			Expat.	02																	13.3
		Skilled manual & clerical employees	Local	03																	42.6
			Expat.	04																	12.5
		Unskilled employees		05																	39.5
		Self-employed		06																	53.6
		Operating surplus		07																	33.4
		Depreciation		08																	23.2
	Institutions: Households	Periurban households		09																	10.9
		Urban hhs., high-density housing		10																	23.6
		Urban hhs., servants' quarters		11																	4.0
		Urban hhs. med.-density housing		12																	13.4
		Urban hhs., low-density housing		13																	19.8
		Rural hhs., <10 cattle		14																	36.3
		Rural hhs., 10–80 cattle		15																	44.6
		Rural hhs., >80 cattle		16																	27.1
		Migrant workers abroad		17																	23.0
	Institutions: Entrp.'s	Major mining enterprises		18																	11.0
		Other private enterprises		19																	30.5
		Parastatal enterprises		20																	10.3
		Private nonprofit & local govt.		21																	11.6
	Central Government	Transfers		22a																	64.6
		Sales		22b																	
		Indirect taxes		22c																	
	Production Activities	Freehold farms		23																	12.9
		Traditional farms—livestock		24																	44.4
		Traditional farms—crops		25																	6.2
		Traditional farms—other activ.		26																	6.1
		Mining (diamond, copper, other)		27																	57.4
		Botswana Meat Commission		28																	36.5
		Other manufacturing		29																	26.5
		Water & electricity		30																	11.1
		Construction		31																	51.2
		Wholesale & retail trade		32																	33.6
		Hotels, bars, restaurants		33																	3.6
		Rail transport		34																	20.5
		Other transport & communications		35																	12.6
		Services, n.e.s. (incl. dwellings)		36																	17.6
		Personal & household services		37																	10.6
	Price Effects			38																	16.4
				39																	6.2
	ROW	Goods & nonfactor services		40																9.1	147.7
		Factor services & transfers		41																	
Capital Account	ROW	Capital transactions		42	5.4							−6.2	5.6								—
	Financial Claims (Assets): Institutions	Households		43					0.2	1.0	0.5										25.1
		Major mining enterprises		44					−1.1		11.5		3.1			21.8			.		41.4
		Other private nonfinan. & local govt.		45					8.4	2.0	0.9		5.1			11.2					32.0
		Nonfinan. parastatal enterprises		46					2.2	1.5	9.9									1.4	16.5
		Banks		47		20.0							3.5			2.2			−8.6	−1.0	17.2
		Other enterprises, incl. BDC		48			2.9		0.1	1.4	1.7									−0.1	6.5
		Central government		49				0.6	1.2					6.0	4.6	0.1				−1.7	53.9
	Financial Claims (Assets)	Domestic currency		50																	5.4
		Bank deposits		51																	20.0
		Other domestic deposits		52																	2.9
		Treasury bills		53																	0.6
		Bank advances		54																	11.0
		Other domestic lending & borrowing	Short term	55																	5.9
			Long term	56																	24.5
		Common customs area account		57																	−6.2
		Other foreign lending & borrowing	Short term	58																	17.3
			LT from govts.	59																	6.0
			LT from orgs.	60																	4.6
			LT from private	61																	35.2
		Official reserves		62																	
		Unallocated		63																	6.8
		Errors & omissions		64																	
Total				65	5.4	20.0	2.9	0.6	11.0	5.9	24.5	−6.2	17.3	6.0	4.6	35.2			−8.6	7.7	

Note: ROW signifies rest of world; n.e.s. signifies not elsewhere specified; BDC is Botswana Development Corporation.

Table 7.2. Summary Structure of the Botswana SAM and Table 2.1 of the United Nations System of National Accounts

Botswana SAM Accounts	SNA Accounts
Current Account	Opening Assets
Factors	Financial claims
Institutions	Net tangible assets
Production Activities	Production
Rest of the World	Commodities
	Activities
Capital Account	Consumption
Rest of the World	Consumer goods purposes
Institutions	(expenditures)
Financial Claims	Income and outlay
	Accumulation
	Increase in stocks
	Fixed capital formation
	Financial claims
	Capital finance
	The Rest of the World
	Current transactions
	Capital transactions
	Evaluations
	Financial claims
	Net tangible assets
	Closing Assets
	Financial claims
	Net tangible assets

Note: SNA accounts are as summarized in table 1.6 of the System of National Accounts (United Nations Statistical Office, 1968).

savings plus change in financial liabilities is equal to capital formation plus change in financial assets—is retained. We will return to the subject of financial claims later, however, because although the Botswana SAM does not diverge from SNA recommendations in this respect it is a feature that differentiates the Botswana SAM from other SAMs presented in this volume.

DETAILED FEATURES OF THE MATRIX

The detailed classifications employed in the matrix naturally differ from those used in SNA table 2.1. The latter table is given in the SNA simply as an illustration and is not concerned primarily with questions of income distribution. The need to consider issues of income distribution was, however, one major reason for preparing the Botswana SAM, and this led to the classification of factor income by broad skill group and by local or expatriate labor, and the breakdown of households into rural and urban groups, with further subgrouping among these. For questions of income distribution, it is not sufficient to have a SAM expressed in money

values, as presented here. Additional information is required for at least some of the cells on the physical values to which the money values relate. For example, although one can estimate from table 7.1 the total income of high-density and low-density urban households, this estimate is only half of the picture as regards income distribution—one also needs to know the number of households or persons to whom these incomes apply. Consequently, supporting estimates of relevant quantities were also produced in Botswana.

The actual classifications employed in a SAM are crucial to its potential usefulness. No one set of classifications can be ideal for all purposes and, unless there are abundant resources to produce a set of SAMs with different classifications, a compromise has to be made to select that set most likely to be required for major policy purposes.

The classifications used in the Botswana SAM were arrived at after lengthy discussion with officials in that country. There are only two points to note, namely, the small number of groupings used for production activities and the fact that a different classification of institutions was used in the current and capital accounts.

The classification of production activities was proposed by officials in Botswana. It does not accord with the normal requirement that the members of any given industrial subgroup should have as similar a production technology as possible. The other manufacturing group is particularly heterogeneous. This classification must add some unreliability to any prediction employing the input-output table, but it is unlikely that this will be significant because, even with the fifteen groups given in the SAM (as opposed to the seventeen for which estimates were made), the degree of interindustry dependence is slight, a reflection of the present stage of economic development in Botswana.

As regards the different classification of institutions between the current and capital accounts, households have been aggregated as a single group in the capital account simply because there was no information on financial claims for the household groups used in the current account. A different classification of enterprises was employed, however, because it was found that those groupings considered the most useful in the current account were not the most useful for understanding capital account transactions. In particular, it was felt essential to identify banks and other financial institutions in the capital account.

Price effects represent an important and unusual feature of the Botswana SAM, although the novelty is partly a matter of terminology since they correspond to "commodity taxes, net" in SNA table 2.1. Some reasons for our preferred terminology are set out in appendix B to this chapter, together with some discussion of associated technical issues. Here it may suffice to note that table 7.1 expresses commodity balances in what the SNA refers to as basic prices and that "commodity taxes, net" or "price effects" have two separate accounts in the table, so that some implications of Botswana's membership of SACUA can be shown separately. Indirect taxes levied in Botswana by central and local government have been charged in rows 21 and 22(c) to those production activities and households paying them. Import duties are levied by SACUA, rather than the government of Botswana, and have already been charged and hence included in the price of imports, when they reach the border of Botswana. In order to show the c.i.f. value of imports (that is, cost plus insurance and freight), as it is conventionally understood, it is therefore necessary to remove the estimated duty charges from the cost component. The true value of this content in any given time period is not known, and reliable estimation would require appreciably more information than was readily available. What is known, however, is Botswana's entitlement to revenue from SACUA for her imports during the period, the calculation of which is fairly complex. The actual estimate of this amount, P16.4 million, has therefore been taken as the duty content of imports, deducted from the value of recorded imports, and entered in row 38. The corresponding revenue payable to the Botswana government has been entered in the row 22(c)/column 38. Insofar as actual receipts from SACUA differed from Botswana's accrued entitlement, a compensating entry is made in the capital account. The

remaining component of price effects, row and column 39, relates to these in the more conventional setting, that is, estimated as arising from locally raised indirect taxes, plus the additional price raising effects of SACUA duties through interindustry transactions.

A final point to note is that intraindustry transactions have been netted out to zero in the input-output submatrix. For the most part these were trivial, the only notable exception being the agricultural sector. The data are available, however, and it is straightforward to convert the matrix and its inverse to one that includes intraindustry intermediate consumption: in retrospect, it would seem preferable to have retained these diagonal elements of the input-output submatrix.

CONCLUDING REMARKS ON THE FORMAT OF THE MATRIX

Many changes in format have been made in the Botswana SAM as compared with table 2.1 of the SNA. The end result is a matrix containing far fewer cells that are blank by definition, and one that is much easier to understand and therefore use. It was considered essential to produce a matrix that could be generally understood by economists and others concerned with planning the economy. Some information is, of course, lost with such condensation, and it is a matter of judgment as to how far one should go. Our own inclination, where more detail is required, would be to provide it in submatrices outside of the main matrix. It would be wrong, however, to conclude with an impression that one has nothing but criticism for the SNA format. Quite the reverse—one has nothing but admiration for the pioneering and meticulous work recorded in the SNA, which provided an invaluable guide and source of reference in preparing the Botswana SAM.

FLOW OF FUNDS

Two members of the team went to Botswana in June 1977, to obtain prior agreement on the classifications to be used, the overall structure of the SAM, and the analyses required, so that when the other five members arrived work could commence immediately on estimating the matrix. This approach proved invaluable, as can be seen in the case of flow of funds. Although initially we had not intended to include a flow-of-funds section, we soon became aware of the considerable interest in monetary and other financial matters among local officials. Local officials insisted that flow of funds be incorporated, even though neither the central bank nor the pula had existed during 1974–75; otherwise they would not consider the SAM worth producing. It was not their intention that the first SAM should be an end in itself, but rather that it should be the first in a regular series. In retrospect, we are grateful to them. Their main argument was that national accounts estimates tend to become available too late for many purposes and, moreover, to contain certain data that are, to put it mildly, of dubious reliability. Through estimating financial flows it was possible to obtain some check on the real flows estimated in the national accounts. Many of the financial flows required were generally available with greater frequency, timeliness, and accuracy than the national accounts. Besides providing a consistency check on the national accounts, the flow-of-funds accounts also provide a way of looking at developments in the economy, which is of value in its own right.

A system of financial programming was being introduced at this time with assistance from the International Monetary Fund (IMF). This was a short-term forecasting exercise, covering a period of up to one year ahead, based on financial variables. A regular data sheet was being prepared, called the "framework," as a basis for the system, and it was necessary that the treatment of flow of funds in the SAM should be compatible with it.

Table 7.3. Reconciliation of Real and Financial Flows

	Private Sector				Government Sector G		Banking Sector B		Foreign Sector F	
	Households P_H		Enterprises P_E							
Savings/Investment	$(S_H - I_H)$		$(S_E - I_E)$		$(T - G) = (S_G - I_G)$		$(S_B - I_B)$		$(M - X) = S_F$	
Financial Flows:	A	L	A	L	A	L	A	L	A	L
Money Market (Including quasi-money)	△		△		△	△		△	△	
Foreign Assets Market (Foreign Reserves)							△			△
Banks loans market (Credit from banks, domestic)		△		△		△	△			
Government bonds market (domestic)	△		△			△	△		△	
Stock market (domestic & foreign)	△		△	△	△		△	△	△	△
Capital flows market										
a) Private	△	△	△	△		△	△	△	△	△
b) Official					△	△	△	△	△	△

Note: A signifies assets, L signifies liabilities, Δ signifies change during time period. An increase in liabilities or a reduction in assets is positive. Entries in the foreign sector are recorded from the point of view of the foreign sector. In general, cells left blank will not have entries.

The basic approach can be summarized as follows. Taking the conventional identities:

$$Y = C_p + I_p + G + X - M \tag{7.1}$$

$$Y = C_p + T + S_p \tag{7.2}$$

where Y is national disposable income, C_p is private consumption expenditure, I_p is private investment expenditure, G is total government expenditure, T is total taxes collected by government, X is total current account balance of payments receipts, M is total payments on current account balance of payments and S_p is private savings.[2] Then

$$C_p + T + S_p = C_p + I_p + G + X - M \tag{7.3}$$

or

$$(S_p - I_p) + (T - G) + (M - X) = 0. \tag{7.4}$$

Since government current expenditure plus government investment is equal to G and government saving is equal to T minus government current expenditure, it follows that

$$(T - G) = (S_G - I_G). \tag{7.5}$$

Given (7.4), it is possible to check the balances on real flows in the economy derived from conventional national accounts estimates against the corresponding financial flows. Table 7.3 gives a summarized illustration of this approach and could be broken down into as much detail as is desired or feasible. In the table, the private sector has been split into households, nonfinancial enterprises, and banks.

The sum of the savings/investment row, that is, the balance of real flows derived from national accounts, will be zero in accordance with equation (7.4), although any individual entry may be positive (or negative), indicating an excess (or shortfall) of saving over investment in a particular sector. The sum of any row in the financial markets will also be zero because any change in assets held by a given sector will be matched by a corresponding change in liabilities of some other sector or sectors. Equally, the sum of change in assets and liabilities in the column for any sector will be identically equal and opposite to the savings/investment balance, showing how that balance is disposed of in the case of a surplus or financed in the case of a deficit. In entering data in table 7.3, failure to achieve these identities indicates errors or omissions in the data which, given knowledge of sources, could also be a useful guide to where the errors are probably located. Even without errors, the table is of value because of the importance of financing the real balances in an economy. It is worth noting that the foreign sector is an integral component of the system, its financial flows representing capital account movements in the balance of payments.

This model for reconciliation of real and financial flows fits into the format of table 2.1 of the SNA for dealing with financial claims. The format adopted in table 7.1 is essentially the same as that of the SNA, and translation between the arrangement of table 7.3 and table 7.1 is more or less immediate. The only change required is in table 7.1, where the sum of savings and the change in financial liabilities is totaled: this should equal, rather than cancel out, the sum of investment and change in financial assets. Consequently, the signs for change in financial assets are the reverse of those in table 7.3 (an increase being positive in table 7.1), as are the signs for investment and current balance of payments receipts.

Our experience with including flow-of-funds data in the SAM will be covered in the next

2. More precisely, G is expenditure of general government (including "government purposes"); private consumption expenditure and investment includes government enterprises; and T is the net income received by general government from taxes, property income, and transfers.

section, but before proceeding there are two further points to mention. First, thirteen categories of financial claim are identified in appendix A (although there is no entry for official reserves, because at the time the SAM was developed Botswana was using the rand and did not have a central bank). These, however, are a summary of the number of categories actually used in the detailed estimation process. In all, eleven categories of domestic claim and twelve categories of foreign claim were employed. These were the categories that would be required in subsequent analytical work, and, while the distinction between domestic and foreign claims was not essential, there was a major advantage in confining the majority of balance of payments transactions to a clearly identified section of the flow-of-funds matrices. In fact, for each entry in row 42, columns 50 to 62, the breakdown of the domestic counterpart change in assets is found in the corresponding rows 50 to 62, against columns 43 to 49. The same applies to entries in column 42, by rows 50 to 62, as against rows 43 to 49 by columns 50 to 62.

The second point, although minor, is raised to avoid possible confusion. The current account balance of payments deficit has not been shown as a single number, as is normally done, but has been allocated between the change in external assets and liabilities (row 42/columns 40, 41, and rows 40, 41/column 42) and includes net errors and omissions. The effect is that the totals of the rest of the world capital transactions, assets, and liabilities, are identically equal to zero.

ESTIMATION AND BALANCING

The problems of estimating the entries in the SAM largely hinged upon availability of data. A surfeit of data could be just as troublesome as a shortage of data, if there were alternative sources providing conflicting estimates of the same items. Apart from certain items in the flow-of-funds section, however, the problems in Botswana arose mainly from lack of data. Nevertheless, many different sources were available and were used.

The most serious data inadequacies were in respect to households, particularly urban households. The latest available information on household expenditure was for 1968–70, and it had to be used for lack of anything better. Fortunately, tabulations of the data were available which largely corresponded with the classification of households employed. The expenditure survey had also obtained information on savings and, although these were clearly understated, they were used as a guide to the distribution of savings between different types of households. For urban areas, there were no estimates in any official surveys undertaken of the channeling of factor income by broad skill group into households, by type of household. The only survey that had attempted to do this was one undertaken in Gaborone by the University of Botswana and Swaziland. Because of a technical fault in the coding of this survey, however, the attempt had failed, and only the marginal totals of income by type of household and broad skill group were available. A matrix was built up from these, using judgment and an RAS balancing technique. The resulting distributions were then taken to be true for all urban areas. In consequence, no consistency check was possible for household income and expenditure; the estimates automatically balanced because of the methodology employed.

For rural households, however, the position was far better than one would normally expect. A major survey of income in rural areas had been undertaken in 1974–75, the main results of which were published in Rural Income Distribution Survey (Botswana, Ministry of Finance and Development Planning, 1976a). This detailed and careful study, undertaken with assistance from the World Bank, attempted to estimate all aspects of rural income, in cash and in kind. In many ways, it could be regarded as a model for developing countries interested in undertaking such studies. Tabulations of the survey were prepared for the desired grouping of rural households, so that all the required information on the channeling of rural factor incomes into

different types of households was available. In addition, the survey obtained information on transfers of income between rural and urban areas. Although the estimated value of consumption of the respondents' own production was covered, cash expenditure was not; for this information, recourse had to be made to the 1968–70 expenditure survey.

For the production activities segment of the matrix, the main sources of information were National Accounts of Botswana 1974/75 (Botswana, Ministry of Finance and Development Planning, 1976b); supporting surveys, particularly the 1974/75 Census of Production and Distribution; and work files. Botswana has a very good set of national accounts estimates, covering production, income and outlay, and capital finance accounts, and the report is well presented. The breakdown of compensation of employees by broad skill group is not, of course, available in the national accounts; although it is covered in the annual employment inquiry, the results of the particular relevant inquiry were clearly unreliable for certain sectors. Consequently, for these sectors, projections were made of the 1972 Manpower Survey (Botswana, Ministry of Finance and Development Planning, 1973). Equally, the national accounts do not include an input-output table, and one had not been previously prepared for Botswana. Even though the input-output table produced is relatively small, its estimation was a major task, requiring a detailed knowledge of industry in Botswana and the use of a multiplicity of sources. Fortunately, the member of the team responsible for this section of the matrix had the requisite knowledge, having been responsible for producing both the 1973–74 and 1974–75 national accounts estimates.

The main source of information for enterprises and central government in the current account was the national accounts, supplemented in certain cases with information from the accounts of individual enterprises. Savings, taken as a residual from the current account, had to be reallocated in the capital account because of the different classification of enterprises employed there. Overall, there were no major problems.

Transactions with the rest of the world, however, did present problems because only recently have there been attempts to produce a comprehensive picture of this aspect of the economy. The collection of foreign trade statistics had not been essential data to Botswana as a consequence of its membership in a customs union. In the early years of collecting such statistics, including 1974–75, imports were understated quite substantially. The first balance of payments estimates were produced in 1976, in respect to 1973–74 with tentative estimates for the calendar year 1975. These formed the starting point for the 1974–75 estimates in the SAM. Not all of the entries were based on firm data sources because so little work of a continuing nature had been conducted. When the estimates were first completed, there was a very substantial balancing item for net errors and omissions, the only satisfactory explanation for which seemed to be that imports had been considerably underestimated, particularly in respect to expenditure on them by households. Customs Department officials were themselves convinced imports had been understated, and they had independently estimated the probable magnitude. Consequently, the figures for imports were increased in line with this estimate, which left a more reasonable balancing item for errors and omissions.

There were several stages in estimating the flow-of-funds submatrices. The first stage separated out those institutional sectors for which reasonably good balance sheet data were available for both 1974 and 1975. In certain cases, the financial year-end for such sectors was not June as required by the matrix; this presented a significant problem only in the case of the major mining enterprises.

The second stage involved taking entries derived from first-stage sources and identifying with whom the transaction had taken place, which was often quite easy. For example, commercial bank data on deposits and loans were readily classified by the corresponding lending and borrowing sectors; Post Office Savings Bank deposits are held almost entirely by households. Thus it was possible to build up a good deal of information on the flow-of-funds entries for

sectors for which balance sheet data were not available. Consistency checks arose when balance sheet information covered both sides of a transaction. If one set of information related to June and the other did not, it was assumed that the discrepancy was due to timing, and the June figures were accepted. In the case of data on transactions between the commercial banks and parastatals, the banks' data were preferred because they related to the desired time period. An inevitable consequence, unfortunately, was that balance sheets of rejected sectors no longer balanced. In certain cases discrepancies were found between balance sheets covering the same time period, although timing could still be a reason if certain items were "in transit."

By the end of the second stage all domestic financial claims were balanced except for currency and trade debtors/creditors accounts. Figures entered for the latter were notional and cannot be improved until considerably more balance sheet information is obtained regularly from private enterprises. The problem of estimating change in currency holdings arose because the rand was still in use during 1974–75; it was possible to estimate the item only by making certain assumptions, the reliability of which could not be confirmed. The final stage in estimating the flow-of-funds section was the incorporation of items from the rest of world capital account.

When all of the above work had been completed, a first draft of the matrix was produced. It showed that the accounts for factors and current accounts of institutions balanced. This result was achieved because in certain cases, we had data with accounting accuracy while in the remaining cases, referred to above, the methodology of preparing the estimates ensured that balance was achieved, so there was no consistency check on them. Production activities did not balance, and in a few cases there were fairly substantial errors. Financial claims balanced, but there were substantial errors in the capital accounts for institutions. In other words, the estimates of savings and investment were not compatible with the independently estimated change in financial claims by institution. If one accepted the financial claims estimates, then household savings were substantially underestimated and the savings of all other institutions were more than correspondingly overestimated.

The balancing procedure then followed was, first, checking entries for errors and, then, in the case of production activities, making adjustments by judgment, some of which also served to reduce errors in the capital account. Such adjustments were made until all remaining errors in the production accounts were within 5 percent of the mean total of corresponding rows and columns, with one exception, for a sector that was in any case small in absolute terms.

In the case of the households' capital account, the financial claims data and the capital formation estimates were treated as being correct, which meant that the household savings figure was adjusted accordingly. This estimate of household savings appeared to be considerably more reasonable than the original estimate, which had largely depended on the Household Expenditure Survey results. The methods employed to raise household saving (mainly through reallocation of factor income between "operating surplus" and "self-employed") also served to reduce savings of enterprises, as was required, so that balance was also achieved for the account for other private nonfinancial institutions and local government. The account for major mining enterprises had already been balanced. For the remaining institutions, we were left with errors that were classified into two types: "unallocated" and "errors and omissions." The unallocated errors are those for which we were able to identify the cause. These errors arise from inconsistencies between the accounts of different institutions, for example, because of the timing of transactions or the valuation of assets and liabilities. The errors and omissions are pure errors for which we could not find any satisfactory explanation, all of which, however, were relatively small. It is perhaps surprising to find such errors in the case of the central government account (row 49), but the reason again is due to differences in timing, since government accounts are not available for the July/June accounting year.

The final stage in balancing was to use the mechanical, simple RAS technique on a computer. The objective was to obtain balance in the production activities accounts, and the method of

application ensured that estimates which one was unwilling to have changed were left untouched, particularly unallocated errors and errors and omissions. Although it seemed reasonable to make mechanical adjustments to data where the adjustments so made were certainly within the margin of likely error of the data, we could see no justification for forcing errors out of existence in data that basically have accounting-type accuracy.

In the end, questions that naturally arise are: Should the SAM have been produced, given the deficiencies noted in data availability? Given these deficiencies, should the SAM be used? And was the incorporation of the flow of funds in fact worthwhile?

The short answer to all of these questions is yes. Until a SAM has been produced for the first time, and the attendant decisions on classifications, for example, have been made, it will almost certainly remain the case that availability of data is inadequate. Producing the SAM pinpoints deficiencies and inconsistencies and gives a clear guide to future statistical requirements. It also demonstrates to economic planners and other users the potential value of the SAM as a planning tool, hence gaining their support for its maintenance, updating, and improvements. In Botswana, measures to rectify the deficiencies in the household sector (noted earlier) are already in hand, and an updated SAM was produced in 1978 for the years 1976–77. The intention is to computerize the SAM, so that as new and better information becomes available updating should be relatively easy. It should be noted, however, the SAM does not call for surveys that would not otherwise be required; virtually everything is required in any case, for other purposes, and the SAM is simply a further reason for obtaining the data.

As to whether the SAM is sufficiently reliable for use, given the amount of judgment that had to be employed in estimating it, the ready answer is that plans and decisions that can be assisted by the SAM have to be made in any case, and judgments not constrained to consistency by the formal structure of the SAM will still be made, possibly subconsciously. It seems preferable to recognize this and to make judgments in the light of all available information and knowledge of likely causes, but explicitly and consciously within a SAM framework.

In the case of Botswana, inclusion of the section on flow of funds resulted in more informative accounts for the rest of the world, and hence permitted consistency checks on the real flows that would not otherwise have existed. These checks led to changes in estimates which improved reliability. At the same time, however, it must be recognized that there were elements in the flow-of-funds section which were just as difficult to estimate and just as unreliable as certain components in the real flows section, particularly trade debtors and creditors. Furthermore, the flow-of-funds estimates were particularly sensitive to timing and valuation questions. Massive flows could occur virtually overnight, and unless one had all major balance sheets for the same time period, reconciliation was very difficult, if not impossible. These difficulties may reduce much of the potential value of the flow-of-funds accounts.

CONCLUSION

As has already been stressed, we regard the 1974–75 SAM as simply the first in a continuing series. Many improvements will doubtless be made to it in time, but one that can be recommended now is that a SAM at purchaser prices be produced. At present, the SAM has been estimated at both producer and true basic prices, each of which has its own uses in different types of analysis. It is also true, however, that there are possible uses for which purchasers' valuation would be the most appropriate.

The possible uses of the SAM have not been of concern here. Nevertheless, one would not wish to conclude without some reference to this subject. A number of analyses on a wide range of topics, such as the impact of wage increases and drought on the economy, are being undertaken or have already been completed at the University of Warwick for the government of

Botswana. Botswana officials have reported that, almost by the day, they are finding the SAM of value in relation to a whole range of issues.

APPENDIX A: BUILDING THE BOTSWANA SAM

Two members of the 1977 SAM team went in advance to discuss classifications and desired analyses among other things with representatives of the Botswana government. These discussions were held with a SAM Reference Group which had been formed by the government of Botswana. This group comprised representatives from the Department of Economic Affairs and the Department of Financial Affairs in the Ministry of Finance and Development Planning and also representatives from the Central Statistical Office and the Bank of Botswana.

As a result of the discussions, the format and classifications desired for the SAM were finalized and, in addition, the following occurred:

1. A seminar was presented to the SAM Reference Group to which all economists and planners in government were invited. Members of the Reference Group were given various reference material, including sections from Pyatt and Thorbecke (1976), and some had the complete volume.
2. A member of the CSO prepared a list of data available from all government departments, the Bank of Botswana, and the University of Botswana and Swaziland, which included the following information:
   - Department or organization producing the data
   - Name of person to contact there
   - Survey involved or other source of the data
   - Periodicity of its collection
   - Where published, if published
   - Coverage and quality of the data.

   The purpose was to minimize the time spent by team members in following up data requirements and availability for their segments of work. The CSO found it very useful themselves to have such a list available.
3. A complete set of the latest reports listed under item 2 was located in one room for easy reference by team members.

Consequently, when the rest of the team arrived, each member was able to commence work immediately on the particular segment of the matrix that had been allocated to him or her.

In order to minimize errors that would arise with individuals working simultaneously on different parts of the matrix, control totals were taken from the national accounts for such items as compensation of employees, operating surplus, capital formation, and so on, and team members were asked to ensure that if it proved necessary to change a control total, they would notify other members and discuss it with them. On one or two occasions this procedure was not followed but, overall, it was certainly worthwhile and reduced balancing errors appreciably.

The members finished their tasks at about the same time, and then all but two left Botswana. This was a mistake. It would have saved much time subsequently if they had stayed in Botswana for about a week afterward, so that major discrepancies could be followed up by members whose sections were affected. Their time would not have been wasted, even if there were no major discrepancies, because final detailed notes and worksheets could have been completed.

As it was, the balancing was done in London, and final detailed notes and worksheets were completed by members in their respective permanent institutions. Since members were located in the north of England, Warwick, Sussex, and Norway, it was possible to bring them all together

again only on one occasion for two days in October 1977 to work on the balancing, which was not finally completed until early November 1977.

In producing the final balanced SAM, various intermediate SAMs were produced, as follows:

- SAM I was the unbalanced SAM produced by taking entries direct from worksheets.
- SAMs II and III contained adjustments to data made on the basis of judgment, local knowledge, and correction of errors.
- SAM IV was that used for the RAS input, containing the totals to which one wanted to work.
- SAM V was the final, balanced SAM, which also contained some minor adjustments to the RAS results made for balancing purposes.

All the above SAMs, together with the detailed notes and worksheets and the final report (United Kingdom, Ministry of Overseas Development, 1977), were returned to the CSO in Botswana at the end of November 1977. It was clearly essential that they have all of this in order to follow what had been done, answer any queries that might arise, and update the matrix in the future. Moreover, the questions of errors in data and adjustments made in balancing warrant more research. If that work is to be done, then a clear record must be left of such errors and adjustments. In presenting the final SAM, a second seminar was given for economists and statisticians throughout government to demonstrate the use of the matrix, taking as an example the possible impact of foot and mouth disease on the economy.

In all, the exercise took about twelve man-months, including work undertaken outside of Botswana. If, however, only one person had worked on it full-time, rather than a team, I think there is no possibility that he would have been able to complete it in one year. The pace of work within a team during a short period is far greater than could be achieved by one individual. Moreover, the interaction among team members is useful in resolving many problems that might stump someone working alone.

APPENDIX B: PRICE EFFECTS

Rows and columns 38 and 39 of the Botswana SAM are designated "price effects," a term not employed in other SAMs. The equivalent term in SNA table 2.1 is "commodity taxes, net." Our reason for preferring a different expression requires explanation.

The transactions in SNA table 2.1 are valued at approximate, as opposed to true, basic prices. The SNA defines true basic values as "producer's values of the gross output of commodities, industries, etc., less the commodity taxes, net, in respect of the gross output and the direct and indirect intermediate inputs; or the sum of the value of the primary inputs, indirect taxes, net, except commodity taxes, net, and the true basic values of the intermediate inputs in respect of the gross output."

The use of true basic values is stressed in the SNA as being essential in order to obtain uniformity of valuation for meaningful manipulation of an input-output table. The standard national accounting convention is followed in estimating basic values, namely, that industries pass on indirect taxes charged to them in full to their customers, through appropriate adjustment of their prices. Insofar as commodity taxes are charged on interindustry transactions, then there will be a multiplier effect, which serves to raise the general price level above the level that would result in the absence of taxes on interindustry transactions. The value of commodity taxes charged is passed on to final demand, identically, but the total value passed on will exceed this by the value passed on in interindustry transactions. These calculations consequently require matrix inversion, because of the interindustry effects. If this inversion is

not done, then the SNA recommends use of approximate basic prices. These approximate basic prices are derived by simply prorating commodity taxes over the values of all transactions, so that the value passed on in total is identically equal to the value of the taxes charged. Consequently, the value charged to final demand is less than the total value charged by the amount allocated to interindustry transactions, which is contrary to the national accounting convention used, and quite arbitrary, depending on the relative magnitude of interindustry transactions as against final demand transaction.

The SNA defines commodity taxes as "preferably, indirect taxes less subsidies, each of which are proportional to the quantity, or the value, of commodities produced or sold. At least, indirect taxes less subsidies, each of which differ from one disposition to another of a commodity or from one commodity to another of the same class." Thus, commodity taxes are a particular subgroup of indirect taxes and normally would form the bulk of these. They will normally be paid, in the literal accounting sense, by industries (including wholesale and retail trade) to government in the same way industries pay wages and salaries to their employees. Some might be paid by final consumers directly to government, for example, on imports they bring into the country themselves, but this would normally be a very small part of total payments.

Commodity taxes shown in SNA table 2.1 are not the taxes paid to government, however, which have already been included in indirect taxes, net (row 32). They are the estimated effects of these taxes through industries passing on the sums charged to them in the prices they charge their customers, using the approximate basic value method of estimation. This is potentially confusing, and the United Nations Statistical Office (1973) seems to fall into the trap. In paragraph 1.12, when describing table 1.2 of the same volume, it states that "industries purchase commodities in matrix 1 and pay the relevant taxes in vector 7," where vector 7 is the intersection of the industry columns with the commodity taxes row. To better understand the objection to this line of reasoning, suppose it was desired to estimate the effect of wages and salaries on prices charged by producers. An exactly equivalent treatment would be to relabel the commodity tax row in table 1.2, "wages and salaries." The actual payment of wages and salaries by employers would appear in the factor income accounts, wages and salaries being the major component of compensation of employees. The entry in the commodity tax row, now called wages and salaries, would be equal in value to the payments that had actually been made and recorded in the factor income accounts and would simply be the estimated value of these payments passed on by sellers to buyers in their selling price (where approximate rather than true values were estimated). The entry in vector 7 of table 1.2 is not the taxes paid by industry, it is the value of the additional price-raising effect of the taxes arising from interindustry transactions.

Thus we have used the expression "price effects" in preference to "commodity taxes" in the appendix, because we feel that this is a better description of the items so described and is less likely to be misunderstood. Following the treatment in table 2.1 of the SNA is not helped in any case by what appears to be a printing error. Total indirect taxes, net, raised (in row 32), are not matched by an equal payment of these to government, that is, there should presumably be an entry of 29 at the intersection of row 53, column 32.

True basic values have been estimated in table 7.1, rather than approximate basic values as in SNA table 2.1. It has been shown by Greenfield and Fell (1979) that the use of approximate basic values, as defined in the SNA, is inadequate for purposes of achieving uniformity of valuation or for estimating price effects in general. They present a better approximate formula which does have the property, for example, that all indirect taxes are passed on to final demand, but conclude in any case that it is preferable to use a true formula. No attempt has been made in table 7.1 to separate commodity from noncommodity indirect taxes and to treat them separately, largely because the bulk of indirect taxes in Botswana are commodity taxes.

PART III

Multipliers and SAM-Based Models

8

The Disaggregation of the Household Sector in the National Accounts

Sir Richard Stone

When the Statistical Office of the United Nations published a major revision and extension of its system of national accounts (UNSO, 1968), it was recognized that, although the revised system had greater coverage than the original (described in UNSO, 1953), a number of topics had been left over for treatment in the future. One of these was the distribution, and in particular the distribution among households, of income, consumption, and wealth. The subject is a difficult one, and it was felt that a good deal of discussion would be needed before a generally acceptable scheme could be devised. However, the matter was not overlooked by the Statistical Office, which at the time of the publication of the revised SNA was engaged in preparing an integrated system of distribution statistics intended to fit into both the SNA and the Material Product System, or MPS (as described in UNSO, 1972); a report on this scheme appeared in UNSO, 1977b.

In the past decade inequality has become a major issue in many parts of the world, and a great deal of new statistical work has been done, mainly on the distribution of income. Apart from data collection, many analytical studies have been made. An interesting one relating to Britain, which is described in Nicholson (1964) and has since been repeated annually by the U.K. Central Statistical Office in Economic Trends, shows for different types of households in various income groups the changes in original income brought about by taxation and social service benefits. For this kind of analysis it is never necessary to move outside the household sector, and so there are no links between the original incomes of households and the activities in which they are gained or between the expenditures of households and the activities which gain from them. To trace these circular flows it is necessary to embed the distribution statistics in a social accounting matrix.

This step has been taken by Pyatt, Roe, and associates (1977). In their study of social accounting for development planning with special reference to Sri Lanka undertaken for the International Labour Office, they have set out a social accounting matrix in which consumers as well as producers are disaggregated.

In what follows I shall describe the main problems encountered in disaggregating the household sector within a social accounting framework, and I shall illustrate my remarks by means of a numerical example relating to Britain in 1968. I shall go on to use this matrix to approximate the interconnections between the current accounts of an economic system and to show their effect in increasing the responses of different parts of the system to supposedly exogenous stimuli. Finally, I shall consider some of the more recent analytical tools that ought eventually to be incorporated in an approach of this kind.

ACTIVITIES AND SECTORS

The SNA, like all systems of national accounts, distinguishes between the given country and the rest of the world and, within the given country, between production, consumption, and accumulation. Production is classified by activities, that is to say, by grouping together establishments producing a range of similar products and responsible for resolving the day-to-day

problems of production. These groups of establishments are usually termed industries, though a place is also given to the producers of government and private services.

The institutional classification of consumption and accumulation is different, the units being grouped into sectors responsible for resolving financial problems including the spending and saving of income. The main sectors distinguished in the SNA are nonfinancial enterprises (corporate and quasi-corporate), financial institutions, general government, households, and private nonprofit institutions. In practice the last two categories are often combined into what is termed the personal sector.

HOUSEHOLDS

Clearly, if the social accounts are to contribute to a discussion of inequality and of the factors that affect it, the household sector must be isolated and divided into categories. Households are appropriate for this purpose because they are the units in which decisions on spending and saving of income are generally made.

Isolating the Household Sector

In attempting to isolate the household sector the following problems are likely to be encountered.

Removing private nonprofit institutions. The construction of an income and outlay account for private nonprofit institutions (PNPIs) is laborious but cannot be avoided because of the importance of PNPIs in the aggregate. An account of British experience in this respect is given in Economic Trends (no. 259). In Britain the sector is composed mainly of universities and colleges, friendly societies, trade unions, housing associations, and charities. The last group is numerous: in England and Wales nearly 77,000 charities were registered with the Charity Commissioners in 1970. A good deal of work, therefore, is needed to yield even a rough set of accounts for PNPIs as a whole; further estimation must be done to fit these figures into a social accounting matrix as set out below.

Removing visitor expenditure. In tables of consumer expenditure it is usual to include the expenditure of visitors from abroad along with the expenditure of local residents and, deducting a single figure unclassified by constituent goods and services, to obtain an estimate of the domestic expenditure of residents. For present purposes it is necessary to decompose this figure and deduct its components from the categories of goods and services, since in many countries tourist expenditures are large and we cannot assume that their composition is similar to that of the residents. This, again, is an area in which reliable information is difficult to obtain. In this context visitors include foreign diplomats and armed forces, as well as visiting businessmen and tourists.

Adjustments for life insurance. The treatment of life insurance in the national accounts may result in a partial amalgamation of life insurance accounts with those of the personal sector; this amalgamation is intended to represent the beneficial interest of that sector in life funds and to ensure that personal saving through life insurance is properly reflected in the personal income and outlay account. In combining information from the national accounts with data from other sources, which is inevitable if disaggregated household accounts are to be constructed, it is necessary to check the consequences of this partial amalgamation for the entries in the national accounts, since they are not likely to accord without adjustment with those to be found in, say, a family expenditure survey.

It may be mentioned in passing that there are many other respects in which the usual

treatment adopted in the national accounts is not followed in other sources. For instance, employers' contributions to national insurance are usually routed through households in the national accounts but not in household surveys.

Unincorporated businesses. In the national accounts all production accounts are brought together independently of the firm's legal form of organization, but the appropriation account entries of unincorporated businesses will usually be lost in the corresponding entries in the income and outlay account of persons. This is highly inconvenient since some unincorporated businesses are very large; to simplify matters, the concept of quasi-corporate enterprises was introduced into the SNA. In the case of small businesses, little harm is done by the conventional treatment provided that income is defined after depreciation and stock appreciation, so that entries out of place in income and outlay accounts are not included. This, of course, has implications for the corresponding production accounts.

Distributions over Households

By such means as I have described we may expect to obtain a more or less clean income and outlay account for the household sector as a whole, and the same could be said of the capital transactions account. The remaining tasks are to distribute the entries in these accounts over types of household and to deal as far as possible with the transfers that make their appearance as a consequence of this disaggregation. The income and outlay account should be the easier to distribute because by now there is a good deal of information in many countries from family expenditure and other household surveys on current account items but very little on the entries in the capital account.

The distribution can be carried out by taking each entry in the account for the household sector in the national accounts, comparing this entry with the nearest corresponding item in the household survey, and distributing the former by reference to the latter. In general, it is not necessary, or even desirable, to assume that the estimate in the national accounts is accurate and that the estimate in the survey must bear the full weight of any adjustment. Household surveys, where they exist, are usually an important source in constructing the national accounts, but they are not always used systematically; if someone with full access to and knowledge of the data to be compared were to carry out the exercise described below, he might well succeed in improving the national accounts, as well as meeting the objective of disaggregation. Many of the problems arising in this endeavor can be summarized as follows.

Definitions and classifications. A detailed comparison of the definitions and classifications in the two sources will provide a means of selecting from the survey the best indicator for each item in the national accounts or, alternatively, of grouping the data from both sources so as to improve their comparability.

The classification of households. Many classifications have been proposed: by size of income, by demographic composition, by age or occupation of the head, by region, and so on. Distributions by these criteria serve different purposes.

Totals and averages. A survey relies on a sample, and since the national accounts do not usually provide demographic information, this information will have to be introduced. An estimate of the total population or the total number of households would enable us to express the national accounts estimates as so much per head or so much per household. At this point we should have to look out for the effect of individuals living in institutions, since at least part of their income and expenditure may get into the personal income and outlay account in the national accounts, whereas they are not likely to be recorded in a household survey.

It must be remembered that the survey sample may not be representative of the entire

population, and it may even be deliberately distorted in order to increase the coverage of certain groups. It would be helpful if more data were available nationally for the total number of households in different categories, as they already are for some classifications in years in which a population census was taken.

Matching and the use of indicators. If the total or the average for an item does not match in the two sources or if an item is simply not recorded in the survey, it is necessary either to aggregate items to improve the match or to select from the survey an item or combination of items which can be used as an indicator of the distribution of the item in the national accounts. For instance, if employers' contributions to social security are not recorded in the survey but bear a known relationship to employees' contributions, then the distribution of the latter will provide a good indicator of the distribution of the former.

To-whom-from-whom problems. Although we may have no difficulty in distributing an item, such as wages and salaries, over different categories of households, it will usually be impossible to distinguish at the same time the activity in which the payment originates or the sector in which a particular producing unit is located. The same is true of rent, dividends, and interest, which typically will have to be treated as a block without further subdivision. Such problems can be resolved by means of dummy accounts. For instance, we might set up an account for income from employment which received this type of income from each activity and paid it out to various types of household. Thus we would obtain distributions by activity and by household but would have no cross classification.

Alternative classifications. Household expenditure should be classified in terms of the goods and services that consumers buy, although eventually this classification will have to be converted into the product classification used in the production accounts of the system. This transformation can be carried out by means of a classification converter, which will be described later.

Discrepancies and adjustments. The social accounts are constructed by combining information from a variety of sources, and discrepancies are certain to appear. If these are not very numerous they may be left as they are and the accounts set up so that they are all shown explicitly, as in the example which follows. Usually there will be many such discrepancies, and these could be adjusted away by the method suggested in my introduction to Pyatt, Roe, and associates (1977). In practical cases a great deal of computing is involved, but this difficulty has been resolved by Byron (1978).

A NUMERICAL EXAMPLE

Table 8.1 sets out a social accounting matrix relating to Britain in 1968. Its main purpose is to illustrate the disaggregation of the household sector, but it also serves two subsidiary purposes: the capital transactions accounts are set up much as in the SNA so that, with minor modifications, opening and closing balance sheets and the associated flow-of-funds and revaluation accounts could be added to them; and all residual errors and unidentified items are brought together and shown explicitly in account 52.

The order of the accounts follows that adopted in Pyatt, Roe, and associates (1977). This order is convenient for present purposes but is not a matter of principle, since the accounts could be rearranged in a more familiar order by a conformable permutation of the rows and columns. Thus if the fifty-two accounts of table 8.1 form the matrix T and the familiar arrangement is denoted by T^*, then

$$T^* = PTP^{-1},$$

where P is the appropriate permutation matrix. Similarly, if A* and A are coefficient matrices derived respectively from T* and T then

$$A^* = PAP^{-1}$$

and

$$(I - A^*)^{-1} = P(I - A)^{-1} P^{-1}.$$

I have chosen 1968 because for that year an input-output table is available (UKCSO, 1973) that is keyed into the national accounts as set out in the 1972 Blue Book (UKCSO, 1952–). The report of the Family Expenditure Survey for 1968 is set out in the 1969 issue of U.K. Department of Employment (1961–). This material makes it relatively easy to construct a numerical example for 1968; with more work and subject to difficulties in obtaining input-output information and in keeping the estimates at a common level of up-to-dateness, it would be possible to construct table 8.1 for other years. In the present case the input-output structure is confined to the six branches given in the small example in UKCSO (1973) and is on an industry basis without reference to commodities. Again this is not essential but seems a justifiable simplification in what is primarily an example.

The Nature of the Accounts and Entries

As usual, each row and column pair of table 8.1 represents an account with incomings in the row and outgoings in the column. The rows and columns of the whole matrix of order 52 have been divided into eleven categories, thus giving rise to 121 submatrices. The nature of these categories is as follows.

Value added: accounts 1–3. The first three accounts relate respectively to income from employment, gross profits and other trading income, and taxes on expenditure (net); and the sum of their entries is equal to the net domestic product at market prices, £39,204 million. Payments to the factors of production are made by the six industries, at the intersections of rows 1 and 2 and columns 34 to 39, and provisions for depreciation are shown negatively at the intersections of row 2 and columns 45 to 47, the capital accounts of the sectors. Taxes on expenditure (net) are received by row 3 from a wide range of accounts, namely 19 to 39, 41 to 43, and 48.

The receipts of account 1 are paid out as wages and salaries to account 4 and as employers' contributions to account 5. The receipts of account 2 are divided into income from self-employment and the rest; the former is distributed over households at rows 7 to 13, while the latter is paid into account 6, which collects together rent, dividends, and interest (property income) from all sources and distributes it to all destinations. The receipts of account 3 are paid to the central government at row 17 and to local authorities at row 18.

Forms of income: accounts 4–6. The wages and salaries and employers' contributions received by accounts 4 and 5, respectively, are distributed by these accounts to households at rows 7 to 13. The receipts into account 6 come not only from domestic production, at column 2, and from the rest of the world, at column 49, but also from most of the income and outlay accounts of the sectors, at columns 7 to 18. Consumer debt interest is included in these entries. Rent, dividends, and interest are paid out to the sectors, at rows 7 to 18, and to the rest of the world at row 49. The entry at row 52 is the residual error. It can be seen that the net receipt of rent, dividends, and interest by the domestic sectors and the rest of the world is exactly equal to the amount generated in the domestic productive system.

Income and outlay of sectors: accounts 7–18. In addition to the types of income already described, rows 7 to 18 show, at the intersections with columns 7 to 18, additional income

Table 8.1. A Social Accounting Matrix for the United Kingdom, 1968

(in millions of pounds sterling)

		1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29
1	Income from employment																													
2	Gross profits & other trading income																													
3	Taxes on expenditure (net)																			104	1809	519	6	155	221	195	784	1	45	110
4	Wages & salaries (incl. Forces' pay)	23056																												
5	Employers' contributions	2284																												
6	Rent, dividends, and interest		5135					8	61	164	212	154	82	175		3534	636	1240	791											
7	Households: income £ 0–10		20		42	21	189								38			823	1											
8	" " £10–20		238		1393	184	771								50			1086	13											
9	" " £20–30		418		5529	549	785								31			629	42											
10	" " £30–40		482		5982	545	707								19			374	38											
11	" " £40–50		308		4079	372	572								9			181	17											
12	" " £50–60		278		2521	231	268								4			87	11											
13	" " £60+		973		3510	382	1020								6			112	11											
14	Private nonprofit institutions						241	13	42	91	103	77	45	116		34		254												
15	Companies						6614																							
16	Public corporations						529																							
17	Central government			4548			881	19	386	1370	1546	1179	762	1483		915	17													
18	Local authorities			1464			560											1898												
19	Food							295	825	1528	1291	760	427	547																
20	Drink and tobacco							80	361	859	771	501	330	421	10															
21	Housing							203	488	800	692	434	230	336	108															
22	Fuel and light							114	234	336	273	162	86	111	24															
23	Clothing and footwear							59	223	527	545	349	203	319	45															
24	Durable & other household goods							64	221	473	471	322	194	258	45															
25	Other miscellaneous goods							59	192	427	405	260	156	236	45															
26	Motor vehicles (incl. running costs)							20	137	450	614	379	252	374	45															
27	Travel and communications							35	129	254	244	157	98	156	35															
28	Entertainments, hotels & restaurants							45	151	352	361	250	159	285	120															
29	Other services							71	189	339	334	243	148	405	314															

30 Military defence																	2370												
31 National health service																	1376												
32 Other central government purposes																	996												
33 Local authorities purposes																		2976											
34 Agriculture etc., mining & quarrying																			796		2	157			45			84	
35 Metals and metal products																					34			371	112	393			
36 Other manufacturing																			2355	645	127	75	1149	713	700	131		252	
37 Construction																					595								15
38 Gas, electricity, and water																					73	948							
39 Services																			1636	806	1925	148	776	628	606	669	1090	1174	1732
40 Sales by final buyers							2	5	11	13	10	5	14													227		81	172
41 Vehicles, ships, & aircraft																													
42 Plant & machinery																													
43 Buildings & works																													
44 Increase in stocks																													
45 Personal sector							37	57	−72	192	253	189	693	51															
46 Companies															1378														
47 Public sector																−124	1637	22											
48 Production							8	27	60	66	49	29	76						772	73	16	6	190	115	122	67	17	87	14
49 Consumption						908	2	7	14	14	9	5	9	17	753		179												
50 Accumulation																													
51 Identified financial assets																													
52 Unidentified items						29																							
Total	25340	7862	6012	23056	2284	14074	1134	3735	7983	8147	5538	3400	6014	1016	6614	529	13242	3922	5663	3333	3291	1340	2270	2048	1780	2271	1108	1723	2043

(Table continues on the following page.)

Table 8.1. (Continued)

		30	31	32	33	34	35	36	37	38	39	40	41	42	43	44	45	46	47	48	49	50	51	52	Total
1	Income from employment					964	4607	3977	1795	514	13493														25340
2	Gross profits & other trading income					889	1324	1958	733	768	5798						−777	−1411	−1430						7852
3	Taxes on expenditure (net)	33	57	66	185	−183	168	332	238	85	940		60	84	24					−26					6012
4	Wages & salaries (incl. Forces' pay)																								23056
5	Employers' contributions																								2284
6	Rent, dividends, and interest																				1882				14074
7	Households: income £ 0–10																								1134
8	" " £10–20																								3735
9	" " £20–30																								7983
10	" " £30–40																								8147
11	" " £40–50																								5538
12	" " £50–60																								3400
13	" " £60+																								6014
14	Private nonprofit institutions																								1016
15	Companies																								6614
16	Public corporations																								529
17	Central government																				136				13242
18	Local authorities																								3922
19	Food																								5663
20	Drink and tobacco																								3333
21	Housing																								3291
22	Fuel and light																								1340
23	Clothing and footwear																								2270
24	Durable & other household goods																								2048
25	Other miscellaneous goods																								1780
26	Motor vehicles (incl. running costs)																								2271
27	Travel and communications																								1108
28	Entertainments, hotels & restaurants																								1723
29	Other services																								2043

30	Military defence																							2370
31	National health service																							1376
32	Other central government purposes																							996
33	Local authorities purposes																							2976
34	Agriculture etc., mining & quarrying	3	31	4	45		51	1193	92	386	20				28	14				130				3081
35	Metals and metal products	848	47	124	57	170		669	709	131	610		780	2046		−76				3363				10388
36	Other manufacturing	49	215	86	277	727	1077		915	140	1401			46	60	160				2474				13774
37	Construction	104	17	47	87	78	94	45		35	70			23	3713	11				25				4959
38	Gas, electricity, and water	23	16	16	76	67	287	278	16		328			159						13				2300
39	Services	1059	1020	835	2438	247	1284	2243	323	197			116	244	410	2				2231				23839
40	Sales by final buyers	−73	−58	−267	−222	3	188	47	15	6	55		−276	−76						118				0
41	Vehicles, ships, & aircraft																127	560	161					848
42	Plant & machinery																226	1550	1158					2934
43	Buildings & works																911	851	2473					4235
44	Increase in stocks																29	140	45					214
45	Personal sector																		194					1594
46	Companies																		460					1838
47	Public sector																427	40						2002
48	Production	324	31	85	33	129	1308	3032	123	38	1124		168	408		103								8700
49	Consumption																			372				2289
50	Accumulation																				271			271
51	Identified financial assets																1537	−944	−996		403			0
52	Unidentified items																−886	1052	−63		−132			0
	Total	2370	1376	996	2976	3081	10388	13774	4959	2300	23839	0	848	2934	4235	214	1594	1838	2002	8700	2289	271	0	0	

received from other domestic sectors and, at column 49, British direct taxes paid by nonresidents. In the columns we find (in addition to payments of rent, dividends, and interest, taxes on income, and other transfers) outlays for consumers' goods and services at rows 19 to 29, for government purposes at rows 30 to 33, and saving at rows 45 to 47. The remaining entries are transfers abroad, at row 49, and consumers' expenditure abroad, at rows 40 and 48. The entries in row 40 are somewhat mysterious, but in UKCSO (1973, p. 121) £60 million of sales by final buyers are shown as a component of consumers' expenditure abroad.

Consumers' goods and services: accounts 19–29. The rows of these accounts collect together the expenditure by the seven categories of households and by PNPIs on one of the eleven categories of consumers' goods and services. Visitors' expenditures could have been treated in the same way in column 48, but in fact they are converted into demands on industries and included among export sales. Columns 19 to 29 show the cost components of these goods and services in terms of taxes on expenditure (net) at row 3, direct demands on industries at rows 34 to 39, purchases from final buyers at row 40, and imports at row 48.

Government purposes: accounts 30–33. These rows collect the expenditure on goods and services for each of the four government purposes distinguished, and the columns show the corresponding cost components, just as in the previous block of accounts for private consumers.

Industries: accounts 34–39. These rows and columns represent the production accounts of the six industry groups into which, following table 7 of UKCSO (1973), the productive system is divided. This simple treatment seems justified for illustrative purposes; there would be no difficulty in introducing much more disaggregation or the familiar commodity/industry treatment, but this would needlessly complicate the present example. It will be noticed that these accounts, like all the accounts of table 8.1, are presented in consolidated form. (The diagonal elements that have been omitted are, in order, 490, 5749, 4668, 945, 66, and 1934.)

Sales by final buyers: account 40. This account contains in its row positive and negative entries which sum to zero, and its column is left blank. The nonzero entries relate mainly to the sale and disposal of goods and services from final demand accounts, such as used cars sold by businesses to consumers, plant and machinery bought by scrap merchants or exported, and payments to public authorities for various services provided.

Investment goods: accounts 41–44. These accounts correspond for investment goods to accounts 19 to 29 for consumption goods and services, that is to say, in the rows they receive finance from the capital accounts of the sectors and in the columns they pay it out to meet the costs of the different categories of goods.

Capital transactions of sectors: accounts 45–47. For each sector or group of sectors these accounts receive capital transfers and the sector's saving, and with them finance gross capital formation less depreciation (in row 2), capital transfers to other sectors, and identified acquisitions (net) of financial assets. The accounts being consolidated, a figure of 204, representing intragovernmental capital transfers, is omitted from the intersection of row and column 47. The personal and the public sectors are shown in aggregated form mainly because information is not available to fill in row 51 for the divisions of these sectors. The entries in row 52 are not real outlays and would all be zero if complete information were available.

The rest of the world: accounts 48–50. Account 48 receives in the row the proceeds from British imports, including British tourist expenditure abroad, and in the column pays for British exports. The negative entry in row 3 represents the remission of taxes on exports, an item of 471 representing reexports is omitted from the intersection of row and column 48, and the

entry of 372 in row 49 represents the excess of British imports and expenditure abroad over British exports and visitors' expenditure in Britain, that is, the rest of the world's favorable balance of trade with Britain. Account 49 receives in addition property income, taxes on income, and other current transfers from Britain and pays out property income, taxes on income, and other current transfers to Britain. The balancing item, 271, represents net lending to Britain by the rest of the world and is paid into account 50, where it is matched by the rest of the world's net acquisition of financial assets, including unidentified items.

Financial assets and errors: accounts 51 and 52. These accounts have positive and negative entries which sum to zero in the rows and no entries in the columns. If we wished to attach balance sheets to accounts 45 to 47 we should have to show these flows gross and also disaggregate them by financial asset. The gross acquisitions of financial assets would appear in a set of rows like row 51, and the gross acquisitions of financial liabilities would appear in the corresponding columns, which in the present example are reduced to column 51 which is blank. It would then be possible to add on revaluation accounts and balance sheets in the manner illustrated in the UN SNA table 2.1.

Finally, row 52 brings together the errors and unidentified items left unresolved in the British national accounts. The entry at column 6 is the residual error, the entries at columns 45 to 47 are the unidentified items in the financial accounts, and the entry at column 47 is also equal to the balancing item in the balance of payments accounts. This is a convenient way in which to introduce the errors into the social accounting matrix but, as explained in Stone and Stone (1977, p. 66), it is impossible to say just where the errors lie since to a greater or lesser extent all the entries in the national accounts are subject to error.

A Word on the Construction of Table 8.1

I do not propose to describe the construction of table 8.1 in detail, but a short account of the procedure adopted may be helpful.

The broad picture. Given the general framework, many of the entries of the table can be obtained from the 1972 Blue Book (UKCSO, 1952–). My first step was to fill in as many entries as possible from this source.

The input-output structure. Most of the entries in rows and columns 1–3, 34–40, and 48 come from the 1968 input-output tables given in UKCSO (1973), which are keyed into the 1972 Blue Book. I adopted an interindustry formulation based on table 7 because it seemed the easier method to follow. In fact a good deal of rather tedious calculation was involved since table 7 does not give all the disaggregation required, while the large tables often provide commodity rather than industry detail. Furthermore, the procedure used by the Central Statistical Office to adjust the small table is not the same as that used to adjust the large tables.

The classification converters. The converters used to transform consumer goods and services, government purposes, and investment goods into industrial cost structures are based on tables O, P, and R of UKCSO (1973). The treatment of table O will serve as an example. The first step was to group the entries in columns 1 to 24 into the eleven categories of consumers' goods and services. The second step was to allocate the entries in columns 27 to 30 row by row over the eleven categories, deducting at the same time expenditure by foreign visitors in column 25; this was done on a pro rata basis with the sole exception of net taxes on mineral oil refining (row 16, column 29), which fall mainly on gasoline used by motor vehicles and only to a minor extent on heavy oils used for domestic heating. The third step was to combine the items column by column to give the elements distinguished in the cost structures. The final step was to adjust the demands on domestic production from a commodity to an industry basis; this was done by

means of the RAS method which, while not correct in principle, was probably as good as anything else I might have done.

The isolation of the household sector. The PNPIs were taken out of the personal sector on the basis of the information provided in Economic Trends (no. 259) and in the 1977 Blue Book, and visitors' expenditures were removed by the method described earlier for the input-output structure. I made no attempt to carry out further adjustments for life insurance or unincorporated businesses.

The allocation of household income and outlay. This allocation was based on information taken from table 3 of the 1969 issue of the Family Expenditure Survey. The twelve household groups (classified by their weekly income) distinguished in the survey were aggregated into seven. For each item of income or outlay the relevant total derived from the 1977 Blue Book was then distributed over these seven groups by means of indicators derived from the survey. As far as possible I constructed a single indicator for each item by adding up what seemed the most appropriate series in the survey: expenditure on food, for instance, was allocated according to numbers 12–42 in the survey; number 43, "meals away from home," was included with expenditure on entertainments, hotels, and restaurants; and so on. In some cases, however, it seemed preferable to subdivide one of my categories of goods and services and use separate indicators to allocate the components. By distributing the Blue Book totals according to the sample total of the indicator in each income group I have implicitly treated the sample as representative.

Household saving. I distributed all other items in the household income and outlay accounts, so saving was left as a residual in each income group. All that can be said is that the series, with almost half of household saving in the top income group, is not altogether implausible. The negative total for the income group £20–30 a week may seem surprising, but there appear to be a large number of young married couples and couples with young children in the group; this would be likely to boost expenditure, particularly in view of the fact that durable goods are treated as part of current expenditure.

WHATEVER BECAME OF THE MULTIPLIER?

It has been more than fifty years since Kahn published his famous paper on the multiplier (1931), which has opened up so many paths. One path has led to the development of the matrix multiplier proposed by Goodwin (1949), which has the form of a Leontief inverse but can be applied to households and government as well as to industries. A recent example of multiplier analysis in a social accounting framework is provided in Copeland and Henry (1975), which contains many calculations relating to Ireland in 1964 and 1968.

The latest development on these lines, which in this section I shall apply to table 8.1, is given in Pyatt, Roe, and associates (1977) and in Pyatt and Round (1979), reproduced in chapter 9 of this volume. A particularly interesting feature of this work is that it shows how a matrix multiplier can be decomposed into multiplicative components each of which relates to a particular kind of connection in the system as a whole. Suppose, as in the following example, that there are three endogenous subsystems; then an injection applied to an account in one subsystem may have the following effects. First, it may move around within the subsystem, giving rise to repercussions of the kind measured by a Leontief inverse. Second, it may move around the whole system and return to the subsystem from which it started. And, finally, it may move around and end up in one of the other subsystems. Pyatt and Round refer to the results of these

movements as direct effects, indirect effects, and cross effects. I prefer to call them, respectively, intragroup, intergroup, and extragroup effects in order to avoid any confusion with the direct and indirect requirements of traditional input-output analysis, especially as both types of requirement are included in what Pyatt and Round call direct effects.

The example that follows starts off from a coefficient matrix based on table 8.1, which is set out in table 8.2. The whole system is divided into four subsystems, three endogenous and one exogenous, namely: (a) value added/income originating, accounts 1–3; (b) forms of income and sectors, accounts 4–18; (c) goods and services, government purposes, and branches of production, accounts 19–39; and (d) everything else, accounts 40–52.

If we write table 8.2 as a partitioned matrix, A^0, say, of order 52, then

$$A^0 = \left[\begin{array}{ccc:c} 0 & 0 & A_{13} & A_{14} \\ A_{21} & A_{22} & 0 & A_{24} \\ 0 & A_{32} & A_{33} & A_{34} \\ \hdashline 0 & A_{42} & A_{43} & A_{44} \end{array}\right]$$

where the first three rows and columns relate to the accounts that are treated as endogenous and the fourth row and column relate to the accounts that are treated as exogenous. In the final terminology this means that leakages from the endogenous part of the system are caught in the capital accounts and in the accounts for the rest of the world.

If we denote the top left-hand partition of A^0 by A, then, say,

$$\begin{aligned} A &= \begin{bmatrix} 0 & 0 & A_{13} \\ A_{21} & A_{22} & 0 \\ 0 & A_{32} & A_{33} \end{bmatrix} \\ &= \begin{bmatrix} 0 & 0 & 0 \\ 0 & A_{22} & 0 \\ 0 & 0 & A_{33} \end{bmatrix} + \begin{bmatrix} 0 & 0 & A_{13} \\ A_{21} & 0 & 0 \\ 0 & A_{32} & 0 \end{bmatrix} \\ &= B + C. \end{aligned}$$

If we denote the vector of totals of the thirty-nine endogenous accounts by y and the vector of the sums of the incoming elements into these accounts from the thirteen exogenous accounts by x, then, say,

(8.1)
$$\begin{aligned} y &= Ay + x \\ &= By + Cy + x \\ &= (I - B)^{-1} Cy + (I - B)^{-1} x \\ &= [I - (I - B)^{-1} C]^{-1} (I - B)^{-1} x \\ &= [I + (I - B)^{-1} C + (I - B)^{-1} C (I - B)^{-1} C] \\ &\quad \cdot \{I - [(I - B)^{-1} C (I - B)^{-1} C (I - B)^{-1} C]\}^{-1} \\ &\quad \cdot (I - B)^{-1} x \\ &= M_3 M_2 M_1 x \\ &= M x. \end{aligned}$$

Table 8.2. Coefficient Matrix, 10000 A°, Derived from Table 8.1 for the United Kingdom, 1968

		1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25
1	Income from employment																									
2	Gross profits & other trading income																									
3	Taxes on expenditure (net)																			184	5428	1577	45	683	1079	1096
4	Wages & salaries (incl. Forces' pay)	9099																								
5	Employers' contributions	901																								
6	Rent, dividends, & interest		6540					71	163	205	260	278	241	291		5343	12023	936	2017							
7	Households: income £ 0–10		25		18	92	120								374			622	3							
8	" " £10–20		303		604	806	549								492			820	33							
9	" " £20–30		532		2398	2404	559								305			475	107							
10	" " £30–40		614		2595	2386	503								187			282	97							
11	" " £40–50		392		1769	1629	407								89			137	43							
12	" " £50–60		354		1093	1011	191								39			66	28							
13	" " £60+		1239		1522	1673	726								59			85	28							
14	Private nonprofit institutions						171	115	112	114	126	139	132	193		51		192								
15	Companies						4706																			
16	Public corporations						376																			
17	Central government			7565			627	168	1033	1716	1898	2129	2241	2466		1383	321									
18	Local authorities			2435			398											1433								
19	Food							2601	2209	1914	1585	1354	1256	910												
20	Drink & tobacco							705	967	1076	946	905	971	700	98											
21	Housing							1790	1307	1002	849	784	676	559	1063											
22	Fuel & light							1005	627	421	335	293	253	185	236											
23	Clothing & footwear							520	597	660	669	630	597	530	443											
24	Durable & other household goods							564	592	593	578	581	571	429	443											
25	Other miscellaneous goods							520	514	535	497	469	459	392	443											
26	Motor vehicles (incl. running costs)							176	367	564	754	684	741	622	443											
27	Travel & communications							309	345	318	299	283	288	259	344											
28	Entertainments, hotels & restaurants							397	404	441	443	451	468	474	1181											
29	Other services							626	506	425	410	439	435	673	3091											

30	Military defence																1790								
31	National health service																1039								
32	Other central government purposes																752								
33	Local authorities purposes																	7588							
34	Agriculture, etc., mining & quarrying																		1406			6	1172		253
35	Metals & metal products																					103		1812	629
36	Other manufacturing																		4159	1935		386	560	5062	3481	3933
37	Construction																					1808				
38	Gas, electricity, & water																					222	7075			
39	Services																		2889	2418		5849	1104	3419	3066	3404
40	Sales by final buyers					18	13	14	16	18	15	23														
41	Vehicles, ships, & aircraft																									
42	Plant & machinery																									
43	Buildings & works																									
44	Increase in stocks																									
45	Personal sector					326	153	−90	236	457	556	1152	602													
46	Companies													2083												
47	Public sector														−2344	1236	56									
48	Production					71	72	75	81	88	86	126							1363	219		49	45	837	562	685
49	Consumption				646	18	19	18	17	16	15	15	167	1138		135										
50	Accumulation																									
51	Identified financial assets																									
52	Unidentified items				21																					
	Total	10000	10000	10000	10000	10000	10000	10000	10000	10000	10000	10000	10000	10000	10000	10000	10000	10000	10000	10000	10000	10000	10000	10000	10000	10000

(Table continues on the following page.)

Table 8.2. (Continued)

		26	27	28	29	30	31	32	33	34	35	36	37	38	39	40	41	42	43	44	45	46	47	48	49	50	51	52
1	Income from employment									3096	4435	2887	3843	2235	5660													
2	Gross profits & other trading income									2885	1275	1422	1426	3339	2432						-4875	-7677	-7143					
3	Taxes on expenditure (net)	3452	9	261	538	139	414	663	622	-594	162	241	463	370	394		708	286	57					-30				
4	Wages & salaries (incl. Forces' pay)																											
5	Employers' contributions																											
6	Rent, dividends, & interest																								8222			
7	Households: income £ 0–10																											
8	" " £10–20																											
9	" " £20–30																											
10	" " £30–40																											
11	" " £40–50																											
12	" " £50–60																											
13	" " £60+																											
14	Private nonprofit institutions																											
15	Companies																											
16	Public corporations																											
17	Central government																								594			
18	Local authorities																											
19	Food																											
20	Drink & tobacco																											
21	Housing																											
22	Fuel & light																											
23	Clothing & footwear																											
24	Durable & other household goods																											
25	Other miscellaneous goods																											
26	Motor vehicles (incl. running costs)																											
27	Travel & communications																											
28	Entertainments, hotels & restaurants																											
29	Other services																											

30	Military defence																														
31	National health service																														
32	Other central government purposes																														
33	Local authorities purposes																														
34	Agriculture, etc., mining & quarrying				488		13	225	40	151		49	866	179	1678	8					66	654				149					
35	Metals & metal products	1731					3578	342	1245	192	552		486	1380	570	256		9198	6973			−3551				3866					
36	Other manufacturing	577			1463		207	1562	863	931	2360	1037		1781	609	583			157	142	7477				2844					
37	Construction					73	439	124	472	292	253	90	33		152	29			78	8767	514				29					
38	Gas, electricity, & water						97	116	161	255	217	276	202	31		138			542						15					
39	Services	2946	9838	6814	8478		4468	7413	8384	8192	802	1236	1628	629	857			1368	832	968	93				2564					
40	Sales by final buyers	1000		470	842		308	−422	−2681	746	10	181	34	29	26	23		−3255	−259						136					
41	Vehicles, ships, & aircraft																							797	3047	804					
42	Plant & machinery																							1418	8433	5784					
43	Buildings & works																							5715	4630	12353					
44	Increase in stocks																							182	762	225					
45	Personal sector																									969					
46	Companies																									2298					
47	Public sector																							2679	218						
48	Production	295	153	505	69		1367	225	853	111	419	1259	2201	239	165	471		1981	1391		4813										
49	Consumption																										428				
50	Accumulation																											1184			
51	Identified financial assets																							9642	−5136	−4975			14871		
52	Unidentified items																							−5558	5724	−315			−4871		
	Total	10000	10000	10000	10000		10000	10000	10000	10000	10000	10000	10000	10000	10000	10000	0	10000	10000	10000	10000			10000	10000	10000	10000	10000	10000	0	0

Note: Components do not always add to totals because of rounding.

The M-notation is used by Pyatt and Round, who also denote $(I - B)^{-1}C$ by A^*.

If we write out the expressions in rows 5, 6, and 7 of (8.1) in terms of the submatrices of A, we obtain the following.

First,

$$M_1 = \begin{bmatrix} I & 0 & 0 \\ 0 & (I-A_{22})^{-1} & 0 \\ 0 & 0 & (I-A_{33})^{-1} \end{bmatrix}. \tag{8.2}$$

Thus the multiplier effects included in M_1 arise from the repercussions of the initial injection within the group of accounts (or subsystems) which it originally entered, and so may be said to measure the intragroup effects.

Second,

$$M_2 = \begin{bmatrix} D & 0 & 0 \\ 0 & E & 0 \\ 0 & 0 & F \end{bmatrix}$$

where

$$\begin{aligned} D &= [I - A_{13}(I - A_{33})^{-1}A_{32}(I - A_{22})^{-1}A_{21}]^{-1} \\ E &= [I - (I - A_{22})^{-1}A_{21}A_{13}(I - A_{33})^{-1}A_{32}]^{-1} \\ F &= [I - (I - A_{33})^{-1}A_{32}(I - A_{22})^{-1}A_{21}A_{13}]^{-1}. \end{aligned} \tag{8.3}$$

Thus the multiplier effects included in M_2 arise from the repercussions of the initial injection when it has completed a tour through all three groups and returned to the one that it had originally entered and so may be said to measure the intergroup effects.

Finally,

$$M_3 = \begin{bmatrix} I & A_{13}(I - A_{33})^{-1}A_{32} & A_{13} \\ (I - A_{22})^{-1}A_{21} & I & (I - A_{22})^{-1}A_{21}A_{13} \\ (I - A_{33})^{-1}A_{32}(I - A_{22})^{-1}A_{21} & (I - A_{33})^{-1}A_{32} & I \end{bmatrix}.$$

Thus the multiplier effects included in M_3 arise from the repercussions of the initial injection when it has completed a tour outside its original group without returning to it, and so may be said to measure the extragroup effects.

It is a simple matter to express M in terms of additive components, and for some purposes it is convenient to do this. Thus

$$M = I + (M_1 - I) + (M_2 - I)M_1 + (M_3 - I)M_2M_1. \tag{8.4}$$

In this expression we start with a matrix of injections, the unit matrix I. In the second term we add on the effects coming from M_1. To this we add on in the third term the effects coming from M_2. And, finally, in the fourth term we add on the effects coming from M_3.

The matrices M_1, M_2, M_2M_1, M_3, $M_3M_2M_1 \equiv M$, $(M_2 - I)M_1$, and $(M_3 - I)M_2M_1$ are set out in tables 8.3 to 8.9.

THE INTERPRETATION OF THE MATRIX MULTIPLIERS

On the assumption that when an account receives money it spends it in the proportions shown in the A-matrix (table 8.2), the numbers in the columns of M (table 8.7) show the ultimate consequences for each account of 1,000 units received exogenously by the account at the head of the column. For instance, the figure of 2,416 in the top left-hand corner of M indicates

that the exogenous receipt of 1,000 in income from employment will ultimately lead to the generation of an additional 1,416 of such income. How does this come about? Clearly it cannot be an intragroup effect since from (8.2) the first diagonal submatrix of $\mathbf{M}_1$ is the unit matrix. Equally it cannot be an extragroup effect since we are considering the effect of a change in something on itself. It must, therefore, be an intergroup effect arising from the movement of the injection through the system and back through its starting point until it has all leaked away. The course it follows is shown in (8.3): it moves from group 1 to group 2 to group 3, then back to group 1, and so on. Thus in terms of (8.4), the element in the first row and first column of M, $\mathbf{M}_{11}$, say, can be expressed as

$$\mathbf{M}_{11} = 1{,}000 + 0 + 1{,}416 + 0$$

$$= 2{,}416.$$

In a similar way the injection of 1,000 of income from employment will also generate as an intergroup effect, 671 of profits and other trading income. Thus

$$m_{21} = 0 + 0 + 671 + 0$$

$$= 671.$$

If we now look at the opposite corner of the matrices we can see how to combine intragroup and intergroup effects and thus extend the familiar results of input-output analysis. Let us take as an example the element $m_{36.35}$, the demand for the output of other manufacturing generated by a demand for metals and metal products. An extra 1,000 units of demand for these products gives

$$m_{36.35} = 0 + 123 + 617 + 0$$

$$= 740.$$

Of the 123 coming from $\mathbf{M}_1$, we can see from A that 104 represent direct requirements, leaving 19 for indirect requirements. Of the remaining 617, only 447 appear at the intersection of row 36 and column 35 of $\mathbf{M}_2$, but it must be remembered that $\mathbf{M}_1$, $\mathbf{M}_2$, and $\mathbf{M}_3$ combine multiplicatively so that the 447 is only one element in the sum.

So far, extragroup effects have not arisen because we have been looking at the ultimate effect on accounts belonging to the same subsystem as the account initially stimulated. Let us now ask what would be the effect on household food expenditure of providing different types of households with an additional 1,000 units of income. The answers for the poorest and the richest households are given in $m_{19.7}$ and $m_{19.13}$, respectively, and these elements can be decomposed as follows:

(8.5)
$$m_{19.7} = 0 + 0 + 0 + 619$$

$$= 619$$

and

(8.6)
$$m_{19.13} = 0 + 0 + 0 + 417$$

$$= 417.$$

From $\mathbf{M}_3$, the poorest households would give rise to an additional expenditure of 260 and the richest to an additional expenditure of 91: these are the proportions that appear in the A-matrix, and so they represent the direct expenditure of the households initially given the extra income. But households do many things besides buying food and so, as we have seen in (8.5) and (8.6), the ultimate effect on food expenditure is 619 if the injection is applied to the poorest

Table 8.3. Matrix Multiplier for Intragroup Effects, 1000 M_1, United Kingdom, 1968

		1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18
1	Income from employment	1000																	
2	Gross profits & other trading income		1000																
3	Taxes on expenditure (net)			1000															
4	Wages & salaries (incl. Forces' pay)				1000														
5	Employers' contributions					1000													
6	Rent, dividends & interest				76	75	1507	14	45	65	77	84	81	93	8	832	1818	197	306
7	Households: income £ 0-10				17	24	38	1002	8	13	15	16	17	19	39	30	48	70	8
8	" " £10-20				84	103	109	3	1013	20	23	25	26	29	51	72	134	100	26
9	" " £20-30				255	256	100	2	9	1013	15	17	17	19	32	63	123	64	31
10	" " £30-40				270	249	86	2	6	9	1010	12	12	13	20	52	104	42	27
11	" " £40-50				183	169	66	1	4	6	6	1007	7	8	10	39	80	24	18
12	" " £50-60				112	104	31	*	2	3	3	3	1003	4	4	18	38	11	9
13	" " £60 +				160	175	112	1	4	7	8	8	8	1009	7	63	136	24	26
14	Private non-profit institutions				20	20	42	12	15	17	19	21	21	28	1003	32	52	29	9
15	Companies				36	35	709	7	21	31	36	40	38	44	4	1392	855	93	144
16	Public corporations				3	3	57	1	2	2	3	3	3	3	*	31	1068	7	12
17	Central government				217	214	288	20	115	190	211	236	247	273	21	302	381	1070	65
18	Local authorities				34	34	101	3	18	30	33	37	39	43	3	76	127	161	1022
19	Food																		
20	Drink and tobacco																		
21	Housing																		
22	Fuel and light																		
23	Clothing and footwear																		
24	Durable and other household goods																		
25	Other miscellaneous goods																		
26	Motor vehicles (incl. running costs)																		
27	Travel and communications																		
28	Entertainments, hotels & restaurants																		
29	Other services																		
30	Military defence																		
31	National health service																		
32	Other central government purposes																		
33	Local authorities purposes																		
34	Agriculture etc., mining & quarrying																		
35	Metals and metal products																		
36	Other manufacturing																		
37	Construction																		
38	Gas, electricity and water																		
39	Services																		

19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36	37	38	39		
																					1	Income from employment
																					2	Gross profits & other trading income
																					3	Taxes on expenditure (net)
																					4	Wages & salaries (incl. Forces' pay)
																					5	Employers' contributions
																					6	Rent, dividends & interest
																					7	Households: income £ 0-10
																					8	" " £10-20
																					9	" " £20-30
																					10	" " £30-40
																					11	" " £40-50
																					12	" " £50-60
																					13	" " £60 +
																					14	Private non-profit institutions
																					15	Companies
																					16	Public corporations
																					17	Central government
																					18	Local authorities
1000																					19	Food
	1000																				20	Drink and tobacco
		1000																			21	Housing
			1000																		22	Fuel and light
				1000																	23	Clothing and footwear
					1000																24	Durable & other household goods
						1000															25	Other miscellaneous goods
							1000														26	Motor vehicles (incl. running costs)
								1000													27	Travel and communications
									1000												28	Entertainments, hotels & restaurants
										1000											29	Other services
											1000										30	Military defence
												1000									31	National health service
													1000								32	Other central government purposes
														1000							33	Local authorities purposes
187	21	21	255	52	40	68	12	9	71	8	19	49	28	39	1029	22	96	40	181	10	34	Agriculture etc., mining & quarrying
47	20	61	73	43	215	101	188	31	34	28	386	72	167	59	79	1014	63	155	80	31	35	Metals and metal products
491	218	122	185	551	406	448	101	66	211	58	106	227	175	168	266	123	1043	212	124	67	36	Other manufacturing
8	2	185	19	5	6	6	4	4	5	11	50	18	53	34	29	11	7	1004	21	4	37	Construction
21	9	36	722	20	21	19	12	16	17	14	30	30	37	43	32	33	27	14	1011	16	38	Gas, electricity and water
392	282	629	233	443	405	433	337	1001	727	863	519	795	896	863	140	151	188	121	133	1017	39	Services

Note: An asterisk denotes an entry of less than 0.5.

Table 8.4. Matrix Multiplier for Intergroup Effects, 1000 M_2, United Kingdom, 1968

		1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18
1	Income from employment	2416	1133	1439															
2	Gross profits & other trading income	671	1535	672															
3	Taxes on expenditure (net)	469	362	1408															
4	Wages & salaries (incl. Forces' pay)				1000			1311	1190	1114	1031	964	940	809	1155			572	1311
5	Employers' contributions					1000		130	118	110	102	96	93	80	114			57	130
6	Rent, dividends & interest						1000	917	832	778	719	672	656	561	783			376	880
7	Households: income £ 0-10							1073	67	64	59	55	54	46	63			29	69
8	" " £10-20							237	1216	203	186	176	172	147	205			99	229
9	" " £20-30							480	437	1409	378	354	345	296	419			206	474
10	" " £30-40							489	444	415	1384	359	351	301	427			210	483
11	" " £40-50							331	301	282	261	1244	238	204	290			142	328
12	" " £50-60							205	186	174	161	151	1147	126	180			88	203
13	" " £ 60 +							383	347	324	300	280	273	1235	333			163	377
14	Private non-profit institutions							65	59	55	51	48	47	40	1056			27	62
15	Companies							432	391	366	338	316	309	264	368	1000		177	414
16	Public corporations							35	31	29	27	25	25	21	29		1000	14	33
17	Central government							870	806	766	713	667	656	557	747			1347	820
18	Local authorities							271	253	243	226	212	209	177	231			104	1249
19	Food																		
20	Drink and tobacco																		
21	Housing																		
22	Fuel and light																		
23	Clothing and footwear																		
24	Durable & other household goods																		
25	Other miscellaneous goods																		
26	Motor vehicles (incl. running costs)																		
27	Travel and communications																		
28	Entertainments, hotels & restaurants																		
29	Other services																		
30	Military defence																		
31	National health service																		
32	Other central government purposes																		
33	Local authorities purposes																		
34	Agriculture etc., mining & quarrying																		
35	Metals and metal products																		
36	Other manufacturing																		
37	Construction																		
38	Gas, electricity and water																		
39	Services																		

19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36	37	38	39		
																					1	Income from employment
																					2	Gross profits & other trading income
																					3	Taxes on expenditure (net)
																					4	Wages & salaries (incl. Forces' pay)
																					5	Employers' contributions
																					6	Rent, dividends & interest
																					7	Households: income £ 0-10
																					8	" " £10-20
																					9	" "" £20-30
																					10	" " £30-40
																					11	" " £40-50
																					12	" " £50-60
																					13	" " £60 +
																					14	Private non-profit institutions
																					15	Companies
																					16	Public corporations
																					17	Central government
																					18	Local authorities
1007	215	63	2	27	43	43	137	*	10	21	6	16	26	25	244	281	211	268	256	397	19	Food
4	1123	36	1	15	24	25	78	*	6	12	3	9	15	14	144	166	124	158	151	234	20	Drink and tobacco
4	127	1037	1	16	25	26	81	*	6	13	3	10	16	15	142	163	123	156	150	231	21	Housing
2	53	15	1000	7	10	11	33	*	3	5	1	4	6	6	58	66	50	64	61	94	22	Fuel and light
3	84	24	1	1011	17	17	54	*	4	8	2	6	10	10	99	113	85	108	103	159	23	Clothing and footwear
3	76	22	1	10	1015	15	49	*	4	8	2	6	9	9	89	102	76	97	93	144	24	Durable & other household goods
2	67	19	1	8	13	1013	42	*	3	7	2	5	8	8	77	88	66	84	81	125	25	Other miscellaneous goods
3	82	24	1	10	16	17	1052	*	4	8	2	6	10	9	99	113	85	108	103	160	26	Motor vehicles (incl. running costs)
1	42	12	*	5	8	8	26	1000	2	4	1	3	5	5	48	55	41	53	50	78	27	Travel and communications
2	65	19	1	8	13	13	41	*	1003	6	2	5	8	7	75	86	64	82	79	121	28	Entertainments, hotels & restaurants
3	79	23	1	10	16	16	50	*	4	1008	2	6	10	9	90	101	77	97	95	144	29	Other services
5	161	47	1	20	32	32	102	*	8	16	1004	12	20	18	92	113	88	113	112	164	30	Military defence
3	93	27	1	12	19	19	59	*	4	9	2	1007	11	11	54	66	51	66	65	95	31	National health service
2	68	20	1	8	13	14	43	*	3	7	2	5	1008	8	39	48	37	48	47	69	32	Other central government purposes
9	257	75	2	32	51	52	163	*	12	25	7	20	31	1029	109	140	111	144	144	206	33	Local authorities purposes
3	97	28	1	12	19	20	62	*	5	10	2	7	12	11	1098	113	85	109	105	161	34	Agriculture etc., mining & quarrying
6	167	49	1	21	33	34	106	*	8	17	4	13	20	19	136	1160	122	156	151	229	35	Metals & metal products
13	387	113	3	49	77	78	246	1	19	38	10	30	47	44	386	447	1337	430	413	634	36	Other manufacturing
2	52	15	*	6	10	10	33	*	2	5	1	4	6	6	45	52	40	1051	49	74	37	Construction
3	78	23	1	10	15	16	50	*	4	8	2	6	10	9	74	85	65	83	1080	121	38	Gas, electricity and water
32	933	271	8	117	185	188	593	2	45	93	24	71	114	107	785	922	701	897	870	2315	39	Services

Note: An asterisk denotes an entry of less than 0.5.

Table 8.5. Matrix Multiplier for Intragroup and Intergroup Effects, 1000 M_2M_1, United Kingdom, 1968

		1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18
1	Income from employment	2416	1133	1439															
2	Gross profits & other trading income	671	1535	672															
3	Taxes on expenditure (net)	469	362	1408															
4	Wages & salaries (incl. Forces' pay)				2289	1289	909	1354	1348	1360	1306	1271	1257	1166	1361	664	1133	1236	1539
5	Employers' contributions				128	1128	90	134	134	135	129	126	125	116	135	66	112	122	152
6	Rent, dividends and interest				968	967	2130	960	983	1009	981	963	950	895	934	1285	2594	1028	1342
7	Households: income £ 0-10				90	97	88	1077	84	90	89	88	88	84	113	66	110	136	90
8	" " £10-20				317	337	271	247	1257	266	259	255	254	239	293	190	337	318	296
9	" " £20-30				727	727	432	498	502	1512	493	482	477	445	527	304	536	512	589
10	" " £30-40				750	729	423	506	508	516	1496	485	479	446	524	298	525	498	595
11	" " £40-50				508	494	295	343	344	349	336	1328	324	302	351	205	365	333	403
12	" " £50-60				314	306	173	213	213	215	207	202	1200	186	216	122	214	203	248
13	" " £60 +				534	549	375	397	397	402	387	377	373	1347	399	255	463	379	468
14	Private non-profit institutions				84	84	87	79	81	84	84	84	83	85	1068	64	107	88	83
15	Companies				456	455	1002	452	463	475	462	453	447	421	439	1605	1221	484	632
16	Public corporations				36	36	80	36	37	38	37	36	36	34	35	48	1098	39	51
17	Central government				1092	1088	889	918	1023	1113	1099	1099	1104	1057	907	736	1128	1852	1036
18	Local authorities				309	309	288	282	303	320	313	309	309	289	277	211	359	401	1318
19	Food																		
20	Drink and tobacco																		
21	Housing																		
22	Fuel and light																		
23	Clothing and footwear																		
24	Durable & other household goods																		
25	Other miscellaneous goods																		
26	Motor vehicles (incl. running costs)																		
27	Travel and communications																		
28	Entertainments, hotels & restaurants																		
29	Other services																		
30	Military defence																		
31	National health service																		
32	Other central government purposes																		
33	Local authorities purposes																		
34	Agriculture etc., mining & quarrying																		
35	Metals and metal products																		
36	Other manufacturing																		
37	Construction																		
38	Gas, electricity and water																		
39	Services																		

19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36	37	38	39		
																					1	Income from employment
																					2	Gross profits & other trading income
																					3	Taxes on expenditure (net)
																					4	Wages & salaries (incl. Forces' pay)
																					5	Employers' contributions
																					6	Rent, dividends and interest
																					7	Households: income £ 0-10
																					8	" " £10-20
																					9	" " £20-30
																					10	" " £30-40
																					11	" " £40-50
																					12	" " £50-60
																					13	" " £60 +
																					14	Private non-profit institutions
																					15	Companies
																					16	Public corporations
																					17	Central government
																					18	Local authorities
1332	387	419	406	350	366	361	352	427	376	392	368	424	496	448	401	387	345	419	410	434	19	Food
196	1224	246	239	206	215	212	205	252	221	231	217	250	292	264	237	228	203	247	241	256	20	Drink and tobacco
193	227	1244	237	204	213	210	206	248	219	228	214	247	289	261	234	225	201	244	239	252	21	Housing
79	93	100	1096	83	87	86	84	101	89	93	87	100	118	106	95	91	82	99	97	103	22	Fuel and light
134	153	168	163	1140	147	145	140	172	151	157	148	170	199	180	162	156	138	168	165	174	23	Clothing and footwear
120	139	151	147	127	1132	131	126	155	136	142	133	154	179	162	146	140	125	152	149	157	24	Durable & other household goods
105	121	132	128	110	115	1114	110	135	118	123	116	134	156	141	127	122	109	132	129	137	25	Other miscellaneous goods
134	151	167	163	140	146	144	1139	172	151	157	148	170	199	180	162	156	139	168	165	175	26	Motor vehicles (incl. running costs)
65	75	82	80	69	72	71	69	1084	74	77	72	83	97	88	79	76	68	82	81	85	27	Travel and communications
102	117	128	125	107	112	110	107	131	1115	120	112	130	151	137	123	118	105	128	126	133	28	Entertainments, hotels & restaurants
121	142	152	149	127	133	132	128	155	137	1143	134	154	180	163	147	140	125	152	151	158	29	Other services
138	231	194	170	153	165	163	190	177	158	169	1153	180	213	193	157	157	142	175	174	179	30	Military defence
80	134	113	99	89	96	95	111	102	92	98	89	1105	124	112	91	91	83	101	101	104	31	National health service
58	97	82	72	65	69	69	80	74	67	71	64	76	1090	81	66	66	60	73	73	75	32	Other central government purposes
125	346	260	218	200	218	216	274	222	201	218	193	231	275	1249	190	195	179	221	221	225	33	Local authorities purposes
322	187	194	420	195	190	216	161	182	223	168	168	221	230	221	1191	178	235	209	348	185	34	Agriculture etc., mining & quarrying
239	286	315	309	250	435	318	418	277	253	258	599	320	458	322	305	1236	262	397	319	282	35	Metals and metal products
1023	880	804	836	1116	999	1033	690	749	814	690	695	908	972	889	903	740	1594	883	783	761	36	Other manufacturing
71	86	266	96	72	77	76	76	84	76	85	119	98	147	120	102	83	72	1082	99	85	37	Construction
123	140	168	847	128	135	132	127	147	132	135	143	161	191	182	154	151	133	143	1137	149	38	Gas, electricity and water
1498	1784	2082	1590	1631	1660	1676	1640	2418	1983	2186	1742	2217	2567	2375	1446	1426	1331	1515	1508	2456	39	Services

Table 8.6. Matrix Multiplier for Extragroup Effects, 1000 M_3, United Kingdom, 1968

		1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18
1	Income from employment	1000						421	375	345	318	297	287	251	386			205	454
2	Gross profits & other trading income		1000					217	188	169	154	143	138	119	176			87	206
3	Taxes on expenditure (net)			1000				122	132	138	132	125	127	103	96			25	77
4	Wages & salaries (incl. Forces' pay)	910			1000														
5	Employers' contributions	90				1000													
6	Rent, dividends and interest	76	1013	224			1000												
7	Households: income £ 0-10	18	33	55				1000											
8	" " £10-20	85	110	82					1000										
9	" " £20-30	255	124	56						1000									
10	" " £30-40	268	121	39							1000								
11	" " £40-50	182	85	22								1000							
12	" " £50-60	112	57	11									1000						
13	" " £60 +	161	200	24										1000					
14	Private non-profit institutions	20	35	24											1000				
15	Companies	36	477	105												1000			
16	Public corporations	3	38	8													1000		
17	Central government	217	267	825														1000	
18	Local authorities	34	79	371															1000
19	Food	168	113	56				260	221	191	158	135	126	91					
20	Drink and tobacco	101	65	27				71	97	108	95	90	97	70	10				
21	Housing	96	68	36				179	131	100	85	78	68	56	106				
22	Fuel and light	38	28	16				101	63	42	34	29	25	18	24				
23	Clothing and footwear	68	45	18				52	60	66	67	63	60	53	44				
24	Durable & other household goods	61	41	18				56	59	59	58	58	57	43	44				
25	Other miscellaneous goods	53	36	16				52	51	53	50	47	46	39	44				
26	Motor vehicles (incl. running costs)	70	45	15				18	37	56	75	68	74	62	44				
27	Travel and communications	33	23	10				31	35	32	30	28	29	26	34				
28	Entertainments, hotels & restaurants	51	37	15				40	40	44	44	45	47	47	118				
29	Other services	57	48	22				63	51	42	41	44	44	67	309				
30	Military defence	39	48	148														179	
31	National health service	23	28	86														104	
32	Other central government purposes	16	20	62														75	
33	Local authorities purposes	26	60	281															759
34	Agriculture etc., mining & quarrying	64	46	40				92	75	65	56	50	47	36	27			11	29
35	Metals and metal products	78	66	107				59	56	56	55	52	51	42	46			89	45
36	Other manufacturing	250	182	165				274	254	241	219	201	194	156	131			56	127
37	Construction	26	22	30				39	29	23	20	18	16	14	25			15	26
38	Gas, electricity and water	46	36	38				91	61	45	38	34	30	23	31			11	33
39	Services	460	387	566				446	403	374	348	329	320	292	534			243	655

19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36	37	38	39		
															310	443	289	384	223	566	1	Income from employment
															289	127	142	143	334	243	2	Gross profits & other trading income
18	543	158	4	68	108	110	345	1	26	54	14	41	66	62	-59	16	24	46	37	39	3	Taxes on expenditure (net)
															282	404	263	350	203	515	4	Wages & salaries (incl. Forces' pay)
															28	40	26	35	20	51	5	Employers' contributions
4	122	35	1	15	24	25	77	*	6	12	3	9	15	14	302	166	171	184	363	298	6	Rent, dividends and interest
1	30	9	*	4	6	6	19	*	1	3	1	2	4	3	12	13	11	14	17	20	7	Households: income £ 0-10
2	45	13	*	6	9	9	28	*	2	4	1	3	5	5	53	53	42	52	59	78	8	" " £10-20
1	31	9	*	4	6	6	19	*	1	3	1	2	4	4	112	130	93	119	101	177	9	" " £20-30
1	21	6	*	3	4	4	13	*	1	2	1	2	3	2	116	135	96	122	102	183	10	" " £30-40
*	12	4	*	2	2	2	8	*	1	1	*	1	1	1	80	92	65	83	70	125	11	" " £40-50
*	6	2	*	1	1	1	4	*	*	1	*	*	1	1	50	57	41	52	44	77	12	" " £50-60
*	13	4	*	2	3	3	8	*	1	1	*	1	2	2	106	97	76	92	104	141	13	" " £60 +
*	13	4	*	2	3	3	8	*	1	1	*	1	2	1	15	14	11	14	17	21	14	Private non-profit institutions
2	57	17	*	7	11	12	36	*	3	6	1	4	7	7	142	78	81	87	171	140	15	Companies
*	5	1	*	1	1	1	3	*	*	*	*	*	1	1	11	6	6	7	14	11	16	Public corporations
15	448	130	4	56	89	90	285	1	22	44	11	34	55	51	95	144	121	160	168	220	17	Central government
7	201	58	2	25	40	41	128	*	10	20	5	15	25	23	11	31	30	42	48	53	18	Local authorities
1000																					19	Food
	1000																				20	Drink and tobacco
		1000																			21	Housing
			1000																		22	Fuel and light
				1000																	23	Clothing and footwear
					1000																24	Durable & other household goods
						1000															25	Other miscellaneous goods
							1000														26	Motor vehicles (incl. running costs)
								1000													27	Travel and communications
									1000												28	Entertainments, hotels & restaurants
										1000											29	Other services
											1000										30	Military defence
												1000									31	National health service
													1000								32	Other central government purposes
														1000							33	Local authorities purposes
															1000						34	Agriculture etc., mining & quarrying
																1000					35	Metals and metal products
																	1000				36	Other manufacturing
																		1000			37	Construction
																			1000		38	Gas, electricity and water
																				1000	39	Services

Note: An asterisk denotes an entry of less than 0.5.

Table 8.7. Matrix Multiplier for All Effects, $1000\,M_3M_2M_1 = 1000\,M = 1000\,(I - A)^{-1}$, United Kingdom, 1968

		1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18
1	Income from employment	2416	1133	1439	1416	1417	1000	1488	1482	1495	1435	1397	1382	1282	1496	730	1245	1358	1691
2	Gross profits & other trading income	671	1535	672	671	671	471	721	709	711	680	661	652	603	702	343	587	633	791
3	Taxes on expenditure (net)	469	362	1408	469	469	312	463	480	496	478	464	464	419	453	223	388	387	476
4	Wages & salaries (incl. Forces' pay)	2199	1030	1309	2289	1289	909	1354	1348	1360	1306	1271	1257	1166	1361	664	1133	1236	1539
5	Employers' contributions	218	102	130	128	1128	90	134	134	135	129	126	125	116	135	66	112	122	152
6	Rent, dividends and interest	968	1721	1105	968	967	2130	960	983	1009	981	963	950	895	934	1285	2594	1028	1342
7	Households: income £ 0-10	90	90	125	90	97	88	1077	84	90	89	88	88	84	113	66	110	136	90
8	" " £10-20	318	295	312	317	337	271	247	1257	266	259	255	254	239	293	191	337	318	296
9	" " £20-30	727	501	531	727	727	432	498	502	1512	493	482	477	445	527	304	536	512	589
10	" " £30-40	748	504	522	750	729	423	506	508	516	1496	485	479	446	524	298	525	498	595
11	" " £40-50	507	344	350	508	494	295	343	344	349	336	1328	324	302	351	205	365	333	403
12	" " £50-60	313	218	214	314	306	173	213	213	215	207	202	1200	186	216	122	214	203	248
13	" " £60 +	535	499	401	534	549	375	397	397	402	387	377	373	1347	399	255	463	379	468
14	Private non-profit institutions	84	86	86	84	84	87	79	81	84	84	84	83	85	1068	64	107	88	83
15	Companies	456	810	520	456	455	1002	452	463	475	462	453	447	421	439	1605	1221	484	632
16	Public corporations	36	65	42	36	36	80	36	37	38	37	36	36	34	35	48	1098	39	51
17	Central government	1091	954	1654	1091	1088	889	918	1023	1113	1099	1099	1104	1057	907	736	1128	1852	1036
18	Local authorities	309	294	624	309	309	288	282	303	320	313	309	309	289	277	211	359	401	1318
19	Food	508	384	396	508	509	328	619	585	564	518	488	475	417	389	231	407	388	424
20	Drink and tobacco	301	224	227	301	300	190	282	310	325	304	296	300	260	234	133	235	220	249
21	Housing	294	226	234	294	295	195	390	345	320	297	286	274	249	334	138	242	230	248
22	Fuel and light	119	92	97	119	120	80	186	150	132	120	114	110	98	118	57	99	96	101
23	Clothing and footwear	204	154	155	205	204	130	196	206	215	210	204	199	183	197	91	161	150	170
24	Durable & other household goods	184	139	141	184	184	118	187	191	194	188	185	183	161	182	83	146	137	153
25	Other miscellaneous goods	160	121	123	160	160	103	165	166	171	163	158	156	142	165	72	128	119	133
26	Motor vehicles (incl. running costs)	206	153	151	206	204	128	162	182	204	218	208	212	191	194	90	158	146	169
27	Travel and communications	99	76	77	99	100	65	102	106	105	101	98	97	90	109	45	80	75	83
28	Entertainments, hotels & restaurants	154	119	119	154	154	102	151	153	159	155	154	154	149	234	72	126	116	130
29	Other services	181	147	146	181	182	127	197	187	182	177	177	175	193	448	90	158	143	156
30	Military defence	195	171	296	195	195	159	164	183	199	197	197	198	189	162	132	202	332	185
31	National health service	113	99	172	113	113	92	95	106	116	114	114	115	110	94	76	117	192	108
32	Other central government purposes	82	72	124	82	82	67	69	77	84	83	83	83	80	68	55	85	139	78
33	Local authorities purposes	235	223	473	235	234	219	214	230	243	238	234	235	219	211	160	273	304	1000
34	Agriculture etc., mining & quarrying	203	158	179	203	204	137	240	227	221	207	198	194	174	185	98	170	171	202
35	Metals and metal products	284	229	308	284	284	203	276	285	296	289	283	282	260	270	153	255	312	295
36	Other manufacturing	803	622	714	803	803	539	859	854	859	817	789	777	703	749	386	670	682	811
37	Construction	93	74	95	93	93	66	109	102	99	94	91	89	82	99	48	82	91	107
38	Gas, electricity and water	153	121	144	153	153	106	203	178	165	154	148	144	131	152	76	132	137	165
39	Services	1636	1320	1718	1636	1636	1170	1689	1696	1718	1655	1616	1601	1499	1821	856	1458	1598	2094

19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36	37	38	39		
1403	1513	1750	1634	1473	1539	1513	1421	1829	1598	1666	1582	1801	2107	1899	1657	1690	1460	1801	1621	1858	1	Income from employment
684	708	811	963	696	712	712	650	843	750	768	712	841	972	887	929	723	706	807	1013	857	2	Gross profits & other trading income
347	940	592	411	427	481	477	705	441	409	458	389	476	576	523	327	386	351	448	421	447	3	Taxes on expenditure (net)
1277	1377	1592	1487	1340	1401	1376	1293	1664	1454	1516	1439	1639	1917	1728	1508	1537	1329	1639	1475	1691	4	Wages & salaries (incl. Forces' pay)
126	136	158	147	133	139	136	128	165	144	150	143	162	190	171	149	152	132	162	146	167	5	Employers' contributions
877	1043	1086	1191	912	946	943	924	1092	972	1007	928	1095	1273	1159	1139	947	905	1054	1243	1109	6	Rent, dividends and interest
66	102	90	83	72	77	76	85	84	75	80	73	85	101	91	78	75	68	83	85	85	7	Households: income £ 0-10
223	284	287	279	237	249	246	251	285	252	264	245	285	334	302	270	255	231	279	284	289	8	" " £10-20
463	528	581	560	487	509	502	483	597	524	547	515	591	692	625	557	543	461	586	564	606	9	" " £20-30
473	528	591	571	496	518	511	487	610	535	558	526	603	705	637	570	556	491	598	574	620	10	" " £30-40
321	356	400	388	337	351	346	329	414	364	379	357	410	479	432	388	377	333	406	390	421	11	" " £40-50
199	219	248	242	209	218	215	203	257	225	235	221	254	297	268	241	234	207	252	243	261	12	" " £50-60
372	409	459	466	387	402	398	376	474	418	433	407	470	548	496	461	426	385	463	474	482	13	" " £60 +
61	78	78	77	65	68	67	68	77	69	72	66	77	91	82	74	69	63	76	79	78	14	Private non-profit institutions
413	491	511	561	429	445	444	435	514	458	474	437	515	599	546	536	446	426	496	585	522	15	Companies
33	39	41	45	34	36	35	35	41	37	38	35	41	48	44	43	36	34	40	47	42	16	Public corporations
773	1293	1085	951	858	921	912	1064	986	884	945	854	1008	1192	1080	877	878	795	976	970	1001	17	Central government
230	456	343	284	263	287	284	361	292	265	287	254	304	362	328	251	258	235	291	291	297	18	Local authorities
1332	387	419	406	350	366	361	352	427	376	392	368	424	496	448	401	387	345	419	410	434	19	Food
196	1224	246	239	206	215	212	205	252	221	231	217	250	292	264	237	228	203	247	241	256	20	Drink and tobacco
193	227	1244	237	204	213	211	206	248	219	228	214	247	289	261	234	225	201	244	239	252	21	Housing
79	93	100	1096	83	87	86	84	101	89	93	87	100	118	106	95	91	82	99	97	103	22	Fuel and light
134	153	168	163	1140	147	145	140	172	151	157	148	170	199	180	162	156	138	168	165	174	23	Clothing and footwear
120	139	151	147	127	1132	131	126	155	136	142	133	154	179	162	146	140	125	152	149	157	24	Durable & other household goods
105	121	132	128	110	115	1114	110	135	118	123	116	134	156	141	127	122	109	132	129	137	25	Other miscellaneous goods
134	151	167	163	140	146	144	1139	172	151	157	148	170	199	180	162	156	139	168	165	175	26	Motor vehicles (incl. running costs)
65	75	82	80	69	72	71	69	1084	74	77	72	83	97	88	79	76	68	82	81	85	27	Travel and communications
102	117	128	125	107	112	110	107	131	1115	120	112	130	151	137	123	118	105	128	126	133	28	Entertainments, hotels & restaurants
121	142	152	149	127	133	132	128	155	137	1143	134	154	180	163	147	140	125	152	151	158	29	Other services
138	232	194	170	153	165	163	190	177	158	169	1153	180	213	193	157	157	142	175	174	179	30	Military defence
80	134	113	99	89	96	95	111	102	92	98	89	1105	124	112	91	91	83	101	101	104	31	National health service
58	97	82	72	65	69	69	80	74	67	71	64	76	1090	81	66	66	60	73	73	75	32	Other central government purposes
175	346	260	216	200	218	216	274	222	201	218	193	231	275	1249	190	195	179	221	221	225	33	Local authorities purposes
322	187	194	420	195	190	216	161	182	223	168	168	221	230	221	1191	178	235	209	348	185	34	Agriculture etc., mining & quarrying
239	286	315	309	250	435	318	418	277	253	258	599	320	458	322	305	1236	262	397	319	282	35	Metals and metal products
1023	880	804	836	1116	999	1033	690	749	814	690	695	908	972	889	903	740	1594	883	783	760	36	Other manufacturing
71	86	266	96	72	77	76	76	84	76	85	119	98	147	120	102	83	72	1082	99	85	37	Construction
123	140	168	847	128	135	132	127	147	132	135	143	161	191	182	154	151	133	143	1137	149	38	Gas, electricity and water
1498	1784	2082	1590	1631	1660	1674	1640	2418	1983	2186	1742	2217	2567	2375	1446	1426	1331	1515	1508	2456	39	Services

Table 8.8. Additional Effects Associated with M_2: $1000 (M_2 - I) M_1$, United Kingdom, 1968

		1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18
1	Income from employment	1416	1133	1439															
2	Gross profits & other trading income	671	535	672															
3	Taxes on expenditure (net)	469	362	408															
4	Wages & salaries (incl. Forces' pay)				1289	1289	909	1354	1348	1360	1306	1271	1257	1166	1361	664	1133	1236	1539
5	Employers' contributions				128	128	90	134	134	135	129	126	125	116	135	66	112	122	152
6	Rent, dividends and interest				892	892	623	946	938	944	905	879	869	802	926	453	776	831	1036
7	Households: income £ 0-10				73	73	50	75	76	77	74	72	71	65	74	36	62	66	82
8	" " £10-20				233	233	163	244	244	246	235	230	228	210	242	118	203	217	270
9	" " £20-30				472	472	332	496	494	498	478	465	460	426	495	242	413	447	557
10	" " £30-40				479	479	337	504	502	506	486	473	468	433	504	246	420	456	563
11	" " £40-50				325	325	229	342	340	343	330	321	317	294	342	167	285	309	385
12	" " £50-60				201	201	142	212	211	213	204	199	196	182	212	103	177	192	239
13	" " £60 +				374	374	263	395	392	395	379	369	364	337	393	192	328	355	442
14	Private non-profit institutions				64	64	44	67	66	67	64	63	62	57	66	32	55	59	73
15	Companies				420	420	293	445	442	444	426	414	409	377	436	213	365	391	488
16	Public corporations				34	34	23	36	35	36	34	33	33	30	35	17	29	31	39
17	Central government				874	874	600	897	907	923	888	863	857	785	886	434	747	783	971
18	Local authorities				275	275	187	279	284	291	280	272	271	246	274	134	232	239	296
19	Food																		
20	Drink and tobacco																		
21	Housing																		
22	Fuel and light																		
23	Clothing and footwear																		
24	Durable & other household goods																		
25	Other miscellaneous goods																		
26	Motor vehicles (incl. running costs)																		
27	Travel and communications																		
28	Entertainments, hotels & restaurants																		
29	Other services																		
30	Military defence																		
31	National health service																		
32	Other central government purposes																		
33	Local authorities purposes																		
34	Agriculture etc., mining & quarrying																		
35	Metals and metal products																		
36	Other manufacturing																		
37	Construction																		
38	Gas, electricity and water																		
39	Services																		

19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36	37	38	39		
																					1	Income from employment
																					2	Gross profits & other trading income
																					3	Taxes on expenditure (net)
																					4	Wages & salaries (incl. Forces' pay)
																					5	Employers' contributions
																					6	Rent, dividends and interest
																					7	Households: income £ 0-10
																					8	" " £10-20
																					9	" " £20-30
																					10	" " £30-40
																					11	" " £40-50
																					12	" " £50-60
																					13	" " £60 +
																					14	Private non-profit institutions
																					15	Companies
																					16	Public corporations
																					17	Central government
																					18	Local authorities
332	387	419	406	350	366	361	352	427	376	392	368	424	496	448	401	387	345	419	410	434	19	Food
196	224	246	239	206	215	212	205	252	221	231	217	250	292	264	237	228	203	247	241	256	20	Drink and tobacco
193	227	244	237	204	213	210	206	248	219	228	214	247	289	261	234	225	201	244	239	252	21	Housing
79	93	100	96	83	87	86	84	101	89	93	87	100	118	106	95	91	82	99	97	103	22	Fuel and light
134	153	168	163	140	147	145	140	172	151	157	148	170	199	180	162	156	138	168	165	174	23	Clothing and footwear
120	139	151	147	127	132	131	126	155	136	142	133	154	179	162	146	140	125	152	149	157	24	Durable & other household goods
105	121	132	128	110	115	114	110	135	118	123	116	134	156	141	127	122	109	132	129	137	25	Other miscellaneous goods
134	151	167	163	140	146	144	139	172	151	157	148	170	199	180	162	156	139	168	165	175	26	Motor vehicles (incl. running costs)
65	75	82	80	69	72	71	69	84	74	77	72	83	97	88	79	76	68	82	81	85	27	Travel and communications
102	117	128	125	107	112	110	107	131	115	120	112	130	151	137	123	118	105	128	126	133	28	Entertainments, hotels & restaurants
121	142	152	149	127	133	132	128	155	137	143	134	154	180	163	147	140	125	152	151	158	29	Other services
138	231	194	170	153	165	163	190	177	158	169	153	180	213	193	157	157	142	175	174	179	30	Military defence
80	134	113	99	89	96	95	111	102	92	98	89	105	124	112	91	91	83	101	101	104	31	National health service
58	97	82	72	65	69	69	80	74	67	71	64	76	90	81	66	66	60	73	73	75	32	Other central government purposes
175	346	260	216	200	218	216	274	222	201	218	193	231	275	249	190	195	179	221	221	225	33	Local authorities purposes
135	166	172	165	143	150	148	148	173	153	160	149	172	202	183	161	156	140	170	167	176	34	Agriculture etc., mining & quarrying
192	266	254	236	207	219	217	230	246	219	230	213	248	291	263	226	222	199	243	239	250	35	Metals and metal products
532	662	682	651	565	593	586	589	683	603	631	589	681	798	722	637	617	551	671	659	693	36	Other manufacturing
62	84	82	77	67	71	70	73	80	71	75	69	80	94	85	74	72	65	79	78	81	37	Construction
102	130	132	125	109	114	113	115	131	116	121	113	131	153	139	122	118	106	129	127	133	38	Gas, electricity and water
1106	1502	1453	1357	1188	1255	1241	1304	1417	1256	1322	1223	1422	1671	1512	1306	1275	1143	1394	1376	1439	39	Services

Table 8.9. Additional Effects Associated with M_3: $1000 (M_3 - I) M_2 M_1$, United Kingdom, 1968

		1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18
1	Income from employment				1417	1417	1000	1488	1482	1495	1435	1397	1382	1282	1496	730	1245	1358	1691
2	Gross profits & other trading income				671	671	471	721	709	711	680	661	652	603	702	343	587	633	791
3	Taxes on expenditure (net)				469	469	312	463	480	496	478	464	464	419	453	223	388	387	476
4	Wages & salaries (incl. Forces' pay)	2199	1030	1309															
5	Employers' contributions	218	102	130															
6	Rent, dividends and interest	968	1721	1105															
7	Households: income £ 0-10	90	90	125															
8	" " £10-20	318	295	312															
9	" " £20-30	727	501	531															
10	" " £30-40	748	504	522															
11	" " £40-50	507	344	350															
12	" " £50-60	313	218	214															
13	" " £60 +	535	498	401															
14	Private non-profit institutions	84	86	86															
15	Companies	456	810	520															
16	Public corporations	36	65	42															
17	Central government	1091	954	1654															
18	Local authorities	309	294	624															
19	Food	508	384	396	508	509	328	619	585	564	518	488	475	417	389	231	407	388	424
20	Drink and tobacco	301	224	227	301	300	190	282	310	325	304	296	300	260	234	133	235	220	249
21	Housing	294	226	234	294	295	195	390	345	320	297	286	274	249	334	138	242	230	248
22	Fuel and light	119	92	97	119	120	80	186	150	132	120	114	110	98	118	57	99	96	101
23	Clothing and footwear	204	154	155	205	204	130	196	206	215	210	204	199	183	197	91	161	150	170
24	Durable & other household goods	184	139	141	184	184	118	187	191	194	188	185	183	161	182	83	146	137	153
25	Other miscellaneous goods	160	121	123	160	160	103	165	166	171	163	158	156	142	165	72	128	119	133
26	Motor vehicles (incl. running costs)	206	153	151	206	204	128	162	182	201	218	208	212	191	194	90	158	146	169
27	Travel and communications	99	76	77	99	100	65	102	106	105	101	98	97	90	109	45	80	75	83
28	Entertainments, hotels & restaurants	154	119	119	154	154	102	151	153	159	155	154	154	149	234	72	126	116	130
29	Other services	181	147	146	181	182	127	197	187	182	177	177	175	193	448	90	158	143	156
30	Military defence	195	171	296	195	195	159	164	183	199	197	197	198	189	162	132	202	332	185
31	National health service	113	99	172	113	113	92	95	106	116	114	114	115	110	94	76	117	192	108
32	Other central government purposes	82	72	124	82	82	67	69	77	84	83	83	83	80	68	55	85	139	78
33	Local authorities purposes	235	223	473	235	234	219	214	230	243	238	234	235	219	211	160	273	304	1000
34	Agriculture etc., mining & quarrying	203	158	179	203	204	137	240	227	221	207	198	194	174	185	98	170	171	202
35	Metals and metal products	284	229	308	284	284	203	276	285	296	289	283	282	260	270	153	255	312	295
36	Other manufacturing	803	622	714	803	803	539	859	854	859	817	789	777	703	749	386	670	682	811
37	Construction	93	74	95	93	93	66	109	102	99	94	91	89	82	99	48	82	91	107
38	Gas, electricity and water	153	121	144	153	153	106	203	178	165	154	148	144	131	152	76	132	137	165
39	Services	1636	1320	1718	1636	1636	1170	1689	1696	1718	1655	1616	1601	1499	1821	856	1458	1598	2094

19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36	37	38	39		
1403	1513	1750	1634	1473	1539	1513	1421	1829	1598	1666	1582	1801	2107	1899	1657	1690	1460	1801	1621	1858	1	Income from employment
684	708	811	963	690	712	712	650	843	750	768	712	841	972	887	929	723	706	807	1013	857	2	Gross profits & other trading income
347	940	592	412	427	481	477	705	441	409	458	389	476	576	523	327	386	351	448	421	447	3	Taxes on expenditure (net)
1277	1377	1592	1487	1340	1401	1376	1293	1664	1454	1516	1439	1639	1917	1728	1508	1537	1329	1639	1475	1690	4	Wages & salaries (incl. Forces' pay)
126	136	158	147	133	139	136	128	165	144	150	143	162	190	171	149	152	132	162	146	167	5	Employers' contributions
877	1043	1086	1191	912	946	943	924	1092	972	1007	928	1095	1273	1159	1139	947	905	1054	1243	1109	6	Rent, dividends and interest
66	102	90	83	72	77	76	85	84	75	80	73	85	101	91	78	75	68	83	85	85	7	Households: income £ 0-10
223	284	287	279	237	249	246	251	285	252	264	245	285	334	302	270	255	231	279	284	289	8	" " £10-20
463	528	581	560	487	509	502	483	597	524	547	515	591	692	625	557	543	481	586	564	606	9	" " £20-30
473	528	591	571	496	518	511	487	610	535	558	526	603	705	637	570	556	491	598	574	620	10	" " £30-40
321	356	400	388	337	351	346	329	414	363	379	357	410	479	432	388	377	333	406	390	421	11	" " £40-50
199	219	248	242	209	218	215	203	257	225	235	221	254	297	268	241	234	207	252	243	261	12	" " £50-60
372	409	459	466	387	402	398	376	474	418	433	407	470	548	496	461	426	385	463	474	482	13	" " £60 +
61	78	78	77	65	68	67	68	77	69	72	66	77	91	82	74	69	63	76	79	78	14	Private non-profit institutions
413	491	511	561	429	445	444	435	514	458	474	437	515	599	546	536	446	426	496	585	522	15	Companies
33	39	41	45	34	36	35	35	41	37	38	35	41	48	44	43	36	34	40	47	42	16	Public corporations
773	1293	1085	951	858	921	912	1064	986	884	945	854	1008	1192	1080	877	878	795	976	970	1001	17	Central government
230	456	343	284	263	287	284	361	292	265	287	254	304	362	328	251	258	235	291	291	297	18	Local authorities
																					19	Food
																					20	Drink and tobacco
																					21	Housing
																					22	Fuel and light
																					23	Clothing and footwear
																					24	Durable and other household goods
																					25	Other miscellaneous goods
																					26	Motor vehicles (incl. running costs)
																					27	Travel and communications
																					28	Entertainments, hotels & restaurants
																					29	Other services
																					30	Military defence
																					31	National health service
																					32	Other central government purposes
																					33	Local authorities purposes
																					34	Agriculture etc.,mining & quarrying
																					35	Metals and metal products
																					36	Other manufacturing
																					37	Construction
																					38	Gas, electricity and water
																					39	Services

households and 417 if it is applied to the richest ones. Apart from the immediate responses of the households concerned, the remaining extragroup effects are not very different: 619 − 260 = 359 for the poorest households and 417 − 91 = 326 for the richest ones. This pattern persists in other categories of expenditure. Although the rich spend initially on all goods and services only 573 out of their 1,000 compared with 923 in the case of the poor, the remaining effects are only about 9 percent less: 1,560 compared with 1,714.

While I believe that the tables described are useful in gaining some insight into economic interdependence, their limitations will be apparent. In the first place, all the relationships are linear, indeed homogeneous. In the second place, they are static and take no account of the time needed for effects to work themselves out. In the third place, I have chosen, as is often done, to treat as exogenous parts of the system which are not altogether exogenous: in some measure, current spending is likely to induce both new investment and exports. Conversely, in the fourth place, I have treated some accounts as endogenous which for some purposes should be treated as exogenous: for instance, in Britain in the past decade there have been immense variations in central government saving. Finally, to conclude a list which is certainly incomplete, I have not distinguished between quantity changes and price changes: when I say that food expenditure will rise by so much, I do not discuss whether this means more food at the same prices or the same amount of food at higher prices. There is nothing new in all this. There is a limit to what we can hope to get out of even sophisticated multiplier analysis, and if we want to deal with the issues just raised we must build more complicated models.

WHERE DO WE GO FROM HERE?

There are plenty of examples of such models but in this section it is not my intention to discuss the problems to which they give rise. Rather I propose to discuss briefly some analytical extensions which ought to be considered in modeling the household sector.

Models of Income Generation

The multiplier analysis of the preceding sections shows the circular flow of payments from consumption to production and back again, and in that way throws some light on the generation of incomes. But my example, at least in the form presented, relies heavily on fixed coefficients: the proportions in which each group of households spends its income are fixed and so are the cost proportions in each of the industry groups; each type of income is collected together and distributed to each of the sectors, and within the household sector to each of the types of household, in fixed proportions; a change in exogenous demand will change output levels and therefore the distribution of the components of value added, but each component will be allocated to household groups in fixed proportions. Thus, whatever happens, the distribution of incomes is not likely to change much. The position would be different if, for instance, income from employment arising in each industry could be divided into earnings groups and if the income in each group could be separately distributed over households. With this information, a shift in demand toward products requiring highly paid labor would tend to be reflected in a relative increase in the incomes of the richer families.

Nothing, however, will help us to connect the income distribution of one period with that of the next. For this purpose we need information on the change in individual incomes from one year to the next. Thus, of the households in a given income category at the end of one year, some will remain in that category throughout the next and others will experience a rise or a fall of income within the year and will be found in a different category at the end of it. These may be called surviving households; yet others will disappear as a consequence of emigration or of dissolution for one reason or another. At the same time, new households will make their

Table 8.10. A Demographic Matrix Connecting the Opening and Closing Stocks of Year θ with the Flows during Year θ

State at new year θ / State at new year θ+1	Entrants in year θ	Our country: opening states	Closing stocks
Leavers in year θ	α	d′	
Our country: closing states	b	S	Λn
Opening stocks		n′	

appearance as a consequence of immigration or of formation from individuals in the country concerned.

This kind of information can be set out in a version of the standard demographic matrix described in Towards a System of Social and Demographic Statistics (UNSO, 1975), as shown in table 8.10. Let us begin with the row vector, n′, the elements of which represent the number of households in each income group at the beginning of year θ. Those which emigrate or dissolve appear in the row vector d′ and those which survive appear in the columns of the matrix S. Looking at the central row of the matrix, the elements of the closing stock vector, Λn, are made up of the entrants in year θ by immigration or formation, the elements of b, and the survivors from the opening stock recorded in the rows of S. The scalar, α, represents those households that both appeared and disappeared in the year and so, while present for a time, were not recorded in either the opening or the closing stock.

As applied to individuals this scheme is quite straightforward since there is only one thing that can move from state to state, namely, the individual himself. But in the case of households, there are typically several things that can move, namely, each of the household members. We must decide what constitutes a household and by what it is replaced when it dissolves. This subject is discussed in UNSO (1975, pp. 64–66).

If from the demographic matrix we calculate a coefficient matrix C, say, as

$$C = S\hat{n}^{-1}$$

that is to say, by dividing the elements in the columns of S by the corresponding element of n, then we can see that

(8.7)
$$\begin{aligned} n &= Si + b \\ &= Cn + b \end{aligned}$$

where i denotes the unit vector, so that Si denotes the row sums of S. This and similar models are discussed at some length in UNSO (1975, pp. 42–47). In suitable circumstances the model set out in (8.7) can be interpreted as a Markov process and the matrix multiplier $(I - C)^{-1}$ as the fundamental matrix of an absorbing Markov chain.

A difficulty which must somehow be dealt with in this kind of model arises from the fact that incomes tend to increase in money terms, so that in a few years the entries in S will move out of the matrix into an area for which no transition proportions are available. This may force us to concentrate on relative movements around a stationary mean income which can then be related to the actual mean income in successive years.

The treatment of income generation as a Markov process has been developed in Champernowne (1953; 1969, vol. 2, ch. 18; 1973), and an early application is given in Vandome (1958). A study of the income mobility of male employees, in Shorrocks (1976), shows that this mobility is not governed by a first-order Markov process but can be represented by a second-order process. Though much work remains to be done, these models seem to offer a convenient starting point for the study of income mobility.

Households as a Branch of Production

In the SNA the activities of general government are provided with production accounts, although these accounts are of a somewhat formal kind because the value of output is equated to the cost of the inputs so that, whatever happens, no gain or loss can arise. Households, in contrast, are not provided with production accounts, although provisions are made to ensure that the services of owner-occupied dwellings and of domestic servants are included within the production boundary; they are provided only with income and outlay and capital transactions accounts, as in this chapter.

Production accounts for households might be introduced for specific activities with the aim of eventually covering all aspects of household management. Suppose we began with an account for the services of dwellings to owner-occupants. At least in countries with a free market in rented housing it should be possible to impute a revenue for the services of owner-occupied houses, against which the relevant expenses could be set off to give a gain or loss on owner-occupation. Where rent control existed, this method would not be applicable to the categories of property affected, and we should have to try by the use of programming methods to generate the kind of information provided by markets. Alternatively, we could fall back on the formal approach, usually adopted in respect of general government services, in which the provider of the services (in this case the owner-occupant) is assumed either to break even or to earn some conventional rate of return on his investment. This kind of accounting may serve to tidy up the limited amount of data we possess, but if presented without due qualifications it can be misleading, since no amount of mismanagement can ever be reflected in a loss.

The next step might be to set up accounts for the services of consumer durables such as cars, major household appliances, and so on. Some progress could certainly be made, and the main difficulty would be to obtain an estimate of the value of the services of these goods which was not built up from costs. But even if the exercise were not a complete success it would provide a measure, in terms of depreciation, of the consumption of durables and also a measure of the stock.

Beyond this point we get into still deeper waters if we try to set up an account for household activities involving the unpaid services of housewives and other members of the household. We may be able to get a clear idea of how people spend their time from time budgets, but there are problems of valuing the unpaid inputs as well as the outputs. For the time being this last step seems more a matter for research and data collection than something whose introduction into the national accounts should be given any priority.

Consumer Behavior

Much work has been done in recent years on consumers' spending and saving behavior. The familiar linear expenditure system is highly convenient, but its main limitation, as shown in

Deaton (1974), is that it entails an implausible connection between own-price and total expenditure elasticities. Much the same can be said of all demand systems based on additive preferences. It is important, therefore, to find an otherwise acceptable demand system not based on this assumption. The latest contribution I know of is in Deaton and Muellbauer (1980).

Household Balance Sheets

In the early days of social accounting there was a tendency to concentrate on the measurement of flows as opposed to stocks, to construct accounts as opposed to balance sheets. This emphasis is now changing. National and sector balance sheets and revaluation accounts which cover the real and financial assets and the liabilities of institutional sectors form an integral part of the SNA, and provisional international guidelines on the subject have recently been published in UNSO (1977a).

In Britain, detailed estimates have been made by Revell and others (1967), Revell and Roe in UKCSO (1953–: no. 211) and Roe in Cambridge University, Department of Applied Economics (1962–74; 1975–). This work has been brought up to date, with revisions, by the Central Statistical Office, and provisional estimates for the personal sector, in which households and PNPIs are shown separately, have appeared in UKCSO (1953–: no. 291). These estimates cover end-1975 and end-1976 in considerable detail and, for the household sector only, the period 1966–74. The estimates, which include consumer durables along with other physical assets, should be extremely useful in studying the spending, saving, and financial behavior of the household sector.

CONCLUSIONS

It seems to me that of all the interesting and useful things that could be done to improve the national accounts, the one most worthy of consideration is the disaggregation of the household sector. I believe that my statistical exercise, embodied in table 8.1, which is nothing more than a demonstration of possibilities, could be carried out effectively in many countries; and the work of Pyatt and his associates suggests that developing countries can be numbered among these. As things are, we already have a disaggregation of the productive system in input-output tables and, for a more restricted number of countries, a disaggregation of the financial system in flow-of-funds tables. The missing piece is the disaggregation of income and outlay. In the present climate of opinion it seems likely that efficiency suffers if explicit regard is not paid to equity. The disaggregation of the household accounts would constitute a recognition of this relationship between equity and efficiency and would open the way to studies that cannot at present be carried out.

APPENDIX: MULTIPLIERS FOR QUESNAY'S TABLEAU

Quesnay (1758) did not produce any multipliers, indeed he did not produce a recognizable transactions table. But later writers, particularly Phillips and Barna, have done better. In a paper entitled "The Tableau Economique as a Simple Leontief System" (1955), Phillips translated the Tableau into a social account matrix of order 3. Continuing on these lines, Barna (1975), in "Quesnay's Tableau in Modern Guise," produced a matrix of order 9. In this latest version, two accounts, for capital transactions and the rest of the world, can be treated as exogenous. The seven endogenous accounts are divided into two groups: production accounts for two activities—agriculture and everything else; and income and outlay accounts for five sectors—landlords, farmers, artisans, the state, and the church. Table 8.A1 is based on Barna's table 1 with an alteration in the order of the accounts and a change in entries ending in 3 to end in 2.5.

Table 8.A1. A Social Accounting Matrix for France, about 1750

		1	2	3	4	5	6	7	8	9
1	Agriculture	525.0	525.0	300.0	525.0	262.5	150.0	75.0	525.0	262.5
2	All other activities			300.0	525.0	262.5	150.0	75.0		
3	Landlords	1050.0								
4	Farmers	1050.0								
5	Artisans		525.0							
6	State			300.0						
7	Church			150.0						
8	Capital transactions	525.0								
9	Rest of the world		262.5							
	Total	3150.0	1312.5	1050.0	1050.0	525.0	300.0	150.0	525.0	262.5

Table 8.A2. Coefficient Matrix, 10000 A°, Derived from Table 8.A1 for France, about 1750

		1	2	3	4	5	6	7	8	9
1	Agriculture	1667	4000	2857	5000	5000	5000	5000	10000	10000
2	All other activities			2857	5000	5000	5000	5000		
3	Landlords	3333								
4	Farmers	3333								
5	Artisans		4000							
6	State			2857						
7	Church			1429						
8	Capital transactions	1667								
9	Rest of the world		2000							

Table 8.A3. Matrix Multiplier for Intragroup Effects, 1000 M_1, France, about 1750

		1	2	3	4	5	6	7
1	Agriculture	1200	480					
2	All other activities		1000					
3	Landlords			1000				
4	Farmers				1000			
5	Artisans					1000		
6	State			286			1000	
7	Church			143				1000

Table 8.A4. Matrix Multiplier for Intergroup Effects, 10000 M_2, France, about 1750

		1	2	3	4	5	6	7
1	Agriculture	3332	1399					
2	All other activities	1388	1833					
3	Landlords			1666	1166	1166	1166	1166
4	Farmers			666	2166	1166	1166	1166
5	Artisans			476	833	1833	833	833
6	State			190	333	333	1333	333
7	Church			95	167	167	167	1167

Table 8.A5. Matrix Multiplier for Intragroup and Intergroup Effects, 10000 M_2M_1, France, about 1750

		1	2	3	4	5	6	7
1	Agriculture	3999	2999					
2	All other activities	1666	2499					
3	Landlords			2166	1166	1166	1166	1166
4	Farmers			1166	2166	1166	1166	1166
5	Artisans			833	833	1833	833	833
6	State			619	333	333	1333	333
7	Church			310	167	167	167	1167

Table 8.A6. Matrix Multiplier for Extragroup Effects, 1000 M_3, France, about 1750

		1	2	3	4	5	6	7
1	Agriculture	1000		480	840	840	840	840
2	All other activities		1000	286	500	500	500	500
3	Landlords	333		1000				
4	Farmers	333			1000			
5	Artisans		400			1000		
6	State	95					1000	
7	Church	48						1000

Table 8.A7. Matrix Multiplier for All Effects, $1000\,M_3M_2M_1 = 1000\,M = 1000\,(I - A)^{-1}$, France, about 1750

		1	2	3	4	5	6	7
1	Agriculture	4000	3000	3500	3500	3500	3500	3500
2	All other activities	1666	2500	2083	2083	2083	2083	2083
3	Landlords	1333	1000	2166	1166	1166	1166	1166
4	Farmers	1333	1000	1166	2166	1166	1166	1166
5	Artisans	667	1000	833	833	1833	833	833
6	State	381	286	619	333	333	1333	333
7	Church	190	143	310	167	167	167	1167

Table 8.A8. Additional Effects Associated with M_2: $1000\,(M_2 - I)\,M_1$, France, about 1750

		1	2	3	4	5	6	7
1	Agriculture	2799	2519					
2	All other activities	1666	1499					
3	Landlords			1166	1166	1166	1166	1166
4	Farmers			1166	1166	1166	1166	1166
5	Artisans			833	833	833	833	833
6	State			333	333	333	333	333
7	Church			167	167	167	167	167

Table 8.A9. Additional Effects Associated with M_3: $1000\,(M_3 - I)\,M_2M_1$, France, about 1750

		1	2	3	4	5	6	7
1	Agriculture			3500	3500	3500	3500	3500
2	All other activities			2083	2083	2083	2083	2083
3	Landlords	1333	1000					
4	Farmers	1333	1000					
5	Artisans	667	1000					
6	State	381	286					
7	Church	190	143					

The Algebra of the Multipliers

In terms of the notation of my paper the present case can be set out as follows. The matrix of the endogenous entries, A, takes the form

$$A = \begin{bmatrix} A_{11} & A_{12} \\ A_{21} & A_{22} \end{bmatrix}$$

$$= \begin{bmatrix} A_{11} & 0 \\ 0 & A_{22} \end{bmatrix} + \begin{bmatrix} 0 & A_{12} \\ A_{21} & 0 \end{bmatrix}$$

$$= B + C$$

and the equation

$$\begin{aligned} y &= Ay + x \\ &= [I + (I - B)^{-1}C][I - (I - B)^{-1}C(I - B)^{-1}C]^{-1}(I - B)^{-1}x \\ &= M_3M_2M_1x. \end{aligned}$$

In this system, first,

$$M_1 = \begin{bmatrix} (I - A_{11})^{-1} & 0 \\ 0 & (I - A_{22})^{-1} \end{bmatrix}.$$

Second,

$$M_2 = \begin{bmatrix} D & 0 \\ 0 & E \end{bmatrix}$$

where

$$D = [I - (I - A_{11})^{-1} A_{12}(I - A_{22})^{-1} A_{21}]$$

and

$$E = I - (I - A_{22})^{-1} A_{21}(I - A_{11})^{-1} A_{12}.$$

And, third,

$$M_3 = \begin{bmatrix} I & (I - A_{11})^{-1}A_{12} \\ (I - A_{22})^{-1}A_{21} & I \end{bmatrix}.$$

The coefficient matrix, A^0, for the whole system is set out in table 8.A2, and M_1, M_2, M_2M_1, M_3, $M_3M_2M_1 = M = (I - A)^{-1}$, $(M_2 - I)M_1$, and $(M_3 - I)M_2M_1$ are set out in tables 8.A3 through 8.A9.

Conclusions

From table 8.A7 we can see what ought to be done if we wish to help one of the accounts. The best thing, as we might expect, is to provide the initial stimulus to the account. Failing this it is better, in the case of activities, to stimulate one of the sectors, and it does not matter which one, rather than the other activity. If we want to help landlords or farmers, it is best to stimulate agriculture and worst to stimulate other activities; and the opposite is true if we want to help artisans. If we want to help the state or the church, it is best to stimulate landlords or, failing them, agriculture or, failing that, any one of the other sectors. Stimulating other activities will do least. Short of providing an initial stimulus to artisans, the next best method of helping them is to stimulate other activities. This will do less for landlords, farmers, the state, and the church than a stimulus of the same size applied to any of the other accounts.

9

Accounting and Fixed-Price Multipliers in a Social Accounting Matrix Framework

Graham Pyatt and Jeffery I. Round

This chapter is concerned with the relationships between output, factor demands, and income and the decomposition of these relationships into separate effects, as suggested by the representation of the flows between them within the structure of a social accounting matrix. Since output, factors, and the nongovernment institutions sector (households and companies) are all disaggregated in the system to be examined, it follows that the analysis is concerned not only with output levels and the level of factor and household incomes, but also with the structure of production, the distribution of factor incomes, and the distribution of disposable income both among households and between them and the corporate sector. This is the first sense in which this chapter is concerned with decomposition, and it makes the point that the distribution of income and the structure of production are inextricably interwoven.

The closed-loop character of the present formulation implies that the incomes of production activities, factors, and institutions are all derived from injections into the economy that result from a multiplier process. This multiplier is a matrix, M, which can be expressed as the product of three multiplier matrices, M_1, M_2, and M_3. The first of these captures the effects of transfers within the economy, such as the distribution of profits from companies to households, and the transfers of goods between activities which is the essence of input-output. The other matrices, M_2 and M_3, capture the consequences of the circular flow of income within the economy. Matrix M_3 shows the full circular effects of an income injection going round the system and back to its point of origin in a series of repeated and dampening cycles. In contrast, M_2 captures the cross-effects of the multiplier process whereby an injection into one part of the system has repercussions on other parts. These cross-effects correspond to open-loop effects and hence to the class of models, such as that of Maton, Paukert, and Skolka (1978), which trace the effects of some exogenous changes in income distribution on output and employment, with no allowance for the effects in the reverse direction of changes in output and employment on the distribution of income. The decomposition of M into component parts is the second sense in which we are concerned with decomposition.

The first perspective on decomposition is illustrated in the next section by a simplified SAM for Sri Lanka in 1970, which shows balanced accounts for factors, production activities, households, and companies set in the broader framework of a full national accounting system. The following section explores the structure of these accounting balances in terms of a multiplier matrix and its decomposition into transfer, open-loop, and closed-loop effects.[1] An additive version of the decomposition developed by Stone in the previous chapter is also presented.

Note: This paper has been published with minor modifications in the Economic Journal (Pyatt and Round, 1979). We are particularly grateful to Charles Blitzer and Sherman Robinson for comments on an early draft and to Sir Richard Stone for his general support of the line of work reported in this paper. Particular contributions from him are acknowledged in the text. We also wish to thank Kenshi Ohashi for computational assistance.

1. This aspect has been treated previously by us in Pyatt, Roe, and associates (1977), ch. 4. However, there is an error in the exposition with respect to the treatment of indirect taxes, which is removed in the present paper. The multiplier decomposition has also been applied in Bell, Hazell, and Slade (1982) and by Stone in the previous chapter.

The multipliers discussed in this chapter are referred to as accounting multipliers. Their data base is the SAM observed for 1970, and their role is simply to represent the accounting balances of the SAM in a novel way which gives some insights into economic structure. With the accounting multipliers as a starting point, it is then possible to consider the potentially more interesting case of multipliers due to income effects in a fixed price model. The argument presented later in this chapter shows that these fixed price multipliers are strictly analogous to the accounting multipliers. The only difference arises from extensive use of marginal expenditure propensities in the fixed price case, while the accounting multipliers are built up from the average expenditure propensities which can be calculated directly from the SAM. Thus the fixed price multipliers can be interpreted as having a data base which is the initial SAM now complemented by estimates of income elasticities when the latter differ from unity. Our pedagogic procedure of presenting accounting multipliers first, and then the fixed price multipliers, makes it possible to bring out the implications of income elasticity effects, such as Engel's law, within a fixed price system. Indeed, following the decomposition of the fixed price multiplier matrix, we are able to show that the difference between this matrix and the accounting multiplier matrix can itself be represented as a multiplicative matrix effect that is dependent on income elasticities which differ from unity.

The empirical results presented later illustrate the various components of fixed price multipliers and alternative ways of deriving them. The results show that the estates sector in Sri Lanka is relatively isolated within the economy because its linkages with other sectors are slight. The results also show the extent to which input-output calculations underestimate the linkages between producing sectors in comparison with the case where the full circular flow of incomes is taken into account. More generally, the anatomy and interdependence of income and production structures in the economy are captured by the various multiplier matrices discussed.

The inclusion of different types of households in the present formulation distinguishes the approach from standard closed-loop Leontief systems and allows the distribution of income to be brought into the picture. Because it includes factors as well as households, the present formulation extends the structure of accounting balances as set out by Quesnay (1758) and the previous closed-loop multiplier formulations which have been developed within his accounting framework.[2]

THE SOCIAL ACCOUNTING MATRIX

The SAM in table 9.1 provides the numerical base for subsequent illustrations. In reading this table it is important to keep in mind the convention that entries are to be read as receipts for the row account in which they are located, and expenditures or outlays for their column account. The SAM is square because each account has both receipts and expenditures; and the row and column sums for a given account must be equal because all income must be accounted for by an outlay of one type or another. Eight groups of accounts are shown, some of which are further disaggregated. The partitioning of the eight groups into endogenous and exogenous accounts is discussed following an explanation of the flows depicted in table 9.1.

Factors of production receive income from domestic production (shown as the intersection of accounts in row block 1 with column block 4) which in turn is distributed to households

2. The distinguishing feature of Quesnay's Tableau Economique from the present perspective is that value added in different production activities is paid directly to households of various types as opposed to being routed to them through a set of factor accounts. This simplified approach is also adopted in Desai (1961) and in a model of Iran (Pyatt and others, 1972) which is of the fixed-price multiplier type. In an appendix to the previous chapter Stone has applied the analysis of accounting multipliers in this paper to Quesnay's Tableau.

Table 9.1. A Social Accounting Matrix for Sri Lanka, 1970

(in millions of rupees)

Receipts						Expenditures: Endogenous Accounts 1 — Factors of Production — Labour — Urban	Labour — Rural	Labour — Estate	Capital — Private	Capital — Public	2 — Household Current Accounts — Urban	Household Current Accounts — Rural	Household Current Accounts — Estate	3 — Corporate Current Accounts — Private	Corporate Current Accounts — State	4 — Production Activities — Commodity Groups — Tea and Rubber	Other Agriculture	Food Processing	Other Manufactures	Mining and Construction	Services	Exogenous Accounts 5 — Government Current Accounts	6 — Consolidated Capital Accounts	7 — Indirect Taxes (net)	8 — Rest of World — Commodity Transactions	Rest of World — Other	Total
Endogenous Accounts	1	Factors of Production	Labour	Urban												16	154	32	187	59	1225						1673
				Rural												133	1171	54	243	123	1460						3184
				Estate												615	34	10	2	4	46						711
			Capital	Private												143	1736	141	586	924	2201						5731
				Public														16	77	22	72						187
			Sub Total																								
	2	Household Current Accounts		Urban		1673			799					436								92					3004
				Rural			3184		3356					204								153					6903
				Estate				711	61					7								6					791
	3	Corporate Current Accounts		Private					1402																		1402
				State						187												294					481
	4	Production Activities	Commodity Groups	Tea and Rubber							14	56	6						8		2	2	-30		1180		1238
				Other Agriculture							404	1199	169			12	166	1294	66	7	45	20	78		108		3569
				Food Processing							275	1065	138				11	34	188		40	26	90		152		2019
				Other Manufactures							341	904	112			121	113	43	490	248	210	66	75		164		2887
				Mining and Construction							2	6	1						5	236	58	92	1595		19		2014
				Services							875	1933	208			74	56	120	251	234	230	1371	154		490		5996
	5	Government Current Account									332	119		236	152							75		1388		44	2346
	6	Institutions Capital Account									520	808	11	505	329							41				382	2596
	7	Indirect Taxes (net)									34	72	3			37	35	76	416	80	205	29	270		131		1388
	8	Rest of World	Commodity Transactions								207	741	143			87	92	199	368	77	202	43	364			-279	2244
			Other						113					16								36					165
Total						1673	3184	711	5731	187	3004	6903	791	1402	481	1238	3568	2019	2887	2014	5996	2346	2596	1388	2244	165	

Source: Adapted from Pyatt, Roe, and associates (1977).

and companies (rows 2, 3 intersecting with column 1) and as net factor income payments abroad (row 8, intersecting with column 1). Factor incomes received by households include wages, unincorporated business profits, and rent on dwellings (row 2, column 1), but households also receive distributed profits from the corporate sector (2,3) and transfers from government (2,8). Similarly, corporate enterprises receive factor incomes in the form of gross profits (3,1), as well as current transfers from government (3,5). Government income is derived from direct tax payments and other transfers by households (5,2) and corporate enterprises (5,3) and from the rest of the world (5,8), as well as intragovernment transfers (5,5), together with net indirect tax payments (5,7), shown as a receipt from a special indirect tax account. The expenditures on domestically produced commodities are shown in the row of account 4. They include outlays by households (4,2), government (4,5), investment (4,6), and the rest of the world (4,8), as well as intermediate transactions between production activities (4,4). Indirect taxes on all of these expenditures, and purchases of imported goods, are shown as separate outlays by the various spending units. They are received in row 7 by the account for (net) indirect taxes and in row 8 by the rest of the world revenue account. Finally, outlays on domestic investment (column 6) are matched by domestic and foreign savings (row 6) where the latter (5,8) is the final balancing item in the rest of the world accounts.

An important feature to note is that factors, institutions, and activities are all disaggregated in table 9.1, so that the SAM captures the distribution of factor incomes as well as their level. It also shows the distribution of income among household types.

To move from a SAM to a model structure requires that each account should be designated as endogenous or exogenous. The accounts in table 9.1 have been ordered so that the endogenous accounts occupy the leading rows and columns of the SAM. This is shown schematically in table 9.2. The notation to be used in subsequent discussion is given with this table, as are a number of accounting relationships, equations (9.1) to (9.11), which follow directly from the SAM structure. Equation (9.1) states that transactions between endogenous accounts, denoted by matrix N, can be expressed as the product of a square matrix, A_n, of average propensities to consume and a vector of endogenous incomes, y_n. Similarly (9.2) equates leakages, L, with the product of a non-square matrix, A_ℓ, of average propensities to leak and the endogenous incomes, y_n. It is important to note that since N, L, and y_n are observed in a SAM such as table 9.1, the matrices A_n and A_ℓ can be obtained directly. Equations (9.3) and (9.4) express the accounting relationship by which endogenous incomes are determined. Equations (9.5) and (9.6) have the same role with respect to incomes of the exogenous accounts, y_x. Equation (9.7) sums expenditures (columns) of the endogenous accounts. It implies that, for these accounts, row and column sums will be equal provided equation (9.8) holds, that is, provided column sums of A_n, plus those of A_ℓ, add to unity in all cases. Equation (9.9) expresses column sums for exogenous accounts. The requirement that these be equal to row sums (equation [9.6]) yields equation (9.10). Finally, an implication of (9.10) is obtained in (9.11), which states that, in aggregate, injections into the system must equal leakages.

From equation (9.4) and the definition of ℓ it follows that

$$y_n = (I - A_n)^{-1}x = M_a\, x \tag{9.12}$$

and

$$\ell = A_\ell\,(I - A_n)^{-1}x = A_\ell\, M_a\, x \tag{9.13}$$

provided that $(I - A_n)^{-1}$ exists. This inverse is the accounting multiplier matrix M_a which relates endogenous incomes, y_n, to injections, x. Numerical values for M_a and $A_\ell M_a$ are given in table 9.3. The existence and decomposition of M_a are discussed in the next section. It can be

Table 9.2. Notation and Accounting Balances for Equations (1) through (11)

		Expenditures		Total
		Endogenous Accounts	Exogenous Accounts	
Receipts	Endogenous Accounts	$N = A_n\hat{y}_n$ (9.1)	X	$y_n = n + x$ (9.3) $= A_n y_n + x$ (9.4)
	Exogenous Accounts	$L = A_\ell\hat{y}_n$ (9.2)	R	$y_x = \ell + Ri$ (9.5) $= A_\ell y_n + Ri$ (9.6)
Total		$y_n' = (i'A_n + i'A_\ell)\hat{y}_n$ (9.7) $\therefore i' = i'A_n + i'A_\ell$ (9.8)	$y_x' = i'X + i'R$ (9.9) $\therefore A_\ell y_n - X'i = (R-R')i$ (9.10)	$\lambda_a' y_n = x'i$ (9.11)

Note:

$A_n = N\hat{y}_n^{-1}$ = matrix of average endogenous expenditure propensities

$A_\ell = L\hat{y}_n^{-1}$ = matrix of average propensities to leak

$Ni = n$ = vector of row sums of $N = A_n y_n$

$Xi = x$ = vector of row sums of X

$Li = \ell$ = vector of row sums of $L = A_\ell y_n$

$\lambda_a' = i'A_\ell$ = vector of column sums of A_ℓ, i.e., the vector of aggregate average propensities to leak

N = matrix of SAM transactions between endogenous accounts

X = matrix of injections from exogenous into endogenous accounts

L = matrix of leakages from endogenous into exogenous accounts

R = matrix of SAM transactions between exogenous accounts.

Table 9.3. Estimates of Matrices M_a, $A_f M_a$, X, and R Derived from Table 9.1

					Expenditures																			
					Endogenous Accounts															Exogenous Accounts				
					1					2			3		4						5	6	7	8	
					Factors of Production					Household Current Accounts			Corporate Current Accounts		Production Activities									Rest of World	
					Labour			Capital							Commodity Groups										
					Urban	Rural	Estate	Private	Public	Urban	Rural	Estate	Private	State	Tea and Rubber	Other Agriculture	Food Processing	Other Manufactures	Mining and Construction	Services	Sub Total	Government Current Account	Institutions Capital Account	Indirect Taxes (net)	Commodity Transactions	Other
Receipts	Endogenous Accounts	1	Factors of Production	Labour	Urban	1.19	0.22	0.23	0.18		0.19	0.22	0.23	0.09		0.22	0.24	0.22	0.23	0.23	0.39						
					Rural	0.38	1.45	0.49	0.37		0.38	0.45	0.49	0.19		0.53	0.74	0.60	0.40	0.45	0.62						
					Estate	0.02	0.02	1.03	0.02		0.02	0.02	0.02	0.01		0.52	0.03	0.03	0.02	0.02	0.03						
				Capital	Private	0.61	0.72	0.78	1.59		0.61	0.72	0.78	0.30		0.80	1.14	0.97	0.73	1.13	0.98						
					Public	0.02	0.02	0.02	0.02	1.00	0.02	0.02	0.02	0.01		0.02	0.02	0.03	0.05	0.04	0.03						
				Sub Total		2.23	2.44	2.55	2.18	1.00	1.23	1.44	1.54	0.60		2.09	2.17	1.84	1.42	1.87	2.06						
		2	Household Current Accounts		Urban	1.33	0.37	0.39	0.52		1.32	0.37	0.39	0.47		0.39	0.48	0.43	0.38	0.48	0.60	98	92				6
					Rural	0.77	1.90	0.97	1.36		0.77	1.90	0.97	0.52		1.03	1.45	1.20	0.85	1.15	1.23	159	153				6
					Estate	0.03	0.03	1.03	0.04		0.03	0.03	1.03	0.02		0.53	0.04	0.04	0.03	0.03	0.04	12	6				6
		3	Corporate Current Accounts		Private	0.15	0.18	0.19	0.39		0.15	0.18	0.19	1.07		0.20	0.28	0.24	0.18	0.28	0.24						
					State	0.02	0.02	0.02	0.02	1.00	0.02	0.02	0.02	0.01	1.00	0.02	0.02	0.03	0.05	0.04	0.03	294	294				
		Sub Total 2 + 3				2.29	2.51	2.62	2.33	1.00	2.29	2.51	2.62	2.09	1.00	2.16	2.27	1.94	1.49	1.98	2.15	563	545				18
		4	Production Activities	Commodity Groups	Tea and Rubber	0.01	0.02	0.02	0.01		0.01	0.02	0.02	0.01		1.02	0.02	0.01	0.01	0.01	0.01	1152	2	30		1180	
					Other Agriculture	0.53	0.68	0.76	0.54		0.53	0.67	0.76	0.27		0.61	1.62	1.17	0.44	0.49	0.54	206	20	78		108	
					Food Processing	0.28	0.38	0.41	0.30		0.28	0.37	0.41	0.14		0.33	0.32	1.29	0.27	0.27	0.30	268	26	90		152	
					Other Manufactures	0.37	0.43	0.46	0.35		0.37	0.43	0.46	0.18		0.49	0.40	0.36	1.44	0.48	0.39	305	66	75		164	
					Mining and Construction	0.01	0.01	0.01	0.01		0.01	0.01	0.01	0.01		0.01	0.01	0.01	0.01	1.14	0.02	1706	92	1595		19	
					Services	0.69	0.75	0.77	0.63		0.69	0.75	0.77	0.33		0.70	0.66	0.62	0.53	0.70	1.66	2015	1371	154		490	
			Sub Total			1.90	2.26	2.43	1.84		1.90	2.26	2.43	0.93		3.16	3.02	3.46	2.71	3.09	2.92	5652	1577	1962		2113	
	Exogenous Accounts	5	Government Current Account			0.19	0.11	0.10	0.15	0.32	0.19	0.11	0.10	0.24	0.32	0.10	0.13	0.12	0.10	0.13	0.14	1507	75		1388		44
		6	Institutions Capital Account			0.39	0.37	0.28	0.40	0.68	0.39	0.37	0.28	0.54	0.68	0.28	0.37	0.32	0.26	0.34	0.36	423	41				382
		7	Indirect Taxes (net)			0.12	0.13	0.13	0.11		0.12	0.13	0.13	0.06		0.16	0.13	0.15	0.25	0.17	0.15	430	29	270		131	
		8	Rest of World	Commodity Transactions		0.29	0.37	0.47	0.30		0.29	0.37	0.46	0.15		0.44	0.34	0.39	0.36	0.33	0.33	128	43	364			-279
				Other		0.01	0.02	0.02	0.04		0.01	0.02	0.02	0.02		0.02	0.03	0.02	0.02	0.03	0.02	36	36				
		Sub Total				1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	2524	224	634	1388	131	147

noted here that the linkage between injections and leakages as given by equation (9.13) satisfies the requirement

$$\mathbf{i}'\mathbf{A}_\ell\mathbf{M}_a = \lambda'_a\mathbf{M}_a = \mathbf{i}' \tag{9.14}$$

or, in words, that each injection is ultimately accounted for by one or more leakages.[3]

In deriving the matrix $\mathbf{M}_a$ it has been assumed that the accounts for factors, households, companies, and production activities are endogenous. The corresponding exogenous accounts are therefore those for government current expenditure, investment,[4] indirect taxes, and international transactions. Injections, x, therefore include current transfers to households and companies both from government and the rest of the world, plus the demands placed on production activities through government consumption, investment, and exports. Direct and indirect taxes, savings, imports, and income transfers abroad constitute the leakages.[5]

DECOMPOSITION OF ACCOUNTING MULTIPLIERS

From equation (9.4) it follows that for any matrix $\mathbf{A}_n^\circ$ of the same size as $\mathbf{A}_n$ and such that $(\mathbf{I} - \mathbf{A}_n^\circ)^{-1}$ exists, we can write

$$\begin{aligned} \mathbf{y}_n &= \mathbf{A}_n\mathbf{y}_n + \mathbf{x} = (\mathbf{A}_n - \mathbf{A}_n^\circ)\mathbf{y}_n + \mathbf{A}_n^\circ\mathbf{y}_n + \mathbf{x} \\ &= (\mathbf{I} - \mathbf{A}_n^\circ)^{-1}(\mathbf{A}_n - \mathbf{A}_n^\circ)\mathbf{y}_n + (\mathbf{I} - \mathbf{A}_n^\circ)^{-1}\mathbf{x} \\ &= \mathbf{A}^*\mathbf{y}_n + (\mathbf{I} - \mathbf{A}_n^\circ)^{-1}\mathbf{x}. \end{aligned} \tag{9.15}$$

Multiplying throughout by $\mathbf{A}^*$ and substituting for $\mathbf{A}^*\mathbf{y}_n$ on the right hand side of equation (9.15) gives

$$\mathbf{y}_n = \mathbf{A}^{*2}\mathbf{y}_n + (\mathbf{I} + \mathbf{A}^*)(\mathbf{I} - \mathbf{A}_n^\circ)^{-1}\mathbf{x}.$$

Similarly, multiplying both sides of (9.15) by $\mathbf{A}^{*2}$ and substituting for $\mathbf{A}^{*2}\mathbf{y}_n$ in this last expression, we get

$$\begin{aligned} \mathbf{y}_n &= \mathbf{A}^{*3}\mathbf{y}_n + (\mathbf{I} + \mathbf{A}^* + \mathbf{A}^{*2})(\mathbf{I} - \mathbf{A}_n^\circ)^{-1}\mathbf{x} \\ &= (\mathbf{I} - \mathbf{A}^{*3})^{-1}(\mathbf{I} + \mathbf{A}^* + \mathbf{A}^{*2})(\mathbf{I} - \mathbf{A}_n^\circ)^{-1}\mathbf{x} \end{aligned} \tag{9.16}$$

provided that $(\mathbf{I} - \mathbf{A}^{*3})^{-1}$ exists.

Comparison of (9.16) with (9.12) shows that the above algebra has decomposed the accounting multiplier matrix $\mathbf{M}_a$ into the product of three separate matrices. This decomposition is quite general. It can become informative by referring to the structure of $\mathbf{A}_n$ and choosing $\mathbf{A}_n^\circ$ accordingly. Specifically, we can write

$$\mathbf{A}_n = \begin{bmatrix} 0 & 0 & \mathbf{A}_{13} \\ \mathbf{A}_{21} & \mathbf{A}_{22} & 0 \\ 0 & \mathbf{A}_{32} & \mathbf{A}_{33} \end{bmatrix} \quad \text{and} \quad \mathbf{A}_n^\circ = \begin{bmatrix} 0 & 0 & 0 \\ 0 & \mathbf{A}_{22} & 0 \\ 0 & 0 & \mathbf{A}_{33} \end{bmatrix} \tag{9.17}$$

3. This follows from the equation:

$$\begin{aligned} \mathbf{i}' &= \mathbf{i}'(\mathbf{A}_n + \mathbf{A}_\ell) = \mathbf{i}'\mathbf{A}_n + \lambda'_a \\ &= \lambda'_a(\mathbf{I} - \mathbf{A}_n)^{-1} = \lambda'_a\mathbf{M}_a. \end{aligned}$$

4. To obtain Tinbergen's semi-input-output model as a special case of our analysis, it would be necessary to make investment in the nontraded goods sector(s) endogenous.

5. It can be noted that if the model were to specify the import and indirect tax content of government expenditure, investment, and exports, some elements of R would be determined as a function of x. The equation (9.11) would then be sufficient to determine the balance of trade, government savings, and the current account deficit on the balance of payments.

so that A^* defined by equation (9.15) can be written

$$A^* = \begin{bmatrix} 0 & 0 & A^*_{13} \\ A^*_{21} & 0 & 0 \\ 0 & A^*_{32} & 0 \end{bmatrix} \tag{9.18}$$

where

$$A^*_{13} = A_{13}$$

$$A^*_{21} = (I - A_{22})^{-1} A_{21}$$

$$A^*_{32} = (I - A_{33})^{-1} A_{32},$$

and where the partitioning of A_n (and of A°_n and A^*) corresponds to the separate accounts in the SAM for factors, the endogenous institutions (households and companies), and production activities.

At this point in the argument it is worth noting that the three-part decomposition of M_a in (9.16) does not require the three-way partitioning of matrix A_n as in (9.17): A_n can be partitioned into as many (or few) sets of accounts as one wishes. Similarly, there is nothing special from a mathematical perspective in choosing to end the sequence of substitutions which leads to equation (9.16) after three steps. Further substitutions are possible, and the general result is

$$y_n = (I - A^{*k})^{-1} (I + A^* + A^{*2} + \cdots + A^{*(k-1)}) (I - A^\circ_n)^{-1} x.$$

Our choice of three partitions for A_n, and the decision to end the chain of successive substitutions after three steps ($k = 3$) derives from the structure of the SAM in table 9.1. And this structure derives in turn from the conceptual framework of economics. Thus the particular application of the mathematics that is illuminating in our context is to have three partitions of A_n (corresponding to factors, endogenous institutions, and production activities) and to choose $k = 3$ not simply because there are three partitions, but because with this particular trio of partitions, three steps in the sequence of substitutions corresponds to one complete cycle in the circular flow of income within the economy.

Further reference to the SAM (table 9.1) shows that with the chosen partitioning of A_n, its zero submatrices are indeed empty blocks within the accounts. The nonzero submatrix A_{13} reflects payments from activities to factors; A_{21} corresponds to the mapping of income from factors to households and companies; and the nonzero elements of A_{32} record the average propensities with which different types of households consume the goods produced by the various production activities. Submatrix A_{22} captures current transfers between endogenous institutions and, in our example, is restricted to the distribution of dividends and interests to households. Submatrix A_{33} shows the transactions between activities, that is, interindustry flows.

With these conventions we now define

$$M_{a1} = (I - A^\circ_n)^{-1}; \quad M_{a2} = (I + A^* + A^{*2}); \quad M_{a3} = (I - A^{*3})^{-1} \tag{9.19}$$

with the implication from (9.12) and (9.16) that

$$M_a = M_{a3} M_{a2} M_{a1} \tag{9.20}$$

Equations (9.17), (9.18), and (9.19) imply, first, that M_{a1} is a block diagonal matrix with

successive diagonal elements given by I, $(I - A_{22})^{-1}$ and $(I - A_{33})^{-1}$. They also imply that

$$(9.21)\quad A^{*2} = \begin{bmatrix} 0 & A^*_{13}A^*_{32} & 0 \\ 0 & 0 & A^*_{21}A^*_{13} \\ A^*_{32}A^*_{21} & 0 & 0 \end{bmatrix} \quad \text{so that} \quad M_{a2} = \begin{bmatrix} I & A^*_{13}A^*_{32} & A^*_{13} \\ A^*_{21} & I & A^*_{21}A^*_{13} \\ A^*_{32}A^*_{21} & A^*_{32} & I \end{bmatrix}$$

and that M_{a3} is also block diagonal with successive diagonal elements given by $(I - A^*_{13}A^*_{32}A^*_{21})^{-1}$, $(I - A^*_{21}A^*_{13}A^*_{32})^{-1}$, and $(I - A^*_{32}A^*_{21}A^*_{13})^{-1}$.

The structure of M_{a2} and M_{a3} derives from that of A^*. From (9.18) it can be observed that the pattern of zero and nonzero cells of A^* corresponds to a circular permutation matrix of size 3×3. Accordingly, if y_n is partitioned compatibly with A_n, then the structure of equation (9.15) implies that the partitions of y_n are related to each other as points on a closed loop. In figure 9.1 these points are shown schematically as the corners of a triangle. Matrix A^*_{ij} represents the mapping from one partition of y_n to another. Starting from any corner of the triangle, three steps in this mapping brings one back to the starting point. Hence the structure of A^* implies that our formulation contains a closed-loop system, which is the algebraic statement of the circular flow of income: for example, from activities to factors to institutions and then back to activities in the form of consumption demand. This structure explains why M_{a3} is block diagonal and justifies referring to this matrix as the closed-loop or circular multiplier matrix.

Matrix M_{a1} is also block diagonal as previously noted. It captures the effects of one group of accounts on itself through direct transfers and is independent of the closed-loop nature of the system. Since there are no direct transfers between factors, the first diagonal block of M_{a1} is simply an identity matrix. The second diagonal block captures the multiplier effect resulting from direct transfers between institutions, $(I - A_{22})^{-1}$. The third diagonal block similarly refers to the multiplier effect of interindustry transfers, $(I - A_{33})^{-1}$, which is the Leontief inverse. Matrix M_{a1} can be referred to as the transfers multiplier.

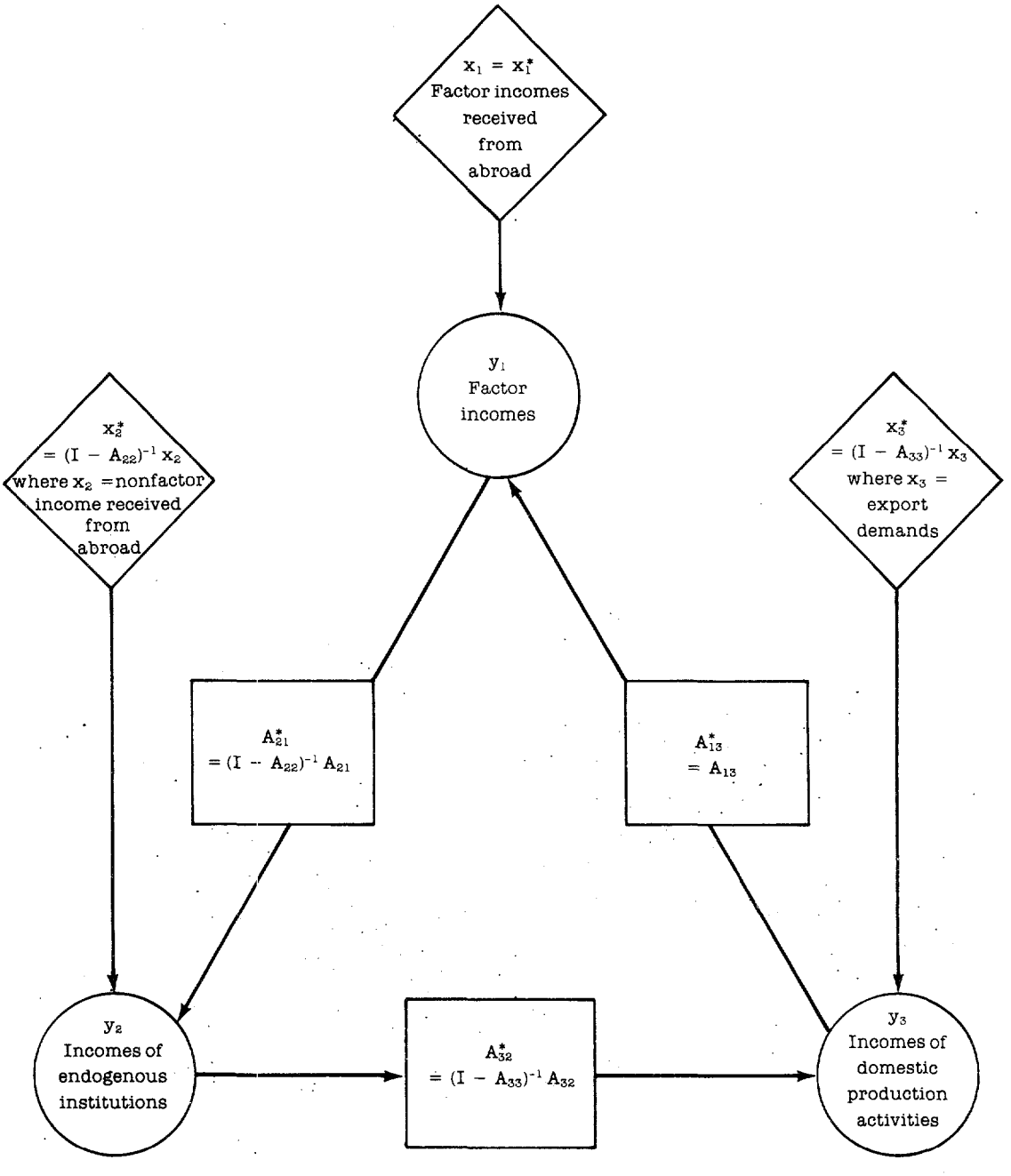
If M_{a1} and M_{a3} are block diagonal, all effects between partitions of y_n must be captured by M_{a2}. This matrix is therefore referred to as the cross-effects matrix or alternatively as the open-loop multiplier matrix. This terminology can be justified by considering the implications of one partition of y_n for the others. Take as an example the effect of household and company incomes on both factor incomes and production. This is an open-loop system and equivalent to breaking the closed loop by setting $A_{21} = 0$, that is, the effects of factor incomes on the incomes of institutions is ignored. From (9.18) it is apparent that A^*_{21} is now zero, so that all terms in M_{a3} and M_{a2} which involve A_{21} will be zero. This implies that M_{a3} will now be an identity matrix. From (9.21), certain cells of M_{a2} will also be zero. But the columns of M_{a2} which refer to households and companies will be unaltered. These columns show the impact of incomes in the second partition of y_n (endogenous institutions) on factor incomes (the first partition) and activity incomes (the third partition) in an open-loop system.

So far the discussion has assumed that the matrices M_{a1}, M_{a2}, and M_{a3} exist and that it is legitimate to describe them as multiplier matrices in the sense that each has elements that are not less than the corresponding elements of an identity matrix. To justify this it can be noted that the matrix A_n is semipositive.[6] It follows that M_a will be a multiplier matrix if it exists.

Mathematical conditions for the existence of M_a can obviously be postulated (see Lancaster, 1968, pp. 94–95). If A_n is a semipositive indecomposable matrix, then M_a will exist if no column

6. This is always possible in a SAM since a negative element in the ith row, jth column can be set equal to zero and balance restored by adding a positive element of the required size in the jth row, ith column.

Figure 9.1. The Closed-Loop Structure of Accounts



Note: The closed-loop structure presented here is defined by equations (15), (17), and (18).

$$x = \begin{bmatrix} x_1 \\ \cdots \\ x_2 \\ \cdots \\ x_3 \end{bmatrix} \qquad y_n = \begin{bmatrix} y_1 \\ \cdots \\ y_2 \\ \cdots \\ y_3 \end{bmatrix}$$

where the partitioning is the same as in equation (17).

Table 9.4. The Matrix Product $M_{a2}M_{a1}$

					Origin of Injection													
					1					2			3		4			
					Factors of Production					Household Current Accounts			Corporate Current Accounts		Production Activities			
					Labour			Capital							Commodity Groups			
					Urban	Rural	Estate	Private	Public	Urban	Rural	Estate	Private	State	Tea and Rubber	Other Agriculture	Food Processing	Other Manufactures	Mining and Construction	Services
Endogenous Accounts	1	Factors of Production	Labour	Urban	1.00					0.09	0.09	0.10	0.04		0.04	0.05	0.07	0.11	0.08	0.22
				Rural		1.00				0.17	0.20	0.22	0.08		0.14	0.35	0.28	0.16	0.13	0.27
				Estate			1.00			0.01	0.01	0.01	*		0.50	0.01	0.01	*	*	0.01
			Capital	Private				1.00		0.27	0.32	0.35	0.13		0.18	0.53	0.45	0.34	0.62	0.41
				Public					1.00	0.01	0.01	0.01	*		*	*	0.01	0.03	0.02	0.01
			Sub Total		1.00	1.00	1.00	1.00	1.00	0.55	0.63	0.69	0.26		0.86	0.94	0.82	0.64	0.86	0.92
	2	Household Current Accounts		Urban	1.00			0.22		1.00			0.31		0.08	0.17	0.16	0.18	0.21	0.31
				Rural		1.00		0.62			1.00		0.15		0.25	0.68	0.56	0.37	0.51	0.52
				Estate			1.00	0.01				1.00	0.01		0.50	0.02	0.02	0.01	0.01	0.01
	3	Corporate Current Accounts		Private				0.25					1.00		0.04	0.13	0.11	0.08	0.15	0.10
				State					1.00					1.00	*	*	0.01	0.03	0.02	0.01
	Sub Total				1.00	1.00	1.00	1.09	1.00	1.00	1.00	1.00	1.47	1.00	0.90	1.01	0.86	0.67	0.90	0.95
	4	Production Activities	Commodity Groups	Tea and Rubber	*	0.01	0.01	0.01		*	0.01	0.01	*		1.00	*	*	*	*	*
				Other Agriculture	0.22	0.31	0.36	0.24		0.22	0.31	0.36	0.11		0.02	1.05	0.69	0.08	0.02	0.02
				Food Processing	0.11	0.17	0.19	0.13		0.11	0.17	0.19	0.06		0.01	0.01	1.02	0.08	0.01	0.01
				Other Manufactures	0.16	0.19	0.20	0.16		0.16	0.19	0.20	0.08		0.12	0.04	0.06	1.22	0.18	0.05
				Mining and Construction	*	*	0.01	*		*	*	0.01	*		*	*	*	*	1.13	0.01
				Services	0.33	0.33	0.31	0.28		0.33	0.33	0.31	0.15		0.07	0.02	0.08	0.12	0.15	1.05
	Sub Total				0.83	1.01	1.08	0.82		0.83	1.01	1.08	0.41		1.28	1.12	1.85	1.51	1.50	1.13

Note: Asterisks indicate amounts less than 0.01.

sum exceeds unity and at least one column sum is strictly less than unity. Expression (9.8) supports the former conditions, and we have only to guarantee a leakage from some accounts for $\mathbf{M}_a$ to exist, providing of course that $\mathbf{A}_n$ is indecomposable. It is of interest to note that since $(\mathbf{A}_n - \mathbf{A}_n^\circ)$ can be viewed as a circular permutation matrix then $\mathbf{A}_n$ is certainly "block" indecomposable of order three. But this is not a sufficient condition for $\mathbf{A}_n$ to be indecomposable in the general sense.

The existence of $\mathbf{M}_a$ is enough to ensure the existence of $\mathbf{M}_{a1}$. This can be shown by first noting that $\mathbf{A}_n$ is a semipositive, completely decomposable matrix. If the condition on the column sums hold for the existence of $\mathbf{M}_a$ then they will hold for the existence of $\mathbf{M}_{a1}$, since $\mathbf{A}_n^\circ$ is contained within $\mathbf{A}_n$. Furthermore, $\mathbf{M}_{a1}$ will be a multiplier matrix. It also follows from (9.16) and (9.17) that $\mathbf{A}^*$ will be semipositive if $\mathbf{M}_{a1}$ exists. Hence from (9.21) $\mathbf{M}_{a2}$ will exist and will be a multiplier matrix. Finally, from (9.20), since $\mathbf{M}_a$, $\mathbf{M}_{a2}$, and $\mathbf{M}_{a1}$ all exist, then $\mathbf{M}_{a3}$ must also exist because it is bounded by finite matrices on both sides. Moreover, $\mathbf{A}^{*3}$ is semipositive, so that $\mathbf{M}_{a3}$ is also a multiplier matrix.

A final remark on the existence of these multiplier matrices is to note that they essentially depend upon the designation of at least one exogenous account with at least some injection into, and hence some leakage from, the endogenous accounts that remain. This ensures at least one element of $\mathbf{M}_a$ is positive.

To provide a useful way of presenting the results of our decomposition, Stone has proposed (see chapter 8) an additive form of equation (9.20), namely,

$$\mathbf{M} = \mathbf{I} + (\mathbf{M}_{a1} - \mathbf{I}) + (\mathbf{M}_{a2} - \mathbf{I})\mathbf{M}_{a1} + (\mathbf{M}_{a3} - \mathbf{I})\mathbf{M}_{a2}\mathbf{M}_{a1} \tag{9.22}$$

so that elements of $\mathbf{M}_a$ are accounted for by (a) the initial injection; (b) the net contribution of transfer multiplier effects; (c) the net contribution of open-loop or cross-multiplier effects; and (d) the net contribution of circular or closed-loop multiplier effects.[7] To illustrate this form of the decomposition requires results for the product matrix $\mathbf{M}_{a2}\mathbf{M}_{a1}$ (table 9.4) in addition to the details of $\mathbf{M}_a$.[8]

FIXED-PRICE MULTIPLIERS

The accounting multipliers described in the preceding section are interesting for the information they contain on the structure of an economy as revealed by a SAM. However, because they are accounting multipliers, they cannot be interpreted directly as measures of the effects of changes in injections into the economy on the levels of endogenous incomes. For such a purpose we need to know how different economic agents behave in response to changes. In this and subsequent sections, we shall be concerned with the behavior which generates the expenditure patterns of endogenous accounts under the assumption that prices remain fixed when income is altered. Since prices may in fact change, the multipliers obtained under this assumption are referred to as fixed-price multipliers.

Under the assumption that prices are fixed, it follows from the accounting balance equation (9.3) that

$$\mathbf{dy}_n = \mathbf{dn} + \mathbf{dx} \tag{9.23}$$

7. The arrangement (9.22) is applied by Stone in the previous chapter to a decomposition $\mathbf{M}_a = \mathbf{M}_{a2}\mathbf{M}_{a3}\mathbf{M}_{a1}$ so that, in comparison with (9.20), the order of $\mathbf{M}_{a2}$ and $\mathbf{M}_{a3}$ is reversed. This alternative ordering was used by us in Pyatt, Roe, and associates (1977), ch. 4. It is easily checked that both orderings are legitimate. However, the ordering adopted in (9.20) is perhaps to be preferred since it corresponds to the progression from transfer effects to open loops to closed-loop models.

8. It can be noted that, since $\mathbf{M}_{a1}$ is block diagonal, it follows from the structure of $\mathbf{M}_{a2}$ defined in (9.21) that setting off-diagonal blocks of $\mathbf{M}_{a2}\mathbf{M}_{a1}$ equal to zero reduces this product to the matrix $\mathbf{M}_{a1}$.

$$= C_n\, dy_n + dx \tag{9.24}$$

$$= (I - C_n)^{-1}\, dx = M_c dx \tag{9.25}$$

and similarly that

$$d\ell = C_\ell dy_n \tag{9.26}$$

$$= C_\ell (I - C_n)^{-1}\, dx = C_\ell M_c dx. \tag{9.27}$$

The result (9.23) is obtained by taking the total differential of (9.3). Equation (9.24) then follows from the fact that, if prices are fixed, the vector n of incomes received by endogenous accounts as a result of expenditures by these same accounts can be a function of y_n but otherwise is constant. Hence (9.24) follows from (9.23) if the $(i,j)^{th}$ element of matrix C_n is the partial derivative of the ith element of n with respect to the jth element of y_n. In this sense, C_n is a matrix of marginal propensities to consume. If $(I - C_n)^{-1}$ exists, then equation (9.25) shows how elements of y_n change as a result of changes in injections. Similarly, the matrix C_ℓ in equation (9.26) is a matrix of marginal propensities to leak, and equation (9.27) shows how leakages change as a result of injections.

Equations (9.25) and (9.27) are analogous to equations (9.12) and (9.13). Consequently, under the condition that the matrix C_n is nonnegative, M_c is a multiplier matrix, to be referred to as the fixed-price multiplier matrix. Matrices C_n and C_ℓ will have column sums that add to unity, and M_c will exist under conditions analogous to those for the existence of M_a. Hence, given estimates of the matrices C_n and C_ℓ, both the fixed-price multiplier, M_c, and the matrix of marginal leakages, $C_\ell M_c$, can be calculated. These matrices are illustrated in table 9.5 using data for Sri Lanka, which are discussed below.

To go further, we need to consider data sources for C_n and C_ℓ. This can be done with reference to table 9.1, which shows that the outlays of factor incomes primarily generate incomes for the endogenous domestic institutions. The table shows that all urban labor income accrues to urban households. Thus the first column of C_ℓ is zero, and all elements of the first column of C_n are also zero except the element in the row for urban households, which is one. Thus the sum of the first column of C_ℓ, plus the sum of the first column of C_n, is unity, as it must be. The second, third, and fifth columns of C_n and C_ℓ are similarly obtained. For the fourth column, there are five different recipients of the income that accrues to private capital. The proportions in which they receive this income will depend on who owns private capital. And if the structure of ownership can be taken as given, then there is no reason to assume other than that increments of income will be distributed in the same proportions as the shares observed in the SAM. On these grounds, columns of C_n and C_ℓ, which refer to factor outlays, are estimated by assuming that marginal and average propensities are the same.

For marginal and average propensities to be equal requires income elasticities of particular expenditures to be unity. This is clearly not true for household expenditures, and table 9.6 sets out the marginal propensities that have been assumed. It is to be noted that the income elasticities of demand for imports are unusually low. This is partly because consumer imports in Sri Lanka include imports of the staple foods, rice and wheat, and partly because the observed cross-section elasticity has been lowered in recognition of the restrictions on imports which were in effect at that time.

For companies, marginal allocations of income have been assumed to be equal to the average allocations implied by table 9.1. This is in default of any better basis for deciding how corporate taxation, savings, and distribution policy might be responsive to changes in corporate income.

It has also been assumed that the allocation of total costs for production activities is the same at the margin as on average. The best way to justify this is as follows. First, the assumption of fixed prices would be reasonable if interindustry technology follows Leontief assumptions,

Table 9.5. Estimates of the Matrices M_c and $C_\ell M_c$ Derived from Tables 9.1 and 9.6

					Origin of Injection															
					1					2			3		4					
					Factors of Production					Household Current Accounts			Corporate Current Accounts		Production Activities					
					Labour			Capital							Commodity Groups					
					Urban	Rural	Estate	Private	Public	Urban	Rural	Estate	Private	State	Tea and Rubber	Other Agriculture	Food Processing	Other Manufactures	Mining and Construction	Services
Endogenous Accounts	1	Factors of Production	Labour	Urban	1.19	0.25	0.28	0.20		0.19	0.25	0.28	0.10		0.26	0.26	0.24	0.24	0.25	0.41
				Rural	0.34	1.47	0.58	0.37		0.34	0.47	0.58	0.18		0.58	0.74	0.60	0.40	0.45	0.62
				Estate	0.01	0.02	1.03	0.02		0.01	0.02	0.03	0.01		0.52	0.03	0.03	0.02	0.02	0.03
			Capital	Private	0.55	0.76	0.94	1.60		0.55	0.76	0.94	0.29		0.88	1.16	0.98	0.73	1.14	0.98
				Public	0.02	0.03	0.03	0.02	1.00	0.02	0.03	0.03	0.01		0.03	0.03	0.03	0.05	0.04	0.04
			Sub Total		2.12	2.53	2.86	2.21	1.00	2.12	1.53	1.86	0.58		2.26	2.21	1.88	1.44	1.90	2.08
	2	Household Current Accounts		Urban	1.31	0.41	0.49	0.54		1.31	0.41	0.49	0.47		0.45	0.51	0.45	0.40	0.49	0.62
				Rural	0.68	1.94	1.16	1.37		0.68	1.94	1.16	0.50		1.13	1.46	1.21	0.86	1.16	1.23
				Estate	0.02	0.03	1.04	0.04		0.02	0.03	1.04	0.02		0.53	0.04	0.04	0.02	0.03	0.04
	3	Corporate Current Accounts		Private	0.14	0.19	0.23	0.39		0.14	0.19	0.23	1.07		0.22	0.28	0.24	0.18	0.28	0.24
				State	0.02	0.03	0.03	0.02	1.00	0.02	0.03	0.03	0.01	1.00	0.03	0.03	0.03	0.05	0.04	0.04
	Sub Total 2 + 3				2.17	2.60	2.95	2.36	1.00	2.17	2.60	2.95	2.07	1.00	2.35	2.32	1.97	1.50	2.00	2.17
	4	Production Activities	Commodity Groups	Tea and Rubber	0.01	0.01	0.02	0.01		0.01	0.01	0.02	*		1.01	0.01	0.01	0.01	0.01	0.01
				Other Agriculture	0.38	0.59	0.84	0.46		0.38	0.59	0.84	0.21		0.62	1.53	1.09	0.38	0.41	0.45
				Food Processing	0.22	0.38	0.52	0.29		0.22	0.38	0.52	0.13		0.38	0.31	1.28	0.27	0.26	0.28
				Other Manufactures	0.42	0.62	0.64	0.48		0.42	0.62	0.64	0.22		0.63	0.54	0.48	1.53	0.59	0.50
				Mining and Construction	0.01	0.01	0.02	0.01		0.01	0.01	0.02	0.01		0.01	0.01	0.01	0.01	1.14	0.02
				Services	0.72	0.86	0.97	0.70		0.72	0.86	0.97	0.35		0.83	0.75	0.69	0.58	0.76	1.73
		Sub Total			1.75	2.47	3.00	1.95		1.75	2.47	3.00	0.92		3.48	3.16	3.56	2.77	3.17	3.19
Exogenous Accounts	5	Government Current Account			0.26	0.15	0.16	0.19	0.32	0.26	0.15	0.16	0.27	0.32	0.15	0.17	0.15	0.13	0.17	0.18
	6	Institutions Capital Account			0.43	0.44	0.38	0.46	0.68	0.43	0.44	0.38	0.56	0.68	0.35	0.42	0.37	0.30	0.39	0.41
	7	Indirect Taxes (net)			0.13	0.17	0.19	0.14		0.13	0.18	0.19	0.07		0.20	0.16	0.18	0.27	0.20	0.18
	8	Rest of World	Commodity Transactions		0.16	0.22	0.25	0.17		0.16	0.22	0.25	0.08		0.28	0.22	0.28	0.28	0.22	0.21
			Other		0.01	0.02	0.02	0.04		0.01	0.02	0.02	0.02		0.02	0.03	0.02	0.02	0.03	0.02
	Sub Total				1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00

so that there are no scale effects, and prices are fixed for given indirect tax rates if import prices are fixed and factor costs per unit of output are constant. These assumptions would make elements of A_ℓ and C_ℓ the same in the corresponding columns for production activities, with a similar equivalence of those elements of A_n and C_n that refer to interindustry transactions. With respect to factor payments, profits will have a constant share if value added price, that is, value added per unit of output, is set as a constant markup over labor costs per unit of output. And labor costs per unit of output will be constant if labor is paid at fixed piece rates. Alternatively, it can be assumed that wage rates are fixed and the average product of labor is constant. This alternative assumption is necessary if labor incomes are assumed to be proportional to employment levels. It implies that the economy is working below capacity in all sectors. With these assumptions it is not unreasonable to assume that prices are fixed and that columns of C_n which relate to activities can be estimated by columns of A_n.

In aggregate, the above arguments imply that A_n is equal to C_n (and similarly for A_ℓ and C_ℓ) except for the data in table 9.6. These arguments also illustrate the fact that to estimate C_n, and

Table 9.6. Average and Marginal Expenditure Propensities of Households in Sri Lanka, 1970

					Urban		Rural		Estate	
					Average	Marginal	Average	Marginal	Average	Marginal
Endogenous	4	Production Activities	Commodity Groups	Tea and Rubber	0.005	0.002	0.008	0.006	0.008	0.006
				Other Agriculture	0.134	0.080	0.174	0.134	0.214	0.241
				Food Processing	0.092	0.059	0.154	0.149	0.174	0.246
				Other Manufactures	0.114	0.122	0.131	0.204	0.142	0.156
				Mining and Construction	0.001	0.001	0.001	0.001	0.001	0.001
				Services	0.291	0.315	0.280	0.311	0.263	0.302
	Sub Total				0.637	0.579	0.748	0.805	0.802	0.952
Exogenous	5	Government Current Account			0.111	0.164	0.017	0.022	-	0.010
	6	Institutions Capital Account			0.173	0.209	0.117	0.135	0.014	0.015
	7	Indirect Taxes (net)			0.011	0.020	0.010	0.014	0.004	0.005
	8	Rest of World		Commodity Transactions	0.069	0.028	0.107	0.024	0.181	0.018
				Other	-	-	-	-	-	-
	Sub Total				0.364	0.421	0.251	0.195	0.199	0.048

Source: Pyatt, Roe, and associates (1977), ch. 5.

hence M_c, it is only necessary to estimate a SAM and those income elasticities which are different from unity.

DECOMPOSITION OF FIXED-PRICE MULTIPLIERS

A further implication of the discussion in the previous section is that the patterns of zero and nonzero entries in partitions of C_n and A_n are the same. Hence the fixed-price multiplier matrix can be decomposed into a transfer effects multiplier, M_{c1}; an open-loop multiplier matrix, M_{c2}; and a closed-loop multiplier matrix, M_{c3}. Furthermore, these effects can be expressed multiplicatively as

$$M_c = M_{c3}\, M_{c2}\, M_{c1} \tag{9.28}$$

or in Stone's additive form

$$M_c = I + (M_{c1} - I) + (M_{c2} - I)M_{c1} + (M_{c3} - I)M_{c2}M_{c1}. \tag{9.29}$$

Results for M_{c1} and M_{c2} are shown in table 9.7.

With prices fixed, the differences between corresponding elements of M_a and M_c must be due to income effects. This can be formalized by writing from (9.24)

$$dy_n = C_n\, dy_n + dx \tag{9.24}$$

$$= (C_n - A_n)dy_n + A_n dy_n + dx \tag{9.30}$$

$$= (I - A_n)^{-1}[(C_n - A_n)dy_n + dx]$$

$$= M_a(C_n - A_n)dy_n + M_a dx$$

$$= [I - M_a(C_n - A_n)]^{-1}\, M_a dx \tag{9.31}$$

$$= M_y\, M_a\, dx \tag{9.32}$$

where

$$M_y = [I - M_a(C_n - A_n)]^{-1} \tag{9.33}$$

and

$$M_y\, M_a = M_c.$$

Thus the income effects can be captured in a matrix M_y which transforms the accounting multiplier matrix M_a into a fixed-price multiplier matrix M_c. However, M_y itself is not a multiplier matrix because, as can be seen from (9.32), elements of M_y can be negative since elements of C_n can be less than the corresponding elements of A_n, that is, income elasticities can be less than one. In our example, the matrix M_y is particularly simple. Since only households have income elasticities which differ from 1, it is only in the columns for households that M_y differs from an identity matrix.

EMPIRICAL RESULTS

A number of general points as well as particular features of the Sri Lanka economy in 1970 can be illustrated from the empirical results. Of the general features it can be noted from table 9.5 that the columns for factors contain little information that is not included in the detail for institutions. With respect to labor this is partly because there is a one-to-one relationship between types of labor and types of household, and partly because the basic SAM shown as table

Table 9.7. The Matrix Product $M_{c2}M_{c1}$

					Origin of Injection															
					1					2			3		4					
					Factors of Production					Household Current Accounts			Corporate Current Accounts		Production Activities					
					Labour			Capital							Commodity Groups					
					Urban	Rural	Estate	Private	Public	Urban	Rural	Estate	Private	State	Tea and Rubber	Other Agriculture	Food Processing	Other Manufactures	Mining and Construction	Services
Endogenous Accounts	1	Factors of Production	Labour	Urban	1.00					.09	.11	.11	.04		.04	.05	.07	.11	.08	.22
				Rural		1.00				.15	.21	.26	.08		.14	.35	.28	.16	.13	.27
				Estate			1.00			.01	.01	.01	*		.50	.01	.01	*	*	.01
			Capital	Private				1.00		.24	.34	.42	.13		.18	.53	.45	.34	.62	.41
				Public					1.00	.01	.01	.01	*		*	*	.01	.04	.02	.01
		Sub Total			1.00	1.00	1.00	1.00	1.00	.49	.67	.81	.25		.86	.95	.82	.65	.85	.91
	2	Household Current Accounts		Urban	1.00			.22		1.00			.31		.08	.17	.16	.18	.21	.31
				Rural		1.00		.62			1.00		.15		.25	.68	.56	.37	.52	.52
				Estate			1.00	.01				1.00	*		.50	.02	.02	.01	.01	.01
	3	Corporate Current Accounts		Private				.25					1.00		.04	.13	.11	.08	.15	.10
				State					1.00					1.00	*	*	.01	.03	.02	.01
	Sub Total				1.00	1.00	1.00	1.09	1.00	1.00	1.00	1.00	1.46	1.00	.88	1.00	.86	.68	.91	.95
	4	Production Activities	Commodity Groups	Tea and Rubber	*	.01	.01	.01		*	.01	.01	*		1.00	*	*	*	*	*
				Other Agriculture	.14	.27	.44	.20		.14	.27	.44	.09		.02	1.05	.69	.08	.02	.02
				Food Processing	.07	.17	.27	.13		.07	.17	.27	.05		.01	.01	1.02	.08	.01	.01
				Other Manufactures	.17	.28	.23	.21		.17	.28	.23	.09		.12	.04	.06	1.22	.18	.05
				Mining and Construction	.01	.01	.01	*		.01	.01	.01	*		*	*	*	*	1.13	.01
				Services	.35	.37	.36	.31		.35	.37	.36	.16		.07	.02	.08	.12	.15	1.05
	Sub Total				.74	1.10	1.31	.86		.74	1.10	1.31	.40		1.28	1.12	1.85	1.51	1.50	1.13

Note: Asterisks indicate amounts less than 0.01.

9.1 does not record any transfers between household types. Similarly, for public capital, all income goes directly to state corporations. From there it all leaks out immediately from the endogenous accounts, so that the columns for public capital and state corporations have a particularly simple structure.

Diagonal blocks of matrices $M_{a2}M_{a1}$ and $M_{c2}M_{c1}$ record the nonzero elements of the transfer matrices M_{a1} and M_{c1}. Given our assumptions, these are identical. Results for the simple Leontief inverse indicate that interindustry linkages are weak in Sri Lanka except for the dependence of the other agriculture account on demands from food processing. In contrast, table 9.5 shows that much stronger linkages are involved when the full circular flow illustrated in figure 9.1 is taken into account.

A general feature of table 9.5 is the relative constancy of the multipliers along rows of the tables. For example, an injection of 100 units into any activity other than services results in a fixed-price multiplier effect on services which lies within the relatively narrow range of 58 to 83 units. The implication is that second- and third-order effects are largely independent of the structure of demand. This phenomenon can be traced back through the structure of the multipliers to the fact that different household types have similar expenditure patterns.

This homogeneity of higher-order effects is important for the structure of employment and income distribution. Table 9.5 shows that, whichever activity might be expanded, urban labor income expands by 24 to 26 percent of the size of the injection, unless the injection is into services, where the multiplier is 0.41. Similarly, over the range of six activities, the multiplier for rural wage income lies between a low of 0.40 (for other manufactures) and a high of 0.74 (for other agriculture). For estate labor there is an exception to this rule: an injection into the Tea and Rubber account has a multiplier of 0.52 for estate labor but otherwise is 0.01, 0.02, or 0.03.

This general pattern of results is the consequence of linkages within the economy, or the lack of them, as seen through the original choice of SAM classifications in table 9.1. The estate sector and the activity of tea and rubber production are largely independent of what goes on elsewhere in the economy, while other sectors are much more closely integrated.

Table 9.8 sets out some examples of the particular method of decomposition that is described in this chapter. The format shows the additive decomposition of fixed-price multipliers in the last four columns and of the accounting multipliers in the first four columns. The central column then shows the income effects that link accounting and fixed-price multipliers, given the assumed fixed-price model.

The first three rows of table 9.8 show the decomposition of an injection of 100 units into the tea and rubber sector on itself. There are virtually no multiplier effects since tea and rubber are not large items in endogenous expenditures for any group. In table 9.6, tea is shown to be an inferior good, and this fact leads to a fixed-price multiplier that is smaller than the accounting multiplier. In contrast, the second and third rows of table 9.8 show that an injection into tea and rubber has a transfer effect on the sectors of other agriculture and food processing, which derives from the input-output inverse $(I - A_{33})^{-1}$. Also, there are substantial closed-loop effects: the extra income in tea and rubber is spent in ways which result, through the closed loop, in extra demands on other agriculture and food processing. These extra demands are larger with the fixed-price multipliers than with the accounting multiplier. This is because, in table 9.6, leakages are a decreasing fraction of income for the estate households, which are the main element in the first link of the multiplier chain which starts with an injection into tea and rubber.

The next three rows of table 9.8 (rows 4 to 6) show how households are affected by injections into tea and rubber. The open-loop effects primarily benefit estate households. But the lack of linkage of this sector to the rest of the economy implies negligible closed-loop effects for them: the closed-loop effects essentially benefit urban and rural households. The closed-loop effects

Table 9.8. Illustrations of Multiplier Decomposition

	Account in Which Injection Originates	Account Affected by the Injection	Accounting Multiplier Effects: Initial Injection I	Transfer Effects $M_{a1}-I$	Open-Loop Effects $(M_{a2}-I)\cdot M_{a1}$	Closed-Loop Effects $(M_{a3}-I)M_{a2}M_{a1}$	Subtotal M_a	Income Effects $(M_y-I)M_a$	Fixed-Price Multiplier Effects: Subtotal M_c	Closed-Loop Effects $(M_{c3}-I)\cdot M_{c2}M_{c1}$	Open-Loop Effects $(M_{c2}-I)\cdot M_{c1}$	Transfer Effects $M_{c1}-I$	Initial Injection I
1	Tea and rubber	Tea and rubber	100	—	—	2	102	−1	101	1	—	—	100
2		Other agriculture	—	2	—	59	61	1	62	60	—	2	—
3		Food processing	—	1	—	32	33	5	38	37	—	1	—
4		Urban households	—	—	8	31	39	6	45	37	8	—	—
5		Rural households	—	—	25	78	103	10	113	88	25	—	—
6		Estate households	—	—	50	3	53	*	53	3	50	—	—
7	Other agriculture	Other agriculture	100	5	—	57	162	−9	153	48	—	5	100
8		Food processing	—	1	—	31	32	−1	31	30	—	1	—
9		Other manufactures	—	4	—	36	40	14	54	50	—	4	—
10		Urban households	—	—	17	31	48	3	51	34	17	—	—
11		Rural households	—	—	68	77	145	1	146	78	68	—	—
12		Estate households	—	—	2	2	4	*	4	2	2	—	—
13	Services	Other agriculture	—	2	—	52	54	−9	45	43	—	2	—
14		Food processing	—	1	—	29	30	−2	28	27	—	1	—
15		Other manufactures	—	5	—	34	39	11	50	45	—	5	—
16		Urban households	—	—	31	29	60	2	62	31	31	—	—
17		Rural households	—	—	52	71	123	*	123	71	52	—	—
18		Estate households	—	—	1	3	4	*	4	3	1	—	—
19	Urban households	Tea and rubber	—	—	*	1	1	*	1	*	*	—	—
20		Other agriculture	—	—	22	31	53	−15	38	24	14	—	—
21		Food processing	—	—	11	17	28	−6	22	15	7	—	—
22		Other manufactures	—	—	16	22	37	5	42	25	17	—	—
23		Services	—	—	33	36	69	3	72	37	35	—	—
24		Urban labor	—	—	9	10	19	*	19	10	9	—	—
25		Rural labor	—	—	17	21	38	−4	34	19	15	—	—
26		Estate labor	—	—	1	1	2	−1	1	*	1	—	—
27		Urban households	100	—	—	32	132	−1	131	31	—	—	100
28		Rural households	—	—	—	77	77	−9	68	68	—	—	—
29		Estate households	—	—	—	3	3	−1	2	2	—	—	—

Note: Asterisks indicate absolute values less than 1.

are again greater according to the fixed-price model than they are according to the accounting multipliers.

Rows 7 to 12 of table 9.8 show similar results for an injection into the production sector of other agriculture. Engel's law as captured in table 9.6 is now sufficiently strong for the fixed-price multipliers to be less than the accounting multipliers in rows 7 and 8. In row 9, the fact that other manufactures are superior goods leads to a relatively large increase in the multiplier as we move from M_a to M_c. It can be noted that the closed-loop effects on household incomes in rows 10 to 12 are very similar to those in rows 4 to 6 and in rows 16 to 18. Similarly, the closed-loop effects on other activities in rows 7 to 9 are essentially replicated when the initial injection is into services, as in rows 13 to 15, or into tea and rubber, as in rows 2 and 3.

In table 9.6, leakages in aggregate are a declining fraction of income for rural and estate households, largely because of the food composition of Sri Lanka imports. The results for urban households in rows 19 to 29 of table 9.8 are therefore more typical of what might be found in economies with a higher degree of self-sufficiency in basic foods and where institutions like Sri Lanka's free rice rations do not exist. These last examples show that the fixed-price multipliers are smaller than accounting multipliers as a general result. Exceptions are for the superior elements of demand, namely, other manufactures and services. It is to be noted that an injection into the urban household sector does next to nothing for the estate sector, but the impact on rural activities and incomes is considerable.

CONCLUSIONS

In this chapter we have been concerned with the structure of simple models from various perspectives. From one perspective we have been concerned with the sequential extension of models from a simple Leontief input-output base, to open-loop models, and hence to closed loops. The novelty here is to consider simultaneously the three possible open-loop models in a triangular system and to show how the multiplier matrix for a model at one stage in this chain of development is obtained as the product of a new multiplier matrix and the multiplier matrix which pertained at the previous stage. This illustrates how complexity in model formulation can be built up sequentially. More innovative is our separate recognition of factors, institutions, and activities, with each being disaggregated into several types so that household income distribution, the structure of production, and the factoral distribution of income are all interwoven in the scheme.

From another perspective, the analysis here illustrates the approach to model building which starts with a SAM and hence with the structure of an economy at some base date. The accounting multipliers described here give insight into the anatomy of this structure in terms of transfer effects and the full circular effects and cross-effects between different parts of the economy, corresponding to the circular flow of income which characterizes the multiplier process. Our analysis shows that this decomposition of structure can be derived directly from accounting balances. An integral part of it is to show how the structure of production and income distribution are interrelated and how they derive from the structure of exogenous demand and the distribution of assets.

The analysis also shows the extent to which initial structure is important in determining the impact of changes in demand. Under the assumption that prices are fixed, incremental changes will follow a different pattern to that of the accounting balances only insofar as income elasticities for the outlays of endogenous accounts differ from their average value of unity.

The fixed-price multipliers discussed here represent only a single step beyond the structure of accounting balances. Subsequent steps could embrace the interaction of price changes and shifts in exogenous demand, including variations in the exchange rate and in factor prices.

Similarly, investment demands might be modified in the light of savings patterns, capacity utilization, and the flow of funds. These and other developments could, in principle, be built on the foundations laid in this paper, which therefore constitute a beginning. But the starting point and the first step are important. The way they are formulated here is in terms of the accounting structure of the circular flow of income and its modification by allowing for income effects. These already cover a wide class of models in actual use, which our analysis extends by embracing the distribution of income among different types of households and the structure of asset ownership, both among these household types and between them and other institutions. Thus, for example, our results on fixed-price multipliers could have been presented as the results of a model with the following specifications: (a) Leontief technology for intermediate inputs, with complementary imports at prices which are set exogenously; (b) Cobb-Douglas production functions, with firms setting prices as a constant markup on material costs and hiring factors so as to minimize variable costs; (c) wages set so as to clear labor markets; and (d) household consumption patterns given by linear expenditure systems. Such assumptions are among the variants with which the results in table 9.5 are consistent. It seems to us much more helpful to see these results for what they are, namely, a SAM structure modified by allowing consumer demand elasticities to be different from unity. Not least, this brings out the importance of structure, as given by the SAM, in determining results, and the incremental adjustments that follow from allowing behavior to be different at the margin from what it is on average.

10

The Social Accounting Matrix and Consistency-Type Planning Models

Erik Thorbecke

In the last dozen years the development community has gradually moved away from an almost exclusive concern with gross national product as the paramount policy objective. This process started in the late 1960s when development economists, planners, and a number of international agencies started emphasizing the importance of employment as a separate objective. In the early 1970s, it became increasingly clear that employment, rather than being an end in itself, was a means to a more fundamental objective, namely, that of achieving a more equal and equitable income distribution. The creation of productive employment opportunities, particularly for the previously unemployed or underemployed, was seen to provide new sources of income and thereby lead to a reduction of the relative inequality in income distribution. It was becoming accepted that GNP growth, even though a necessary condition to the achievement of a more equal income distribution, was hardly a sufficient one.

The next step in this progression was to focus on poverty alleviation as a key objective and therefore to be more concerned with the state of the absolute, rather than the relative, income distribution. This approach culminated with the rediscovery of the basic needs concept, which became the cornerstone of the World Employment Conference sponsored in 1976 by the International Labour Office (ILO).

If the purpose and meaning of the process of economic and social development is, ultimately, to improve the standard of living of individuals through appropriate strategies, then both the data system and the conceptual framework used by policymakers and development planners must incorporate both aggregate GNP variables and distributional variables. In particular, the latter should include the household income distribution and the extent to which the basic needs of the poor are fulfilled. Thus there has been a growing desire to develop a data system that could provide initial (or base-year) comprehensive information on such variables as (a) the structure, composition, and level of production; (b) the factorial value added; and (c) the distribution of income among household groups.

The need for such a data system encouraged work on the design of a systematic SAM which could capture all the components. The SAM is clearly an essential tool in diagnosing the initial situation and in organizing data in a systematic way with respect to accounts and the classification and interrelationship of variables appearing in these accounts. At the same time, by itself, the SAM is nothing more than a snapshot in time, yielding base-year information in a consistent way among a whole set of variables. If the SAM is to be used for policy rather than purely diagnostic purposes, it has to be coupled with a conceptual framework that contains the behavioral and technical relationships among variables within and among sets of accounts or modules. In other words, the SAM as a data framework is a large-scale identity which, to come alive, should be linked to a model of the causal relationships among variables. By analogy, the conventional national income accounts provided the basis and the classification of variables underlying the Keynesian macroeconomic model, and in a more restrictive sense, the input-output table provided the foundation of the closed Leontief-type models.

It is natural that as the focus of development economics and planning shifted from a predom-

inant concern with the determinants of output growth to the joint determinants of growth, income redistribution, and poverty alleviation, a new breed of development planning models would appear. The major purpose of this chapter is to review a number of these models critically and comparatively and to show their explicit or implicit reliance on a SAM-type framework. Six models were selected as the best examples of comprehensive consistency models, which attempt to explain and determine jointly the pattern of output and income distribution.

The next section of this chapter reviews the SAM data framework in both a simplified and comprehensive form to show how the SAM can serve as an organizational system of accounts, modules, and variables upon which a conceptual model can be built. In particular, it will be seen that under certain assumptions, such as linear transformations, fixed coefficients, and the exogenous determination of some variables, there exists a class of planning models that replicates the linear mappings which underlie a static SAM.

The following section evaluates three first-generation, consistency-type models which fall in the above class of fixed coefficient models. It is shown that the linear interdependence characterizing these models can be presented and formalized within a SAM framework.

The fourth section reviews and evaluates three second-generation computable general equilibrium models which, in contrast with the first-generation models, do not rely on fixed coefficients and linear relationships among variables. The behavioral and technical relationships underlying these models are more elaborate and complex than in the first-generation case. The level of disaggregation is also greater. These models rely either implicitly (in two cases) or explicitly (in the third case) on a SAM-type information system, and their underlying structure and specification can be analyzed within a SAM-type conceptual framework.

The final section is devoted to some specific recommendations about ways of improving the specification of this type of consistency model and the design of the corresponding SAM data system. The gist of these recommendations is (a) to increase the explanatory power of these models, particularly as they relate to the determination of income distribution and poverty alleviation, and (b) to render the underlying SAM data system and corresponding models more useful for policy purposes.

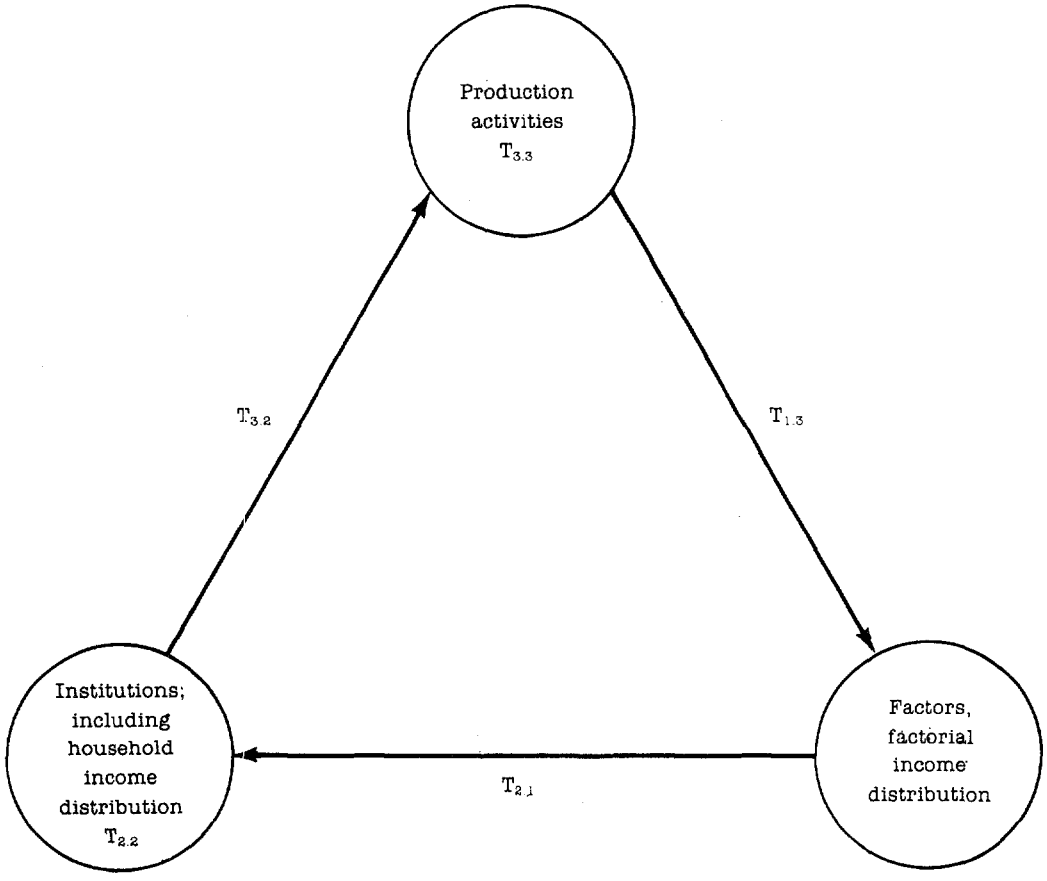
THE SOCIAL ACCOUNTING MATRIX AS A DATA FRAMEWORK

In a narrow sense, a SAM is a systematic data and classification system. In a broader sense, it can be conceived as embracing, in addition to the classification system, a modular analytical framework specifying, for a set of interconnected subsystems, the major relationships among variables within and between these subsystems (see Pyatt and Thorbecke, 1976). As a data framework, the SAM is a snapshot which incorporates explicitly various crucial transformations among variables, such as the mapping of factorial income distribution from the structure of production and the mapping of the household income distribution from the factorial income distribution.

If the SAM is to be used as a modular analytical framework complementary to its role as a data framework, the forms of the relationships underlying these transformations and mappings among variables have to be specified in a causal way through an appropriate set of behavioral and technical relations in at least a comparative-static if not dynamic setting. Furthermore, this conceptual framework, in order to be useful for policy purposes, should include potential policy means which can be controlled to move the system in the direction of growth and equity consistent with the preferences of the policymakers. Hence, in what follows, an attempt is made to identify the major causal relationships which a comprehensive and consistent conceptual planning framework should contain and to show how these relationships are implicitly—if not explicitly—incorporated into the SAM data system.

Figure 10.1 illustrates the major interrelationship among accounts and variables in the

Figure 10.1. Simplified Interrelationships among Principal SAM Accounts



Note: T stands for the corresponding matrix in the simplified SAM that appears in table 10.1. Thus, for example, $T_{1.3}$ refers to the matrix at the intersection of row 1 (account 1), that is, "factors," and column 3 (account 3), that is, "production activities."

simplified SAM shown in table 10.1. The structure of production can be defined in terms of a set of production activities classified according to criteria such as type of commodity, level of technology, and prevailing form of organization. These production activities generate a flow of value added which accrues to the various factors of production which, in turn, can be broken down according to labor skills, type of capital, and land classification according to agroecological criteria. The resulting factorial income distribution provides the major source of income for the institutions including different types of households which might be classified according to socioeconomic criteria. When transfers (including taxes and subsidies) are added, the income distribution among institutions, and particularly among household categories, is determined. Finally, the various institutions, which include corporate and unincorporated firms as well as government, in addition to the different classes of households, spend their incomes on a variety of commodities and services which are supplied by the production activities, thus completing the feedback system (loop) shown in figure 10.1.[1]

1. It should be noted that figure 10.1 abstracts, for the sake of simplicity, from the other two accounts appearing on table 10.1: the rest of the world and combined capital.

Table 10.1. A Simplified Social Accounting Matrix

				Expenditures					
				1	2	3	4		
				Factors	Institutions Including Households	Production Activities	Other Accounts: Combined Capital	Other Accounts: Rest of World	Total
Receipts	1	Factors				Factorial Income Distribution ($T_{1,3}$)			Income of Factors
	2	Institutions Including Households		Income Distribution to Households and Other Institutions ($T_{2,1}$)	Transfers, Taxes, and Subsidies ($T_{2,2}$)			Receipts of Institutions from Rest of the World	Income of Institutions
	3	Production Activities			Institutional Demand (Households and Others) for Goods and Services ($T_{3,2}$)	Interindustry Demand ($T_{3,3}$)	Gross Capital Formation	Exports	Gross Demand = Gross Output
	4	Others	Combined Capital		Domestic Savings			Balance of Payments Current Account Deficit	Aggregate Savings
			Rest of World		Imports of Competitive Goods	Imports of Complementary Goods			Total Foreign Exchange Outflow
		Total		Outlay (=Income) of Factors	Expenditures of Institutions	Gross Output	Aggregate Investment	Total Foreign Exchange Inflow	

The major causal relationships which are shown in the interdependent diagram in figure 10.1 find their counterpart in the simplified SAM data system presented in table 10.1. Thus, the factorial income distribution is derived from the value added generated by various production activities—a transformation that is represented by matrix $T_{1.3}$ (the intersection of row 1, "factors," and column 3, "production activities") in table 10.1.[2] Likewise, the mapping of the distribution of income among institutions (including households) from the factorial income distribution is given by matrix $T_{2.1}$. In addition, the former distribution is affected by transfers, taxes, and subsidies which appear in $T_{2.2}$. The final loop in figure 10.1, showing the expenditures of institutions on the various commodities supplied by the production activities, appears on table 10.1 as $T_{3.2}$.

It is important to recall that in a SAM table the various causal relations (such as those shown in figure 10.1) reveal the situation prevailing at one point in time. The causal process which generates any given SAM may be very complex and nonlinear and would have to be explicitly specified in equation form in a conceptual model. The generating mechanism is, of course, not reflected in the resulting static matrices in table 10.1. Only in a special (linear) case does the SAM as a data system become identical with the SAM as a conceptual framework or model.

Whereas the SAM framework appearing in figure 10.1 and table 10.1 is presented in a simplified form, figure 10.2 and table 10.2 represent a more complete and comprehensive SAM coverage. Specifically, the schema in table 10.2 includes more accounts than the simplified SAM in table 10.1. These new accounts are for "commodities" (account 14) to distinguish the demand for the latter from the "production activities" (account 13) which produce these commodities. Thus, for example, households may have an effective demand for rice as a commodity which is to be satisfied out of the output of the activity "agriculture" or "domestic crops." In the same vein, an additional account for "wants" (account 1) is incorporated in the table to reflect the fact that consumers have certain basic needs which give rise to wants for items such as food, clothing, housing, and furniture, as well as for some of the so-called public basic needs such as education and health. In turn, these wants can be fulfilled by commodities or combinations of commodities; for example, maize, milk, and meat help satisfy the want for food, and shoes and textile products satisfy the want for clothing.

Finally, table 10.2 uses a much more disaggregated approach to the treatment of capital by adding, in particular, an account for "domestic factor endowments" and one for "financial claims" (accounts 9 and 10, respectively). The incorporation of these two accounts makes it possible to identify the initial wealth distribution in terms of educational skill levels possessed, and land and capital held, by the various institutions and households, as well as the initial wealth held as financial claims.[3]

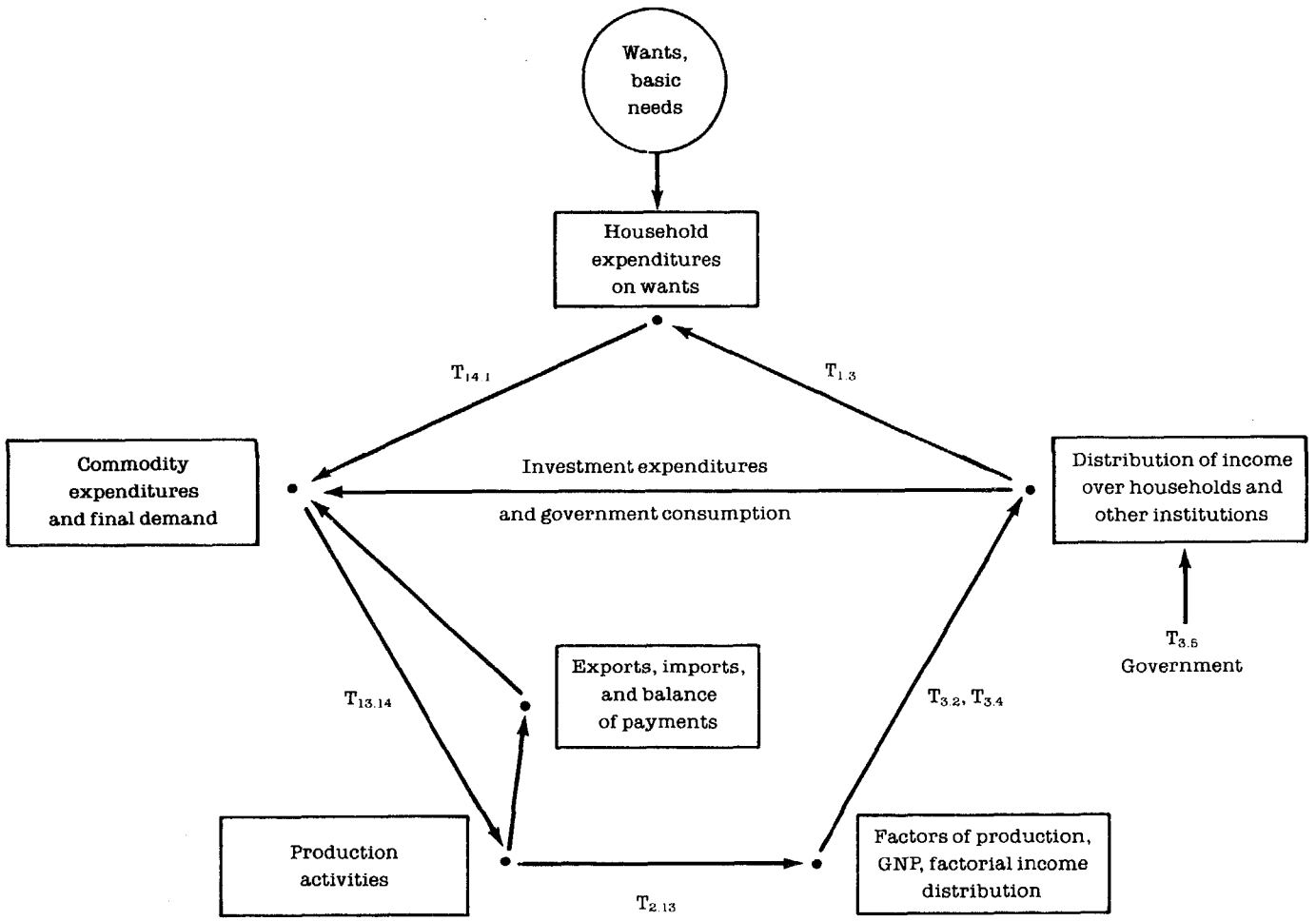
The interdependence among accounts and subsystems, as well as the major transformation corresponding to the SAM in table 10.2, is represented in the flow diagram in figure 10.2. Again, it can be seen that the underlying system generating a SAM is an interdependent, closed, and consistent system. The pentagonal arrow diagram in figure 10.2 reflects some of the new accounts (but not all) and corresponding transformations which appear in the SAM on table 10.2. Thus, the set of production activities generates GNP and the factorial income distribution through matrix $T_{2.13}$ which, in turn, helps to map the distribution of income over households and other institutions through $T_{3.2}$ (the allocation of labor income) and $T_{3.4}$ (the allocation of profit income), in addition to actual and imputed transfers appearing in $T_{3.5}$.

In the next link, the different categories of households spend part of their incomes on wants

2. The notation used here is to refer to matrices appearing in a SAM table by way of two subscripts where the first subscript represents the row account and the second subscript the column account.

3. The underlying logic of the SAM schema appearing in table 10.2 and the corresponding causal interdependence among subsystems shown on figure 10.2 are discussed in some detail in Pyatt and Thorbecke (1976), ch. 2.

Figure 10.2. Causal Interdependence among Subsystems



Note: T stands for the corresponding matrix in table 10.2.
Source: Adapted from Pyatt and Thorbecke (1976).

Table 10.2. Final SAM Schema Including Commodity Accounts

Receipts				Expenditures														
				1	2	3	4	5	6	7	8	9	10	11	12	13	14	
				Current accounts					Capital accounts						Current accounts			
						Domestic institutions			Domestic institutions			Domestic factor endowments	Financial claims	Rest of the world	Rest of the world net excl. imports	Production activities	Commodities	Totals
				Wants	Factors of production	Households	Companies	Government	Households	Companies	Government							
Current accounts	1		Wants			Want satisfactions												Demand for want and need satisfactions
	2		Factors of production												*Net factor incomes received from abroad*	Value added payments to factors		Incomes of domestic factors of production
	3	Domestic institutions	Households		Allocation of labour income to households		Profits distributed to domestic households	*Current actual and imputed transfers to h'holds*										Incomes of the domestic institutions after transfers
	4		Companies		Allocation of operating surpluses to companies			*Current transfers to domestic companies*							*Net non-factor incomes received from abroad*			
	5		Government			*Direct taxes rates*	*Company tax rates*											
Capital accounts	6	Domestic institutions	Households			Household savings						*Initial wealth held as factors of production*	*Initial wealth held as financial claims*					Revised wealth of the domestic institutions
	7		Companies				Undistributed profits after tax											
	8		Government					Government current account surplus										
	9		Domestic factor endowments						Revised wealth held as factors of production									Revised factor endowments
	10		Financial claims						Revised wealth as financial claims				Flow of funds	Revised foreign claims on domestic institutions				Revised financial claims
	11		Rest of the world										*Initial foreign claims on domestic insts.*		Balance of payments current account deficit			Revised foreign claims
Current accounts	12		Rest of the world imports														Imports	Total imports
	13		Production activities														Domestic supplies of commodities	Total revenue
	14		Commodities	H'sehold consump. demand for goods, services				*Govt. demand for goods and services*				Investment expenditure			Exports	Raw material purchases		Total commodity demands
	15		Commodity taxes					Net commodity tax receipts									*Indirect tax rates, etc.*	0
			Totals	Supply of want and need satisfactions	Incomes of domestic factors of production	Total outlay of households	Total outlay of companies	Total outlay of government	Revised wealth as domestic institutions			Revised factor endowments	Revised financial claims	Revised foreign claims	Total for. exch. receipts *less* imports	Total costs	Total commodity supplies	

Source: Pyatt and Thorbecke (1976).

($T_{1.3}$) which are ultimately fulfilled through combinations of commodities ($T_{14.1}$). In addition to household consumption on commodities, investment expenditures, government consumption, and exports make up the total final demand which has to be supplied by the production activities through $T_{13.14}$—thereby completing the interdependent system in figure 10.2. The subsequent analysis of SAM-type models uses the major links appearing in figure 10.2 as a basis for comparing these models.

The underlying system of relationships which generates any given SAM is likely to be complex and nonlinear. This system can be broken down into a set of modular subsystems according to the major links appearing in figure 10.2. Under certain limiting assumptions such as fixed coefficients, linear relations, and the exogenous determination of at least some variables, the SAM as a data system becomes tantamount to, if not identical with, the SAM as a conceptual framework. It might be useful at this stage to formalize the class of models for which the SAM represents both a data system and a conceptual framework in the form of a set of (linear, fixed coefficient) behavioral and technical equations.

This formalization process can perhaps best be undertaken on the basis of the simplified SAM framework which appeared in table 10.1 and which is schematically reproduced in table 10.3. This last table consolidates the combined capital account and the rest of the world account together into a vector sum which is entitled "sum of other accounts," assumed to be exogenously determined. The vector of row sums, that is, the x_i values appearing in column 4 of table 10.3, can be thought to represent injections while the vector of column sums (ℓ_j') in row 4 represents leakages. The other three accounts (factors, institutions, and production activities) are assumed to be endogenously determined. The mappings and transformations within and among accounts which are spelled out explicitly in table 10.1 (and are shown causally as links in figure 10.1) are denoted symbolically in table 10.3 by means of the corresponding matrices.

Table 10.3. A Simplified Schematic Social Accounting Matrix

				Expenditures				
				Endogenous Accounts			Exog.	
				Factors	Institutions	Production Activities	Sum of Other Accounts	Total
				1	2	3	4	5
Receipts	Endogenous Accounts	Factors	1	0	0	$T_{1.3}$	x_1	y_1
		Institutions	2	$T_{2.1}$	$T_{2.2}$	0	x_2	y_2
		Production Activities	3	0	$T_{3.2}$	$T_{3.3}$	x_3	y_3
	Exog.	Sum of Other Accounts	4	$1_1'$	$1_2'$	$1_3'$	r	y_x
	Total		5	y_1'	y_2'	y_3'	y_x	

Thus, consistent with the notation previously introduced, T_{ij} stands for the expenditures of the classes or categories of account j accruing as receipts or income to the classes or categories of account i. For example, $T_{1.3}$ represents the mapping of the factorial income distribution, that is, the allocation of value added generated by the different production activities to the various classes of factors; y_i values represent vectors of total incomes or receipts of classes into which account i was subdivided; and y_j' stands for the vectors of total expenditures of or outlay for the elements of account j. Thus, for example, y_2 is the vector of total incomes received by the different household categories and other institutions and y_3' is the vector of gross output (outlays) of the different production activities. For each variable total income equals total expenditures, that is, corresponding elements of y_i and y_j' are equal when i equals j.

Each of the elements of the T_{ij} matrices can be expressed as a proportion of the corresponding column sum total which yields a new set of matrices A_{ij}. Thus, A_{ij} is obtained from T_{ij} by dividing elements of the latter by the sum of the column in which they appear,

$$A_{ij} = T_{ij}\,\hat{y}_j^{-1} \tag{10.1}$$

where $\hat{y}_j$ is a diagonal matrix of column sums.

Since the fourth row and column represent the sum of all other accounts which are assumed to be exogenously given, it follows that the vectors of injections x_i and of leakages ℓ_j', respectively, are determined outside the SAM framework in table 10.3. Conversely the endogenous part of the SAM consists of the income and expenditure determination of the first three accounts (factors, institutions, and production activities). Hence, the five nonzero A_{ij} matrices representing the interacting endogenous part of the SAM can be grouped into a corresponding partitioned matrix A such that

$$A = \begin{bmatrix} 0 & 0 & A_{1.3} \\ A_{2.1} & A_{2.2} & 0 \\ 0 & A_{3.2} & A_{3.3} \end{bmatrix}. \tag{10.2}$$

It follows that

$$y = Ay + x \tag{10.3}$$

where y stands for the total income (receipts) vectors of the first three accounts and where x represents the vector of exogenous injections of the other accounts (namely, capital and rest of the world), which accrue as receipts or income to accounts 1 to 3.

It follows from (10.3) that

$$y = (I - A)^{-1}\,x. \tag{10.4}$$

The meaning of this equation is that the income levels of factors (y_1), institutions (y_2), and production activities (y_3) are endogenously determined as functions of the exogenous demand on the other accounts. All the behavioral and technical coefficients of the underlying interdependent system are explicitly incorporated in the partitioned (fixed coefficient) matrix A. Thus, by way of illustration, $A_{1.3}$ allocates the value added generated by the various production activities to the various factors such as labor skills as a proportion of the value of gross output of each activity (sector). Likewise, $A_{3.3}$ represents the intermediate (input-output) demand. As such, the elements of $A_{1.3}$ and $A_{3.3}$ must be based on an empirical knowledge of the sectoral production functions. Each column of the production activities account represents, in fact, a linear Leontief-type sectoral production function.

Another example should suffice to illustrate the fact that the partitioned A matrix contains all the necessary behavioral and technical relations to close the system in a consistent way. $A_{3.2}$ reflects the consumption behavior of the different socioeconomic household groups and

other institutions. More specifically, it shows the proportion of incomes (expenditures) of each household and institutional class which is spent on each production activity.[4]

At first glance, the model specified in equation (10.4) appears analogous to the Leontief model. The basic difference, however, is that the SAM model is closed with respect to the determination of the factorial and household income distribution and the consumption behavior of households. Indeed, the open Leontief model can be written as follows using the notation of table 10.3,

$$y_3 = [I - A_{3.3}]^{-1} x_3. \tag{10.5}$$

It allows the vector of total output of production activities (y_3) to be determined endogenously by premultiplying the exogenously given vector of final demand (x_3) by the Leontief-inverse (where $A_{3.3}$ is the matrix of input-output coefficients). It is clear that the partitioned matrix A in equation (10.4) incorporates four other matrices in addition to $A_{3.3}$ which permits a much higher degree of closure of the interdependent system.

In chapter 9 of this volume, Pyatt and Round formalize linear SAM models as exemplified by equation (10.4). They compute the matrix of multipliers corresponding to the generalized inverse in equation (10.4) applying to the case of Sri Lanka. Furthermore, they decompose the generalized inverse into three components, as follows:

$$(I - A)^{-1} = M = M_3 M_2 M_1. \tag{10.6}$$

M represents the matrix of multipliers and is decomposed into (a) M_1, which captures the effects of transfers within accounts; (b) M_2, which can be referred to as the "circular multiplier" matrix and indicates how an exogenous injection into the economy will result in endogenous demands which circulate back to increase incomes beyond the size of the initial injection; and finally, (c) M_3, which represents the "cross multiplier" matrix and captures the effects of an exogenous injection into one part of the economy on other parts.

A few additional observations about the SAM model in equation (10.4) might be relevant at this stage. First, one important implication of fixed coefficients is that it normally presumes constant prices.[5] This case, in turn, is only possible within the context of excess capacity. In other words, each of the production activities must display excess capacity, which means that the underlying structure is Keynesian. Second, this type of model can be used to simulate the effects of changes in such exogenous variables as exports (broken down by activity or sector) and sectoral investment allocation on the whole set of endogenous variables, that is, the total incomes accruing to the factors, institutions and production activities.

One important limitation of this type of simulation follows directly from the exogenous nature of the investment and savings determination process. Since the system is not closed with respect to savings and investment, an independent check is required of whether the existing capacity is sufficient to produce the increased output mix that is generated by the new assumed exogenous demand. Any capacity limitation would, of course, invalidate the assumption of price constancy. Implicit in this type of fixed coefficient model is the assumption that there are no fixed factors. Given capital scarcity and its immovability among production activities after it has been imbedded in the machines, equipment, and plants, this assumption is not really tenable in the real world. Yet, as will be seen in the review of fixed coefficient models in the next section, there

4. Of course, in a more elaborate SAM framework, as was pointed out previously, household classes can be conceived as having a demand for wants to be satisfied by commodities which are, in turn, supplied by activities. In this case, instead of one matrix, $A_{3.2}$, three matrices, such as $A_{1.3}$, $A_{14.1}$ and $A_{13.14}$, in table 10.2 would be needed to reflect the more elaborate specification.

5. One possible exception which is reviewed and analyzed in the next section—the Ng (1974) model—is the case where the sectoral production functions are of the Cobb-Douglas type. In this case, the elasticity of substitution among inputs is unity, which means the shares of value added accruing to the various inputs are constant regardless of changes in prices.

are procedures to determine independently, or outside the simple model, whether enough investment is likely to be forthcoming through domestic savings and foreign borrowing to permit the new output mix to be produced.

COMPARATIVE EVALUATION OF FIRST-GENERATION MODELS

The three models reviewed and analyzed in this section are either explicitly or implicitly based on a SAM framework and rely on linear behavioral and technical relationships and fixed coefficients. As such, they belong to the broad class of interdependent, consistent, fixed-coefficient models discussed in the previous section. These three models are respectively, the Pyatt and others (1972) model of Iran; the Thorbecke-Sengupta (1972) model of Colombia; and the Ng (1974) model of the Philippines. The common concern in all three models is to make income distribution endogenous within a multisectoral macroeconomic consistency framework. The Iran model is explicitly based on a SAM system, whereas the other two use it implicitly in the process of building internally consistent, interdependent, and relatively closed models.

In order to bring out the major similarities and differences in the structure and specification of first-generation models discussed in this section and of second-generation models discussed in the following section, the comparative evaluation is undertaken on the basis of the interdependent links in figure 10.2 (that is, production activities—factorial income distribution—household income distribution—household expenditures on wants—household expenditures on commodities and final demand—production activities). In other words, the SAM tables presented here, particularly the simplified SAM appearing in tables 10.2 and 10.3, provide the frame of reference for analyzing and comparing these models. Furthermore, a number of characteristics and criteria are used to capture the essence of these models as well, such as (a) price formation, (b) nature of production function or relationship, (c) degree of substitution among inputs and employment determination, (d) nature of consumption functions, (e) treatment of the foreign sector, (f) major policy means, (g) treatment of static and dynamic forces, (h) major policy experimentation, and (i) special features. Table 10.4 provides a comparative synopsis of the three models according to the above links and characteristics. In what follows, each model is analyzed in turn according to these links and characteristics.

The Pyatt and Others (1972) Model of Iran

The Iran model was the work of a small group, undertaken as part of the ILO World Employment Program Comprehensive Employment Strategy Mission to Iran in 1971–72. From the outset, the model was conceived in a SAM framework, and the exercise was directed at evaluating the initial position and the prospects for the plan period 1972–77. Table 10.5 presents the SAM framework that was used in the Iran model. The major difference between this and the simplified framework presented in tables 10.2 and 10.3 is that no separate account for factors appears. As will be shown shortly, the two endogenous accounts are those for (a) production activities, which are broken down into twelve sectors represented by the first twelve rows and columns in table 10.5, and (b) institutions, which are subdivided into three types of households (rural, urban poor, and urban rich) and the government sector. These appear in rows and columns 14 to 17.[6] Thus, the interacting and endogenous part of the framework consists of the first sixteen rows and columns. The X_{ij} matrix, defined by the first twelve rows and columns, represents interindustry demand; C_{ij} represents the matrix (rows 1–12 and columns 14–16) of consumption expenditures by the three household groups on the products of the twelve

6. The government sector is exogenous, so that only the three household categories' incomes and expenditures are considered to be endogenously determined.

Table 10.4. First-Generation Consistency and Social Accounting Matrix-Type Models: Comparative Evaluation

Links and Characteristics	Pyatt Model Iran (1972)	*Thorbecke-Sengupta Model Colombia (1972)	Ng Model Philippines (1974)
Production Activities ↓ Factorial Income Distribution	From 12 production activities directly to 3 household groups: rural, urban rich, and urban poor. Specification bypasses factorial distribution	Value added from 12 production activities is subdivided into labor and nonlabor (property) income.	13 production sectors include government; sectoral production functions yield labor income shares of skill groups and property income.
Factorial Income Distribution ↓ Household Income Distribution		Labor income from 11 nonagricultural activities is assumed to accrue to 11 corresponding income groups. Property income from nonagriculture is assumed to accrue mainly to an entrepreneurial income class. Agricultural value added is channeled into 3 agricultural income categories and the entrepreneurial income class. Hence 14 different income classes are specified along sectoral lines. A lognormal personal income distribution is derived from these 14 (homogeneous) income classes.	Earnings distribution of labor income is derived in terms of 78 occupation-sector classes (13 sectors × 6 skill groups). Nonlabor income is assumed to accrue mainly to an entrepreneurial class. A lognormal income distribution is derived from these income classes.
Household Income Distribution ↓ Household Expenditures on Wants ↓ Household Expenditures on Commodities and Final Demand	Consumption of 3 household groups for 12 production goods and services is directly estimated. Demand for wants is bypassed.	Total domestic and import consumption of 12 types of goods and services (corresponding to the 12 production sectors) is estimated with the help of adjunct macro-model. Other components of final demand such as investment and changes in stocks are determined at the aggregate level through macro-model and then sectorally allocated assuming constant proportions.	Consumption expenditures for 12 goods and services expressed as function of total consumption and household distribution of the latter. Sectoral consumption functions depend in a nonlinear way on the mean and variance of the lognormal household distribution of total consumption. Hence the demand subsystem can distinguish between commodities facing relatively high and low income elasticities (e.g., luxuries and necessities).
Household Expenditures on Commodities and Final Demand ↓ Production Activities	Output of 12 production activities and incomes of 3 household groups determined simultaneously.	The total final demand vector for 12 types of goods and services which is affected by growth and changes in personal income distribution is applied to a Leontief-inverse type of matrix to yield new sectoral output levels.	Once the components of sectoral final demand are determined (consumption, imports and investment endogenously and exports exogenously) the aggregate final demand vector is linked to the input-output I-O framework to derive the corresponding vector of sectoral gross outputs.
Price Formation	Constant prices	Constant prices	Input and output prices are endogenously determined.
Nature of Production Function or Relationship	Leontief linear I-O relations with respect to intermediate inputs.	Leontief linear I-O relations with respect to intermediate inputs. Attempt is made to forecast future I-O matrix. In the projection runs it is assumed that the sectoral production functions are of the Cobb-Douglas type, where the shares of output value accruing to inputs remain constant.	Generalized Cobb-Douglas production functions for 12 sectors. Sectoral output depends on 13 intermediate inputs and the following primary inputs: 6 types of labor and capital. Elasticity of substitution between all pairs of inputs is unitary or alternatively share of output accruing to any given input is constant.

Substitution among Primary Inputs; Employment Determination	No substitution. Verdoorn coefficients linking sectoral employment to sectoral output.	No substitution. Attempt is made to estimate technological change as it affects sectoral rates of growth of labor productivity. Sectoral employment is derived from sectoral output given labor-output ratios and endogenously determined growth rates of labor productivity.	Unitary elasticity of substitution between all pairs of primary and intermediate inputs. Employment of 6 labor-skill categories is determined through operation of labor markets equating labor supply and demand for each of 6 labor groups.
Nature of Consumption Functions	Linear Engel curves for 3 household groups and 12 commodities.	Linear Engel curves for 12 commodity groups.	Sectoral consumption functions expressed as depending on total household consumption and mean and variance of lognormal distribution of consumption.
Foreign Sector	Constant import-output ratios for intermediate imports and constant import-consumption ratios for consumption imports. Exogenous capital goods imports and government imports.	Sectoral import functions for 12 commodity groups. Exports assumed exogenously given.	Sectoral import functions.
Major Policy Means	Direct and indirect taxes, government investment and transfers.	Indirect tax rates, investment allocation by sector.	Sectoral investment allocation, indirect taxes, educational policy of government affecting the supply of different skill groups.
Static-Dynamic	Model essentially static. Comparative static simulation runs can be undertaken.	A recursive macro-econometric model yields endogenous values for total income, consumption, imports, and investment given exports and terms of trade. These macro variables are used to estimate the various components of sectoral final demand which are made to yield, in turn, the future sectoral output levels and the new personal income distribution. Consistency checks are undertaken with regard to the feasibility of achieving sectoral output level given the endogenously determined investment level and the impact of changes in the personal income distribution on demand and growth.	A recursive macroeconometric model projects the values of macroendogenous variables. The next step consists of deriving at the sectoral level within the demand subsystem the various components of final demand consistent with the macrosimulation. These components are then linked to the I-O and supply subsystem to obtain sectoral productions. Given constant value added shares, the factoral income distribution is derived. Employment by skill group and sector is also derived and confronted with labor supply by skills to yield wage rates. Income distribution is determined by occupation-sector classes and sectoral consumption re-estimated until the system converges. Effects of different sectoral allocations of investment, effects of different educational policies, and the supply of different skills.
Major Policy Experimentation	Keynesian-type model. Major test is whether sectoral output determination from demand side is consistent with likely sectoral capacity output.		
Special Features	Simultaneous determination of sectoral output vector and household income groups vector.	Determination of personal income distribution rather than household income distribution.	Price endogenous model. Labor markets are modeled for 6 labor skills.

Table 10.5. The Framework of Accounts for the Pyatt Model of Iran

Receipts	Expenditures																		
		Livestock	Other agric.	...	Construction	Owner of dwelling	Σ 1 to 12	Households: Rural	Households: Urban low	Households: Urban high	Govt.	Σ 14 to 17	Exports	Indirect taxes	Σ 13 + 18 + 19 + 20	Direct taxes	Savings: Private	Savings: Government	Savings: Foreign	Σ 21 to 25
		1	2	...	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26
	1. Livestock	$X_{1.1}$	$X_{1.2}$	...	$X_{1.11}$	$X_{1.12}$	$\sum_j X_{1.j}$	$C_{1.r}$	$C_{1.l}$	$C_{1.h}$	$\bar{C}_{1.g}$	$\sum_k C_{1.k}$	E_1	—	$X_1 - I_1$	—	I_1^p	I_1^g	—	X_1
	2. Other agriculture	$X_{2.1}$	⋮		⋮	$X_{2.12}$	$\sum_j X_{2.j}$	$C_{2.r}$	$C_{2.l}$	$C_{2.h}$	$\bar{C}_{2.g}$	$\sum_k C_{2.k}$	E_2	—	$X_2 - I_2$	—	I_2^p	I_2^g	—	X_2
	⋮	⋮				⋮	⋮	⋮	⋮	⋮	⋮	⋮	⋮	⋮	⋮	⋮	⋮	⋮	⋮	⋮
	11. Construction	$X_{11.1}$			$X_{11.11}$	$X_{11.12}$	$\sum_j X_{11.j}$	$C_{11.r}$	$C_{11.l}$	$C_{11.h}$	$\bar{C}_{11.g}$	$\sum_k C_{11.k}$	E_{11}	—	$X_{11} - I_{11}$	—	I_{11}^p	I_{11}^g	—	X_{11}
	12. Owner of dwelling	$X_{12.1}$	$X_{12.2}$	...	$X_{12.11}$	$X_{12.12}$	$\sum_j X_{12.j}$	$C_{12.r}$	$C_{12.l}$	$C_{12.h}$	$\bar{C}_{12.g}$	$\sum_k C_{12.k}$	E_{12}	—	$X_{12} - I_{12}$	—	I_{12}^p	I_{12}^g	—	X_{12}
	13. Σ 1 to 12	$\sum_i X_{i.1}$	$\sum_i X_{i.2}$	...	$\sum_i X_{i.11}$	$\sum_i X_{i.12}$	$\sum_i \sum_j X_{ij}$	$\sum_i C_{ir}$	$\sum_i C_{il}$	$\sum_i C_{ih}$	$\sum_i \bar{C}_{ig}$	$\sum_i \sum_k C_{ik}$	$\sum_i E_i$	—	$\sum_i (X_i - I_i)$	—	$\sum_i I_i^p$	$\sum_i I_i^g$	—	$\sum_i X_i$
	14. Households: Rural	$V_{r.1}$	$V_{r.2}$	...	$V_{r.11}$	$V_{r.12}$	$\sum_j V_{rj}$	V_{rr}	—	V_{rh}	$\bar{V}_{rg}$	$\sum_k V_{rk}$	—	—	Y_r	—	—	—	—	Y_r
	15. Households: Low urban	$V_{l.1}$	$V_{l.2}$	...	$V_{l.11}$	$V_{l.12}$	$\sum_j V_{lj}$	—	V_{ll}	V_{lh}	$\bar{V}_{lg}$	$\sum_k V_{lk}$	—	—	Y_l	—	—	—	—	Y_l
	16. Households: High urban	$V_{h.1}$	$V_{h.2}$	...	$V_{h.11}$	$V_{h.12}$	$\sum_j V_{hj}$	—	—	V_{hh}	$\bar{V}_{hg}$	$\sum_k V_{hk}$	$-E_h$	T_h^v	Y_h	—	—	—	—	Y_h
	17. Government	$V_{g.1}$	$V_{g.2}$	...	$V_{g.11}$	$V_{g.12}$	$\sum_j V_{gj}$	—	—	—	—	$\sum_k V_{gk}$	—	T_g^v	Y_g	—	—	—	—	Y_g
	18. Σ 14 to 17	$\sum_k V_{k.1}$	$\sum_k V_{k.2}$	...	$\sum_k V_{k.11}$	$\sum_k V_{k.12}$	$\sum_j \sum_k V_{kj}$	$\sum_k V_{kr}$	$\sum_k V_{kl}$	$\sum_k V_{kh}$	$\sum_k \bar{V}_{kg}$	$\sum_k \sum_k V_{kk}$	$-E_h$	T^i	GNP at mkt. p.	—	—	—	—	GNP at mkt. p.
	19. Imports	M_1^a	M_2^a	...	M_{11}^a	M_{12}^a	$\sum_j M_j^a$	M_r^c	M_l^c	M_h^c	$\bar{M}_g^c$	$\sum_k M_k^c$	—	—	$M^a + M^c$	—	M_p^b	M_g^c	—	M
	20. Indirect taxes	T_1^i	T_2^i	...	T_{11}^i	T_{12}^i	$\sum_j T_j^i$	T_r^i	T_l^i	T_h^i	$\bar{T}_g^i$	$\sum_k T_k^i$	E_f	—	T^i	—	—	—	—	T^i
	21. Σ 13 + 18 + 19	X_1	X_2	...	X_{11}	X_{12}	$\sum_j X_j$	C_r	C_l	C_h	$\bar{G}$	$C + \bar{G}$	E	T^i			I_p	I_g	—	Total
	22. Direct taxes	—	—	...	—	—	—	T_r^d	T_l^d	T_h^d	$-T^d$	—	—	—	—	—	—	—	—	—
	23. Savings: Private	—	—	...	—	—	—	S_r^p	S_l^p	S_h^p	—	$\sum_k S_k^p$	—	—	$\sum_k S_k^p$	—	—	—	—	$\sum_k S_k^p$
	24. Savings: Government	—	—	...	—	—	—	—	—	—	S_g	S_g	—	—	S_g	—	K	—	—	$S_g + K$
	25. Savings: Foreign	—	—	...	—	—	—	—	—	—	—	—	W	—	W	—	$T_p^v - K$	$T_g^v + K$	—	$T_p^v + T_g^v + W$
	26. Σ 21 to 25	X_1	X_2	...	X_{11}	X_{12}	$\sum_j X_j$	Y_r	Y_l	Y_h	Y_g	GNP at mkt. p.	M	T^i	Total	—	$I_p + T_p^v$	$I_g + T_g^v + K$	$-W$	—

GDP at factor cost = $\sum_j \sum_k V_{kj} + \sum_k \sum_k V_{kk} + E_f$.

Source: Clark (1975).

activities; V_{kj} denotes the matrix of value added payments by activities to household groups (rows 14–16, columns 1–12); and finally, the V_{kk} matrix stands for the intrahousehold and interhousehold transfers (the intersection of rows and columns 14–16). All other accounts are assumed to be exogenously given. The fact that in this model the value added is paid directly to the households instead of being routed first to factors and then to institutions means that the treatment of income distribution was somewhat short-circuited. This simplified specification was made necessary by the absence of available data on the factorial income distribution.

For the sake of comparability, the Pyatt model above is expressed in table 10.6 according to the simplified format of the SAM tables 10.2 and 10.3. This schematic representation of the Iran model shows in panel A the major transformations using the same four sets of accounts and notations of the simplified SAM in table 10.3. The corresponding coefficient matrices and vectors are shown in panel B. An examination of table 10.6 reveals immediately that the factor account is empty and that the interdependent part of the SAM, which is endogenously determined, consists of the institutions (or, more exactly, the three household types) and the production activities.

To recapitulate, the four endogenous mappings which appear in table 10.6 are, respectively, intrahousehold and interhousehold transfers (H_{kk}), consumption propensities of the three household categories for the twelve activities (C_{jk}), the allocation of value added of the twelve activities to the three household types (V_{kj}), and the interindustry (input-output) flows (L_{jj}). The elements of the first two matrices are expressed, of course, as proportions of total household incomes (h_k), and the last two matrices are expressed as proportions of the total gross output of the activities (the vector p_j). The other elements in table 10.6 are exogenous and have the same meaning as in table 10.3. Thus, for example, the vector x_j represents the total sum of export earnings and capital accruing to activity j from the other accounts.

It is clear that the unknowns of the system, that is, the vectors of household incomes (h) and gross output of activities (p), can be solved simultaneously in an interdependent way. Indeed, it follows from table 10.6B that

$$p = Lp + Ch + x_j \tag{10.7}$$

$$h = Vp + Hh + x_k. \tag{10.8}$$

This system can be solved simultaneously for vectors p and h by inverting the partitioned matrix of coefficients as follows:

$$\begin{bmatrix} p \\ \hline h \end{bmatrix} = \left[\begin{array}{c|c} I - L & -H \\ \hline -V & I - C \end{array}\right]^{-1} \begin{bmatrix} x_j \\ \hline x_k \end{bmatrix}. \tag{10.9}$$

As Clark (1975) pointed out, this model yields output and income vectors that are mutually consistent because they are computed simultaneously in a fully determined system.[7]

Three out of the four transformations in the Iran model are completely straightforward: all the elements of V, L, and H are expressed as ratios of the corresponding column totals. The coefficient matrix C, in contrast, which reflects the consumption behavior of households, is slightly more complicated. It is defined as follows:

$$C_{jk} = \bar{c}_{jk} + c_{jk} y_k \tag{10.10}$$

where $\bar{c}_{jk}$ equals autonomous household expenditures, independent of household income, and

7. It should be noted that the present analysis and notation use a different SAM format and notation than Clark's perceptive exposition of the Pyatt model (see Clark, 1975).

Table 10.6. A Schematic Representation of the SAM Structure of the Pyatt Model of Iran

A. Transaction Matrix

				Expenditures				
				Endogenous Accounts			Exog.	
				Factors	Institutions	Production Activities	Sum of Other Accounts	Total
				1	2	3	4	5
Receipts	Endogenous Accounts	Factors	1					
		Institutions	2		$T_{2.2}$	$T_{2.3}$	x_2	$y_2=h_k$
		Production Activities	3		$T_{3.2}$	$T_{3.3}$	x_3	$y_3=p_j$
	Exog.	Sum of Other Accounts	4		l_2'	l_3'	r	y_x
		Total	5		$y_2'=h_k'$	$y_3'=p_j'$	y_x	

B. Coefficient Matrix

				Expenditures				
				Endogenous Accounts			Exog.	
				Factors	Institutions $k = 3$	Production Activities $j = 12$	Sum of Other Accounts	Total
				1	2	3	4	5
Receipts	Endogenous Accounts	Factors	1					
		Institutions	2		H_{kk}	V_{kj}		
		Production Activities	3		C_{jk}	L_{jj}		
	Exog.	Sum of Other Accounts	4		l_k'	l_j'		
		Total	5		1	1		

Note: Matrices are denoted by capital letters and vectors and scalars by lower case letters. Table 10.6A is the SAM transaction matrix where the notation is analogous to that in table 10.3, while table 10.6B gives the corresponding SAM coefficient matrix, i.e., $H_{kk} = T_{2.2}\hat{y}_2^{-1}$; $C_{jk} = T_{3.2}\hat{y}_2^{-1}$, etc. It should be noted that the notation in table 10.6 differs from that in table 10.5. Table 10.6 introduces a notation which is followed consistently in the evaluation of all subsequent models.

H_{kk} = coefficient matrix of transfers among institutions, where k = 3 household categories (i.e., rural, urban poor, and urban rich households)
V_{kj} = coefficient matrix of value added allocation from activity j to institution k; j = 12 sectors
C_{jk} = coefficient matrix of consumption expenditures by institution k on activity j
L_{jj} = coefficient matrix of intermediate demand of activity j for activity j
x_k = exogenous demand (injection) of institution k for "other accounts"
x_j = exogenous demand (injection) of activity j for "other accounts"
l_k' and l_j' = exogenous leakages out of institution k and activity j, respectively
h_k = y_2 total income of institution k
p_j = y_3 total demand (= output) of activity j.

c_{jk} equals marginal propensity to consume of household k on activity j. This type of specification of consumption allows one to postulate different income elasticities of demand for different income groups. Linear approximations of Engel curves can be obtained.

The system as represented in equation (10.9) is moved by the exogenous components which are collapsed into the two vectors x_j and x_k. These components consist of government expenditures, investment, exports, and the government's indirect tax receipts from exports (mainly revenue from the nonresident oil sector). These variables jointly determine the household income distribution and the output mix.

An appropriate interpretation of the model is that it generates consistent, disaggregated output and income multipliers for any given change in the exogenous variables. In addition, by linking employment to output levels through Verdoorn-type coefficients, it can also yield estimates of employment. It is therefore essentially a Keynesian model. There is no guarantee that supply is capable of meeting the total demands generated by the system. Consequently, an attempt was made in the Iran model to check the projected gross output levels resulting from running the model according to the assumptions made in the plan against some independent estimates of likely capacity availabilities by sector. In fact, the results of policy simulation indicated that supply constraints were an important potential issue in the Iran context, and that, for example, a failure to plan for agricultural expansion consistent with demand would tend to lower rural incomes in the model and hence aggravate rural-urban income differentials.

The major characteristics of the Pyatt model are presented in table 10.4. There is no doubt that this model represented an innovative approach for deriving endogenously incomes and income distribution in an interdependent fashion. One of its major advantages is that it was embedded from the outset in a SAM data system which provided the base-year information and permitted the calibration of all linear coefficients appearing in the model.

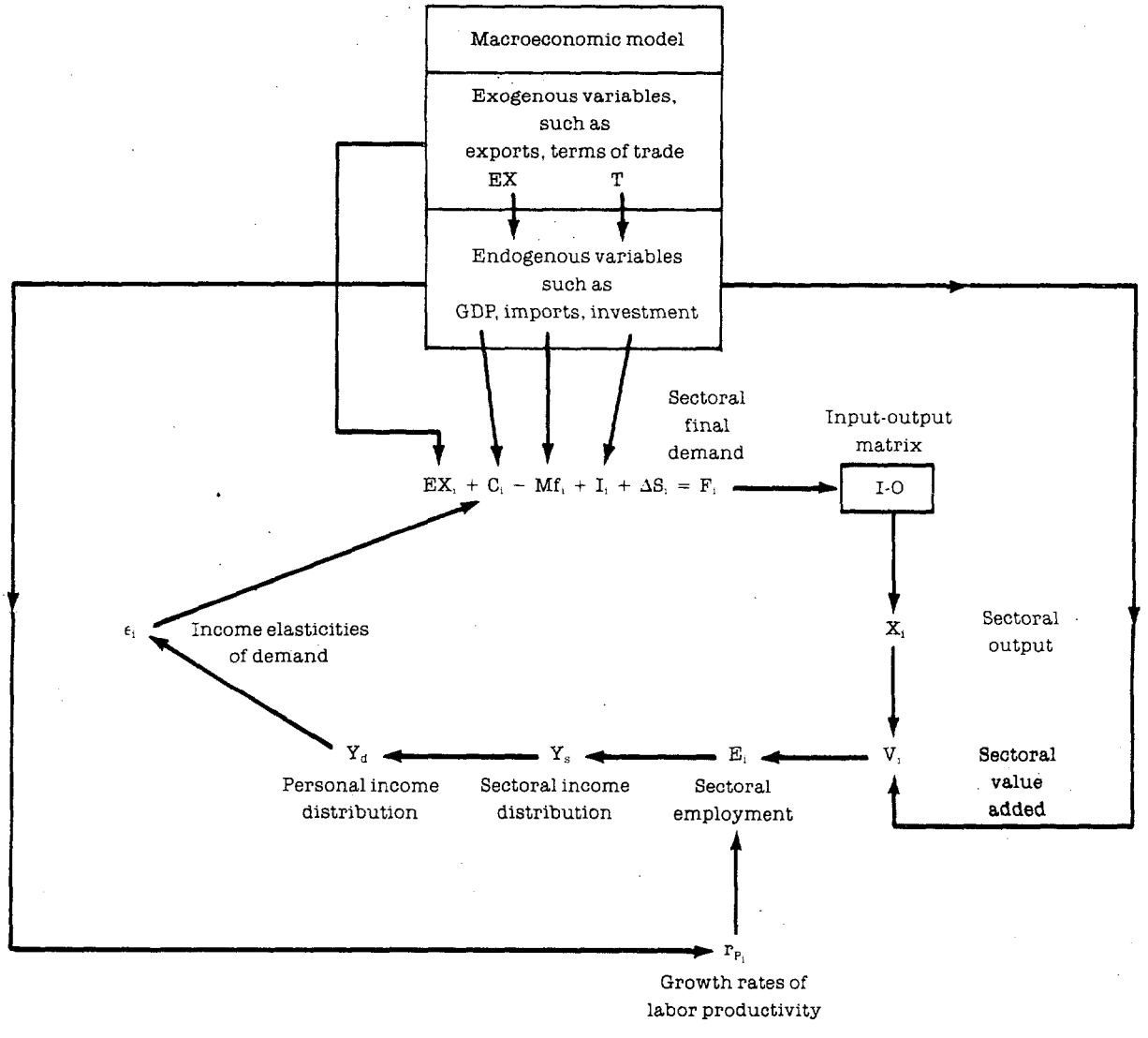
The Thorbecke-Sengupta (1972) Model of Colombia

The scheme of the consistency framework developed by Thorbecke and Sengupta (1972) applied to Colombia is set out in figure 10.3. The general spirit of the model closely parallels that of the Iran model discussed previously: certain key exogenous variables such as exports and public expenditure determine other elements of final demand and hence, through input-output, the sectoral values added and employment. However, unlike the Iran study, both these elements are important in generating the personal income distribution which, in turn, yields the consumption component of final demand.

The Thorbecke-Sengupta study is divided into two major parts. The first part attempts to describe quantitatively the macroeconomic and sectoral structure of the Colombian economy over the period 1950–67 in terms of output, employment, and income distribution. The second part projects these variables to 1980 within a consistent framework and under different assumptions regarding export growth and technological change.

Part I entailed a number of steps. The first step consisted of building a macroeconomic model of Colombia over the period 1950–67 which determined the paths of the endogenous variables consisting of gross domestic product, total consumption, investment, and imports as functions of exogenous variables such as exports, changes in terms of trade, and public expenditures. The second step consisted of obtaining input-output and employment information on a comparable basis in a ten- to twelve-sector breakdown. From this it was possible to derive the sectoral income distribution and to design a methodology that provided a mapping between the sectoral and personal income distribution prevailing in the mid-1960s. This methodology will be discussed in detail later. Meanwhile, it is apparent from figure 10.3 that it plays a major part in the model, providing a feedback loop which in practice tends to stabilize the model considerably.

Figure 10.3. Analytical Schema of the Thorbecke-Sengupta Consistency Framework for Colombia



Source: Thorbecke and Sengupta (1972).

Part II of the study projected the major macroeconomic variables to 1980 within the context of the macroeconomic model mentioned above on two alternative assumptions regarding exports and public expenditure variables. Next, the various components of sectoral final demand were projected in a way consistent with the macroeconomic projections. For example, final consumption demand for the various sectors was computed as a function of GDP growth, given likely values of the sectoral income elasticities of consumption demand. Likewise, the sum of the sectoral final demand components—consumption, changes in stocks, investment, exports, and imports—were consistent with (that is, added up to) the projected values of the variables appearing in the macroeconomic model.

Third, the sectoral gross output and value added vectors were projected to 1980, given projected final demand and the consolidated input-output table of 1966. Furthermore, on the basis of magnitudes of the growth rates of labor productivity by sector likely to prevail over the projection period, the sectoral employment and income distributions were derived.

At this stage the methodology for mapping the personal income distribution from the projected sectoral-factorial distribution was used. Since Cobb-Douglas type sectoral production functions were postulated with constant returns to scale, the ratios of sectoral value added to gross sectoral output and the shares of labor income and nonlabor income out of sectoral value added remained constant over time. From this information, both the sectoral and the personal income distributions could be endogenously derived, and it could be determined whether the projected changes in the composition of output and employment would affect the personal income distribution. To the extent that changes in the latter were projected to prevail in 1980, revised projections of the final demand components (specifically, consumption of agricultural and manufacturing goods) were undertaken to ensure consistency with the new income distribution. In addition, a fairly rudimentary test was conducted to check whether the alternative output combinations resulting from the projections to 1980 could be produced, given the total investment funds generated by the macroeconomic model. It was found that the investment availability would not constrain the attainment of the projected sectoral output and value added combinations reached under the two growth alternatives.

The whole set of projections described above reflected the likely consequences of maintaining the productive structure of the Colombian economy, since the input-output matrix prevailing in the base year (1966) was used to generate the projections. Their value for policy purposes is that they may provide the policymaker with a quantitative view of the consequences of essentially neutral technological policies.[8] The final section of the model was devoted to a simple analysis of the effects of technological changes in agriculture on employment and income distribution.

Even though this model is not explicitly based on a SAM framework, it can easily be fitted into one. This is attempted in table 10.7, which uses the same breakdown of accounts as in tables 10.3 and 10.6. Thus, the major differences between the Pyatt model and that of Thorbecke and Sengupta are clearly revealed by a comparison of tables 10.6 and 10.7. In contrast to the Iran model, the value added generated by twelve production activities here accrues to two factors of production (labor income and nonlabor income)—a transformation that is represented by the matrix V_{sj} in table 10.7B.[9] The next link allocates factorial value added to fourteen household income categories which are defined essentially along sectoral lines except for one entrepreneurial and managerial class which receives mainly capital income. This mapping is represented by F_{ks} in table 10.7B. Thus, in contrast with the Iran model, value added first accrues to the factors of production before it is distributed to household groups. The determination of this last matrix is of particular interest. The totality of labor income outside of agriculture accrues to different income classes, according to the sector in which the workers are employed. (In other words, for each nonagricultural sector, there is a corresponding income class.) In turn, the great bulk of nonlabor income outside of agriculture is assumed to be received by one entrepreneurial and managerial class. Finally, within agriculture, rather than distinguishing between labor and nonlabor value added—a distinction that would be meaningless, at least for the smallholders—total value added is apportioned to four agricultural income groups according to an existing knowledge of the agricultural income distribution. The above mapping generates

8. It is, of course, true that the underlying structure of an economy may change during the projection and planning periods. Thus, a model which describes accurately the performance of the macroeconomic variables over some (historical) sample periods may still not predict well. It is even more likely that the intersectoral (input-output) structure will change over, say, a ten-year planning horizon. It may be very difficult to approximate quantitatively the new structural relations. However, even when it is not possible to make reasonable "guesstimates" of likely changes, it can be very revealing to simulate the effects of the maintenance of the prevailing structure (at both the macroeconomic and the intersectoral levels) and then to simulate various types of presumed technological changes.

9. It should be noted that table 10.7B gives the transaction matrix of the SAM, in contrast with table 10.6B which gives the coefficient matrix. Thus, for example, V_{sj} in table 10.7B denotes the allocation of value added from production activities to factors in absolute amounts, while V_{kj} in table 10.6 represents the coefficient matrix; that is, $T_{2.3} = V_{kj}\hat{p}^{-1}$ in table 10.6B, while $T_{1.3} = V_{sj}$ in table 10.7B.

Table 10.7. A Schematic Representation of the Implicit SAM Structure of the Thorbecke-Sengupta Model of Colombia

A. Transaction Matrix 1

				Expenditures				
				Endogenous Accounts			Exog.	
				Factors	Institutions	Production Activities	Sum of Other Accounts	Total
				1	2	3	4	5
Receipts	Endogenous Accounts	Factors	1			$T_{1.3}$	x_1	y_1
		Institutions	2	$T_{2.1}$			x_2	y_2
		Production Activities	3		$T_{3.2}$	$T_{3.3}$	x_3	y_3
	Exog.	Sum of Other Accounts	4	$1'_1$	$1'_2$	$1'_3$	r	y_x
		Total	5	y'_1	y'_2	y'_3	y_x	

B. Transaction Matrix 2

				Expenditures				
				Endogenous Accounts			Exog.	
				Factors $s = 2$	Institutions $k = 14$	Production Activities $j = 12$	Sum of Other Accounts	Total
				1	2	3	4	5
Receipts	Endogenous Accounts	Factors	1			V_{sj}	x_s	v_s
		Institutions	2	F_{ks}			x_k	h_k
		Production Activities	3		C^*_{jk}	L_{jj}	x_j	p_j
	Exog.	Sum of Other Accounts	4	$1'_s$	$1'_k$	$1'_j$	r	y_x
		Total	5	v'_s	h'_k	p'_j	y_x	

Note: Both panel A and panel B of table 10.7 are equivalent transaction matrices using two different notations. Matrices are defined by capital letters and vectors and scalars by lower case letters.

V_{sj} = value added allocation from activity j to factor s; j = 12 sectors and s = 2 factors (labor, capital)
F_{ks} = factorial income s accruing to household category k; k = 14 household categories
C^*_{jk} = expenditures by income class k on activity j (see text for discussion of this transformation)
L_{jj} = intermediate demand of activity j for activity j
v_s = value added income accruing to factor s.

fourteen income classes which are assumed, by definition, to be completely homogeneous in the sense that intraclass variance is zero.[10]

These income classes can be ranked on the basis of average class income, from the lowest to the highest (see table 10.8). The results of this clustering of income classes according to average income reveal the big gap that exists between traditional and modern sectors. The first two agricultural classes, embracing 80 percent of agricultural populations, personal services, craft manufacturing, and perhaps commerce, with average annual incomes ranging from 780 pesos to 2,190 pesos clearly represent traditional activities. At the other end of the spectrum, high average incomes in utilities, finance, government services, modern manufacturing, and the entrepreneurial class reflect modern activities.

The last two columns of table 10.8 indicate the cumulative percentage of income and corresponding population, respectively, of the derived personal income distribution. A three-parameter distribution was fitted to these data, which assumed that all incomes exceed a minimum threshold and that the distribution of the excess is lognormal.[11] This distribution yielded for the base year (1966) a Gini coefficient of inequality of personal incomes of 0.55 which corresponded almost exactly to two independent estimates of the degree of personal income inequality in Colombia in the same period.

The next endogenous transformation, namely, the determination of consumption demand for the various activities which is reflected by the matrix (C^*_{jk}) in tables 10.7, needs to be explained briefly. Rather than estimating demand functions by the k income classes for the i commodities, as is implied by this matrix, the demand for the twelve activities was directly related to the personal income distribution. In other words, a consumption relationship for each of the twelve commodities (or activities) was postulated as a function of the mean and the variance of the prevailing lognormal income distribution.[12]

The final matrix in table 10.7B is the input-output matrix (L_{ij}). In most projection runs, the input-output matrix for the base year was used, which, of course, introduced a bias. In a few runs, a very modest attempt was made at incorporating into the L_{ij} matrix some expected technological changes in agriculture.

The Ng (1974) Model of the Philippines

Since the starting point for the Ng (1974) model was the Thorbecke-Sengupta Colombia study, it follows that the two have much in common. However, the Philippines model is more ambitious in a number of respects. First, the model disaggregates labor and endeavors to solve for employment by industry and skill. Second, relative prices are solved endogenously within the model. In both these and other respects, this model anticipates the specification of the nonlinear second-generation models which are reviewed in the next section.

The Philippines model consists of four major subsystems: (a) the macroeconomic model, (b) the demand subsystem, (c) the supply, price, and employment determination subsystem, and (d) the income distribution subsystem. These four subsystems are interrelated as shown in figure 10.4. The macroeconomic model simulates or projects the values of the endogenous

10. This last assumption is, of course, unrealistic. In fact, every income class has its own distribution around its mean income, which is influenced first by the distribution of income for the employed within a sector, and second by the distribution within a household. Clearly, the procedure used here is, at best, an approximation of the true personal income distribution which can only be derived exactly when the distributional parameters of all income classes are fully specified. The difficult question of the sensitivity of the overall personal income distribution to the intraclass variance is discussed in the original source.

11. The value of the threshold was preassigned at 680 pesos per capita per year, corresponding to what was considered to be a subsistence level for the minimum feasible nutritional standard.

12. This yielded twelve consumption functions rather than the 168 functions ($= 12 \times 14$), had consumption functions been estimated for each income class for each activity.

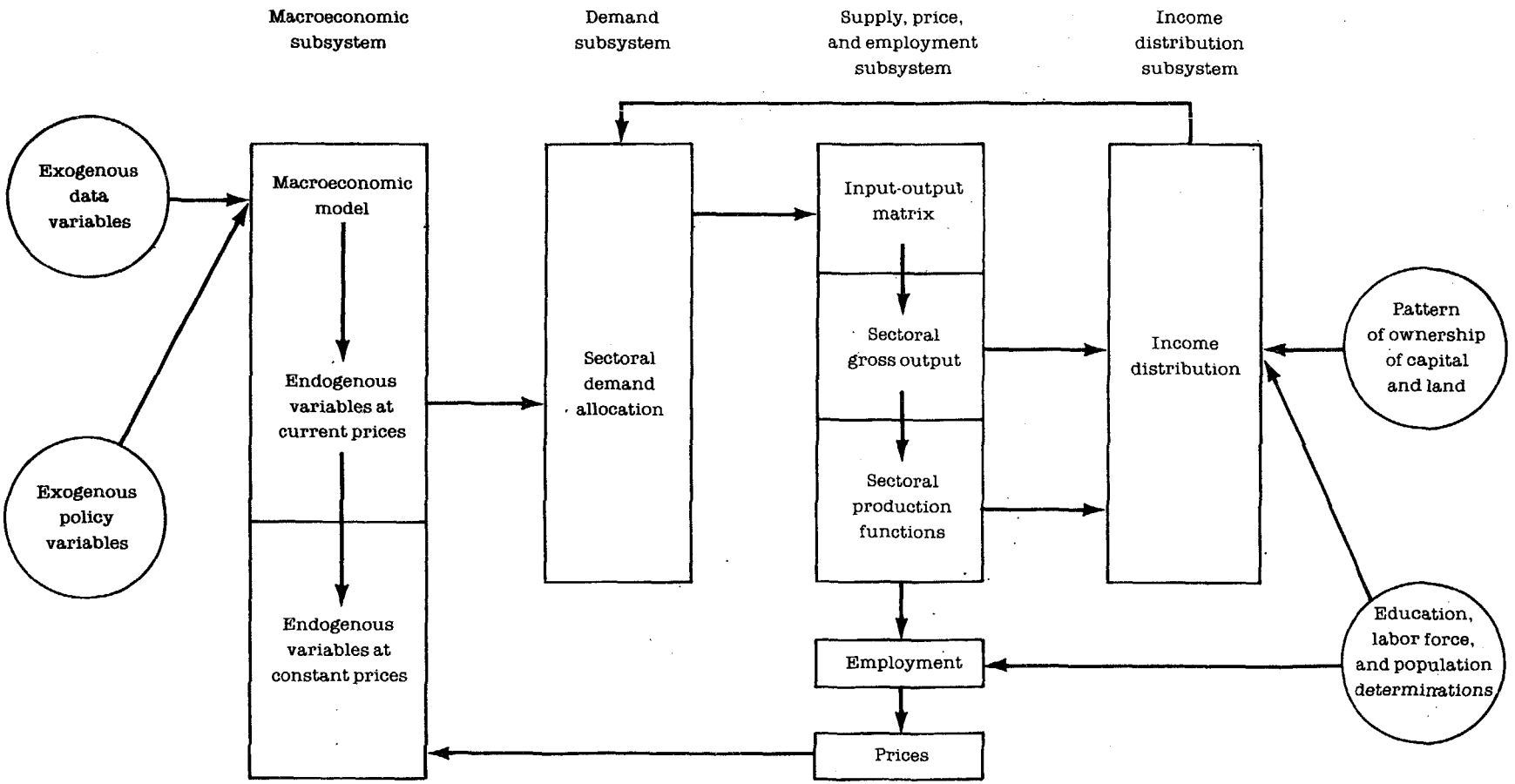
Table 10.8. Distribution of Income by Sector and Derived Personal Income Distribution in Colombia, 1966

Income Class	Average Income (thousands of pesos)	Total Income (millions of pesos)	Population (thousands)	Cumulated Income (millions of pesos)	Cumulated Population (thousands)	Cumulated Income (percent)	Cumulated Population (percent)
	x_i	Y_i	N_i				
Agriculture I	0.78	3,471	4,450	3,471	4,450	5.8	23.9
Personal Services	1.05	2,732	2,613	6,203	7,063	10.3	38.0
Craft Manufacturing	1.27	1,696	1,337	7,899	8,400	13.1	45.2
Agriculture II	1.30	3,471	2,670	11,370	11,070	18.8	59.9
Commerce	2.19	3,345	1,528	14,715	12,598	24.4	67.7
Agriculture III	2.88	3,827	1,330	18,542	13,928	30.7	74.9
Construction	3.05	2,458	805	21,000	14,733	34.8	79.2
Mining	3.17	854	270	21,854	15,003	36.2	80.6
Transportation and Communication	4.31	2,959	687	24,813	15,690	41.1	84.3
Modern Manufacturing	4.46	4,505	1,011	29,318	16,701	48.6	89.8
Government Services	5.35	3,872	724	33,190	17,425	55.0	93.7
Finance	8.58	1,762	205	34,952	17,630	57.9	94.8
Utilities	9.86	465	47	35,417	17,677	58.7	95.0
Entrepreneurial and Managerial	26.7	24.943	926	60,360	18,603	100.0	100.0
TOTAL	3.24	60,360	18,603				

Note: For methodology, see text. Pesos are 1966 pesos.

Source: Thorbecke and Sengupta (1972).

Figure 10.4. Major Subsystems of the Ng Model of the Philippines



variables as a function of two types of exogenous variables, the noncontrollable ones (including the initial values of all variables), and policy means under the control of the policymaker. The next step consists of deriving within the demand subsystem the various sectoral components of final demand consistent with the macroeconomic simulation. A particularly important part of this subsystem is the derivation of sectoral consumption. In the supply and price determination subsystem the sectoral final demand vector is linked to the input-output framework by premultiplying it by the Leontief inverse to obtain the corresponding vector of gross sectoral production. Since the sectoral production functions are of the generalized Cobb-Douglas type, where output is expressed as a function of the intermediate and primary inputs, the labor income shares accruing to the various skill groups as well as the nonlabor (that is, capital and rent) value added are derived as fixed proportions.

These income shares, which reflect a functional-skill distribution, are subsequently transmitted to the income distribution and employment subsystem. In determining employment, the supply of various occupational groups is related to educational attainments which are given exogenously, as is the pattern of ownership of capital and land. Labor supply by skill group is equated to the corresponding labor requirements after making some assumptions about the underemployment rate prevailing in each labor skill-sectoral class.[13] Thus, the pattern of employment is generated within a relatively detailed cross classification by sector and by occupational group. This information is then used to obtain the equilibrium input prices (that is, labor income and wage rates of the occupational groups) and the net rate of return on capital and output prices by sectors given the sectoral production functions.

Finally, in the income distribution subsystem, the household income (and consumption) distribution is derived indirectly from the endogenously determined earnings distribution of labor income (in terms of seventy-eight occupation-sector classes) and assumptions regarding the distribution of nonlabor income, which is itself influenced by the pattern of ownership of capital and land. In turn, the resulting household income distribution is used as an additional explanatory variable in estimating sectoral consumption in the demand subsystem. This process is continued until the complete system converges after a few iterations.[14]

Figure 10.4 indicates that the starting point of the model is the demand subsystem, where the aggregate components of final demand are either determined by the macroeconomic model, such as aggregate consumption, or determined exogenously, such as exports. Furthermore, it is assumed that total consumption is (a) invariate to a change in income distribution and (b) distributed lognormally among households. In turn, the sectoral consumption expenditures of households are specified to depend on total consumption and the household distribution of the latter. Thus, by expressing the sectoral consumption functions as depending in a nonlinear way on the mean and variance of the lognormal household distribution of consumption, the demand subsystem can distinguish between commodities facing relatively high or low income elasticities (for example, luxuries or necessities). Thus, as in the Thorbecke-Sengupta model, no C^*_{jk} matrix exists as such. Rather than specifying demand functions for each of the labor skill-sectoral household classes for each of the commodities, aggregate demand functions for each activity are expressed as functions of the mean and variance of the lognormal household income distribution.[15]

Once all the components of sectoral final demand are obtained, the aggregate final demand

13. Since the overall model is broken down into thirteen activities (twelve productive sectors and government consumption) and six skill groups, there are, potentially, seventy-eight such labor skill-sectoral classes. In fact, some of these classes are empty.

14. It should be noted before completing this review of the model that it is only after factor and sectoral output prices have been derived that real GDP (and real values for all other variables) can be determined.

15. Since the structure of the Ng model incorporates the same transformations as the Thorbecke-Sengupta model—although in a more elaborate way and with a greater degree of closure—the reader is referred to table 10.7.

vector is linked to the input-output framework to derive the corresponding vector of sectoral gross outputs. At this stage one enters the supply subsystem, which consists of twelve productive activities and government. It is assumed that the cost structure of each of these activities is a fixed proportion of the column totals. Since this is postulated to hold in current prices, the value shares of total input costs are constant. Thus, value added is a constant proportion of gross output in money terms, and the share of each factor of production—six types of labor, capital and rents—is a fixed proportion of value added in each industry. (Hence, the coefficient matrix V_{sj} in table 10.7 is fixed once and for all.) This then corresponds to the assumption that output in each sector is determined by a Cobb-Douglas production function.

Similarly, with respect to intermediate inputs (L_{ij}) expenditure on each input is assumed to be a constant proportion of money costs. This implies unitary substitution elasticity between any pair of primary and intermediate inputs. Taking all these assumptions together implies that gross sectoral outputs are a generalized Cobb-Douglas function of all inputs for each production activity. This is an upper limit to the amount of substitutability likely to exist and is almost certainly excessive. However, it does make modeling of the first twelve activity columns very simple.

After determining gross output for each sector, the next step consists of generating the corresponding income distribution. The subsystem that yields income distribution through the operation of labor markets is the most interesting part of the Philippines model. The mechanisms incorporated in this subsystem generate information on employment, wages, and income distribution. The last, in turn, provides the measure of income inequality necessary to determine sectoral consumption.

It is assumed that labor supply for the six occupational groups is determined by educational policies with two exceptions, namely, for occupational group 3 (farmers, farmworkers, fishermen, and so forth) and group 5 (manual workers) for which supply was taken as exogenously given. Given the supply—which in fact is a stock—of individuals in the six occupational groups, it is postulated that the economic system is forced to absorb this stock. This means that the total supply (or stock) of individuals in each occupational group must be absorbed across sectors requiring or demanding this group, and by the government subject to an exogenously estimated fraction of underutilized labor for each skill group. It is clear that in reality any assumed discrepancy between the labor force (or labor availability) on the supply side and the labor requirements on the demand side is adjusted through a combination of changes in (a) overt unemployment, (b) underemployment, and (c) the labor income rate per full man-year. However, it appears that in many developing countries the main adjustment mechanism takes the form of changes in the underemployment level and in the labor income rate rather than in that of overt unemployment. This is clearly the case of the Philippines where the unemployment rates for different occupational groups have remained fairly constant in the past.

In the context of the model formulation, the assumption that numbers employed in each occupation follow directly from labor supply means that the adjustment of demand and supply is brought about by wage levels—since the underemployment rates are somewhat arbitrarily taken as constant. On the demand side, the Cobb-Douglas assumptions imply that the expenditure of a production activity on each type of labor was a fixed proportion of the value of its gross output. Given the latter, the number of jobs offered for a particular type of labor can be derived by dividing the wage bill for that type of labor by the wage rate paid to it by that activity. More generally, given the value of gross output for each activity, the numbers employed in each occupational category by each activity can be determined if wage rates by skill and activity are known. Hence, total employment for each skill will depend on the average wage for that skill and on relative differences in the wage paid to that particular skill by the different production activities.

Of course, an alternative assumption to the effect that each occupational group is paid the

same wherever it is employed could have been made. However, the classification that has been used here, namely, (a) professionals, (b) sales and clerical workers, (c) farmers, fishermen, and farm workers, (d) semiskilled and skilled workers, (e) manual workers, and (f) service workers, is too broad to really reflect completely homogeneous skill groups. The specification of truly homogeneous skill groups from a labor market standpoint would have necessitated a much larger number of classes. But data limitations precluded this. Instead, it was assumed that for each skill group the labor income (wage) rates by sector are distorted by a constant factor to reflect the complex mix of skills and labor returns and wages within each of the six occupational categories selected in the model. Incidentally, this same assumption is made in the three second-generation models reviewed in the next section. The implicit assumption is that the subskills within a given occupational group coincide reasonably well with the sector employing that occupational group. In other words, an occupational-sector group is considered to approximate a specific homogeneous skill or subskill relatively well.

At this point in the model, given assumptions about education policy and hence exogenous labor supply by occupational groups and given the value of gross outputs in each sector, then the wage rate and numbers employed by sector and occupation are determined. This information provides the basis for determining the distribution of income along the lines pioneered in the Colombia study as discussed in the previous section. However, in the present case there is much more detail available because the labor force in each sector is disaggregated by skill groups, that is, labor income is distributed over seventy-eight (6×13) groups corresponding to the six occupations and twelve production activities plus government, in addition to an entrepreneurial class.[16]

It is possible to derive a rather detailed distribution of earnings for the employed on the basis of the distribution of labor income and nonlabor income among these occupational-sectoral classes and one entrepreneurial class. Under the assumption that each of these classes represents a homogeneous socioeconomic group (that the variance of the individual incomes within each class is zero) the corresponding lognormal income distribution can be derived.

A final point to note about this model is that while the assumptions made to determine wage rates may be questioned, the fact that wage rates are endogenously derived implies that there is a basis for generating prices throughout the system. The complete determination of prices requires an exogenous estimate of either the rental price of capital or of quantities of capital employed in each sector which can then be used to deflate the known profits figures to obtain estimates of the rental prices. These questions are treated in more detail in regard to the second-generation models.

COMPARATIVE EVALUATION OF SECOND-GENERATION MODELS

The three second-generation consistency-type models that are reviewed in this section are (a) the Adelman-Robinson (1978) computable general equilibrium model of the Republic of Korea, (b) the Lysy-Taylor (1977) computable general equilibrium (CGE) model of Brazil,[17] and the Ahluwalia-Lysy (1979) model of Malaysia. Only the third of these models is based explicitly on a SAM framework, while the first two can be considered as using an implicit SAM.

The second-generation models are much more ambitious than the first-generation models discussed in the previous section in at least three ways: (a) many of the behavioral and technical

16. In fact, because some of these groups are empty, the total number of sectoral-skill groups is less than seventy-eight.

17. Lance Taylor and a number of associates built three different models which were applied to the Brazilian situation (see Taylor and others, 1980). The most relevant one from the standpoint of the study is the Lysy-Taylor CGE model which is presented in chs. 6–9 of their book.

relations appearing in these models are nonlinear; (b) the degree of closure of these models in depicting endogenously the interdependence among the various parts of the system is much greater; and (c) the level of disaggregation in terms of the number of classes or categories into which the accounts are subdivided is much more elaborate.

In order to bring out the major similarities and differences among these models, the comparative evaluation is undertaken on the basis of the same format (links and characteristics) as in the previous section. Table 10.9 provides this comparative evaluation in synoptic form. It will be seen that these models incorporate some relationships or specification features that had already been adopted by the previous set of models. To this extent the detailed treatment of these features is not repeated.

The Adelman-Robinson (1978) Model of Korea

The Adelman-Robinson model is specified neither as a full neoclassical, general equilibrium model nor as a pure disequilibrium or partial equilibrium model. The economy is supposed to adjust from one set of conditions and institutional constraints to another in a kind of "lurching equilibrium" over time. Even though a number of neoclassical behavioral rules are postulated for firms, consumers, and other economic agents, there are certain elements of the model that are clearly not neoclassical, particularly with regard to the treatment of factor markets. The model is essentially short-run with a time horizon of a decade in which wages, prices, and income distribution are endogenously determined.

The model is decomposed into three stages or submodels. Stage I describes the interaction between firms and financial markets in determining expenditures on investment goods. The second stage depicts the operation of factor and product markets subject to the investment constraints determined in stage I and various institutional rigidities and specifications affecting these markets. Finally, stage III introduces expectations and, in general, contains the dynamic part of the whole system.

Stage II contains the heart of the interactive, general equilibrium part of the model. On the supply side, twenty-nine production activities are identified which are further disaggregated into four firm (or farm) sizes. On the demand side, households are disaggregated into fifteen different types according to socioeconomic criteria. The specification of the production side is based on alternative sectoral production functions—either Cobb-Douglas or constant elasticity of substitution (CES)—and the assumption that firms maximize profits subject to a number of constraints which are discussed subsequently. In turn, on the demand side, consumption functions for each household group and for each type of commodity are specified. One of the distinguishing features of this model is that it incorporates monetary phenomena with the rate of inflation determined endogenously.

To better analyze this model and compare it with others, table 10.10 expresses the model in an implicit SAM framework. However, in contrast with tables 10.6 and 10.7, which express the Pyatt and Thorbecke-Sengupta models, respectively, the mappings (transformations) that appear in table 10.10 either as matrices or as vectors do not necessarily represent linear transformations (that is, the elements of these transformations are not necessarily derived through fixed coefficients). In addition, to reflect the greater degree of endogeneity that exists in the Adelman-Robinson model, separate accounts are distinguished for companies, government, capital, and the rest of the world, respectively.

Since the model is interdependent, its description can start with any link in the system. A natural starting point is the analysis of the specification of the production structure and its mapping into a factorial income distribution.[18] Before reviewing the form of the production

18. The sequence in which the major links are discussed in this section is the same as the one used with respect to the first-generation models. Thus, to help the comparative evaluation of all of these models, the format of table 10.9 is the same as that of table 10.4.

Table 10.9. Second-Generation Consistency and Social Accounting Matrix-Type Models: Comparative Evaluation

Links and Characteristics	Lysy-Taylor Model Brazil (1977)	Adelman-Robinson Model Republic of Korea (1978)	Ahluwalia-Lysy Model Malaysia (1977)
Production Activities ↓ Factorial Income Distribution	Value added originating in 25 production activities is allocated to (a) 5 labor skill groups defined by educational status; (b) family farm workers and sharecroppers, proprietors, and employers. Capital income is allocated to proprietors, employers, and highly skilled workers. The above distribution yields approximately 130 different groups of income recipients.	Production activities are broken down into 29 sectors following the input-output (I-O) classification. Fifteen different factorial groups are distinguished: (a) 6 labor skill categories defined according to occupational and educational characteristics; (b) 2 groups of self-employed; (c) 5 agricultural groups—4 defined according to farm size plus 1 group for laborers (presumably landless); (d) 1 group of capitalists; and (e) government workers. For wage earners (by skill categories, including hired labor in agriculture) the model generates wages for about 500 groups distinguished according to skill, sector, and firm size.	Production activities are broken down into 15 sectors after consolidating a 60 sector I-O table. Twelve different factorial groups are distinguished: 5 labor skill groups defined according to educational levels and also racially broken down. Self-employed are included in the labor skill groups and receive their share of capital (nonlabor) income. Wage differentials for the same labor skill can exist across sectors.
Factorial Income Distribution ↓ Household Income Distribution	The above groups of income recipients are aggregated into 4 consumer classes (1) rural income recipients; (2) urban uneducated workers, informal workers, and self-employed; (3) urban manufacturing workers with primary education, all workers with middle-level schooling, and recipients of capital incomes from agriculture; and (4) highly skilled workers, proprietors in manufacturing, and employers from nonrural production sectors.	The household income distribution is mapped almost directly from the above 15 categories. Thus, prototype households are defined according to the occupation of the head of the household for these 15 categories. Each household class can have other workers or fractional workers. The distribution within each household category is assumed to be lognormal. Finally, the overall size distribution of income is derived from the 15 lognormal household distributions.	From the above total income accruing to 12 factorial classes is generated. Through a household composition matrix allowing for households defined according to the skill level of the head to include other skills on a fractional basis, the income distribution in terms of 12 household types is derived. It is assumed that each type is totally homogenous with respect to income and consumption.

Household Income Distribution ↓ Household Expenditures on Wants ↓ Household Expenditures on Commodities and Final Demand	Each of the 4 income classes is assumed to have expenditure functions for the 25 sectoral goods and services and for noncompeting imports. The form of these consumption functions corresponds to Houthakker's direct addilog system. It should be noted that the 4 income classes' disposable income is computed assuming different tax and transfer rates. The other components of final demand are determined as follows, sectoral investment is assumed to be determined by differing expectations or "animal spirits"; government demand and exports are assumed exogenously given.	Each of the 15 household classes is assumed to have expenditure functions for the 29 sectoral goods and services. The form of these functions corresponds to Houthakker's addilog function. Disposable income by household class is determined after deducting savings and allowing for transfers and subsidies. An important innovation is that because the monetary sector is included in a nonneutral way, the demand for cash balances by each class has to be subtracted from disposable income after savings to obtain the remaining amount to be spent on goods and services. Other components of final demand are derived as follows: (a) investment is derived in a first-stage submodel based on expectations at the sectoral level with regard to variables discussed below under Savings-Investment Behavior, and real financial factors; (b) imports are broken down into noncompetitive and competitive and derived through fixed coefficients; (c) exports are essentially exogenously determined (see below under Foreign Sector); (d) government purchases are also exogenous.	For each household class savings and taxes were deducted and transfers added to obtain total consumption. Seven consumption categories were specified corresponding essentially to wants (e.g., food, clothing, house and furniture, services). In effect, a multilevel structure of consumer demands is specified. The expenditures system used is a combination of the linear expenditure system and multilevel CES. At the highest level each consumer allocates his budget among broad categories of consumption (wants) such as food. At the next level the food budget is then suballocated to sectoral products such as agriculture and food processing. Finally at the lowest level the consumer decides how to allocate his spending on the sectoral product—say, food processing—between domestically produced and imported output. Thus, the whole expenditures system consists of 12 household classes choosing among 7 wants to be satisfied by 15 sectoral products (either domestic or imported). Different levels of substitution elasticities are specified. Other components of final demand are essentially exogenously determined (i.e., investment in nominal terms and exports depending on world prices).

(Table continues on the following page)

Table 10.9. (Continued)

Links and Characteristics	Lysy-Taylor Model Brazil (1977)	Adelman-Robinson Model Republic of Korea (1978)	Ahluwalia-Lysy Model Malaysia (1977)
Household Expenditures on Commodities and Final Demand ↓ Production Activities	A neoclassical specification of production and cost functions is adopted. Separate subproduction functions are specified for aggregate labor (5 skill groups + 2 agricultural groups), aggregate capital, entrepreneurial inputs, and intermediate inputs. Substitution is allowed among the different types of labor within that aggregate and between aggregate labor and capital. With regard to capital, fixed proportions are maintained among different capital types within each sector and capital cannot be shifted out of a sector once it is installed. Finally, aggregate labor and capital inputs combine to produce value added according to a two-level CES function.	Different types of sectoral production functions are postulated: (a) either Cobb-Douglas or two-level CES neoclassical specification for manufacturing and agricultural sectors allowing substitution among labor skills at the first level, and between aggregate labor and capital at the second level; (b) essentially fixed capital-output or labor-output ratios for other sectors such as services, construction, and utilities.	Sectoral production functions are built up along multilevel CES lines. A given aggregate sectoral output is produced through two (artificial) aggregate components representing intermediate inputs and "value added." These two aggregates combine in a CES way to produce sectoral output. At a lower level intermediate inputs combine again in a CES way to yield the aggregate and the different labor skills and capital goods combine to determine aggregate labor and capital. Finally, at the lowest level any intermediate input is made up of domestic and imported components which substitute for one another, and, likewise, any given capital good is made up of a domestic and an imported part.
Price Formation	Endogenous price determination. Commodity prices are determined as functions of factor prices. Prices are solved iteratively. First it is assumed that levels of value added are temporarily given in each sector, which yields factorial income and consumption levels for the income groups. Along with exogenously specified items of final demand (e.g., investment and exports), consumption levels by sector then give estimates of sectoral output which in turn determine sectoral value added. Iteration on output levels is made to yield consistent prices.	Endogenous price determination. Outside agriculture, wage rates are determined through the operation of labor markets for each skill level. Labor demand equations—derived from the production functions—and labor supply functions are specified and it is assumed that the markets are always cleared. Sectoral wage differentials are postulated for given skills. The agricultural labor market is treated separately in that only agriculture is permitted to hire agricultural labor. Profits are assumed to be maximized subject to technical constraints and a given capital stock. Product prices are determined so as to clear markets.	Endogenous price determination. Multilevel CES production functions are converted into corresponding price functions. (In equilibrium costs are dual to quantities.) Given a value for all wages and for all sectoral outputs one can solve for all other (e.g., commodity) prices. Prices of goods for intermediate and final uses and for value added and output are determined through the multilevel cost functions derived from the production functions.

Nature of Production Function or Relationship	Sectoral production functions of the CES type are specified. The CES specification is of the two-level form (see description above). At the first level an aggregate labor component is expressed as a CES function of different labor inputs defined according to skill and educational levels. The aggregate capital component assumes essentially a fixed mix of capital goods at the sectoral level. At the second level the aggregate labor component can be substituted for the aggregate capital component, again according to a CES function.	Various forms are used: Cobb-Douglas and two-level CES in manufacturing, CES in agriculture, and fixed coefficients in services, construction, and some other sectors. Fixed coefficients are assumed with respect to intermediate inputs and substitution allowed among labor skills and between aggregate labor and capital. In each firm total investment expenditure is fixed in nominal terms which can be aggregated by capital goods and sectors through fixed coefficients.	Multilevel sectoral production functions (see above). The treatment of imports among intermediate inputs and capital is interesting. The first branching of the multilevel CES function is between value added and intermediate inputs. Value added is composed of aggregate labor and capital with the latter further broken down between domestic and imported. Intermediate inputs, in turn, are combined among sectors and between domestically produced and imported.
Substitution Among Primary Inputs; Employment Determination	The sectoral elasticities of substitution between different labor skills are taken as very high (between 4 and 7) while between labor and capital they are taken in the range of 0.4 to 2.2. Employment levels of the various skill groups by sector are determined along neoclassical lines by equating exogenously projected labor supplies with labor demands. Hence, the model forces full employment of all the members of the economically active population.	Substitution among labor skills and between aggregate labor and capital in manufacturing and agriculture. For other sectors, see above. Employment is determined at the skill level through the determination of wage rates which clear the segmented labor markets. Self-employment in nonagriculture is assumed fixed except for the trade sector serving as an employment sink. Migration is modeled as a function of urban-rural wage differentials with migrants coming from the landless and first 2 farm sizes and going into 3 urban labor categories.	As seen above, substitution is possible among or between (a) intermediate inputs where a very low substitution elasticity is assumed (0.1); (b) domestic and imported inputs where the sectoral range is from 0.1 to 1.5; (c) aggregate intermediate and value added where $\sigma = 0.1$; (d) aggregate capital and labor where the sectoral range is 0.4 to 1.5; (e) labor types where σ is assumed very high, 4–7. Two alternative approaches are used to solve the whole model; (i) assume money wages are fixed and solve for labor demand, and (ii) equate labor demand to exogenous labor supply.
Nature of Consumption Functions	As previously indicated each of the 4 income classes is postulated to have sectoral expenditures functions of the addilog type.	Houthakker addilog form for 15 household groups and 29 commodities (see also Household Expenditures).	As was indicated above, the demand structure is multilevel of the CES type formally analogous to the form used on the production side. The system can be viewed as resulting from consumers maximizing a special type of multilevel utility function, with strong assumptions postulated on pairwise substitutability of goods within and across levels. The introduction of the "want" concept is interesting.

(Table continues on the following page)

Table 10.9. (Continued)

Links and Characteristics	Lysy-Taylor Model Brazil (1977)	Adelman-Robinson Model Republic of Korea (1978)	Ahluwalia-Lysy Model Malaysia (1977)
Foreign Sector	Noncompeting and competing imports as well as exports are given exogenously, as is the rate of exchange.	Quantitative targets for exports are fixed as a share of output for large sectors and in absolute terms for small exporting sectors. Two kinds of imports are distinguished: competitive and noncompetitive. The first type is assumed to be a fixed proportion of domestic production while the latter are computed with import coefficient matrices. The model distinguishes between two types of traded goods: goods whose prices are determined in the domestic market or in the world market.	Imports are determined as follows: (a) final consumption imports are derived from the multilevel demand subsystem; (b) intermediate imports are derived from the multilevel production system, as are capital imports. Exports are essentially assumed to respond to relative changes in prices of domestic and world goods.
Major Policy Means and Policy Experimentation	Simulation of changes in tax rates and the exchange rate, changes in labor supplies by education type, and modifications in profit distributions and wage structures. Some major conclusions: (a) more difficult substitution among labor types equalizes earnings and a narrow wage structure; (b) reduced investment demand leads to fall in price level, improving distribution since the economy is under less pressure to produce savings; (c) changes in pattern of investment can lead to significant improvements in distribution; (d) growth as well as equity considerations lead to the conclusion that education programs should be directed to the illiterate. In general model not very responsive to policy shifts.	Rural policy means: land reform, changes in production and productivity, employment promotion, human resources (subsidization of consumption of poor, population control), and overall strategy using all the above policies. Urban policy means: human resources (same as above), employment promotion, technology, nationalization, and overall urban development strategy. Major conclusions of policy experimentation are (a) size distribution of income is extremely stable; (b) comprehensive development strategy combining structural changes and other policy means is essential, and (c) agricultural terms of trade and rural-urban migration are important instruments.	Static experiments were undertaken of the following types: (a) variations in the level of exogenous components of aggregate (final) demand, i.e., investment, exports and government (demand); (b) government intervention in key relative prices: devaluation, tax on labor, tax on capital; and (c) changes in resource endowments of the economy (e.g., increasing the supply of higher skilled labor classes). These experiments are run under two alternative model specification and solution algorithms: (a) Keynesian, assuming unemployment of labor and constant given money wages and solving for the levels of employment; and (b) neoclassical, assuming exogenously determined labor supplies and solving endogenously for equilibrium wage rates.

Static-Dynamic	The model is essentially comparative-static.	A serious attempt is made at capturing some dynamic elements. The overall model is decomposed into three stages. Stage I is used to determine nominal investment on the basis of firms' expectations and accumulated earnings and credit availability. Stage II contains the basic part of the model and deals with the determination of wages, employment, prices and profits, and the demand for products and income distribution. Stage III updates variables and formulates expectations which enter stage I. It is really the dynamic part which specifies the intertemporal linkages embracing such variables as population, technological change, and migration.	Model is essentially static or timeless at this stage. Only counterfactual simulations can be undertaken for given base year conditions.
Special Features	Cambridge (England) specification of investment determination with sectoral investment depending on expectations and "animal spirits."	Modeling of financial sector and influence of money. Specification of different firm and farm sizes. Incorporation of dynamic elements.	Introduction of consumer wants to be satisfied by commodities. Multilevel CES demand and production systems. Explicit linking of model to SAM data framework.
Savings-Investment Behavior	Linear savings functions are specified for the 4 income groups. Investment is determined in an expectational way—depending on "animal spirits" at the sectoral level. In this specification it is investment which moves the system and income distribution has to adjust so as to be capable of generating the required savings.	Savings functions are postulated for 15 household groups. Nominal investment is determined in nominal terms in stage 1 at firm and sector level on the basis of expectations and financial considerations.	Savings functions are built for 12 household categories. Nominal investment is determined exogenously and fixed capital matrix linking capital by sectors of origin to sectors of destination is assumed as well.

CES signifies constant elasticity of substitution.

Table 10.10. A Schematic Representation of the Implicit SAM Structure of the Adelman-Robinson Model

			Expenditures								
				Endog. Insts.							
			s = 15 Factors	k = 15 House-holds	b = 4 Com-panies	j = 29 f = 4 Produc-tion Activi-ties	Government	Capital	Rest of World (Commodities)	Sum of Other Accounts	Total
			1	2	3	4	5	6	7	8	9
Receipts	Factors	1				V_{sjf}				x_s	v_s
	Endog. Insts. House-holds	2	F_{ks}	H_{kk}	P_{kb}		g_k			x_k	h_k
	Endog. Insts. Companies	3	F_{bs}				g_b			x_b	v_b
	Production Activities	4		C_{jk}		L_{jjf}	g_{jf}	k_{jf}	z_{jf}	x_{jf}	p_{jf}
	Government	5		d'_k	p'_b						r=g
	Capital	6		s'_k	s'_b				b		s=h
	Rest of World (Commodities)	7		$m^{c'}_k$		$m^{nc'}_{jf}$					m=z
	Sum of other Accounts	8	l'_s	l'_k	l'_b	l'_{jf}					
	Total	9	v'_s	h'_k	v'_b	p'_{jf}	g=r	k=s	z=m		

Note: The transformations involving accounts that are mostly exogenously determined, i.e., government, capital, and the rest of the world (commodities), are represented as vectors even though in some instances the actual mappings in the model were matrices.

The SAM in table 10.10 is a transaction matrix. Matrices are denoted by capital letters and vectors and scalars by lower case letters.

V_{sjf} = value added generated in firm (or farm) size f in activity j accruing to factor s; f = 4; j = 29; s = 15
F_{ks} = factorial income s accruing to household group k; k = 15
F_{bs} = factorial income s accruing to company group b; b = 4
H_{kk} = intrahousehold and interhousehold transfers
C_{jk} = consumption expenditures by household k on commodity (= activity) j
P_{kb} = distributed profits of company group b to household group k
L_{jjf} = input-output coefficients
s'_k = savings by household group k
s'_b = undistributed profits by company group b
d'_k = taxes paid by household group k
p'_b = business taxes paid by company group b
$m^{c'}_k$ = competing imports purchased by household group k
$m^{nc'}_{jf}$ = noncompeting imports by activities
k_{jf} = investment demand by activities
z_{jf} = exports by activities
g_k = transfers and subsidies from government to household group k

functions that Adelman and Robinson specify, it is essential to focus on the degree and type of disaggregation that is used. As indicated earlier, twenty-nine production activities are identified, based on the prevailing input-output information available. The nonagricultural sectors are further broken down into four firm sizes based on the number of employees, while agriculture is represented by two sectors and according to four farm sizes. Hence, independent production functions are specified for a possible total of 116 (29 × 4) sectoral outputs by firm or farm size. (In fact, the total number is less since in some sectors not all firm sizes are represented.)

The value added that is generated by these j × f activities (where j = 29 and f = 4) is distributed to fifteen different sectoral groups (s = 15), comprising (a) six labor skill categories defined according to occupational and educational characteristics, (b) two groups of the self-employed, (c) five agricultural groups—four defined according to farm size plus one group for laborers (presumably landless), (d) one group of capitalists, and (e) government workers. The distribution of value added to factors is represented symbolically by the matrix V_{sjf} in table 10.10.

Different types of sectoral production functions are postulated: (a) either Cobb-Douglas or two-level CES neoclassical functions for manufacturing and agricultural sectors, allowing substitution among different labor skills at the first level, and between aggregate labor and aggregate capital at the second level; and (b) essentially fixed capital output, or labor output ratios for other sectors such as services, construction, and utilities. The demand for intermediate inputs (L_{ijf}) is assumed to be proportional to the gross sectoral output levels by firm size (p_{jf}). Thus, the structure of production allows substitution among primary inputs, but requires intermediate inputs in fixed proportions. Firms are assumed to maximize profits subject to different market structures and other institutional constraints prevailing in Korea over the historical sample.

In the second link, the household income distribution is mapped almost directly from the above factorial distribution. Prototype households are defined according to the occupation of the head of the household for the same fifteen factorial groups. With the help of a household composition matrix, the number of additional workers or fractional workers in the same or in other factorial categories is specified. The income distribution within each household category is assumed to be lognormal. This distribution is estimated on the basis of the different household incomes in each of the household categories. (It ought to be noted that the wage rate received by workers in the same skill categories, but in different sectors, can vary as can firm sizes.) The total income distribution among household categories (h_k) is arrived at after allowing for intrahousehold and interhousehold transfers (H_{kk}) and government transfers and subsidies (g_k) which modify the initial household distribution.

Each of the fifteen household classes is assumed to have expenditure functions for the twenty-nine sectoral goods and services. The form of these functions corresponds to Houthakker's addilog function. The consumption demand by each household class (C_{jk}) is related to its dispos-

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Notes to Table 10.10. (Continued)

g_l = transfers and subsidies from government to company group l
g_{jf} = government purchases of production activities
b = import surplus
v_f = factorial incomes
h_k = household incomes
w_b = company incomes
p_{jf} = gross output of activities by firm size
s = k = aggregate savings equals investment
m = z = commodity imports equals commodity exports plus import surplus
r = g = total government revenues equals total expenditures
x and l′ = entries in penultimate column and row are exogenous injections and leakages, respectively.

able income after deducting savings (s'_k) and direct taxes (d'_k). An important conceptual innovation incorporated in this model is the inclusion of the monetary sector in a nonneutral way. Hence, the demand for cash balances by each category must be subtracted from disposable income to obtain the remaining amount to be spent on goods and services. Incidentally, linear savings functions are postulated for the fifteen household groups.

Other components of final demand are determined as follows: (a) investment is postulated in nominal terms in stage I at the firm and sectoral level on the basis of expectations and financial considerations; (b) imports are broken down into noncompetitive and competitive and derived essentially through fixed coefficients, while (c) exports and government purchases are essentially exogenously determined.[19] The resulting total final demand at the sectoral (activity) level is next transmitted to the production subsystem, completing the interdependence.

As was previously indicated, an essential feature of the model is the endogenous nature of price formation. In all markets—products, factors, and money—a clearing mechanism is postulated through setting excess demand functions equal to zero. In the factor markets, the capital endowment of firms is given (at least in the comparative static case). Investment by sector and by firm size is determined in stage I, which is then translated into specific demands for investment goods through a fixed coefficient capital matrix. At the level of stage II, investment and the demand for capital goods is predetermined, and the main issue in factor markets is the clearing of labor markets. Since it is a short-run model, supply of most skills (except for the unskilled who can migrate from traditional agriculture into the informal urban sector) is exogenously given.

Given the derived demand for different types of labor consistent with equilibrium in the product markets, wage rates are determined in each labor market so as to equate supply and demand. This treatment of the employment problem is perhaps somewhat limiting. Indeed, it might have been more realistic for a number of occupational groups to have assumed that adjustment takes place through a change in the effective employment rate (or the extent of underemployment) rather than just the wage rate. This issue was discussed earlier for the Ng model.

The mechanism that generates equilibrium in the money market is interesting and novel with regard to this class of planning models. The change in money supply occurs from two sources: (a) the injection of new money (from stage I) which is reflected in stage II as investment spending by firms; and (b) net dis-hoarding of money from firms, households, government, and the foreign sector. The demand for new cash balances is given by the Cambridge quantity equation where the proportion of firm output or household income kept in cash (the Cambridge k) is assumed to be a function of the interest rate and the inflation rate. The excess demand for money, as well as the net value of all excess demands, must equal zero in this general equilibrium approach.

It should be noted that the clearing prices for the two sets of markets (product and factor) are not solved simultaneously but serially through a set of iterations. In the dynamic version of the model, capital stocks by firm size are determined in stage I and, hence, not treated exogenously as in the comparative case, and stage III is used to update the variables and parameters which are required to solve the stage II model of the next period.

The main purpose of the model was not forecasting as such, but rather to provide a laboratory

19. Foreign trade is modeled as follows. Quantitative targets for exports are fixed as a share of output for large sectors and in absolute terms for smaller exporting sectors. Two kinds of imports are distinguished, competitive and noncompetitive. The first is assumed to be a fixed proportion of domestic production while the latter are computed with import coefficient matrices relating imports to the total component of final demand. Furthermore, the model distinguishes between two types of traded goods, namely, goods whose prices are determined in the domestic market or those for which prices are determined in the world market.

analog within which the consequences of alternative policy packages could be compared, particularly in terms of their distributional and growth effects. In turn, the effects of these alternative strategies were compared against a benchmark consisting of the dynamic path resulting from an extrapolation of present trends in Korea. This policy experimentation provides interesting insights into the dynamics of the development process and particularly a more explicit understanding of the tradeoff between growth and distribution. The benchmark basic dynamic run yielded a serious deterioration in the distribution of household income over the ten-year planning horizon,[20] combined with a continuation of a high overall growth performance.

In the light of this likely trend, some counterfactual alternative development strategies are simulated and their effects on the policy objectives explored. The policy experiments are divided into alternative packages, each containing a set of more specific policy instruments or structural changes. The first set of alternative experiments (or policy packages) is applied exclusively to the rural areas while a second set deals with the urban areas, exclusively, before simulating the effects of a third set applying to a combination of policies affecting both rural and urban areas. Thus, for example, the rural experiments include such alternatives as land reforms, rural cooperatives, rural public works, and subsidies to consumers, while the urban experiments include policy packages focused on human resources, employment orientation, technology, and nationalization of large industry. The last set which combines the rural-urban depauperization strategies is, of course, the most interesting and most relevant set of policy simulations.

The authors, in their conclusions, derive some lessons for model builders and policymakers. Two lessons are perhaps the most interesting for model builders. First is the finding that there seems to be little connection empirically between the size distribution of income (in deciles) and the functional distribution of income (by socioeconomic classes of recipients). More specifically, the size distribution of income tends to remain extremely stable under a variety of policy experiments while the functional distribution varies widely. The second lesson is that a planning model oriented toward distributional issues should focus heavily on the agricultural and service sectors and should incorporate endogenously and explicitly prices and employment. Thus the models will differ from traditional planning models oriented toward growth per se which emphasize the manufacturing sectors relative to other sectors in the economy and use trade and investment as the driving forces rather than prices and employment. These issues are discussed later, but it is particularly relevant to note that the Adelman-Robinson model uses a very high level of aggregation in agriculture. Production in that sector is subdivided into only two activities and four farm sizes. Considering the relative importance of agricultural households in the total population and the incidence of poverty in the rural areas, this is probably the weakest part of the model.

Among the most important lessons for policymakers, the authors suggest that (a) a distributionally oriented strategy can succeed only if it is based on the interactive effects of a package of instruments rather than on single policy instruments (because the effects of a set of policy instruments tend to be multiplicative rather than additive), and (b) the agricultural terms of trade and rural-urban migration are the most effective measures in affecting poverty.[21]

In any case, the major conclusion reached by the authors is that the achievement of a development path combining growth and depauperization is an extremely difficult task on both economic and political grounds. In this light, two alternative strategies and philosophies can be argued. The conservative one, in the words of the authors, could be argued as follows:

20. The share of income accruing to the lower quintile drops from 6.9 to 4.6 percent while the share accruing to the top decile rises from 29.7 to 33.0 percent over this period.

21. Demographic variables are mostly exogenously determined in the model. One surprising finding is that reduced population growth is likely to worsen poverty in the rural areas by limiting effective demand for food. This is due to the assumption that the prospects for food exports are very limited. This assumption is unrealistic in the general case.

> The effort required is large and we cannot afford it. We will stress growth now, and, when we can afford it, we will shift our emphasis to the necessary attack on poverty. In the meantime, we will handle the unrest of the poor as best we can, and the unrest of the more powerful will be postponed until a more propitious time (Adelman and Robinson, 1978, p. 201).

The alternative view which is preferred by the authors is expressed as follows:

> The effort required, though large, is feasible. With an integrated, well-balanced, mutually reinforcing selection of development strategy and anti-deprivation policy packages, substantial improvement is possible over relevant time periods. A nation should, therefore, reorient its policies in this direction and deal with the unrest of the wealthy now, as best we can (Adelman and Robinson, 1978, p. 201).

The Lysy-Taylor (1977) Model of Brazil

The review and analysis of this model can be relatively brief since its specification has many similarities with both the Adelman-Robinson Korea model and the SAM model of Malaysia, discussed below. At the same time, there are certain important differences which are brought out here. Although it does not rely on an explicit SAM, both the underlying data system and major transformations and links could easily fit into an implicit SAM. In fact, the CGE model specification was arrived at gradually after the authors had experimented with simpler specifications such as Belindia (for Belgium-India, to reflect the underlying dualism in the economy) and an identity model in the Johansen tradition embedded in national income account identities. The two major purposes of the Lysy-Taylor CGE model were: (a) to replicate and explain the behavior of the Brazilian economy from the late 1950s to the early 1970s with regard to growth, employment, and income distribution; and (b) to undertake some counterfactual simulation experiments to estimate the presumed effects of alternative policies.

As in the previous cases, this model is analyzed according to an implicit SAM framework which permits the major links and transformations to be described systematically. Table 10.11 presents these major mappings in a schematic SAM form, while table 10.9 provides the comparative synopsis.

The production activities are broken down into twenty-five sectors consistent with existing input-output information. The corresponding sectoral production functions are based on a multilevel CES specification. At the first level, seven different labor skill groups can be substituted for one another to create an aggregate labor input, while the aggregate capital input is made up of fixed proportions of different capital goods for any given sector. Furthermore, capital cannot be shifted out of a sector once it has been installed. At the next level, aggregate labor and aggregate capital combine to produce sectoral value added according to the second level CES function.[22] Since perfect competition is assumed, the cost functions corresponding to the production function are derived as duals through a procedure known as Shephard's lemma.

The factorial distribution of value added is derived through V_{sj} (see table 10.11) which maps the value added generated by the twenty-five activities to the seven factorial groups, namely, noneducated workers, primary-educated workers, middle-educated workers, superior-educated workers, family farm workers, sharecroppers, and proprietors.[23] The above distribution yields approximately 130 different groups of income recipients defined according to sectoral and factorial criteria.[24]

22. The sectoral elasticities of substitution among different skills are taken as very high (4–7), while between aggregate labor and capital they are assumed to be within the range of 0.4 to 2.2.

23. In fact, value added is distributed to six labor skills, N self-employed proprietors' categories, where N is equal to the number of activities, and four types of employers. Thus, potentially thirty-five factorial categories are specified.

24. Out of the possible 25 × 7 = 175 such groups, a number of them are empty, yielding about 130 nonempty groups.

Table 10.11. A Schematic Representation of the Implicit SAM Structure of the Lysy-Taylor Model

Receipts			Expenditures: Factors s = 7	Endog. Insts.: Households k = 4	Endog. Insts.: Companies b = 2	Production Activities j = 25	Government	Capital	Rest of World (Commodities)	Sum of Other Accounts	Total
			1	2	3	4	5	6	7	8	9
	Factors	1				V_{sj}				x_s	v_s
	Endog. Insts.: Households	2	F_{ks}		P_{kb}		g_k			x_k	h_k
	Endog. Insts.: Companies	3	F_{bs}				g_b			x_b	v_b
	Production Activities	4		C_{jk}		L_{jj}	g_j	k_j	z_j	x_j	p_j
	Government	5		d'_k	p'_b						r=g
	Capital	6		s'_k	s'_b				b		s=k
	Rest of World (Commodities)	7		$m^{nc'}_k$		$m^{nc'}_j$					m=z
	Sum of other Accounts	8	$1'_s$	$1'_k$	$1'_b$	$1'_j$					
	Total	9	v'_s	h'_k	v'_b	p'_j	g=r	k=s	z=m		

Note: For definitions of symbols, see table 10.10. In this table, s consists of six labor skills and one group of proprietors and employers. This last group is composed of N types of self-employed proprietors, one for each activity (thus potentially as many as twenty-five, if all sectors include this class of self-employed proprietors) and four types of employers. Thus, s may consist of as many as thirty-five different factorial groups.

The above groups of income recipients are aggregated into four household or consumer classes: (1) rural income recipients, (2) urban manufacturing workers with primary education, plus all workers with middle-level schooling and recipients of capital incomes from agriculture, and (4) highly skilled workers, proprietors in manufacturing, and employers from nonrural production sectors. The mapping from factorial labor income to households is represented by F_{ks}, while F_{bs} reflects profit and property income going to essentially two types of companies (b = 2, that is, incorporated and unincorporated) and family enterprises. In turn, F_{ks} combined with nonlabor income allocation to households (P_{kb}) and government transfers (g_k) yield the income distribution for these four household groups (h_k).[25]

The next link consists of deriving household expenditures for these four income classes. Each of the four income classes is assumed to have expenditure functions for the twenty-five sectoral

25. It does not appear that intrahousehold and interhousehold transfers (the matrix D_{kk}) are incorporated into this model.

goods (or activities) and for noncompeting imports, yielding C_{jk} and $m_k^{nc\prime}$ in table 10.11, respectively. It should be noted that the disposable income of these four consumer classes is computed assuming different linear tax rates (d_k'). Likewise, linear savings functions are postulated for each of these groups (s_k').

One important difference between the formulation of income distribution in this model compared with that of Adelman and Robinson is that the latter assumes the distribution of each household (income) class to be lognormal. In contrast, Lysy and Taylor assume that all members of a given income class have identical average income, tax liability, and consumption functions, respectively. The specification of the household expenditure side appears to be overly aggregative. The assumption that all households fall into only four prototype classes which are completely homogeneous in their consumption and savings behavior and tax rate appears to be overly simplistic. Incidentally, given the very detailed breakdown in which the factorial income distribution is available (v_s, where s is potentially equal to thirty-five classes), it is surprising that this disaggregated information was consolidated and mapped into only four household income classes.

Perhaps the most interesting feature of this model is the way in which the model is closed with respect to the savings-investment balance. After experimenting with two different specifications with regard to the savings and investment behavior, the authors conclude that the Cambridge specification explained the Brazilian economic performance over the sample period much better than the alternative neoclassical specification. Under the first specification, entrepreneurs or planners modify the rate at which they accumulate capital in line with changes in expectations and "animal spirits." Thus, given the sectoral capital stock and the desires of the entrepreneurs with respect to sectoral capital accumulation, sectoral investment is determined endogenously. Alternatively, under the neoclassical specification, any increase in aggregate demand would require additional savings which could only be generated through a shift in the income distribution toward great inequality. The authors examined both alternative specifications and concluded:

> If the Brazilian experience in the 1960s must be forced into one of these alternative Procrustean beds of economic theory, the one built up from [the Kaldorian] hypothesis is far less deforming. Even with wildly implausible parameterization, the neoclassical hypothesis cannot reproduce Brazilian experience as recorded by the official statistics (Taylor and others, 1980, p. 78).

The employment levels of the various skill groups by sector are determined along strict neoclassical lines by equating exogenously projected labor supplies with labor demands. Hence, the model forces full employment of all the members of the economically active population.

By deriving cost functions for each commodity (activity) as duals of the sectoral production functions through Shephard's lemma, commodity prices can be determined as functions of factor prices. An iterative procedure is used to solve for equilibrium prices in the model. First, it is assumed that levels of value added are temporarily given in each sector which yields factorial income and consumption levels for the income groups. Along with exogenously specified items of final demand (for example, investments and exports), demand levels by sector then give estimates of sectoral output which in turn determine sectoral value added. Iterations on output levels are then undertaken until the system converges in yielding consistent prices.

A number of counterfactual simulation runs were undertaken with this model. The principal policy means that were varied were tax rates, the exchange rate, changes in labor supplies by educational level, and modifications in profit distribution and wage structures. Some of the specific conclusions reached within the Brazilian context were: (a) a more difficult substitution among labor types equalizes earnings and yields a narrow wage structure; (b) reduced investment demand leads to a fall in the price level, thereby improving the income distribution since

the economy is under less pressure to generate savings; (c) changes in the pattern of investment (among sectors) can lead to significant improvements in income distribution; and (d) growth as well as equity considerations are best served by educational programs directed to the illiterate.

In general, the model did not appear to be very responsive to policy shifts. As the authors point out,

> tinkering with tax rates, profit redistributions and wage structures will not move the Brazilian economy very far towards egalitarianism. The general equilibrium model results may provide some sort of guide about how to take small equalizing steps, but they say very little indeed about the design of larger political and economic changes in Brazil (Taylor and others, 1980, p. 295).

As will be pointed out in the final section, it is probably only through changes in the asset distribution that significant changes in the size distribution of income can be achieved.

The Ahluwalia-Lysy (1979) Model of Malaysia

This model, in contrast with the two previous ones, was built within an explicit SAM framework. In this connection it is relevant to note that it took more than twice as long to gather the initial data set as it took to formulate and estimate the model itself. This reflects the painstaking way in which the data set was collected (see Chander and others, 1980). The fact that an explicit SAM framework was used in the calibration of initial conditions and in the formulation of the conceptual model must undoubtedly have improved the efficiency of the process of model specification.

Table 10.12 gives the schematic representation of the Ahluwalia-Lysy model within an explicit SAM framework. It is important to note that the SAM in table 10.12 incorporates two new accounts, "wants" and "commodities," which are needed to reflect the specification of the demand subsystem of the model, as will be seen subsequently. Consequently, the causal structure of this model is essentially pentagonal as illustrated in figure 10.2.

The analysis of the modules of this model will again start with the structure of production and its mapping into the factorial income distribution. Production activities are broken down into fourteen sectors in addition to the government after consolidating a sixty-sector input-output table. As in the previous two cases, the sectoral production functions are built up along a multilevel CES line, but in a more ambitious way and including more levels.

The multilevel, cascading specification of the production process is shown graphically on figure 10.5. Thus, at the highest level of aggregation there are two aggregate inputs, namely, intermediates (i_j) and value added (v_j) which combine to produce sectoral output (x_j). These two aggregate inputs are in fact artificial CES indices which may not be observable in the real world. The aggregate intermediates index, in turn, is produced as a function of all intermediate inputs entering into the production of activity j. Finally, to complete the discussion of the left-hand branch in figure 10.5, each intermediate input used in the production of activity j consists of a combination of the corresponding domestic and imported inputs.

Similarly, aggregate value added, on the right-hand side of figure 10.5, is a CES function of aggregate labor (ℓ_j) and aggregate capital. At the lowest level of this CES cascade, aggregate labor is produced as a function of different labor skills, and aggregate capital consists of different capital goods. Different degrees of substitutability among inputs are assumed.[26]

The value added, generated by the fourteen activities, accrues to twelve different factorial

26. Thus, a very low elasticity of substitution is assumed among intermediate inputs and between the intermediates and value added aggregates ($\sigma = 0.1$). A much higher substitution elasticity is assumed to prevail between aggregate capital and labor where, depending on the sector, the selected range is from 0.4 to 1.5 and among labor skills where the range is from 4 to 7.

Table 10.12. A Schematic Representation of the Explicit SAM Structure of the Ahluwalia-Lysy Model

			Expenditures											
				Endog. Insts.										
			Factors s = 12	House-holds k=12	Com-panies b=2	Wants w=7	Commodi-ties c=14	Produc-tion Activi-ties j = 14	Government	Capital	Indirect Taxes	Rest of World (Commodities)	Sum of Other Accounts	Total
			1	2	3	4	5	6	7	8	9	10	11	12
Receipts	Factors	1						V_{sj}					x_s	v_s
	Endog. Insts. Households	2	F_{ks}		P_{kb}				g_k				x_k	h_k
	Endog. Insts. Companies	3	F_{bs}						g_b				x_b	v_b
	Wants	4		W_{wk}										w_w
	Commodities	5				C_{cw}		L_{cj}	g_c	k_c		z_c	x_c	c_c
	Production Activities	6					D_{jc}							p_j
	Government	7		d'_k	p'_b						g			r=g
	Capital	8		s'_k	s'_b							b		s=k
	Indirect taxes	9					i'_c							
	Rest of world (Commodities)	10					$m_c^{c'}$	$m_j^{nc'}$						m=z
	Sum of Other Accounts	11	l'_s	l'_k	l'_b		l'_c						r	y_x
	Total	12	v'_s	h'_k	v'_b	w'_w	c'_c	p'_j	g=r	k=s		z=m	y_x	

Note: The major difference between the format of the present table and that of tables 10.10 and 10.11 is that two additional accounts have been added representing wants and commodities. The numbering of the accounts is different from tables 10.10 and 10.11 because of the inclusion of these two new accounts. For definitions of symbols, see table 10.10. The new transformations and corresponding symbols which have been added are:

W_{wk} = expenditure of household k on want w; k = 12; w = 7

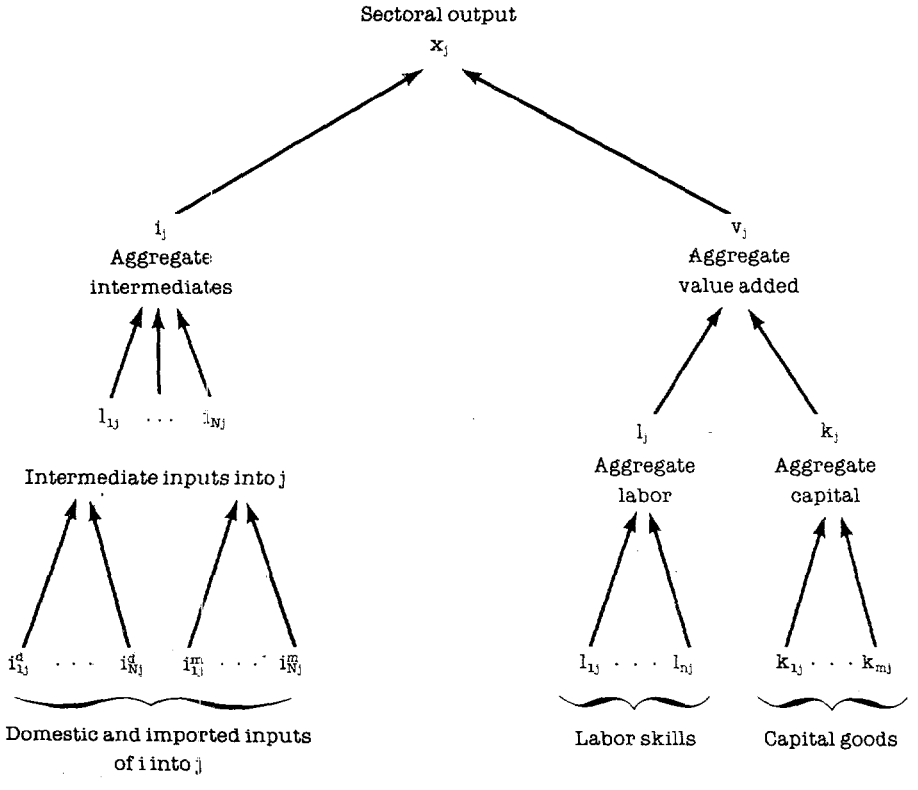
C_{cw} = satisfaction of want w by commodity c; c = 14

D_{jc} = demand for commodity c satisfied by domestic production activity j; j = 15 (the sectoral breakdown of c and j is identical)

i'_c = indirect taxes paid by commodity c to government

g = total indirect taxes accruing as revenues to government.

Figure 10.5. Multilevel Production Structure of the Ahluwalia-Lysy Model of Malaysia



groups, consisting of five labor skill groups defined according to educational levels and one class of proprietors. Each of these classes is, in turn, broken down on racial lines between Malay and non-Malay. This mapping from production activities to factors is represented in table 10.12 as V_{sj} which yields the factorial income distribution (v_s).

In the next link the household income distribution is derived from the factorial distribution through the allocation of labor income, F_{ks}, and property income, P_{kb}. It is assumed that there are twelve different household income groups corresponding to the twelve factorial categories. As in the Adelman-Robinson specification, a household composition matrix is used to allow household classes, defined according to the skill level of the head, to include other skills on a fractional basis. It is assumed that each household within a type is totally homogeneous with respect to income and consumption. The income distribution among households (h_k) is determined after government transfers (g_k) have been added to factorial income.

It is in the next link that this particular model introduces a conceptual innovation by mapping household consumption with respect to wants rather than with respect to production activities or commodities directly. This can be seen best by looking at the column of the household account (2) in table 10.12. For each household class savings (s'_k) and taxes (d'_k) are deducted from total household expenditures (h'_k) and the remainder is spent on wants (the matrix W_{wk}).[27] Seven categories of wants are specified, such as food, clothing, housing and furniture, and services.

27. Linear functions are postulated for savings and taxes for each household category.

In fact, the structure of consumer demand was specified in a multilevel fashion somewhat analogous to its specification on the production side. The expenditure system which is postulated is a combination of the linear expenditure system and multilevel CES. At the highest level, each of the twelve types of consumers allocates his budget among broad categories of consumption (wants) such as food. At the next level a mapping takes place from wants to commodities capable of satisfying these wants (C_{cw}). Thus, the seven wants are suballocated to fourteen commodity groups, which are broken down according to the same sectoral classification scheme as production activities. For example, the want for food, that is, the food budget, is suballocated to sectoral products such as agriculture and food processing. This last transformation from wants to commodities does not distinguish, at this stage, between imported and domestic commodities.

Finally, at the lowest level of the multilevel demand subsystem the consumer decides how to allocate his total commodity demand between domestic production and imports. This process is represented by reading down the columns of account 5 of table 10.12 where D_{jc} stands for the demand of commodity c to be satisfied by domestic output activity j and m_c^c stands for the part of total commodity demand to be imported (the competing imports). In conclusion, the whole expenditure system consists of twelve household classes choosing among seven wants to be satisfied by fourteen sectoral products, either domestic or imported. This multilevel CES demand system postulates different levels of substitution elasticities.

The treatment of foreign trade is relatively straightforward. Final consumption imports are presumably competing imports (m_c^c) and are derived from the multilevel demand subsystem as noted previously. Intermediate imports (m_c^{nc}), which are typically noncompeting, and capital inputs are derived as indicated previously through the multilevel production system. Exports (z_c), in contrast, are essentially assumed to respond to relative changes in prices of domestic to world goods and, as such, can be taken as exogenously given.

In summary the flow diagram of the model presented in figure 10.2 clearly reveals a pentagonal structure. The distinction between production activities and commodities can be justified in this specific case only by the fact that commodity demand can be satisfied by either domestic production activities or competing imports. Otherwise the use of an identical classification scheme for activities and commodities would render this distinction meaningless.[28]

As in the two previously reviewed models, the process of determining prices endogenously is a crucial feature of the present model. The multilevel sectoral CES production functions are converted into corresponding price functions, since in equilibrium costs are duals of quantities. Thus, the multilevel production cascade given in figure 10.5 can be translated into a corresponding set of cost functions. An elaborate and rather complex algorithm is designed to solve for a consistent set of prices. Of particular interest is the treatment of labor markets and wage determination. Two alternative approaches are postulated, a Keynesian approach and a neoclassical one. Under the first approach money wages are assumed to be fixed, and the model is solved for labor demand by skill groups; under the alternative neoclassical specification, labor demand is equated to exogenous labor supply.

As in the Lysy-Taylor model, nominal investment is determined exogenously (presumably influenced by "animal spirits"). A fixed-capital matrix linking capital by sectors of origin to sectors of destination is postulated as well.

A number of static laboratory experiments were undertaken on the model. The most important exogenous policy changes that were introduced are: (a) variations in the level of demand for investment, exports, and government expenditures; (b) government intervention in affecting key relative prices such as devaluation, taxes on labor, and taxes on capital; and (c) changes

28. Of course, the conceptual distinction between activities and commodities can be meaningful when the classification schemes are different and the number of commodities is different from that of activities.

in resource endowments of the economy and, in particular, increasing the supply of higher skilled labor classes. These experiments were run under two alternative model specifications and solution algorithms. The first specification, as previously indicated, assumes unemployment of labor and constant money wages. Given these money wages the model can be solved for the level of employment by skill categories, which is determined by the demand for these skills at the prevailing wage rates. Under the alternative neoclassical specification, labor supply by skills is exogenously determined and the model is used to solve endogenously for the corresponding equilibrium wage rate.

CONCLUDING REMARKS AND SUGGESTIONS

On the basis of the preceding comparative evaluation of development planning models based implicitly or explicitly on a SAM framework, a number of suggestions can be made to modify and improve the organizational framework of the SAM and the specification and design of corresponding planning models. These suggestions fall into five categories: (a) the treatment of structural changes and reforms particularly as they relate to changes in asset distribution (such as land reform) and in the resulting factorial and household income distributions; (b) the treatment of the agricultural and informal sectors, particularly with respect to the appropriate level of disaggregation and the classification criteria used to break down production activities; (c) the incorporation of some regional dimensions; (d) the treatment of basic needs and the measurement and identification of poverty by socioeconomic household classes; (e) the limitations of using neoclassical or Keynesian equilibrium assumptions in closing these models through market clearing mechanisms at the product and factor levels, and the scope for an alternative disequilibrium approach. It will be seen in the subsequent analysis that these five issues are, at least to some extent, interrelated.

Changes in Asset Distribution

A universal finding shared by the six models reviewed in this chapter, as well as by other such models, is that the size distribution of income remains stable even under significant policy changes. The relative degree of poverty as a whole is much less affected than the composition of the poor.

There appear to be two major reasons for this outcome. First, the great majority of the policy experiments and simulations undertaken in these models rely on rather conventional packages of policy instruments instead of structural changes or reforms, to use Tinbergen's terminology. Second, the household income distribution is derived rather mechanically from the factorial (functional) distribution.

Policy instruments consist of marginal changes in the quantitative magnitude of means under the control of the government within a structural and institutional setting that assumes as specifically given the asset distribution among households. In contrast, structural changes and reforms entail fundamental changes in the underlying institutional setting, including changes in the asset (wealth) distribution. Three different types of wealth might fruitfully be distinguished: (a) human capital, in the form of educational and skill levels possessed by individuals; (b) the land tenure system, including property rights or tenure arrangements with respect to land; and (c) the ownership of and access to other forms of capital. It is only with respect to human capital (changes in the composition of skills among households) and to a very limited extent land tenure (the simulation of a moderate land reform in the Adelman-Robinson model) that the second-generation models incorporated changes in the asset distribution of their policy simulations. The major policy experiments undertaken in these models are listed in table 10.9.

It was seen in the preceding section that both the Adelman-Robinson and Ahluwalia-Lysy

models used a household composition matrix to map the factorial income distribution into a household income distribution and to reflect exogenous changes in the educational and skill levels possessed by different household categories. To some extent, the household composition matrix is a device for incorporating the wealth distribution by household category explicitly as a major element predetermining the household income distribution. This matrix determines the composition of each household category in terms of the various factorial classes, where the classes could include, at least conceptually, different labor skill groups and diffferent groups of proprietors and farmers defined according to farm size and land ownership. As such, the classes can take into account implicitly, if not explicitly, the differential skill levels possessed by households as well as the average land and capital available to individuals in each of the factorial and household groups.

Thus, this formulation is an interesting first attempt at incorporating the wealth or asset distribution into a planning model. However, to the extent that the wealth distribution is a crucial determinant of the household and size income distributions, it appears essential to incorporate explicitly the household wealth distribution as one account within the SAM. This could be done, for instance, by adding an account for domestic factor endowments as indicated previously in connection with table 10.2. The corresponding matrix ($T_{6,9}$ in table 10.2) would extend the coverage of the household composition matrix to land and capital ownership in addition to skills.

The inclusion of the initial distribution (in terms of educational skills, land, and capital) among household groups in a SAM data system and the conceptual treatment of the effects of changes in the asset distribution on the structure of production and technology and thereby on the factorial and household income distribution would greatly enhance the operational usefulness of the SAM approach. Thus, for example, a land redistribution may have an important impact on the cropping pattern and the technology that is adopted. A land reform process that would entail the breakdown of large holdings previously cultivated by tenants and landless workers into small private farms might well trigger a technological shift away from mechanization and tractorization to the use of labor-intensive techniques in the production of the same crops. It might also lead, to some extent, to a shift in the composition of output away from relatively capital-intensive crops to labor-intensive products.

It is clear that such a process of land redistribution would have a major impact on the factorial income distribution, as rent would accrue to the new small landowners who were formerly tenants and hired workers. In turn, the size distribution of income may be affected in a significant way through, for instance, the reduction or disappearance of landless workers and tenants. In summary, the incorporation of an initial domestic factor endowments account and the design of the link between the asset distribution and the resulting factorial and household income distributions are crucial elements to make the SAM more useful both as a data system and as a conceptual framework.

Treatment of the Agricultural Sector and Informal Activities

A second important issue is the inadequate treatment of the agricultural sector and, in a more general sense, of traditional and informal activities inside and outside of agriculture. None of the six models breaks down agricultural production activities into more than two sectors—the most disaggregated treatment is that of Adelman and Robinson, who divided the two agricultural sectors into four farm sizes.

It can be argued that for a number of reasons this consolidation of all agricultural production into only two activities is, at best, inappropriate and, at worst, an important source of bias through the process of averaging out very different agricultural income classes. The point is that the standard of living of agricultural households is largely determined by their land tenure

status (whether they are small or large landowners, tenants, or landless workers hiring themselves out), their cropping pattern, and the technologies adopted. The cropping pattern, in turn, is related to regional agroecological factors. It seems essential that models explaining the determination of income distribution should attempt to capture the diversity among all three of these elements.

This differential production pattern and its implications with respect to income distribution can be approximated by an appropriate classification of agricultural production activities. It is suggested that these activities be broken down according to the following criteria: (a) the nature of the crops and agricultural products; (b) the type of technology used (for example, traditional and almost totally labor-intensive methods, intermediate methods relying on chemical and biological inputs such as fertilizer and high-yielding varieties of seed, and capital-intensive methods relying on mechanical energy such as tractors); (c) the form of organization and the tenure system to reflect, for instance, the impact of different farm holdings by size on the incomes accruing to the cultivators; and (d) regional variables such as soil type.

These criteria tend to be significantly interrelated in the real world. Thus, it is typical for large farmers to produce export crops under relatively capital-intensive technologies in specific regions. In contrast, small farm owners often produce a combination of food and cash crops using a traditional labor-intensive technology, or alternatively, an intermediate technology in different regions. The fact that these criteria are often systematically interrelated makes it easier to design an operationally useful classification scheme of agricultural production activities. Furthermore, there exists a wealth of information in many developing countries on the determinants of agricultural production from such varied sources as farm management studies, farm surveys, and integrated rural surveys.

A concrete problem facing builders of SAMs and SAM-type models is the treatment of agriculture in input-output tables. It is either too consolidated in a small number of subsectors or the classification scheme is based on the commodity structure alone rather than on other relevant criteria such as type of technology, form of organization, and tenure system. In such cases, an attempt should be made to combine various sources of information in order to improve the breakdown of agricultural activities.

Just as it is desirable to classify agricultural production activities according to technology and form of organization in addition to the nature of the product, such a distinction should be attempted outside of agriculture as well. More specifically, goods and services produced under informal, small-scale, labor-intensive conditions should be distinguished from those produced under formal, large-scale, capital-intensive conditions. The types of production functions underlying modern manufacturing and formal services are totally different from those underlying workshop-type output and informal services. Likewise they yield very different flows of value added and resulting factorial income streams. Again, a shortcoming of the models is that they did not introduce this distinction, relying instead on input-output information.

In addition to distinguishing between formal and informal activities in the urban areas, a serious attempt should be made to model the rural nonagricultural activities separately from, say, the informal urban activities. Underlying this recommendation is the fact that a large number of rural households derive their incomes from a combination of employment in agricultural and nonagricultural activities. Given the highly seasonal variability in agricultural employment, off-farm activities provide a means to absorb what would otherwise have been seasonal underemployment on the part of the agricultural labor force into additional effective employment in a seasonally complementary way. The effects of increasing effective employment of the rural labor force through the design of appropriate rural nonagricultural activities, such as construction and public work projects, can contribute significantly to raising the incomes of certain household groups such as landless workers.

In conclusion, the type of breakdown suggested here with respect to agricultural and informal

activities outside of agriculture appears to be essential in capturing and reflecting the underlying dualism that prevails in most developing countries.

A Regional Dimension

Another feature that has not yet been systematically incorporated in the planning models is a regional breakdown. In many instances differences in the output mix and the pattern of production in agriculture can be explained by interregional differences with respect to such variables as agroecological factors, soil fertility, the extent of irrigation and rainfall, and the amount of social overhead capital in support of agricultural production. Thus, to the extent that differences in living standards among different groups of households are significantly influenced by regional elements, it is important to include this regional dimension in a SAM.

Another important advantage of the explicit inclusion of the regional dimension into a SAM conceptual framework is that a large number of policy means tend to be location-specific. These may include investment projects; current government expenditures on services such as credit, extension, health, and education; and price policies with respect to commodities and inputs at least to the extent that the production of specific commodities is regionally concentrated.

Whereas in principle there are compelling reasons for adding a regional dimension to the SAM, in practice there are serious difficulties on the data side. Clearly, in the absence of a set of interregional social accounts, which are not available on a systematic basis in any country (developed or developing), production activities and interregional trade cannot be expressed in the form of an integrated set of interregional input-output tables.

Given the data limitations there are two alternative procedures which suggest themselves and which appear to be feasible within the context of many developing countries. The first procedure would be to divide the economy into a very small number of regions and divide production activities into those that are typically national and those that are more regional in character. National activities would be those characterized by economies of scale and reasonably low transportation cost and would in many instances be produced in the modern sector or, in other words, the industrialized region which often coincides with the larger urban centers embracing the capital city. Thus, in this type of specification the regional dimension would be introduced only with regard to the production accounts which, in turn, would be broken down into national production activities and a small number of regional production activities.

A second more modest and perhaps more realistic alternative procedure for capturing some of the regional effects of production consists of breaking down the factor and household accounts along regional lines without using a regional classification of production activities. Hence, the mapping from production activities to factors of production (V_{sj} in table 10.11, for example) would allocate the value added generated by the various national production activities to factors where at least some of the factors were defined on a regional basis. A specific example might be the allocation of value added generated by agricultural production activities to regional groups of smallholders. Likewise, the mapping from the factorial to the household income distribution, particularly if it was based upon a household composition matrix, would yield a regional income distribution for at least some household groups.

This type of information can be quite valuable in those instances where there exist marked interregional income differences which can be accounted for by differences in the pattern of interregional production—particularly in agriculture. In Kenya, for example, the findings of a large-scale integrated rural survey suggest that very significant interregional income differences prevail among smallholders. Both these interregional and intraregional differences in the standard of living among different classes of smallholders can to a large extent be explained by the pattern of production. Two studies by the author have demonstrated the possibility of an approximate mapping from the structure of production to the factorial and household income distribution (see Crawford and Thorbecke, 1978).

Basic Needs

The standard of living of different individuals and households is to a large extent related to their income level or, better, their total consumption levels. Yet it is clear that a scalar concept such as the value of total household consumption expenditures, even when all government services are imputed, reflects only imperfectly the degree to which the basic needs of a household are met. There are at least two reasons why this should be so.

First, total consumption may be allocated very unevenly among the goods and services which fulfill the various private needs such as nutrition, shelter, and clothing, and public needs such as education and health. Consequently, it is conceivable that some basic needs might be over-fulfilled, whereas others might be only inadequately met. This imbalance is all the more likely with respect to the public needs, because the imputed consumption of these services depends largely on current and capital expenditures by the government and as such is outside the direct control of any given household.

A second reason why total household consumption is an inadequate measure of a household's physical well-being is that well-being can only be expressed meaningfully in terms of physical or quantitative units and not in value terms. Indeed, the adequacy of a diet from a nutritional standpoint needs to be expressed in terms of such indicators as number of calories or grams of protein per day per adult equivalent, while the adequacy of shelter might be expressed as a function of the number of square meters of shelter per adult equivalent and the quality of building material. Likewise, the adequacy of education is reflected by such criteria as the student-teacher ratio, the level of education of teachers, and the average distance from residence to school; health services may be measured by the ratio of doctors to inhabitants, the distance to the nearest health dispensary or hospital, the frequency of diseases, and life expectancy. Since prices differ significantly from one region to another and, in some instances, among different household groups within the same region, any serious attempt at identifying pockets of poverty should include for each of the distinct household categories (which are likely to represent distinct socioeconomic groups), physical or quantitative measures of the degree of satisfaction for each of the basic needs.

In this fashion it should be possible to obtain a profile of need satisfaction for average households, in each of the relatively homogeneous socioeconomic categories. This type of information can be incorporated into a SAM through the wants accounts, as long as the classification of wants embraces the major needs. (See tables 10.2 and 10.12 for examples of SAMs that contain wants as a separate account.) However, it should be recalled that the wants account in a SAM data system contains entries expressed in value terms and not in physical terms. Hence, in the light of the previous discussion, these value terms for the subset of wants consisting of basic needs would have to be converted into physical units by using the appropriate prices faced by each category of households. This means, for example, that the matrix $T_{1,3}$ in table 10.2 (the intersection of the row of wants and the column of households), or alternatively, the matrix W_{wk} in table 10.12 would need to be expressed in physical terms, at least for that part of the matrix representing basic needs. In order to judge the well-being of each household category with regard to such needs, the prevailing conditions as given, for instance, in an initial SAM would have to be gauged against some threshold levels considered minimal with regard to some normative definition of poverty.

The incorporation of a way to measure the degree of satisfaction of needs by household categories in a SAM should not imply an endorsement of a so-called basic needs strategy in contrast, for instance, to a strategy of growth with redistribution or asset redistribution with growth. Rather, the reason for incorporating basic needs in a SAM is, first, for diagnostic purposes so as to identify poverty groups. Second, the effects of different development strategies on need satisfaction and other policy objectives can be simulated within a SAM-type conceptual model if the various transformations discussed above are explicitly incorporated in the model.

Equilibrium and Disequilibrium Specifications

The six models that have been reviewed relied on either Keynesian or neoclassical specifications upon which, in some cases, institutional constraints were superimposed. Crucial to both of these types of specifications is the concept of equilibrium and maximizing behavior on the part of consumers and producers. Equilibrium in the markets for products and factors requires that markets are totally cleared, that is, that all excess demands are zero.

It could be argued that, in fact, equilibrium in that sense is never reached and excess demand, or supply, always prevails. More exactly, the adjustment mechanism that moves the system from one time period to another could be expressed as a function of the prevailing disequilibrium situation. Thus, for example, excess supply of a given commodity in period t would be reflected by increases in stocks and a tendency for prices to fall to a new level in the next period. This fall in price could be related to the rate of increase in stocks. Any change in this rate or reversal would be translated into corresponding price movements. In this sense the system would move from one disequilibrium situation to another over time.

A disequilibrium specification appears to reflect best the operation of labor markets. It has already been argued—in the discussion of the Ng model—that any prevailing (or assumed) discrepancy between the labor force (or labor availability), on the supply side, and labor requirements, on the demand side, tends to be adjusted in developing countries through a combination of changes in: (a) overt unemployment, (b) underemployment, and (c) the wage rate (the hourly or daily rate). For a number of skills, such as farm workers and unskilled workers in nonagricultural activities, the labor markets operate in such a way that (a) overt unemployment tends to be very low and stable and (b) the wage rate remains very stable over a long development stage characterized by labor surplus. Consequently, the burden of the adjustment process falls on the extent of underemployment, that is, the effective employment rate per member of the economically active population.

This process has been verified empirically in a number of developing countries. Thus, it has been demonstrated that in agriculture the number of man-days of work per year per member of the labor force tended to rise very significantly over an extended period before the labor shortage point was reached, and to be reflected in an increase in the wage rate.[29]

Neither the Keynesian nor the neoclassical specifications which were adopted to reflect the workings of labor markets in the models reviewed describe the above adjustment process accurately. It is, of course, unfair to criticize models for using the only specifications that are founded on existing deductive theories. It may not be unfair, however, to suggest that certain processes may be empirically tested and explained through inductive methods rather than derived deductively from an existing body of theory that does not fit the underlying relationships. It seems that SAM-type models could and should experiment with new specifications which can be empirically tested and, it is hoped, confirmed.

The underlying dynamic processes might be tracked more realistically by a recursive (period to period) adjustment mechanism that would not impose a market-clearing condition but would explain empirically changes in prices and levels of inputs and outputs as functions of the tensions which prevail in each period. [30] Clearly, such a disequilibrium approach must be based on a detailed and comprehensive data system to generate and test the empirical relationships among variables. The SAM can help provide this data set upon which more empirical specifications might be built.

29. In Taiwan, for example, the number of man-days of work per year per worker rose from slightly above 100 in 1946 to about 200 in the late sixties at which time the agricultural wage rate started moving up.

30. The Adelman-Robinson "lurching equilibrium" concept described previously is, perhaps, a step in this direction. Nevertheless the underlying specification of product and factor markets is still essentially neoclassical in their model.

11

Social Cost-Benefit Analysis in a Semi-Input-Output Framework: An Application to the Muda Irrigation Project

Clive Bell and Shantayanan Devarajan

Investment projects affect the incomes of households, firms, and government, not only directly through the value added produced by the projects themselves, but also by inducing additional output through interindustry linkages and the expenditures out of the extra incomes accruing to their beneficiaries. The latter, which are sometimes called the "multiplier" or "downstream" effects of a project, have been discussed in some of the recent literature on social cost-benefit analysis (see Scott, 1976), which has been concerned with the derivation of shadow prices which capture all such effects in full. If these shadow prices are correctly calculated, so it is asserted, then valuing a project's direct inputs and outputs at these prices yields the right measure of its social profitability. This approach is in the spirit of, and consistent with, that of the various manuals on social cost-benefit analysis (UNIDO, 1972; Little and Mirrlees, 1974; Squire and van der Tak, 1975).

This paper also deals with the problem of allowing fully for multiplier effects in project evaluation, but approaches it on a different tack. Here, the total (direct and indirect) impact of a project on outputs, incomes, savings, and expenditure, which are the elements entering into the calculation of social profits, is derived using a linear model of the economy which is both an extension and an elaboration of Tinbergen's (1966) semi-input-output framework. In other words, we follow the "primal" route of quantity and income flows rather than the "dual" route of shadow prices. This use of the notion of primal and dual is more than suggestive, for there is an intimate connection between the model developed in this paper and that which underlies the manuals. Although this connection will not be analyzed in detail here, the concepts and formulations that the two approaches share will be discussed as they appear.[1]

To illustrate our method, we apply it to an evaluation of an existing large-scale irrigation project in northwest Malaysia, the Muda River scheme. The main reason for the choice of this particular project is that a semi-input-output model of the project's impact on the Muda region already exists (Bell and Hazell, 1980) and there is an excellent data base in the form of a SAM for the Muda region (Bell, Hazell, and Slade, 1982, ch. 5). The general model is set out in the next section. Following sections deal with the specific application to the analysis of the Muda irrigation project, with the estimation of certain national parameters that are indispensable for the calculation of social profitability.

Note: An earlier version of this paper appeared in Pakistan Development Review (Bell and Devarajan, 1979) and, with further revision, as chapter 8 of Bell, Hazell, and Slade (1982).

1. Wanhill (1974) and Kuyvenhoven (1975) have tried to synthesize the Little-Mirrlees and semi-input-output approaches without alluding to the primal-dual distinction. In another paper (Bell and Devarajan, 1980), we show why their approach may have departed from the spirit of Little and Mirrlees. The only other empirical application of a similar nature known to us is by Seton (1973), who attempts to calculate shadow prices for Chile, allowing for output- and expenditure-linkage effects. Unfortunately, as noted in Bell and Devarajan, Seton's otherwise commendable paper is marred by a theoretical flaw.

THE MODEL

The model is a variant of Tinbergen's (1966) semi-input-output framework. At this point, the model is best thought of as one of a national economy, although its application to a regional context is discussed in the next section. The M production activities in the economy are divided into two groups: those producing tradables and those producing nontradables.[2] The former have parametrically fixed output levels, that is, they operate at full capacity, so that variations in demand are met entirely by changes in net exports. Changes in demand for nontradables, however, are met solely by adjustments in domestic output. The latter sectors either have excess capacity, in which case they are producing at constant marginal costs, or they add just enough new plant and equipment to satisfy demand, in which case production takes place at constant average costs. It is also important to note that this classification of sectors is not necessarily a statement about whether the commodities they produce are, in fact, traded. Rather, the distinction is whether changes in domestic demand are met by changes in net exports or domestic output. To keep the national income accounts consistent, it is necessary to introduce a third type of sector—for distribution and transportation services—since export activities, both exogenous and endogenous alike, purchase those services domestically.

Material Balances

The subscripts T, D, and N denote the set of tradable, distribution/transport, and nontradable sectors, respectively. The rows and columns of the fixed coefficient technology matrix, A, are ordered so that it can be partitioned as follows:

$$A = \begin{bmatrix} A_{TT} & A_{TD} & A_{TN} \\ A_{DT} & A_{DD} & A_{DN} \\ A_{NT} & A_{ND} & A_{NN} \end{bmatrix}$$

The submatrix A_{TN}, for example, represents the inputs of tradables required by the nontradable sectors when the latter are operating at unit activity levels.

The material balance equations for the economy are:

$$X_T = A_{TT}X_T + A_{TD}X_D + A_{TN}X_N + C_T + G_T + J_T + E_T \tag{11.1}$$

$$X_D = A_{DT}X_T + A_{DD}X_D + A_{DN}X_N + C_D + G_D + J_D + \mu E \tag{11.2}$$

$$X_N = A_{NT}X_T + A_{ND}X_D + A_{NN}X_N + C_N + G_N + J_N + E_N, \tag{11.3}$$

where

$X = [X_T, X_D, X_N]$ are gross outputs.

$C = [C_T, C_D, C_N]$ are consumption demands.

$G = [G_T, G_D, G_N]$ are government demands.

$J = [J_T, J_D, J_N]$ are private investment demands.

$E = [E_T, E_D, E_N]$ are net exports demands.

2. Tinbergen calls these two types of sectors "international" and "national." To highlight the relationship of our approach to that of Little and Mirrlees, we have adopted their terminology.

Note that

$$E_D = \mu[E_T, E_N],$$

where μ is the matrix of trade and transport margins on net commodity exports accruing to the domestic economy.[3]

Now equations (11.1) through (11.3) are expressed in physical units. By choosing units of physical measure such that all domestic prices are unity, the same equations would result if everything were measured in value terms, provided the user price of each commodity (net of transport and distribution margins, which may vary across users) is the same for all users.

Incomes

The vector of incomes $Y = [Y_1, \ldots, Y_L]$ earned by the L household types in the economy is determined by direct earnings in production and distributed profits. Let v_{kj} and ω_{kj} be the direct earnings and dividend payments, respectively, accruing to the kth household type for each unit of output produced by industry j. Then,

$$Y = (V + \Omega)X, \tag{11.4}$$

where $V = \|v_{kj}\|$, $\Omega = \|\omega_{kj}\|$.

Consumption

The gross income of household class k is used to pay lump sum taxes, $\bar{T}_k$, and income taxes, $\tau_k Y_k$; a constant share, s_k, of posttax income is saved. A fixed proportion of its marginal income is also spent on the consumption of each good. These proportions are given by the matrix B, where β_{ik} is household k's marginal propensity to consume good i. Denoting the intercept terms of these consumption functions by γ_{ik}, and noting that domestic prices are normalized to unity, we have

$$C = \Gamma u + B(I - s)[(I - \tau)Y - \bar{T}], \tag{11.5}$$

where $\Gamma = \|\gamma_{ik}\|$; $(I - s)$ and $(I - \tau)$ are diagonal matrices whose kkth elements are $1 - s_k$ and $1 - \tau_k$, respectively; $\bar{T} = [\bar{T}_1, \ldots, \bar{T}_L]$; and u is a column vector of ones.

Government

Government derives its revenue from direct taxes, tariff collections, and ownership of state corporations. In addition to income taxes, the government collects corporate taxes, which are denoted by $\tau_F \zeta' X$, where τ_F is the corporate tax rate and ζ' is the vector of profit margins on gross outputs. Letting δ_G be the vector of profit margins on state-owned corporations, the government's receipts from these enterprises are $\delta' X$. Finally, let P_i be the ratio of the world price to the domestic producer price of good i, where the vector P is exogenously given. Then government revenue from tariff collections is $[P' - (u' + \bar{\mu}')]E$, where u' is a row vector of ones and $\bar{\mu}$ is the vector of total trade and transport margins on net exports which accrue to domestic producers.[4]

3. As these margins are earned on gross rather than net flows, the above formulation is strictly correct only when there are no competitive imports of characteristic commodities which are exported. In the present application, that is a fair approximation to the observed trade patterns. The transport and distribution margins on noncompetitive intermediate and consumer goods are included in A_{DT}, A_{DD}, A_{DN}, and C_D, respectively. Noncompetitive imports may be placed in category T, the corresponding element of X_T being zero.

4. When the sum of the trade and distribution margins ($\bar{\mu}_j$) on net exports of a commodity accrue to domestic producers, the extariff f.o.b. (free on board) price of the exports is $(1 + \bar{\mu}_j)$.

We now assume that the government spends exactly what is received in revenues.[5] The bundle (G) of government purchases is given by: a vector (C_G) of obligatory purchases for current consumption (education, health, and so forth), a vector (K) of exogenous outlays on investment goods (project-related expenditure), and a residual whose composition is fixed. The latter is given by the vector ϕ, where ϕ_i is the government's outlay on goods from sector i out of each domestic currency unit of the revenue remaining after outlays on current consumption and the project in question. We have, therefore,

$$G = K + C_G + \phi u' (G - K - C_G). \tag{11.6}$$

Equating the government's purchases to its revenue yields

$$u'G = t'Y + u'\bar{T} + (\tau_F\zeta' + \delta')X + (P' - (u' + \bar{\mu}'))E, \tag{11.7}$$

where $t' = (\tau_1, \ldots, \tau_L)$.

It is now necessary to relate government revenues (and purchases) as defined here to the concept of "uncommitted social income, measured in terms of convertible foreign exchange," which is the numeraire advocated by Little and Mirrlees (1974, pp. 145–51). In our model, the impact of a project on government revenue in a particular period is simply the change in u'G associated with the project, that is, the difference between u'G in equilibrium with the project and u'G in equilibrium without the project. As K is the set of government purchases required to put the project into effect, the change in $u'(G - K - C_G)$ arising from the project will measure the change in social income available for commitment to other uses only if there is no change in public consumption, C_G. However, this change in "uncommitted social income" will indeed take the form of a change in the holdings of foreign exchange reserves only under special conditions. Because the government can exchange one tradable good against another in any quantity it desires at fixed world prices, a necessary condition for its marginal income to be uncommitted, in the sense that the composition of its marginal purchases does not matter, is that there are no allocations for the purchase of nontradables, that is, that ϕ_D and ϕ_N are both zero. Hence, by setting all values of ϕ_i in equation (11.6) equal to zero, except those for noncompetitive imports (which will be unity), and by keeping C_G invariant with respect to K, the project's effects on uncommitted social income, measured in terms of noncompetitive imports, is simply the associated change in $u'(G - K - C_G)$. Measured in terms of convertible foreign exchange, the change in uncommitted social income is, therefore, the change in $u'(G - K - C_G)$ times the ratio of the world to the domestic price of noncompetitive imports.[6]

Savings and Investment

A crucial feature of the model developed here is that private investment is assumed to be financed solely by private (household and corporate) savings. Although this is a plausible assumption in a national setting over the long run, it introduces certain difficulties in the context of a regional economy, which will be discussed in a later section.

Taking corporate savings to be equal to undistributed net-of-tax corporate profits, we have:

$$u'J = u'\hat{S} + [(1 - \tau_F)\zeta' - u'\Omega]X, \tag{11.8}$$

where the vector of household savings is given by

$$\hat{S} = s[(I - \tau)Y - \bar{T}]. \tag{11.9}$$

5. The alternative is to assume that the government's total outlays, including those on the project, are given exogenously. In this case, any difference between revenues and outlays must show up as an equal change in foreign borrowing if private agents are on their budget lines. For a full discussion, see Bell and Devarajan (1983).

6. This is a consequence of the fact that the economy is in balance of payments equilibrium, as is shown later in this section.

Investment demand in this model has two components. First, "balancing" investment may be needed to release capacity bottlenecks in the nontradable sectors as the economy moves from one steady state to another: this is denoted by the vector H. Second, there is "voluntary" investment, which is taken to be the residual investable funds allocated in fixed proportions (ψ_i) across the various sectors. Thus,

$$J = H + \psi u'(J - H). \tag{11.10}$$

It should be noted that in order to value private investment in the social cost-benefit calculation, we must know the distribution of investment demands among households (since, presumably, investment by poor households will be socially more valuable than that by rich ones). As our data do not permit this level of disaggregation, however, we must represent private investment by a single vector, implicitly assuming that the composition of investment demand is the same across all private institutions.

The particular set of assumptions we have made also guarantees balance of trade equilibrium for the economy, that is, $P'E = 0$. This is readily seen by adding equations (11.1) through (11.10) and setting prices equal to costs at domestic prices.

Labor Supply

When a project is undertaken, one of its direct effects is to increase the demand for labor, both during the construction phase and when the project is producing output. The laborers thus employed would otherwise have been idle or engaged in some other activity, depending on whether there was full employment to start with.[7] As we are dealing with a general equilibrium system, the total effects of a project will, of course, usually differ from its direct effects. Yet the central question remains, Where is the labor coming from? Since the output of nontradables is driven by the level of domestic demand, the ultimate source of labor to the economy, in the sense that all adjustments in the total demand for labor elsewhere in the economy fall upon it, is a subset of sectors producing tradables and the pool(s) of unemployed.[8]

If labor is perfectly mobile and homogeneous and its supply is perfectly inelastic, we have

$$\ell'X + L_p = \bar{L},$$

where $\ell' = (\ell_1, \ldots, \ell_M)$ is the vector of labor-output ratios; L_p is the pool of unemployed workers; and $\bar{L}$ is the total labor force. This equation implies nothing about which classes of households reallocate their labor in response to changes in output, and it will be consistent with equation (11.4) only if there is but one class of household. When there is more than one such class, there is, in effect, more than one sort of labor, or "characteristic factor." The appropriate generalization to the case of L household classes is immediate:

$$\Lambda X + L_p = \bar{L}, \tag{11.11}$$

where $\Lambda = \|\ell_{kj}\|$ is the matrix of labor-output ratios, and L_p and $\bar{L}$ denote vectors whose elements are the pools of unemployed workers and total workforces, respectively.

Solving the Model

The linear system (11.1) through (11.11) has $4M + 2L$ linearly independent equations in $5M + 2L$ variables. Hence, to solve the system, M of the variables must be specified exogenously. There are two cases of interest.

7. If, initially, there were some unemployment of (mobile) labor and the project were big enough, the project would draw off labor from other sectors as well as exhaust the pool of unemployed.

8. There may be more than one such pool if labor is not perfectly mobile and homogeneous.

First, if there is unemployment of all kinds of labor ($L_p > 0$), (11.11) can be ignored. In this case, we fix the levels of outputs of tradable goods, X_T, and the levels of (net) exports by sectors in the subset N, so that the system is solved for E_T, E_D, X_D, X_N, and Y. The system may be written compactly as follows:

$$\begin{bmatrix} R_{11} & R_{12} \\ -(V + \Omega) & I \end{bmatrix} \begin{bmatrix} X \\ Y \end{bmatrix} = \begin{bmatrix} R_{13}E + R_{14} \\ 0 \end{bmatrix} \tag{11.12}$$

where

$$R_{11} = I - A - \phi(\tau_F\zeta' + \delta') - \psi[(1 - \tau_f)\zeta' - u'\Omega]$$

$$R_{12} = -[B(I - s)(I - \tau) + \phi t' + \psi u's(I - \tau)]$$

$$R_{13} = \phi[P' - (u' + \bar{\mu}')] + I$$

$$R_{14} = \Gamma u + B[(I - s) + (\phi - \psi)u']\bar{T} + (I - \phi u')H + (I - \psi u')(C_G + K).$$

Second, for each instance in which there is full employment of one kind of labor, the output of a traded good (or a bundle of traded goods) becomes endogenous, as well as the exports of that good (or goods). This restores the degree of freedom lost whenever an element of L_p is zero, and so (11.11) becomes an effective part of the system, which may be written as:

$$\begin{bmatrix} R_{11} & R_{12} & 0 \\ -(V + \Omega) & I & 0 \\ \Lambda & 0 & I \end{bmatrix} \begin{bmatrix} X \\ Y \\ L_p \end{bmatrix} = \begin{bmatrix} R_{13}E + R_{14} \\ 0 \\ \bar{L} \end{bmatrix} \tag{11.13}$$

After suitable transpositions of columns and a simple rearrangement of variables, both variants of the above model can be represented in the following schematic form:

$$Z = A^*Q + A^{**}u, \tag{11.14}$$

where Q and Z are the vectors of exogenous and endogenous variables, respectively, and the system's parameters enter into the elements of the matrices A^* and A^{**}. The precise form of the scheme will, of course, depend on whether there is full employment of each and every kind of labor.

In all of the above cases, the levels of the endogenous variables represent their values when all responses to the exogenous variables are complete. We assume the system adjusts instantaneously when perturbed by a change in the exogenous variables.

Social Cost-Benefit Analysis

To determine the impact of a project, we must specify the values taken by the exogenous variables, Q, both in the presence of the project and in its absence, in each case solving for the endogenous variables, Z. If, as is usual, the project affects the technology employed in its own sector, or even elsewhere in the economy, one or both of the matrices A^* and A^{**} will be different in the two cases. Denoting the case in which the project is not undertaken by the superscript °, the difference between the ordered pairs of vectors (Q, Z) and (Q°, Z°) represents the project's impact on the economy.

How can the project's impact on outputs, incomes, savings, and so forth be used to determine the contribution of the project to social welfare in a given year? Following well-established tradition, the arguments of the instantaneous social welfare function are: private consumption; private savings over and above that needed to finance the balancing investments in the nontradables sectors; and uncommitted public income. Here, it will be assumed that the weights for private savings and consumption relative to uncommitted social income (the numeraire) are estimated so as to remain constant over the relevant ranges of these variables, ranges which

may be quite large. Hence, the social profit, ΔU, associated with the project for a unit time period is given by

$$\Delta U = u'(G - G^\circ - K) + \lambda'(\hat{C} - \hat{C}^\circ) + \xi'(\hat{S} - \hat{S}^\circ) + \xi_F[(1 - \tau_F)\zeta' - u'\Omega](X - X^\circ) - \xi_H H, \tag{11.15}$$

where the vectors λ and ξ denote, respectively, the social valuations of a unit increase in the levels of consumption and savings for each of the household classes; ξ_F is the social valuation of a unit of retained corporate profits; ξ_H is the social valuation of the savings which finance the balancing investment, H, whose composition by source may differ from that for savings as a whole; and $\hat{C} = (I - s)[(I - \tau)Y - \overline{T}]$ is the vector of household consumption levels.

It is important to note that (11.15) departs from Little and Mirrlees in that the weights λ, ξ, ξ_F, and ξ_H are applied to private consumption and savings measured at market, as opposed to accounting, prices. In their discussion of this choice, Little and Mirrlees (1974, pp. 236–37) seem to be concerned principally with the fact that different consumers may pay different prices for the same good. Faced with this difficulty, they suggest, as a shortcut, that consumers' expenditures be valued at accounting prices. Although we do not find this a very appealing suggestion for making "baskets" of goods purchased at different market prices comparable with one another, it is the only strictly correct way of comparing consumers' expenditures with uncommitted social income unless the consumer's consumption conversion factors happen to be the same. As Little and Mirrlees recognize, however, an assessment of equity among consumers requires comparisons of their expenditures (or incomes) at market prices, even though this may mean that incomes of two people which differ greatly at market prices may differ little at accounting prices—and hence be of roughly the same social value if this shortcut method is adopted.

We have formulated exactly this issue of equity among consumers at the possible cost of introducing some errors into the valuation of their expenditure relative to the numeraire. Indeed, since the method advanced here is designed to finesse the task of estimating accounting prices for nontradables and shadow wage rates, we have no choice in the matter. As for the possibility that different people may pay different prices for the same good, the region under study is blessed with a good transportation system. Moreover, the provincial capital is both modest in scale and readily accessible to all rural households, so that urban and rural cost of living indices probably differ little.

To complete the evaluation of the project, the stream of social profits—as given by equation (11.15)—generated by the project throughout its lifetime is discounted at the accounting rate of interest.

APPLYING THE MODEL TO THE MUDA IRRIGATION PROJECT

The model set out in the preceding section describes the flows within a national economy and those to and from the rest of the world. In applying the model to evaluate the Muda scheme, however, we employ data for its surrounding region, which encompasses the state of Perlis and the northern half of Kedah, in northwest Malaysia. Although the basic structure of the model is preserved for a regional economy, some additional considerations are necessary if the results are to be interpreted correctly.

First, there are primary commodities, like paddy and smoked rubber sheet, which do not normally enter international trade until they are processed, but instead are shipped in raw form from the producing region to other regions for processing. With the advent of irrigation in 1970, the surge in the region's paddy output resulted in substantial exports of paddy to rice

mills in southern Kedah and Province Wellesley. As for rubber, less than 15 percent of the output of the region's smallholders and estate sectors is processed within the region itself. Strictly speaking, therefore, these two commodities should be treated as tradables with respect to the region. Yet, the processing of paddy and rubber generates value added within the Malaysian economy, and the multiplier effects of this value added would go unaccounted for if the model were applied literally. To correct for this, processing activities outside the region are treated in the model as if they took place inside the region, which entails the assumption that technologies, the distribution of value added among households, and the levels of household incomes do not vary across regions. As this comparison involves northern Kedah, on the one hand, and southern Kedah and Province Wellesley, on the other, all of them contiguous, rather poor regions, the accompanying assumption seems defensible.

Second, by no means is the whole of private savings invested in the region itself. The outflow of private capital from the region, much of it through the banking system, was especially large in 1972 and for some years thereafter. Very little is known about the uses to which these savings have been put, and for want of anything better it has been assumed that they have been used to finance the purchase of a bundle of investment goods whose composition is the same as that of the region's own investment activities. As all private savings are invested in the model presented above, the procedure adopted here is tantamount to incorporating within the region those activities making deliveries to meet investment demands from outside the region which are also financed by the region's savings.

Third, there is a stream of seasonal workers into the Muda region during the paddy harvesting period. Some of these agricultural workers come from southern Kedah and Kelantan, but others come from Thailand. The former belong to households whose incomes are, in all probability, at best equal to those received by landless paddy farm households in the Muda region. Hence, at one extreme, the migrants' seasonal earnings could be simply lumped in with those of Muda's landless households, on the assumption that the output forgone in their home regions is zero. Alternatively, it can be assumed that their seasonal earnings in Muda are exactly equal to the output forgone elsewhere in the economy, both valued at market prices. The assumption underlying the results presented below rests somewhat uneasily in between, inasmuch as all payments to seasonal workers, Malay and Thai alike, are treated as imports used in paddy production. This is undeniably rough and ready, but the sums involved are small and hardly worthy of more elaborate treatment. However, there is one respect in which payments to Malay and Thai seasonal workers must be distinguished: presumably the Malaysian government attaches no social value to extra income enjoyed by Thai workers, whereas it ought to smile on additional income accruing to poor Malay agricultural workers. For this reason, payments to Malay seasonal workers must feature in an appropriate way in the calculation of the project's stream of social profits.

The next step in the calculation of the project's social profitability is to set up a pair of vectors of exogenous variables for each year of the project's expected lifetime, one denoting the estimated actual values of such variables and the other their estimated values in the hypothetical event that the project had not been undertaken. Construction work on the project began in a small way in 1965, reached a peak in 1967 and 1968, and then tailed off steadily to completion in 1974. Irrigation commenced on a small scale in 1970, about three-quarters of the project command area was served in 1972, and the project attained full maturity in 1974. However, 1974 was also an abnormal year for the ratio of the domestic to the world price of rice, and that ruling in 1975 seems more representative of the conditions likely to hold over the project's lifetime. Hence, assuming that a steady state ruled after 1975, this chronicle of events appears to entail the estimation of no fewer than twenty-two separate vectors of exogenous variables—a daunting task indeed.

Fortunately, it turns out that during that part of the project construction period when no

output is produced, it suffices to estimate the two sets of exogenous variables for just one year. For recall from equation (11.14) that so long as A^* and A^{**} are unchanged, that is, there are no changes in technology and expenditure propensities, the change in the levels of the endogenous variables is given by:

$$Z - Z^\circ = A^*(Q - Q^\circ). \tag{11.16a}$$

Now if during this phase of the project, the members of the sequence of exogenous vectors $Q - Q^\circ$ are scalar multiples of one another—in this case, $Q - Q^\circ$ is the project's demand for investment deliveries from the construction sector—the members of the sequence $Z - Z^\circ$ are likewise. Hence, once the sequence of $Q - Q^\circ$ has been estimated, it is enough to estimate one member of the sequence of $Z - Z^\circ$ in order to arrive at the rest. The year actually chosen for this purpose is 1967, in keeping with the discussion in Bell and Hazell (1980), from which the estimates of most of the parameters of the system are drawn.

Once the project begins to produce output, however, A^* will change continuously until the project reaches maturity. Hence, in principle, it is necessary to estimate

$$Z - Z^\circ = A^*Q - A^{*\circ}Q^\circ \tag{11.16b}$$

for all years after 1970, the matrix A^{**} being unaltered by the project.

In the present case, the pair of vectors (Q, Q°) had already been estimated for the years 1967, 1972, and 1974 in connection with the model in Bell and Hazell (1980). To keep the amount of additional work within reasonable bounds, it was decided to estimate $(A^*, A^{*\circ})$ and (Q, Q°) for 1970 alone and to use linear interpolation in order to arrive at the values of relevant variables for the intervening "transitional" years, 1971 and 1973. In brief, the paddy production technologies entering into A^* and $A^{*\circ}$ were taken to be output-weighted averages of the corresponding technologies for 1967 and 1972. Apart from the obvious difference of deliveries from the construction sector in the presence of the project, Q departs from Q° by virtue of the additional paddy output from irrigation and extra throughput in the region's rice mills. There is a small fall in rubber output and processing as labor is drawn off into paddy harvesting activities. Furthermore, exogenous taxes change somewhat as farmers benefit from irrigation subsidies and greater activity in the region swells tax receipts from vehicle and business registration fees.

In treating investment, government outlays, and labor demand endogenously, the model employed here features three sets of parameters, namely, Φ, Ψ, and Λ, which are not found in Bell and Hazell (1980). As was already explained, residual government purchases are allocated entirely to noncompetitive imports. The vector Ψ denotes the composition of demand for investment goods by the private sector after all necessary purchases of balancing investments have been made. A critical assumption underlying the estimation of Ψ is that the share of noncompetitive imports in total outlays on such investments stayed constant at its 1972 level. That being so, Ψ varied little up to 1970, thereby keeping A^* invariant to all intents and purposes. It showed only slight year-to-year variation thereafter, so it seems reasonable to assume that there were no fluctuations after 1974, when the project attained its steady state configuration.

Turning, at last, to labor supply and demand, we begin by noting that virtually all the people engaged in farming are ethnic Malays, whereas most of the workers employed in the secondary and tertiary sectors are Chinese and many of the firms in those sectors are family businesses. Thus, the mobility of labor between the farm and nonfarm sectors is somewhat imperfect, so that the labor market is segmented—at least, to a degree.

In keeping with the evidence discussed in Bell and Hazell (1980), the endowments of labor of Muda's paddy farming households are treated as if they were specific to the paddy farming sector. However, it turns out that the project brings about an increase in the demand for labor by this sector which is so large that family labor supplies cannot meet it, and so labor is drawn

in, first, from the rubber smallholdings on the periphery of the scheme and then from southern Kedah, Kelantan, and Thailand. The losses of output that result elsewhere in the economy have been discussed above; they capture the effects of the project on the allocation of labor in the farming sectors.

To complete the story, it is necessary to specify the source of labor to the sectors producing nontraded goods, the output of which will, in general, be affected by the project. If the labor force available to these sectors is not fully employed, even after the project has reached maturity, there will be no effects on output elsewhere in the economy, and the appropriate model is given by equation (11.12). Conversely, if there is always full employment, labor will be drawn off from one or more sectors producing traded goods, and the appropriate model is furnished by equation (11.13).

In the present case, the real state of affairs lay somewhere between these two extremes. From what we know of the region's economy a decade ago, it is hard to avoid the conclusion that there was some underemployment of family labor engaged in the sectors producing nontraded goods. At the same time, the boom in employment in the free trade zones in Penang, which began in the early seventies and drew in large numbers of young women from Kedah and Province Wellesley, was attended by a rise in real wage rates. Thus, in the recent past, it is probable that the Muda region and Penang's free trade zones were competing for labor. The evidence is far too shaky to warrant simulations in which there is a switch, at some point, from equations (11.12) to (11.13). Rather, we shall estimate the effects of the project using first the one and then the other. This should suffice to bracket what actually happened.

It is also apparent that we are treating the industries in Penang's free trade zone as the source of additional labor to the Muda region's economy, at least where the production of nontraded goods is concerned. At first sight, this may appear somewhat odd to hardened practitioners of social cost-benefit analysis, who naturally think of subsistence agriculture as the source of labor to the rest of the economy. However, there is nothing in the celebrated manuals that commands subsistence agriculture to fulfill this role; on the contrary, by examining carefully how the labor market actually works, we have adhered closely to the spirit of their recommendations.

For simplicity, we assume that only one sector yields up its labor in response to changes in the demand for workers by other activities. That sector is electronics, which is far and away the biggest employer of labor in Penang's free trade zone. Given the tax and commercial policies toward these zones and the nature of the manufacturing technology in electronics, this sector affects the national economy solely through its demand for domestic labor; for imports of intermediate inputs, final output, and profits all go untaxed, foreigners provide all finance, and the requirements for nontraded goods, such as utilities, are negligible. In effect, therefore, the sole activity of this sector from the point of view of the Malaysian economy is the hiring of labor.

In the case of full employment with competitive labor markets, any change in the wage bill for this sector must be accompanied by an equal and offsetting change in the incomes accruing to nonfarm households from the sectors producing nontraded goods.[9]

ESTIMATION OF NATIONAL PARAMETERS FOR SOCIAL COST-BENEFIT ANALYSIS

Four sets of national parameters are used in our calculus: (a) the accounting ratios of traded goods, that is, the ratio of their world price to their domestic price; (b) the social valuation, in terms of uncommitted social income, of a unit of private consumption enjoyed by each household

9. Note that the supply of labor to each sector is assumed to be perfectly elastic, and recall that there are constant returns to scale with no joint production—and no fixed factors outside agriculture.

class (the vector λ); (c) the social valuation of private savings in terms of the numeraire (ξ); and (d) the accounting rate of interest.

Veitch (1976) estimates ratios for our ten tradable sectors for 1974. Except for the two rice milling sectors, we assume these ratios were the same throughout the period under study. Since the ratio of the world price to the domestic price of rice changed considerably over the period 1967–75, and rice is the sole direct output of the project, the accounting ratio for rice was estimated separately for each year in this period (Goldman, 1975; and Malaysia, 1974):

1967	0.867	1970	0.895	1973	0.716
1968	0.914	1971	0.776	1974	1.110
1969	0.905	1972	0.732	1975	0.901

The sectors producing nontraded goods in this economy that also export significant amounts (albeit in exogenously fixed quantities) are "other agriculture" and "manufacturing n.e.c. (not elsewhere classified)." Their accounting ratios were estimated by using the ratios for those categories in Veitch that correspond most closely to their characteristic commodities. Finally, the accounting ratio for noncompetitive imports was derived by taking a weighted average of the different imports, the weights being obtained from the original SAM tableau. The complete set of accounting ratios by sector for 1974 (from Veitch, 1976) is:

Commercial rice mills	1.11	Smallholder rubber	1.22
Small rice mills	1.11	Rubber processing	1.22
Food processing	0.91	Other agriculture	0.91
Fish processing	1.19	Sawmilling	1.32
Paddy production	1.00	Manufacturing n.e.c.	0.80
Fishing	1.19	Noncompetitive imports	0.90
Estates rubber	1.22		

(No paddy is in fact exported, and so the value of unity is used solely for accounting requirements.)

To estimate λ, the set of social weights for household consumption, two parameters are needed: $\bar{c}$, the so-called critical per capita consumption level, at which a unit of additional consumption (valued at market prices) is just as valuable socially as a unit of uncommitted government income; and η, the elasticity of the marginal utility of consumption. For $\bar{c}$, it is reasonable to take the official "poverty line," on the grounds that a prime objective of government policy is to bring all individuals to that level of living as soon as possible. At the time of writing, the value of $\bar{c}$ in 1972 prices is \$375 a year (Visaria, 1979, p. 29), which is about one-third of per capita GDP.[10] It is difficult to be so definite about η. Following a well-established tradition in this literature, two values will be used: unity, which arises from a logarithmic utility function and is mildly egalitarian; and two, which corresponds to Atkinson's (1970) equally distributed equivalent income being the harmonic mean of all incomes and is quite strongly egalitarian.

As the project brought about large changes in the per capita consumption levels of the five classes of households (Bell and Hazell, 1980), the concavity of the utility function implies that potentially serious errors will arise if λ is estimated at the steady state values of household consumption. Instead, we proceed as follows. In view of equation (11.15), two additional parameters of the utility function may be fixed. First, the marginal social utility of a unit of private consumption at $\bar{c}$ should be unity. Second, the absolute social utility attached to a private consumption level of $\bar{c}$ may be normalized to $\bar{c}$. Hence, we have, for $\eta = 1$ and $\eta = 2$, respectively,

$$V(c) = \bar{c}[1 + \log_e(c/\bar{c})] \tag{11.17a}$$

$$V(c) = \bar{c}[2 - \bar{c}/c]. \tag{11.7b}$$

10. The unit of currency is Malaysian dollars (\$1 = US\$0.40 in 1974).

Table 11.1. Social Weights for Household Consumption at Market Prices

Household Class	1967		1970		1972		1974	
	$\lambda(1)$	$\lambda(2)$	$\lambda(1)$	$\lambda(2)$	$\lambda(1)$	$\lambda(2)$	$\lambda(1)$	$\lambda(2)$
1 Landless paddy worker	3.25	10.53	2.62	6.90	2.29	5.39	2.14	4.70
2 Labour-abundant paddy farm	2.37	5.63	2.11	4.45	1.83	3.41	1.61	2.63
3 Land-abundant paddy farm	1.54	2.36	1.38	1.92	1.19	1.43	1.03	1.08
4 Nonproject farm	1.75	3.09	1.59	2.55	1.39	1.94	1.25	1.42
5 Nonfarm	0.78	0.61	0.73	0.53	0.63	0.41	0.53	0.29

Note: $\lambda(\eta)$ denotes the value of λ evaluated at $\eta = 1, 2$.

The value of λ arising from a movement from c° to c is, therefore,

$$\lambda = [V(c) - V(c^\circ)]/[c - c^\circ]. \tag{11.18}$$

The per capita consumption levels of the various classes of household for 1967 and 1974, both with and without the project, are taken from Bell and Hazell (1980), while those for 1972 with the project have been estimated directly in the course of constructing the SAM for that year. Those for 1970 and 1972 (without the project) were derived by linear interpolation. The resulting values of λ are set out in table 11.1. There is no call for the (spurious) accuracy of similar calculations for the intervening years. Up to 1970, the values of λ for 1967 will do; those for 1972 will be applied to 1971; and those for 1974 are assumed to hold for 1973 and all years thereafter.

In placing a social value on a household's savings, Little and Mirrlees (1974, p. 243) make the suggestion that, as a shortcut, the weight attached to a unit of savings by household class k, ξ_k, be taken as halfway between unity (the weight for uncommitted government income) and the weight for a unit of consumption by that household. Of course, if the latter exceeds unity, the rule of thumb implies that the households concerned are deemed to be saving "too much," given their poverty. Using the Little-Mirrlees rule of thumb, the sets of weights for household savings corresponding to those for consumption follow at once from table 11.1. As for corporate savings, which are ultimately distributed to very rich households or foreign nationals, these will generally have a very low social valuation. In the light of the social weight attached to the savings of nonfarm households, perhaps a weight of 0.2 for corporate savings does not seem objectionable. Finally, there is the matter of the social valuation of the savings needed to finance the set of balancing investments, H. Most of these investments were undertaken in the nonfarm sector of the economy between 1970 and 1974, by incorporated and unincorporated enterprises alike, while others took the form of house construction or improvement by farm households. Accordingly, in rather rough and ready fashion, the value of ξ_H is taken to be 0.7.

The argument advanced above rests on the notion that all households have access to a perfect capital market and so earn the same real rate of return on their savings. In practice, poorer households in the Muda region are likely to place their financial savings in bank accounts yielding zero or negative real rates of return, to the advantage of affluent borrowers who have access to highly profitable investment opportunities. If, in the extreme, all household savings were placed in the banking system and then lent to the government, to the richest class of households, or to private corporations, then the social weight attached to all savings, irrespective of source, would lie somewhere in the range of those for these three institutional

categories, depending on their shares in the total volume of lending. Very little is known about these matters, and it is profitless to attempt a refined calculation. Moreover, since the purpose of setting up this extreme case is to establish a parameter value for sensitivity analysis, a social weight of 0.7 for all private savings should provide a plausible lower bound on the valuation of this use of income flowing from the project.

Turning to the accounting rate of interest (ARI), Anand (1977) arrives at an estimate for Malaysia of 10 percent. An alternative, crude approach is as follows. A nominal rate of 10 percent is fairly close to the rate at which Malaysia was able to borrow on the world market, since the country's balance of payments position was quite strong in the period 1967–74 and foreign reserves have remained high thereafter. However, the model set out here is formulated in constant (domestic) prices. Adjusting for an average annual inflation rate of 5 percent and assuming exchange rate stability against an appropriate basket of currencies, we estimate the ARI to be around 5 percent. It may be felt, however, that public sector projects should have a higher rate of return than the marginal cost of foreign borrowing, so that this figure of 5 percent is probably a lower bound. To reflect this consideration, we perform sensitivity experiments using figures of 5, 10, and 20 percent for the ARI.

SOCIAL COST-BENEFIT CALCULATIONS

As shown in equation (11.15), the stream of social profits generated by the project is made up of various elements: the project's effects on household consumption and savings, on retained corporate profits, and on uncommitted government income. It is worthwhile setting out the individual trajectories of these elements before combining them to yield the time path of social profits, for the positive basis of the subsequent normative aggregation is then clear.

The trajectories for the two extreme cases of labor supply facing the nonfarm sectors of the economy, namely, unemployment and full employment, are laid out in tables 11.2 and 11.3, respectively. Qualitatively, there is nothing very startling about them, given the nature of the project. In the construction phase, the government made large outlays on construction, which accrued, in the first instance, as incomes to nonfarm households and corporations, both domestic and foreign. (In the full employment case, of course, output and incomes fell in the "source" sector, so that these households gained little on balance.) Agricultural households participated only marginally in construction and the extra activity in other domestic sectors induced in its wake. Indeed, the incomes of farm households on the periphery of the scheme fell slightly, since they earned much of their livelihood from rearing livestock, the numbers of which declined in the face of mechanization induced by the irrigation project. After the project came on stream in 1970, the incomes of agricultural households rose sharply. In the case of unemployed labor in the nonfarm sectors, the additional spending by paddy farming households boosted nonfarm incomes and corporate profits as construction work on the project wound down. Uncommitted government income recovered, too, as revenue from income and indirect taxes increased by more than enough to offset the losses arising out of the protection afforded to the paddy sector in all years. (In 1974, an almost mature project and a very high world price of rice combined to yield an exceptionally high payoff for the government.) In the case of fully employed nonfarm labor, the increase in incomes accruing to nonfarm households is naturally rather modest, with attendant repercussions on farm households, which do earn small incomes from the production of nontraded goods. The fall in the output of traded goods as labor is drawn off from the electronics sector results in a fall in uncommitted government income, and a substantial one it has been since the project has attained maturity. The outlays on balancing investments are the higher of the two (rather rough) estimates discussed in Bell and Hazell (1980), just to be on the safe side. The flows for 1975 are assumed to be the steady state values of relevant variables

Table 11.2. Changes in Incomes Due to the Project: Unemployed Nonfarm Labor
(in thousands of 1972 U.S. dollars)

Institution		1965	1966	1967	1968	1969	1970	1971	1972	1973	1974	1975
Household Class												
1	$C_1 - C_1^*$	4	16	44	56	40	648	1,120	1,591	1,858	2,124	2,124
	$S_1 - S_1^*$	0	0	0	0	0	2	3	4	5	5	5
2	$C_2 - C_2^*$	9	36	102	129	94	2,875	5,345	7,814	10,013	12,211	12,211
	$S_2 - S_2^*$	1	5	13	16	12	359	667	975	1,249	1,523	1,523
3	$C_3 - C_3^*$	6	23	64	81	59	8,091	15,383	22,674	28,989	35,304	35,304
	$S_3 - S_3^*$	1	5	14	18	13	1,717	3,264	4,811	6,151	7,490	7,490
4	$C_4 - C_4^*$	-6	-22	-62	-78	-57	-96	405	906	2,112	3,317	3,317
	$S_4 - S_4^*$	-1	-5	-13	-16	-12	-20	85	190	442	694	694
5	$C_5 - C_5^*$	1,527	5,834	16,468	20,832	15,121	13,904	20,343	26,782	32,271	37,760	37,760
	$S_5 - S_5^*$	289	1,105	3,123	3,946	2,864	2,633	3,853	5,073	6,113	7,152	7,152
Change in retained corporate profits		617	2,358	6,664	8,421	6,112	3,911	4,460	5,008	5,354	5,700	5,700
Change in uncommitted government income		-6,539	-16,920	-42,483	-51,401	-40,540	-14,874	-29,713	-16,259	-2,861	16,227	11,350
"Balancing" investments		-720	-2,160	-5,040	-5,760	-5,040	-5,760	-10,080	-12,240	-14,400	-10,800	0
Total		-4,812	-9,725	-21,088	-23,756	-21,334	13,390	15,135	47,329	77,296	118,707	124,630

Table 11.3. Changes in Incomes Due to the Project: Fully Employed Nonfarm Labor
(in thousands of 1972 U.S. dollars)

Institution		1965	1966	1967	1968	1969	1970	1971	1972	1973	1974	1975
Household Class												
1	$C_1 - C_1^*$	2	6	17	21	16	630	1,094	1,558	1,815	2,071	2,071
	$S_1 - S_1^*$	0	0	0	0	0	2	3	4	5	5	5
2	$C_2 - C_2^*$	-3	-11	-31	-39	-28	2,787	5,220	7,652	9,800	11,947	11,947
	$S_2 - S_2^*$	0	-1	-4	-5	-4	348	651	954	1,222	1,490	1,490
3	$C_3 - C_3^*$	-20	-76	-216	-273	-198	7,904	15,118	22,332	28,541	34,749	34,749
	$S_3 - S_3^*$	-4	-16	-46	-58	-42	1,677	3,208	4,738	6,056	7,373	7,373
4	$C_4 - C_4^*$	-28	-106	-300	-379	-275	-255	181	617	1,732	2,847	2,847
	$S_4 - S_4^*$	-6	-22	-63	-80	-58	-53	38	129	363	596	596
5	$C_5 - C_5^*$	396	1,513	4,275	5,402	3,921	5,563	8,743	11,923	12,806	13,688	13,688
	$S_5 - S_5^*$	75	287	810	1,024	743	1,054	1,656	2,258	2,426	2,593	2,593
Change in retained corporate profits		561	2,143	6,054	7,650	5,553	3,489	3,878	4,266	4,383	4,499	4,499
Change in uncommitted government income		-6,787	-17,867	-45,161	-54,785	-42,996	-20,942	-37,080	-24,924	-11,801	7,011	2,060
"Balancing" investments		-720	-2,160	-5,040	-5,760	-5,040	-5,760	-10,080	-12,240	-14,400	-10,800	0
Total		-6,534	-16,130	-39,705	-47,282	-38,408	-3,556	-7,370	19,267	42,948	78,069	83,918

for the rest of the project's life. In keeping with the procedures used in the final appraisal by the World Bank, the project is assumed to have a salvage value of $100 million in 2000.

The streams of social profits associated with the flows in tables 11.2 and 11.3 have been calculated under five sets of assumptions about the social valuation of household consumption, savings, and corporate profits. These correspond to three values of the elasticity of the marginal utility of consumption and two methods of placing a social valuation on household savings and retained corporate profits, as already discussed in the previous section. In particular, to satisfy those who would have no truck with distributional weights to value private consumption and savings in terms of government income, the streams of social profits have been calculated with all such weights set to unity. In this case, the streams are then simply the algebraic sums of the elements making up the individual columns of tables 11.2 and 11.3.

These alternative streams are set out in tables 11.4 and 11.5 In all cases, the project's net present social value is handsomely positive at an accounting rate of interest of 10 percent, and it can get by even at 20 percent. Not surprisingly, the project turns out to be more profitable if nonfarm labor is not fully employed. Thus, the great improvements in the material living standards of people in the Muda region which have been brought about by the project—at once evident to the casual observer—are reflected in, and consistent with, the project's high social profitability.

Interestingly enough, the value of η makes very little difference to the project's net present social value, even at the extreme ends of its range. This has come about by chance in that the poverty line, $\bar{c}$, where unit increases in private consumption and uncommitted government income are equally valuable, happens to be roughly equal to the mean social value of additional household consumption as actually distributed over the five classes of households. If, for example, $\bar{c}$ had been set at the level at which households are just drawn into the income tax net, which is much higher than the official poverty line, the project would show much higher social profits for $\eta = 2$ than $\eta = 0$. As it is, in the case of unemployed nonfarm labor, the results for these cases are almost identical (given the ARI), but the net present value is somewhat higher in both than that for $\eta = 1$. For $\eta = 2$, the higher social values placed on government outlays early in the project's life happen to be counterbalanced by the large net social benefits associated with the high income accruing to the project's comparatively poor beneficiaries when it attained maturity. When the social utility function is less concave, the fall in the mean social value of additional private income is apparently strong enough to cause a reduction in the project's net present social value. For similar reasons, the two methods of valuing private savings do not make much of a difference to the project's profitability.

For the case in which nonfarm labor is fully employed, the project's net present social value increases with η. The reason for this is that in the face of full employment of nonfarm labor, the additional income accruing to nonfarm households is more modest, so that the ratio of additional farm to nonfarm income generated by the project is greater than in the previous case. In turn, this implies that the social value of additional household income is also greater, for the distribution of income generated by the project is more favorable to farm households when nonfarm labor is fully employed. Moreover, the higher is η, the stronger is this effect.

CONCLUSIONS

It is clear that the analytical approach adopted here rests explicitly on the use of a simple general equilibrium model of the economy to determine a set of endogenous variables with the prices of all goods, domestic and foreign alike, parametrically given. Starting from an initial equilibrium for the economy, as characterized by the conditions set out earlier in this chapter, a "project" takes the form of a sequence of changes in the economy's exogenous variables and

Table 11.4. Social Profits from the Project: Unemployed Nonfarm Labor
(in thousands of 1972 U.S. dollars)

Stream of Undiscounted Social Profits

Year	$\eta = 0$	$\eta = 1$		$\eta = 2$	
		A	B	A	B
1965	- 4,812	- 5,332	- 5,388	- 5,556	- 5,590
1966	- 9,725	- 11,857	- 12,071	- 12,717	- 12,843
1967	- 21,088	- 27,482	- 28,087	- 29,910	- 30,268
1968	- 23,756	- 32,006	- 32,770	- 35,074	- 35,526
1969	- 21,334	- 27,082	- 27,637	- 29,309	- 29,637
1970	13,390	15,016	13,444	26,625	24,439
1971	15,135	18,971	16,546	33,862	30,707
1972	47,329	52,730	49,452	70,904	66,779
1973	77,296	77,528	73,867	92,290	88,109
1974	118,707	112,048	108,002	123,378	119,161
1975	124,630	114,731	110,686	126,061	121,844

Net Present Social Value of the Project

Accounting Rate of Interest	$\eta = 0$	$\eta = 1$		$\eta = 2$	
		A	B	A	B
5%	1,260,000	1,160,000	1,110,000	1,300,000	1,250,000
10%	547,375	494,632	469,906	568,036	541,805
20%	132,719	111,152	101,915	136,891	127,167

Note: The value η is the elasticity of the marginal social utility of private consumption. In case (A), the social weights for private savings (ξ_k) are drawn from table 11.1, using the rule $\xi_k = [1 + \lambda_k(\eta)]/2$. In case (B), a uniform weight of 0.7 applies to all private savings.

underlying technology. Within each time period, we assume that the system adjusts fully to the changes in the exogenous variables. The time path followed by the system's variables may be forged out of the chain of comparative static equilibria thus derived. This yields, among other things, the streams of consumption, savings, and government revenues, the changes in which are the arguments of the social welfare function. The criterion for accepting the project is that the net present social value of the stream of changes in national income, as given by equation (11.15), should be positive.

Table 11.5. Social Profits from the Project: Fully Employed Nonfarm Labor
(in thousands of 1972 U.S. dollars)

Stream of Undiscounted Social Profits

Year	$\eta = 0$	$\eta = 1$		$\eta = 2$	
		A	B	A	B
1965	- 6,534	- 6,796	- 6,803	- 6,927	- 6,922
1966	- 16,130	- 17,453	- 17,481	- 17,956	- 17,936
1967	- 39,705	- 43,292	- 43,374	- 44,714	- 44,660
1968	- 47,282	- 51,984	- 52,087	- 53,780	- 53,712
1969	- 38,408	- 41,583	- 41,658	- 42,887	- 42,837
1970	-3,556	559	-704	13,423	11,428
1971	-7,370	826	-1,246	17,815	14,819
1972	19,267	30,897	28,016	52,011	48,014
1973	42,948	52,773	49,508	71,887	67,718
1974	78,069	84,371	80,721	101,484	97,144
1975	83,918	86,980	83,330	104,094	99,754

Net Present Social Value of the Project

Accounting Rate of Interest	$\eta = 0$	$\eta = 1$		$\eta = 2$	
		A	B	A	B
5%	734,979	779,666	737,101	992,354	940.839
10%	267,500	289,562	268,779	396,027	370,706
20%	13,801	19,780	12,625	57,499	48,728

Note: The value η is the elasticity of the marginal social utility of private consumption. In case (A), the social weights for private savings (ξ_k) are drawn from table 11.1, using the rule $\xi_k = [1 + \lambda_k(\eta)]/2$. In case (B), a uniform weight of 0.7 applies to all private savings.

The implicit assumption of instantaneous and full adjustment to the exogenous disturbances of the period in question, and the neglect of all such disturbances in the future, which entails myopic expectations, are certainly very strong assumptions. Yet the "dual" route of using shadow prices is tarred with the same brush (Srinivasan, 1982). Perhaps nothing better can be done where practical analysis is concerned, but this does not exonerate the analyst of the responsibility to be clear about what he is doing. Even if a truly dynamic structure were available, it is far from obvious that the costs of such intrinsically difficult refinements would be justified by the improvements in practical decisions they would bring about. Still, one is left feeling

uncomfortable that the results should rest on such foundations—unless one seeks refuge in the convention that projects are small enough for these considerations not to matter.

A more particular point to emerge from the analysis is that the only interindustry linkages that have an induced—as opposed to a direct—effect on the determination of the endogenous variables are those expressed by the technologies for producing nontradables. This follows immediately from the semi-input-output formulation, of course, but it highlights the fact that capturing multiplier effects in cost-benefit analysis requires, in principle, that the estimates of the relevant parameters pertain to the region in question. As developing countries are usually regionally heterogeneous, this requirement cannot be dismissed as a theoretical nicety. However, the analyst usually considers himself fortunate if he has access to a fairly recent national input-output table.

As for the issues in social cost-benefit analysis, in this particular case study, variations in the elasticity of the marginal social utility of private consumption have relatively little effect on the project's present social value, at least within the range of values considered as normal in this literature. The project's main beneficiaries are poor and hence socially deserving. However, even when all incomes are given the same social weight the social rate of return exceeds 20 percent,.

It will not have escaped the reader's attention that for all the care lavished on incorporating all of the project's effects in a static framework, the treatment of the intertemporal aspects of resource allocation has been rough and ready. Thus, in estimating the social value of private savings, we have resorted to one shortcut method recommended in the literature. As it turns out, the social profitability is robust to changes in this parameter. Were this not so, a detailed treatment of the dynamics of the economy would have been necessary.

Once the model has been built and estimated, it can be used to evaluate any project. Computationally, nothing more than matrix inversion is needed. Even so, this invites the retort that valuing the direct inputs and outputs of a project at their (appropriate) shadow prices is more straightforward still, assuming that a set of such shadow prices is available. That, however, raises an important question: What are the shadow prices that correspond to the primal model laid out here? Although we have addressed this question at length elsewhere (Bell and Devarajan, 1983), it should be noted that the Muda project was sufficiently large to affect the supply price of labor, so that the shadow prices for the economy at that point would not have been stationary. Hence, the use of shadow prices based on a constant supply price of labor, which is advocated (and usually valid) for small projects, would be incorrect in this case. Moreover, estimating the shadow prices appropriate to this case would involve the same steps followed in the primal route taken here, so that there would be no saving in effort.

References

The word "processed" is used in this list to indicate that a work has been reproduced by some process other than conventional typesetting and printing, such as photocopying or mimeographing.

Adelman, I., and S. Robinson (1978) Income Distribution Policy in Developing Countries: A Case Study of Korea, London: Oxford University Press.

Aghevli, B. B. (1977) "Money, Prices and the Balance of Payments: Indonesia 1968–73," Journal of Development Studies, vol. 13, January, pp. 37–57.

Aghevli, B.B., and M. Khan (1977) "Inflationary Finance and the Dynamics of Inflation: Indonesia 1951–72," American Economic Review, vol. 67, no. 3, June, pp. 390–403.

Ahluwalia, M., and H. B. Chenery (1974) "A Model of Distribution and Growth," ch. 11 in H. B. Chenery and others, Redistribution with Growth, London: Oxford University Press.

Ahluwalia, M., and F. Lysy (1979) "Welfare Effects of Demand Management Policies: Impact Multipliers under Alternative Model Structures," Journal of Policy Modeling, vol. 1, no. 3, September, pp. 317–42.

Altimir, O. (1975) "Income Distribution Estimates from Household Surveys and Population Census in Latin America: An Assessment of Reliability," paper prepared for the Economic Commission for Latin America and the Development Research Center, Washington, D.C.: World Bank (processed).

Anand, S. (1977) "A Comparison of the IBRD and Little-Mirrlees Appraisal of a Highway Project in Malaysia," Washington, D.C.: World Bank (processed).

Atkinson, A. B. (1970) "On the Measurement of Inequality," Journal of Economic Theory, vol. 2, September, pp. 244–63.

Bacharach, M. O. L. (1970) Biproportionate Matrices and Input-Output Change, Cambridge: Cambridge University Press.

Balassa, B., and associates (1971) The Structure of Protection in Developing Countries, Baltimore, Md.: Johns Hopkins University Press.

Barkay, R. M. (1975) "National Accounting as a Planning Tool in Less Developed Countries: Lessons of Experience," Review of Income and Wealth, series 21, no. 4, pp. 349–70.

Barna, T. (1975) "Quesnay's Tableau in Modern Guise," Economic Journal, vol. 85, no. 339, September, pp. 485–96.

Bell, C. L. G., and S. Devarajan (1979) "Towards a Synthesis of Semi-Input-Output and Little-Mirrlees: A Social Cost-Benefit Analysis with Multiplier Effects of an Irrigation Project in Northwest Malaysia," Pakistan Development Review, vol. 18, no. 2, pp. 165–85.

——— (1980) "Semi Input-Output and Shadow Prices: A Critical Note," Bulletin of the Oxford Institute of Economics and Statistics, vol. 42, no. 3, pp. 251–56.

——— (1983) "Shadow Prices for Project Evaluation under Alternative Macroeconomic Regimes," Quarterly Journal of Economics, vol. 98, no. 3, pp. 457–78.

Bell, C. L. G., and P. B. R. Hazell (1980) "Measuring the Indirect Effects of an Agricultural Investment Project on its Surrounding Region," American Journal of Agricultural Economics, vol. 62, no. 1 (February), pp. 75–86.

Bell, C. L. G., P. Hazell, and R. Slade (1982) Project Evaluation in Regional Perspective, Baltimore, Md.: Johns Hopkins University Press.

Bhat, M. D. (1972) "Forecasting in Financial Sector," presented at the European meeting of the Econometric Society, Budapest, September.

Bhatia, R. J., and P. Engstrom (1972) "Nigeria's Second National Development Plan: A Financial Analysis," IMF Staff Papers, vol. 19, no. 1, March, pp. 145–73.

Bhatt, V. V. (1969) "Savings and Flow of Funds Analysis: A Tool for Financial Planning," Reserve Bank of India Bulletin, vol. 22, no. 9, September, pp. 1387–1401.

Blitzer, C. R., P. Clark, and L. Taylor (1975) Economy-Wide Models and Development Planning, London: Oxford University Press.

Botswana, Ministry of Finance and Development Planning (1973) Manpower and Employment, Gaborone: Central Statistical Office.

——— (1976a) Rural Income Distribution Survey, 1974/5, Gaborone: Central Statistical Office.

——— (1976b) National Accounts of Botswana 1974/5, Gaborone: Central Statistical Office.

Brainard, W. C., and J. Tobin (1968) "Pitfalls in Financial Model-Building," American Economic Review, vol. 58, no. 2, May, pp. 99–122.

Byron, R. (1978) "The Estimation of Large Social Accounting Matrices," Journal of the Royal Statistical Society, series A, vol. 141, part 3, pp. 359–67.

Cambridge University, Department of Applied Economics (1962–74) A Programme for Growth, vols. 1–11, London: Chapman and Hall.

——— (1975–) Cambridge Studies in Applied Econometrics, London: Chapman and Hall.

Ceylon, Central Bank (1971) Annual Report, Colombo.

Ceylon, Department of Census and Statistics (1971) "Preliminary Report on the Socioeconomic Survey of Ceylon, 1969–70," Colombo.

——— (1973) National Accounts 1970, Colombo.

Champernowne, D. G. (1953) "A Model of Income Distribution," Economic Journal, vol. 63, no. 250, pp. 318–51.

——— (1969) Estimation and Uncertainty in Economics, vols. 1–3, Edinburgh: Oliver and Boyd.

——— (1973) The Distribution of Income between Persons, Cambridge: Cambridge University Press.

Chander, R., and others (1980) "Social Accounts and the Distribution of Income: The Malaysian Economy in 1970, Review of Income and Wealth, vol. 26, no. 1, March, pp. 67–85.

Chenery, H. B., and others (1974) Redistribution with Growth, London: Oxford University Press.

Chenery, Hollis B., and Alan Strout (1966) "Foreign Assistance and Economic Development," American Economic Review, vol. 56, pp. 679–733.

Clark, P. B. (1975) "Intersectoral Consistency and Macroeconomic Planning," ch. 5 in C. R., Blitzer, P. Clark, and L. Taylor, Economy-Wide Models and Development Planning, London: Oxford University Press.

Copeland, J. R., and E. Henry (1975) Irish Input-Output Income Multipliers, 1964 and 1968, paper no. 82, Dublin: Economic and Social Research Institute.

Corden, M. (1966) "The Structure of a Tariff System and the Effective Protection Rate," Journal of Political Economy, vol. 74, no. 3, June, pp. 221–37.

Crawford, E., and E. Thorbecke (1978) "Employment, Income Distribution, Poverty Alleviation and Basic Needs in Kenya," report of an International Labour Office consulting mission (processed).

Deaton, A. (1974) "A Reconsideration of the Empirical Implications of Additive Preferences," Economic Journal, vol. 84, no. 334, pp. 338–48.

Deaton, A., and J. Muellbauer (1980) "An Almost Ideal Demand System," American Economic Review, vol. 70, no. 3, June, pp. 312–26.

deMelo, M. (1979) "Agricultural Policies and Development: A Socioeconomic Investigation Applied to Sri Lanka," Journal of Policy Modelling, vol. 1, no. 2, May, pp. 217–34.

Dervis, K., J. de Melo, and S. Robinson (1982) General Equilibrium Models for Development Policy, Cambridge: Cambridge University Press.

Dervis, K., and S. Robinson (1978) The Foreign Exchange Gap, Growth and Industrial Strategy in Turkey: 1973–83, Staff Working Paper no. 306, Washington, D.C.: World Bank.

Desai, P. (1961) "A Short-Term Planning Model for the Indian Economy," Review of Economics and Statistics, vol. 43, no. 2, pp. 193–200.

Divatia, V. V. (1969) "An Operational Technique of Financial Planning," Reserve Bank of India Bulletin, vol. 23, no. 9, September, pp. 1402–13.

Drud, A., W. Grais, and G. Pyatt (1983) "The TV-Approach: A Systematic Method of Defining Economy-wide Models Based on Social Accounting Matrices," paper presented at the Fourth IFAC/IFORS Conference on Modeling and Control of National Economies, Washington, D.C., June 17–19.

Frank, C. R. (1967) "The Seers Modified Input-Output Table: Some Projection Techniques," paper no. 112, New Haven, Conn.: Yale University, Economic Growth Center.

Goldman, R. N. (1975) Staple Food Self-Sufficiency and the Distributive Impact of Malaysian Price Policy, Minden, Penang: Universiti Sains, Malaysia, School of Comparative Social Sciences.

Goldsmith, R. (1969) Financial Structure and Economic Development, New Haven, Conn.: Yale University Press.

Goodwin, R. M. (1949) "The Multiplier as Matrix," Economic Journal, vol. 59, no. 236, pp. 537–55.

Grais, W. (1982) "The Transaction Values Approach to the Formulation and Implementation of Computable General Equilibrium Models," Washington, D.C.: World Bank (processed).

Greenfield, C. C., and H. Fell (1979) "The Estimation of Price Effects in a Social Accounting Matrix," Review of Income and Wealth, series 25, no. 1, March, pp. 65–81.

Hayden, C., and J. I. Round (1982) "Developments in Social Accounting Methods as Applied to the Analysis of Income Distribution and Employment Issues," World Development, vol. 10, no. 6, pp. 451–65.

Hicks, J. R. (1942) The Social Framework, Oxford: Clarendon Press (4th ed., 1971).

International Labour Office (1970) Towards Full Employment: A Program for Colombia, Geneva.

——— (1971) Matching Employment Opportunities and Expectations: A Program of Action for Ceylon, vols. 1 and 2, Geneva.

——— (1973a) Employment and Income Policies for Iran, Geneva.

——— (1973b) Strategies for Employment Promotion: An Evaluation of Four Interagency Employment Missions, Geneva.

——— (1976) Employment, Growth and Basic Needs: A One-World Problem, Geneva.

Johansen, L. (1960) A Multi-Sectoral Study of Economic Growth, Amsterdam: North Holland.

Kahn, R. F. (1931) "The Relation of Home Investment to Unemployment," Economic Journal, vol. 41, no. 162, pp. 173–98.

Khan, M. S. (1974) "Experiments with a Monetary Model for the Venezuelan Economy," IMF Staff Papers, vol. 21, pp. 389–413.

King, G. (1696) "Natural and Political Observations and Conclusions upon the State and Condition of England," printed as an appendix to Sir George Chalmers, An Estimate of the Comparative Strength of Great Britain. Reprinted in Two Tracts by Gregory King, Baltimore, Md.: Johns Hopkins University Press, 1936.

Kuyvenhoven, A. (1975) "The Integration of Project and Sector Analysis—Some Further Remarks," Bulletin of the Oxford Institute of Economics and Statistics, vol. 38, pp. 66–77.

Lancaster, K. J. (1966) "A New Approach to Consumer Theory," Journal of Political Economy, vol. 74, no. 2, April, pp. 132–57.

——— (1968) Mathematical Economics, London: Macmillan.

Little, I. M. D., and J. Mirrlees (1974) Project Appraisal and Planning for Developing Countries, London: Heinemann.

Malaysia, Department of Statistics (1974) External Trade Statistics, Kuala Lumpur.

——— (1975) National Accounts of Peninsular Malaysia, 1960–71, Kuala Lumpur.

Malaysia, Government of (1976) Third Malaysia Plan 1976–80, Kuala Lumpur.

Maton, J., F. Paukert, and J. Skolka (1978) Redistribution of Income Patterns of Consumption and Employment: A Case Study for the Philippines, Geneva: International Labour Office.

Narapalasingam, S. (1970) "On the Construction and Implementation of a Planning Model for Ceylon," Ph.D. dissertation, University of Bristol.

Ng, L. S. (1974) "An Income Distribution and Employment Consistency Model of the Philippines," Ph.D. dissertation, Iowa State University.

Nicholson, J. L. (1964) "Redistribution of Income in the United Kingdom in 1959, 1957, and 1953," Income and Wealth, Series X, London: Bowes and Bowes.

Otani, I. (1975) "Inflation in an Open Economy: A Case Study of the Philippines," IMF Staff Papers, vol. 23, no. 1, March, pp. 164–99.

Otani, I., and Y. C. Park (1976) "A Monetary Model of the Korean Economy," IMF Staff Papers, vol. 22, no. 3, November, pp. 750–74.

Patrick, H. (1966) "Financial Development and Economic Growth in Underdeveloped Countries," Economic Development and Cultural Change, vol. 14, no. 2, January, pp. 174–89.

Phillips, A. (1955) "The Tableau Economique as a Simple Leontief System," Quarterly Journal of Economics, vol. 69, no. 1, February, pp. 137–44.

Ploeg, F. van der (1982) "Reliability and the Adjustment of Sequences of Large Social Accounting Matrices," Journal of the Royal Statistical Society, Series B, vol. 145, part 2, pp. 169–94.

Polak, J. (1957) "Monetary Analysis of Income Formation and Payments Problems," IMF Staff Papers, vol. 6, no. 1, November, pp. 1–50.

Pyatt, G., and others (1972) Employment and Income Policies for Iran: Methodology for Macroeconomic Projections, Geneva: International Labour Office.

Pyatt, G., A. R. Roe, and associates (1977) Social Accounting for Development Planning with Special Reference to Sri Lanka, Cambridge: Cambridge University Press.

Pyatt, G., and J. I. Round (1977) "Social Accounting Matrices for Development Planning," Review of Income and Wealth, series 23, no. 4, December, pp. 339–64.

——— (1978) "The Distribution of Income and Social Accounts: A Study for Malaysia in 1970," Washington, D.C.: World Bank, Development Research Center (processed).

——— (1979) "Accounting and Fixed-Price Multipliers in a Social Accounting Matrix Framework," Economic Journal, vol. 89, no. 356, December, pp. 850–73.

Pyatt, G., and E. Thorbecke (1976) Planning Techniques for a Better Future, Geneva: International Labour Office.

Quesnay, F. (1758) Tableau Economique, reproduced in facsimile with an introduction by H. Higgs by the British Economic Society, 1895.

Revell, J., and others (1967) The Wealth of the Nation, Cambridge: Cambridge University Press.

Roe, A. R. (1978) "Administered Interest Rates, Transaction Costs and Capital Market Imper-

fections in Developing Countries," Washington, D.C.: World Bank, Development Economics Department (processed).

Saito, K. W. (1977) "The Determinants of Savings Behaviour: A Survey of the Evidence," Studies in Domestic Finance no. 35, Washington, D.C.: World Bank, Development Economics Department.

Scott, M. F. G. (1976) "Shadow Wages in Mauritius," in I. Little and M. Scott, eds., Using Shadow Prices, London: Heinemann.

Seers, D. (1975) "The Structure, Content and Uses of the Revised SNA in the Light of the Requirements and Circumstances of Developing Countries," paper prepared for the Interregional Seminar on the Revised System of National Accounts, United Nations Statistical Office, New York (processed).

Sen, A. K. (1973) On Economic Inequality, Oxford: Clarendon Press.

Seton, F. (1973) "Shadow Prices for Chile," in R. Eckaus and P. Rosenstein-Rodin, eds., Analysis of Development Problems: Studies in the Chilean Economy, Amsterdam: North Holland.

Shorrocks, A. F. (1976) "Income Mobility and the Markov Assumption," Economic Journal, vol. 86, no. 343, pp. 566–78.

Squire, L., and H. van der Tak (1975) Economic Analysis of Projects, Baltimore, Md.: Johns Hopkins University Press.

Srinivasan, T. N. (1982) "General Equilibrium Theory, Project Evaluation and Economic Development," Walras-Bowley lecture, Econometric Society, Boulder, Colorado, published in M. Gersovitz and others, eds., The Theory and Experience of Economic Development, London: Allen and Unwin, pp. 229–51.

Stone, J. R. N. (1966) "The Social Accounts from a Consumer Point of View," Review of Income and Wealth, series 12, no. 1, March, pp. 1–33.

Stone, J. R. N., D. Champernowne, and J. Meade (1942) "The Precision of National Income Estimates," Review of Economic Studies, vol. 9, pp. 111–25.

Stone, J. R. N., and Giovanna Stone (1977) National Income and Expenditure, 10th ed. London: Bowes and Bowes.

Taylor, L., and others (1980) Models of Growth and Redistribution for Brazil, London: Oxford University Press.

Thorbecke, E., and J. Sengupta (1972) "A Consistency Framework for Employment Output and Income Distribution Projections Applied to Colombia," Washington, D.C.: World Bank, Development Research Center (processed).

Tinbergen, J. (1966) "Some Refinements of the Semi-Input-Output Method," Pakistan Development Review, vol. 6, pp. 243–47.

United Kingdom, Central Statistical Office (1952–) National Income and Expenditure, London: HMSO.

——— (1953–) Economic Trends, London: Her Majesty's Stationery Office (HMSO).

——— (1973) Input-Output Tables for the United Kingdom, 1968, studies in official statistics no. 22, London: HMSO.

United Kingdom, Department of Employment (1961–) Family Expenditure Survey, London: HMSO.

United Kingdom, Ministry of Overseas Development (1977) "Social Accounting Matrix, Botswana, 1974/5," London (processed).

United Nations Industrial Development Organization (UNIDO) (1972) Guidelines for Project Evaluation, New York: United Nations.

United Nations Statistical Office (1953) A System of National Accounts and Supporting Tables, Studies in Methods, series F, no. 2, rev. 1, 1960; rev. 2, 1964, New York: United Nations.

——— (1968) A System of National Accounts, series F, no. 2, rev. 3, New York: United Nations.

——— (1972) "Draft System of Statistics on the Distribution of Income, Consumption and Accumulation," Statistical Commission agendum Paper, New York: United Nations.

——— (1973) Input-Output Tables and Analysis, Studies in Methods, series F, no. 14, rev. 1, New York: United Nations.

——— (1975) Towards a System of Social and Demographic Statistics, series F, no. 18, New York: United Nations.

——— (1977a) "Provisional International Guidelines on the National and Sectoral Balance Sheet and Reconciliation Accounts of the System of National Accounts," Statistical Papers, series M, no. 60, New York: United Nations.

——— (1977b) Provisional Guidelines on Statistics of the Distribution of Income, Consumption and Accumulation of Households, Studies in Methods, series M, no. 61, New York: United Nations.

Vandome, P. (1958) "Aspects of the dynamics of consumer behaviour," Bulletin of the Oxford Institute of Economics and Statistics, vol. 20, no. 1, pp. 65–105.

Veitch, M. D. (1976) National Parameters for Project Appraisal in Malaysia, vol. 1, Kuala Lumpur: Economic Planning Unit.

Venkatachalam, T. R., and Y. Sarma (1977) "Structure and Trends in the National Balance Sheet of India," Journal of Income and Wealth, New Delhi, vol. 1, April, pp. 95–136.

Visaria, P. (1979) "Incidence of Poverty and the Characteristics of the Poor in Peninsular Malaysia," Washington, D.C.: World Bank (processed).

von Saleski, R. (1977) "A Network Approach to the Refinement of Social Accounting Matrices," Baltimore, Md.: Johns Hopkins University, Department of Mathematical Sciences (processed).

Wanhill, S. R. C. (1974) "A Note on the Integration of Project and Sector Analysis," Bulletin of the Oxford Institute of Economics and Statistics, vol. 36, pp. 109–13.

World Bank (1979) Yemen Arab Republic, Development of a Traditional Economy, Washington, D.C.: World Bank.

THE WORLD BANK

In his contribution to this volume, Sir Richard Stone, the 1985 Nobel laureate, notes that "of all the interesting and useful things that could be done to improve the national accounts, the one most worthy of consideration is the disaggregation of the household sector." This statistical approach can help in measuring how living standards for different groups change in the process of economic development, and thus it can help in addressing questions about the distribution of income, the scope of employment opportunities, and the alleviation of poverty, which in recent years have come to the forefront of debates on economic policy in developing countries.

The established technique for capturing the details of disaggregated national accounts is the social accounting matrix, or SAM, in which data are displayed in a single-entry matrix format, rather than in the traditional form of double-entry bookkeeping. The data base embodied in the SAM then can serve as a statement of initial conditions in an economy and as a starting point for theoretical analysis of the mechanics of growth or the likely effects of policies. A particular feature of this approach is that the SAM structure graphically demonstrates the interconnection between the distribution of living standards and the structure of production in an economy.

Although limitations and inadequacies of data may always plague national accounting, a SAM is an invaluable tool for bringing together whatever data are available. The many examples in this volume of SAMs created for developing countries show that much can be done even in small countries with limited resources. Moreover, because the SAM approach as illustrated here is simpler than other systems of national accounts, it is a potentially lively and constructive link between statisticians and economic planners—two groups that are all too often observed to have a muted relationship.

The eleven chapters in this volume cover three broad areas of concern in social accounting. The first four describe the methodology of SAMs as a discipline within economic statistics and include a comprehensive, nontechnical introduction to the subject. The next three recount the experience of Sri Lanka, Swaziland, and Botswana in constructing, maintaining, and using SAMs. The final four chapters illustrate the step from data systems to models in a SAM context. In addition to the editors and Sir Richard Stone, contributors include Clive Bell, Shantayanan Devarajan, Colin Greenfield, Benjamin B. King, S. Narapalasingam, Alan R. Roe, Eric Thorbecke, and S. J. Webster.

ALSO OF INTEREST

Improving the Macroeconomic Data Base: A SAM for Malaysia, 1970
Graham Pyatt and Jeffery I. Round, assisted by Jane Denes

This 1984 addition to the World Bank Staff Working Paper series (number 646) documents the construction of a social accounting matrix in Malaysia, with emphasis on the statistical issues that arose and their practical resolution. The SAM described is a large, disaggregated one, more similar to detailed national accounts than to the aggregated formats that are often adopted for macroeconomic models and analysis. Because the final version of the matrix was reduced in size from initial compilations, the study is able to explore the implications of working at different levels of statistical detail.

The study draws on the wealth of economic data available for Malaysia. It outlines the strengths and weaknesses of using market prices as the basis of evaluation of commodity balances and gives reasons, in formal algebraic terms, for preferring this approach to other conventions. The study also addresses issues that arise in disaggregating household accounts, particularly the reconciliation of national accounts and household survey data, not least with regard to savings.

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