

PACIFIC POLICY PAPER No. 5

Growth, Structural Change and Economic Policy in Papua New Guinea

Implications for agriculture

**Frank G. Jarrett and
Kym Anderson**

National Centre for Development Studies
The Australian National University

PACIFIC POLICY PAPER No. 5

**Growth, Structural
Change and
Economic Policy in
Papua New Guinea**

Implications for agriculture

**Frank G. Jarrett and
Kym Anderson**

© National Centre for Development Studies 1989

This book is copyright. Apart from those uses which may be permitted under the Copyright Act 1968 as amended, no part may be reproduced by any process without written permission. Enquiries should be made to the publisher.

All or part of this work may be copied by members of educational institutions and libraries for the purpose of research, study or teaching provided the source is acknowledged.

National Library of Australia
Cataloguing-in-publication entry

Jarrett, F.G. (Frank G.)

Growth, structural change and economic policy
in Papua New Guinea

Bibliography

ISBN 0 7315 0768 1.

1. Agriculture — Economic aspects — Papua New Guinea

2. Agriculture and state — Papua New Guinea.

3. Papua New Guinea — Economic conditions.

4. Papua New Guinea — Economic policy.

I. Anderson, Kym. II. Australian National University.

National Centre for Development Studies. III. Title.

(Series: Pacific policy papers; no. 5).

338.1'09956'3

Printed in Australia by
The Australian National University

National Centre for Development Studies
Research School of Pacific Studies
The Australian National University
GPO Box 4, Canberra, A.C.T., 2601, Australia.

Preface

Papua New Guinea's disappointing economic growth performance since its Independence in 1975, particularly in the rural sector, is prompting the government to reassess its policies and priorities with a view to placing more emphasis on smallholder agriculture. The purpose of the present study is to examine possible reasons for the economy's — and especially agriculture's — poor record, to suggest in broad terms ways in which the government might remedy the situation, and to point to priority areas where further policy analysis could enrich the information base for policy-makers.

The study was commissioned by the National Centre for Development Studies (NCDS) at the Australian National University, Canberra. It forms part of the Centre's overall research program on Papua New Guinea which is funded by the Australian International Development Assistance Bureau. The authors are most grateful to Rodney Cole, Brian Brogan, Will Martin and Barry Shaw at NCDS and Tom Nguyen at Griffith University for encouragement and feedback; to the many people in Papua New Guinea who generously gave their time and views in discussions with the authors; to staff at the Institute for Applied Social and Economic Research and the Institute of National Affairs who co-hosted the authors in Port Moresby during their fieldtrip; to the Institute for International Economic Studies of the University of Stockholm for providing a congenial atmosphere for Kym Anderson while he was drafting parts of the report; to Melissa Gibbs, Young-II Park and Helen Wickens who helped as research assistants; and to Debbie Jackson and Davina Dolman for word processing. We also thank Maree Tait, Margaret Callan and May Stinear at the NCDS for producing the monograph. Needless to say, responsibility for the views expressed rests solely with the authors.

Contents

Preface	v
Overview	xiii
Agriculture's relative decline	
1. Economic growth and structural changes since the 1960s	3
Economic growth	3
Structural changes	11
Features to be explained	15
2. Reasons for the structural changes	18
Why agriculture declines relatively as an economy grows	18
Why Papua New Guinea's staple food sector has performed poorly	21
Policies affecting agricultural incentives	
3. Factor market distortions	31
Agricultural land	31
Financial capital	36
Labour	42
4. Distortions in product markets	51
Agricultural product price distortions	51
Non-agricultural product price distortions	55
Exchange rate policy	56
Taxation policy	58
Conclusions	61
5. Agricultural stabilization policy	63
Objectives of agricultural stabilization policy	63
Sources of variation in agricultural export earnings	64
Contribution of schemes to macro stability	67
Contribution of schemes to producer welfare	69
Why have stabilization schemes?	73
Public Investment in the rural sector	
6. Agricultural research and extension	77
History of investment in agricultural innovations	78
Economics of investing in agricultural innovations	81

7. Other investments in human capital and infrastructure	93
Education	93
Health	101
Transportation	104
Law and order	107
The way ahead	
8. Conclusions	111
Lessons from the recent past	111
Policy implications	113
Priority areas for further research	115
References	117

Tables

1.1 Growth in real GDP, population and real GDP per capita, Papua New Guinea and other economies, 1960-86	4
1.2 Growth in real GDP per capita, Papua New Guinea, sub-Saharan Africa and all developing economies, 1965-86	5
1.3 Growth in export volume, Papua New Guinea and other developing economies, 1965-86	7
1.4 Indexes of export volume, terms of trade and export value, Papua New Guinea, 1965-86	8
1.5 Food and agricultural production in Papua New Guinea and other developing economies, 1975-86	9
1.6 Social development indicators, Papua New Guinea and other developing economies, 1985	10
1.7 Sectoral shares of gross domestic product, Papua New Guinea and other economies, 1965-86	12
1.8 Sectoral shares of merchandise exports, Papua New Guinea and other economies, 1960-86	13
1.9 Shares of selected commodities in total exports, Papua New Guinea, 1958-86	13
1.10 Shares of subsistence food production in GDP and in private expenditure, Papua New Guinea, 1961-80	14
1.11 Indigenous (smallholders') share of total production of various export crops, Papua New Guinea, 1969-83	14
1.12 Sectoral shares of employment, Papua New Guinea and other economies, 1960-80	16
1.13 Land and labour productivity in agriculture, Papua New Guinea and other developing economies, 1970-85	16
2.1 Nominal and real effective exchange rates and external debt, Papua New Guinea, 1974-86	22
2.2 Indexes of international prices of coffee, cocoa, copra and palm oil, in kina and US dollars, 1981-86	25
2.3 Current and prospective mineral developments, Papua New Guinea, 1971-97	25
2.4 Copper ore grade, mining costs, prices and earnings, Bougainville Copper Ltd, 1972-87	26
3.1 Land availability per capita, Papua New Guinea and other developing economies, 1970 and 1985	32
3.2 Interest rates by type of loan, Agriculture Bank of Papua New Guinea, 1981	39
3.3 Industry distribution and average size of rural loans by the Agriculture Bank of Papua New Guinea, 1967-84	41
3.4 Agricultural loans approved by the Agriculture Bank and by commercial banks, Papua New Guinea, 1980-86	42
3.5 Recorded unemployment rates, Papua New Guinea, 1980	44
4.1 Per capita consumption of (and self sufficiency in) various meats, Papua New Guinea, 1971-86	54

4.2 Central government expenditure and internal sources of tax revenue, Papua New Guinea, 1965-86	59
4.3 Mineral Resources Stabilization Fund operations and North Solomons royalty receipts, 1975-87	60
5.1 Sources of variation in agricultural export earnings, Papua New Guinea, 1961-85	66
5.2 End-year balances in agricultural stabilization funds, Papua New Guinea, 1975-86	67
5.3 Changes in the price and quantity of coffee exports and in the coffee stabilization fund, Papua New Guinea, 1975-86	68
5.4 Changes in the total value of exports and of stabilization fund deposits for coffee, cocoa and coconut products, Papua New Guinea, 1976-86	69
5.5 Changes in the unit value of coffee exports before and after the stabilization fund levy/subsidy, Papua New Guinea, 1976-86	71
6.1 Agricultural research manpower relative to agricultural output, Papua New Guinea and other economies, 1980	82
6.2 Agricultural research and extension manpower resources, by crop, Papua New Guinea, 1980	83
6.3 Research intensity for selected export crops and other agricultural products, Papua New Guinea, 1980	84
6.4 Estimated costs of the agricultural support services project, Papua New Guinea, 1987-91	90
7.1 Central government expenditure on education and health, Papua New Guinea and other developing economies, 1986	96
7.2 Private and social rates of return to investment in education, Papua New Guinea, 1979	96
7.3 Social rates of return to education, Papua New Guinea and other developing countries, circa 1979	97
7.4 Recurrent expenditure per equivalent full-time student, Papua New Guinea, 1973 and 1983	98
7.5 Community school enrolment ratio by province, Papua New Guinea, 1977-85	99
7.6 Indicators of the availability of health services, Papua New Guinea, 1973 and 1984	102
7.7 Importance of major diseases in Papua New Guinea, 1974 and 1985	103
7.8 Provincial distribution of trafficable roads and population, Papua New Guinea, 1980	105
7.9 Distribution of exports by port, Papua New Guinea, 1981 and 1986	106

Boxes

2.1 Effects of a boom in one export sector on other sectors	22
3.1 Effects of high minimum wages on the agricultural sector	45
3.2 Labour market equilibrium in the presence of urban unemployment	46
3.3 Employment and output effects of an urban subsidy	47
3.4 Effects of higher input costs on farmers	49
5.1 Statistical technique for analysing variance in export earnings	64
5.2 Effects of price stabilization schemes on producer welfare	71
6.1 Market effects of a process innovation	85

Figures

1.1 Index of volumes of exports of selected crops, Papua New Guinea, 1958-86	5
1.2 Index of aggregate volume of exports of major agricultural products and of copper, Papua New Guinea, 1958-86	6
1.3 Terms of trade for Papua New Guinea, all developing economies and all industrial market economies, 1960-86	6
1.4 Indexes of prices for major exports of Papua New Guinea, 1966-87	8
1.5 Foreign indebtedness, debt service and foreign investment, Papua New Guinea, 1975-87	9
2.1 Changes in the supply of and demand for agricultural and non-agricultural goods in a growing economy	19
2.2 Real international prices for agricultural products, 1900-85	20
2.3 The market for non-tradables in a booming economy	23
3.1 Inter-connections between secure land tenure and the credit market	37
3.2 Real minimum weekly wages, rural and urban, Papua New Guinea, 1972-86	43
3.3 The labour market in Papua New Guinea	45
3.4 The labour market with a subsidized urban sector	47
3.5 Effects of increased urban wage costs on the quantity produced and price received by farmers	49
4.1 Volume of log and other forest product exports, Papua New Guinea, 1971-86	56
4.2 Value of log and other forest product exports, Papua New Guinea, 1971-86	57
5.1 Fluctuations in the unit values of coffee, cocoa and coconut products exported from Papua New Guinea, 1961-86	65

5.2 Fluctuations in the quantities of coffee, cocoa and coconut products exported from Papua New Guinea, 1961-86	66
--	----

5.3 Effects of price stabilization on producer welfare	72
--	----

6.1 Market effects of a process innovation	86
--	----

7.1 Age earnings profiles, Papua New Guinea, 1979	95
---	----

Key to symbols used in tables

n.a.	Not applicable
..	Not available
-	Zero

Overview

Post-Independence Papua New Guinea: a resource-rich economy with good prospects

Papua New Guinea has many of the signs of a newly independent developing economy on the move. Leading up to and following its Independence from Australia in September 1975, its trade, particularly exports, has diversified away from Australia, the monetized sector of the economy has expanded substantially, the overwhelming reliance on agriculture has moderated and the dependence on foreign aid is gradually falling (see Garnaut and Baxter 1983; Goodman, Lepani and Morawetz 1985). Moreover, two spectacular copper mines have been successfully developed — Bougainville from the early 1970s and Ok Tedi from the early 1980s — and another series of gold and petroleum developments are in prospect for the 1990s. Largely as a result of Bougainville, the value of Papua New Guinea's exports at constant prices quadrupled between 1971 and 1976.

Disappointing record of recent economic development. Why?

Yet, despite all these signs of economic progress in Papua New Guinea, the average income in this resource rich economy has not grown. In fact, for the vast majority of the population still living in villages, real incomes may well have declined during the first decade of Independence, a period when food production per capita fell by an estimated 7 per cent. Moreover, urban unemployment has become serious in recent years.

Poor performance of agricultural sector in particular

This disappointing growth performance has led the government to reassess its policies and priorities. Why have living standards not risen during the past decade or so? In particular, why has agriculture performed so poorly? If another minerals export boom eventuates in the 1990s, will that leave the country too vulnerable to multinational companies and to the vagaries of international market fluctuations? Will it ease or exacerbate urban unemployment problems? Will it make Papua New Guinea more dependent on imports of food? The latter is a particular concern of former Deputy Prime Minister Sir Julius Chan who, according to Gupta and Polume (1984:8), believes it is a 'national shame' that such a land-abundant country cannot completely feed itself.

Government looks to shift policy emphasis towards smallholder agriculture

With these questions in mind, the Papua New Guinea government is looking to shift its policy emphasis toward smallholder agriculture. The multiple aims of such a change, as perceived by the government, are to:

- boost incomes in rural areas;

- diversify and expand the monetized part of the economy and thereby broaden the domestic tax base so that the government can reduce its dependence on foreign aid;
- expand export earnings to help meet the country's rapidly expanding debt service obligations;
- alleviate the problems associated with high urban unemployment;
- reduce the country's dependence on food imports; and
- reduce dependence on multinational companies and international markets for export earnings.

Aims of this study

The purpose of this study is to examine the impact of recent economic growth, structural changes and policies on the role that agriculture — particularly smallholder agriculture — has played in Papua New Guinea's development. This is an essential step in the process of assessing alternative development strategies the government might adopt in the years ahead.

The study is in four parts. The first documents the extent of Papua New Guinea's economic growth and structural changes since the 1960s and the contribution of those developments to agriculture's relative decline during that period. They are not the only reason for agriculture's poor growth performance, however. Much of the explanation has to do with government policies. The second analyses the effects of policies which alter the incentives faced by farmers in both factor and product markets. The third examines the role played by public investment in technology, human resources and infrastructure in the rural sector. Finally, lessons and key policy implications are drawn from the recent past, and a list is provided of some of the priority areas where further economic analysis could improve public debate.

The pattern of economic change since the 1970s: the relative decline of agriculture

By global standards the aggregate economic growth of Papua New Guinea has been very slow since the mid 1970s. Yet the growth in export volumes and the extent of inter-sectoral change in the structure of its economy — typically indicators that are highly correlated with the rate of economic growth — are shown in Chapter 1 to have been equal to or, in the case of exports, well above the average for developing countries. Even after adjusting for a one-third deterioration in the country's terms of trade, its exports in 1986 were able to buy three times as many imports as in 1970 and ten times as many as in 1965. Large-scale mining began only in the early 1970s, but by the end of that decade minerals accounted for one-eighth of national income and half of the country's export earnings. Meanwhile, agriculture's share of national product fell from 42 to 34 per cent and its share of exports fell from more than 90 per cent to just 40 per cent between the late 1960s and 1986. One in four workers had non-agricultural jobs by 1980, compared with only one in ten in the early 1960s.

Effects of the mineral export boom

The relative decline of agriculture in Papua New Guinea has four sets of explanations. First, this is something that tends to happen, to some extent at least, in all economies in the course of national and global economic growth, for reasons spelt out in the first part of Chapter 2.

Second, agriculture's decline was accentuated in Papua New Guinea because of the construction of the massive Bougainville and Ok Tedi mine sites — financed largely by foreign capital inflows — and the subsequent boom in mineral exports. The consequent real appreciation in the value of Papua New Guinea's currency reduced the competitiveness of other sectors producing tradables or goods such as perishable food staples for which there are close substitutes which are tradable. The effects of this second set of forces on agriculture are analysed in the latter part of Chapter 2.

Government policies affecting the agricultural sector

The other two sets of explanations for the relative decline of agriculture — and for the economy's overall sluggishness — have to do with government policies. One set is concerned with policies affecting incentives faced by farmers and other producers in factor and product markets (Chapters 3 to 5). The other relates to public investments in technology, human capital and infrastructure which affect both rural and non-rural output and productivity (Chapters 6 and 7).

Policies affecting agricultural incentives involve much more than what are typically called agricultural policies. They include policies affecting markets for land, labour and financial capital, since these have an important bearing on costs of agricultural production and on the supply of resources to agriculture. They also include trade and exchange rate policies, which affect the kina value of agricultural products both directly and indirectly, and taxation policies which influence the net return to producers.

Problems with the land tenure system

Chapter 3 begins with the land market. An extremely small proportion — only 1.2 per cent — of Papua New Guinea's land is used for agriculture, and three-quarters of that is planted to export tree crops. Hence, even though the total land area per capita is quite high by global standards, the amount of land used for agriculture per farm worker is less than one-tenth that for the average developing country. One reason so little land is used stems from the land tenure system. Traditionally, customary land is owned by groups or clans, and people born into a group automatically become co-owners. There are no titles to that land, however, so tenure is insecure and the right to buy, improve and resell land is absent. This reduces the incentive for an individual to make long-term investments in improving the productivity of the land, including the initial investment of clearing forest land for agricultural purposes. Progress toward issuing formal titles for land has progressed extremely slowly, primarily because it is almost impossible to get the required consensus before land is alienated. Moreover, even the 2 or 3 per cent of land that has a freehold or leasehold title cannot be sold to non-nationals, and nationals do not value highly the certificate of title because they fear conflict with other groups who may claim customary right to that land. Hence, there is a major divergence between the private and social value of land, leading to gross underutilization of, and underinvestment in land. In addition, without land titles as collateral, farmers have difficulty obtaining long-term credit for investment in agriculture. Clearly the government needs to make a much bigger investment in finding ways to improve the security

of customary land tenure and to speed up the process of issuing new titles and transferring existing titles.

**Rural credit policy
weakens the position of
smallholders**

The market for financial capital is also grossly distorted, and in ways which probably reduce the resources available for agricultural production, especially smallholder production. The banks have tried to find ways to reduce the uncertainty of lending to farmers in the absence of secure land titles, though such attempts inevitably raise the cost of agricultural lending. Partly in response to this high cost of lending the government has chosen to subsidize loans for farmers, especially via the government's Agriculture Bank, and to require commercial banks to offer some additional agricultural loans at concessional rates of interest. The latter necessarily means that those banks have to charge higher rates of interest to other borrowers and/or pay lower rates of interest to depositors. This most probably has meant that fewer funds are available in aggregate for agricultural lending. It certainly has meant that the available concessional finance is allocated to the banks' least risky and least costly customers, who tend to be the large borrowers with secure collateral. Thus agriculture as a whole — but especially the smallholder subsector — is likely to be worse off, rather than better off, as a result of Papua New Guinea's rural credit policy.

**High non-farm wages and
the shift to the towns**

The distortions in the labour market also generate inefficiencies and inequities in resource use. The very high minimum urban wage in Papua New Guinea ensures that fewer people are employed in the non-agricultural sectors than would be the case otherwise. This does not necessarily mean that more people are employed in agriculture, or that the rural wage level is lower than it would otherwise be. High urban wages attract rural people to the towns in search of jobs. There is a limited number of urban jobs, and the consequent unemployment results in less production in the economy, law-and-order problems in the towns, and possibly even less labour and higher wage costs in the agricultural sector. These problems may be exacerbated if the non-agricultural sectors are protected from import competition or otherwise subsidized. Moreover, as farmers expand their cash sales and their purchases of modern inputs they will be further disadvantaged by the effect of high non-farm wages on the price of purchased inputs and marketing services.

**Effects of market
distortions on agriculture**

The net effect of these distortionary policies in the markets for the country's land, capital and labour resources is certainly to reduce aggregate production and most probably to reduce agricultural production in particular. Without doubt a great deal more agricultural land would become available, and all agricultural land would be utilized better, if more secure forms of land tenure could be implemented. Freeing up the finance and labour markets would also improve the efficiency with which the nation's resources are used, and make for greater equity.

**Implications of government
trade restrictions
— on food**

Product markets, too, are distorted by government policies. While Papua New Guinea is not as interventionist as many developing countries, there appears to be increasing use of trade restrictions as a

means of encouraging or discouraging the production or consumption of selected goods. For example, imports of many food items are banned, apparently to encourage the production of domestic substitutes. Diverting agricultural resources from low cost to high cost activities reduces the overall efficiency and growth of the agricultural sector, however, and raises the cost of purchasing food while reducing the variety of nutrients available for consumption. Also, in the case of intensive livestock products which can be produced efficiently only by relying on imported feedgrains, it does little to boost the country's food self-sufficiency.

— and on non-agricultural goods

Import restrictions also apply to many non-agricultural goods. While to date these have not encouraged a large amount of manufacturing activity, they have the potential to do so as cash incomes and hence domestic demand expand. A more uniform set of import tariffs in place of the current wide diversity of tariff and non-tariff barriers would be less likely to encourage resources to move into high cost industries. At the same time they would enhance the amount of government revenue raised by a given degree of trade restriction. An alternative and more radical policy change would be to replace import barriers by a uniform export tax. The latter would be no more disadvantageous than the former from the viewpoint of export industries, and it would have a number of advantages including lower costs of administering trade restrictions and fewer opportunities for potential import-replacing producer interest groups to seek favours from the government.

The 'hard kina strategy' and agriculture

The other important policy which affects product prices, also discussed in Chapter 4, concerns the exchange rate. Insofar as Papua New Guinea's 'hard kina strategy' has artificially held up the value of the kina, it has raised the price of non-tradable goods and services relative to the price of tradables. It is true that the real depreciations allowed since 1983 represent a slight change in government policy to allow market forces to play more of a role in the foreign exchange market than had hitherto been the case. However, given the substantial deterioration in the country's terms of trade during the 1980s and the economy's mounting foreign debt service obligations, further devaluation may be warranted. If such action were forthcoming, it would allow the sectors producing tradable goods, not least agriculture, to make a more substantial contribution to the economy's development.

Inadequacies of price stabilization schemes

Papua New Guinea, like many primary exporting developing countries, faces rather unstable external terms of trade. Fluctuations in export earnings are commonly assumed to be bad for a developing economy because of their contribution to macroeconomic instability and because they will induce producers to invest less in the export sector. Governments therefore conclude that price stabilization schemes are desirable for any major export commodity whose international price fluctuates markedly. Not surprisingly, Papua New Guinea has implemented buffer fund arrangements for its major tree crops. These schemes require levies from producers in high-price years with the money being deposited in a fund to be drawn on in low-price years when producers receive a supplement to the export

price. In practice such schemes turn out at best to make a minor contribution to welfare and development but more usually to worsen welfare and inhibit development. The brief examination in Chapter 5 of Papua New Guinea's schemes seems to be consistent with this general experience.

— they contribute little to macroeconomic stability

First, the agricultural price stabilization schemes have contributed very little to the stability of Papua New Guinea's macro-economy. Except during the very exceptional coffee price boom of the late 1970s, the change in the stabilization funds in aggregate has never been more than 5 per cent of the money supply (M3). Furthermore, the change in export receipts has been rather imperfectly matched with the change in stabilization fund deposits by the administrators of the scheme, and at times the schemes have added to macro instability because of lags in adjusting the levies/subsidies to the changing international market. It would thus appear that Papua New Guinea would be better off simply using conventional monetary and fiscal policy instruments for managing the macro-economy rather than agricultural price stabilization schemes.

— and do little to enhance producer welfare or encourage investment

Second, the schemes have done little better in contributing to producer welfare. It is true that producers' gross receipts have fluctuated less on average because of the schemes for coffee, cocoa and coconut products, though not for palm oil to date. But the average level and growth of producers' receipts have been reduced by the schemes, and only part of the loss to producers is preserved in the stabilization fund for future disbursement. Moreover, by dampening incentives to innovate and to expand during long periods of high export prices, these schemes may well lead to less, rather than more, investment in export agriculture.

Need to reassess efficiency of public and private investments

A fundamental aspect of economic development involves improving the quantity and quality of capital assets, the services of which, when combined with people's labour, are able to generate products desired by the community for consumption or export. Johnson (1964) suggested that the most rapidly growing economies are those which are most efficient at using existing resources to increase the quantity and enhance the quality of the stock of capital through investment activities. He also stressed that capital should be taken to include not just physical assets such as machines, land and mineral deposits but also human health and skills, knowledge about how best to transform inputs into outputs, and institutions such as a well-functioning legal system. Since Papua New Guinea may well have a steadily increasing flow of investable revenue over the next decade or so (as newly developed mineral and energy resources are exploited), now is an especially appropriate time to reassess the efficiency of major public and private investment activities undertaken to help achieve the country's development goals.

Greater investment in agricultural research is needed

Chapter 6 examines the recent performance of, and future prospect for, investing in agricultural research and extension activities. The slow growth in agricultural production and productivity in Papua New

Guinea compared with other developing countries, and the government's desire to boost agricultural exports and the incomes of villagers, highlight the need to look critically at this area. The evidence presented suggests Papua New Guinea has been greatly underinvesting in agricultural research. Further investment in this area is likely to provide a very high (though not necessarily immediate) pay off in terms of expanded agricultural and national income. The evidence also suggests that the extent of underinvestment has varied widely between different activities. Too little is going to research compared with extension, and of the research expenditure too little is going to coffee, coconuts and, to a slightly lesser extent, cocoa. This does not necessarily mean more government expenditure from consolidated revenue needs to be spent on government research stations. Instead the government might simply increase the export levies currently imposed on producers and pass that money to existing or new producer-owned research and extension institutions. As for traditional staple food crops, there appears to be little demand for research in this area by either smallholder producers or consumers. Thus, given the extremely high returns likely to flow from further research investment in export crops in which Papua New Guinea already has a strong comparative advantage, the latter would appear to be the most appropriate way to satisfy the government's objectives.

***Investment reallocation
needed — In education***

The more educated the farming population, the greater the benefits from new agricultural technologies. This is because new technologies typically involve more complex management decisions and education tends to enhance decision-making capabilities. For this reason alone the returns from investing more in rural education will increase as agricultural research expands. In addition, a better-educated rural population will provide more capable workers for the expanding proportion of jobs in the non-farm sectors of the economy. Thus, even though a large proportion of the government's budget is already devoted to education, Chapter 7 shows that further investment in elementary education would yield a very high social return. The same cannot be said for upper secondary and especially tertiary education, however, so the proportion of the resources currently devoted to these areas might be reduced somewhat during the next few years. In addition to improving the efficiency of public investment in education, such a reallocation would also reduce future income inequalities.

— and in health

In the health area, too, Papua New Guinea is spending more per capita than many other developing countries. Despite that, the standard of health is still low, although switching to a more nutritious diet would be sufficient to solve some of the problems. As with education, it would appear that a reallocation of current spending away from hospitals in the larger towns and towards small scale health services in rural areas — and perhaps also to lower cost, church-run health services in the towns — would result in both more efficient and more equitable access to health care. Not only would a better rural health service enhance the welfare of rural people directly, but through boosting labour productivity

it would also contribute to food output and income growth in the agricultural sector.

More expenditure on maintaining roads and port facilities is warranted

Transport infrastructure and the efficiency of transport services also have a major impact on the welfare of rural people as traders and passengers. From the viewpoint of a producer of agricultural exports, transport and handling costs are essentially an export tax: the higher they are, the lower is net income. Furthermore, high transport costs reduce the volume of staple food that is marketed and so reduce overall food self-sufficiency. While no major new road construction projects seem to be economically justified, greater expenditure on maintaining and upgrading roads is warranted. Similarly, while no additional ports are warranted there may be a high rate of return from improving a number of the major existing ports. In addition, fewer regulations in the provision of port, coastal shipping and airline services and a fostering of private competition in these areas could contribute toward containing expenditure on transportation.

Better maintenance of law and order required

Also noted in Chapter 7 is the role the government plays in maintaining law and order. A breakdown in law and order reduces well-being by eroding people's peace of mind and raising their cost of living. In addition, it can reduce rural people's income directly. For example, cash buyers who purchase coffee from smallholders along the Highlands Highway inevitably pass on the cost of higher premiums for insurance against robbery. In the longer term, the absence of law and order can adversely affect income growth; the quality of agricultural research, rural education and the training of teachers and nurses, for example, will suffer through difficulties in attracting and recruiting people with the required skills.

Priority areas for further analysis identified

This study is very much a broad brush view of the implications for agriculture of Papua New Guinea's economic growth, structural change and economic policies. In skimming the surface of numerous issues it raises implicitly many more questions — particularly of an empirical nature — than it has answered. Some of them must await an improvement in the collection and publication of statistics on the economy before they can be answered. But even with currently available data there would be much to gain from further in-depth empirical analysis of a number of issues that have had to be ignored or only briefly touched on here. The final chapter identifies some priority areas: assessing alternative tax structures, booming sector analysis, land tenure alternatives and analysis of priorities in government expenditure and of sectoral taxation and assistance policies. Research into these aspects of government policy and resource allocation would clearly promote a much more informed debate within the policy-making process.

Agriculture's relative decline

1

Economic growth and structural changes since the 1960s

**Poor economic growth,
poor agricultural
performance**

In the 1960s Papua New Guinea's economy performed better than the average for developing countries. Since then, however, it has performed poorly both in absolute terms and relative to other economies. Agriculture in particular has not performed well especially in producing food for local consumption. This chapter examines Papua New Guinea's economic growth performance compared with other developing countries and discusses the structural changes that have occurred in the process of Papua New Guinea's economic development. From this examination a number of notable features emerge, explanations for which are sought in subsequent chapters. The most significant feature is the relatively slow growth of Papua New Guinea's economy in spite of massive mineral exploitation. Another is the speed of structural change— typically something that is highly correlated with the rate of economic growth which — for Papua New Guinea, has been above the average for developing countries. A third feature is that food production per capita in Papua New Guinea appears to have declined in absolute terms since the mid 1970s.

Economic growth

**Comparative growth
respectable in 1960s**

The economy of Papua New Guinea grew relatively rapidly in the 1960s. Its real gross domestic product (GDP) grew at an annual average rate of 6.5 per cent, compared with 5.9 per cent for other middle income economies and 4.4 per cent for low income economies other than China and India. During that decade Papua New Guinea's population is estimated to have grown a little less rapidly than populations in other developing countries, and hence real per capita GDP grew substantially faster in Papua New Guinea than in other developing countries and even slightly faster than in industrial countries (Table 1.1).

poor in 1970s

However during the 1970s real per capita income stagnated in Papua New Guinea, and in the 1980s it even declined. While the global economy generally has grown much more slowly during the past fifteen years than in the 1960s, in relative terms Papua New Guinea's performance has been poor and contrasts markedly with neighbouring Indonesia and Malaysia which also enjoyed booms in export earnings in the 1970s. The only group of countries to have done worse than Papua New Guinea in the 1980s (though not in the 1970s) is sub-Saharan Africa (Table 1.2).

even poorer in 1980s

Table 1.1

Growth in real GDP, population and real GDP per capita, Papua New Guinea and other economies, 1960-86 (per cent per year)

	Real GDP			Population			Real GDP per capita		
	1960-70	1970-80	1980-86	1960-70	1970-80	1980-86	1960-70	1970-80	1980-86
Papua New Guinea	6.5	2.3	1.8	2.1	2.3	2.3 ^a	4.4	-	-0.5
Industrial market economies	5.2	3.2	2.5	1.0	0.8	0.6	4.2	2.4	1.9
Middle income economies	5.9	5.6	2.3	2.5	2.4	2.3	3.4	3.2	-
Low income economies (excl. China & India)	4.4	3.5	2.9	2.4	2.6	2.8	2.0	0.9	0.1
Indonesia	3.9	7.6	3.4	2.0	2.3	2.2	1.9	5.3	1.2
Malaysia	6.5	7.8	4.8	2.8	2.4	2.7	3.7	5.4	2.1

^aThere is considerable uncertainty as to the actual population growth rate in Papua New Guinea. In its 1987 World Development Report the World Bank quoted 2.6 per cent for 1980-85, which is close to unofficial estimates by observers in Papua New Guinea. In the 1988 World Development Report, however, a value of 2.1 per cent is quoted. The intermediate value of 2.3 per cent, used by Goodman et al. (1985), is adopted.

Source: World Bank, *World Development Report*, New York, Oxford University Press, 1982 and 1988.

Effect of departing expatriates

To some extent the poor performance from 1973-80 is simply a consequence of many high income expatriates leaving the country taking their savings and skills with them. However, the corollary of this has been that increasing proportions of export tree crop production, urban commercial business activities and jobs in the bureaucracy previously owned or held by non-nationals are now in the hands of nationals and their real incomes have increased substantially. According to Garnaut and Baxter (1983:66) the increase in the share of market GDP accruing to nationals in the late 1970s is a reversal of the trend during the 1960s and early 1970s. This suggests that incomes of nationals grew less rapidly in the 1960s and early 1970s and more rapidly in the rest of the 1970s than the aggregate data in Tables 1.1 and 1.2 suggest. However, Garnaut and Baxter also note that, by the end of the 1970s, nationals' share of production was stabilizing at a high level. Lack of growth in aggregate GDP per capita in the 1980s thus reflects a loss in real income even for nationals.

Effective changes in terms of trade

Real GDP growth rates in Tables 1.1 and 1.2 are estimated at constant prices. However, if a country's terms of trade change over time the purchasing power of traded production also changes. A more accurate measure of the real value of production would adjust for the effects of changes in the terms of trade. Papua New Guinea's terms of trade deteriorated markedly in the 1970s and 1980s whereas for other developing countries, on average, the opposite occurred. Adjusting for this fact shows Papua New Guinea to have done even worse since 1973. Growth rates for real per capita GDP, after adjusting for the terms of trade change, are -2.3 per cent for 1973-80 and -1.5 per cent for 1980-86 (for 1965-73 the growth rate remains 4.2 per cent), well below the unadjusted rates shown in Table 1.2.

Table 1.2 Growth in real GDP per capita, Papua New Guinea, sub-Saharan Africa and all developing economies, 1965-86 (per cent per year)

	1965-73	1973-80	1980-86
Papua New Guinea ^a	4.2	-1.0	-0.5
All developing economies	3.9	3.1	1.5
Sub-Saharan Africa (excl. S. Africa)	3.7	0.7	-2.9

^aGDP per capita adjusted using Papua New Guinea National Statistical Office estimates for 1965-80.

Source: World Bank, *World Development Report*, New York, Oxford University Press, 1988.

Massive growth in exports

This poor performance is surprising given the dramatic growth in the volume of Papua New Guinea's exports in the decade to the mid 1970s. In the 1960s, coffee and cocoa were the key sources of export growth. Then, from 1974, palm oil exports began to grow (Figure 1.1). However, the growth in agricultural exports was eclipsed during the period 1972-75 by the export of massive volumes of copper and gold from Bougainville (Figure 1.2). Exports did not expand much in the latter half of the 1970s; indeed Papua New Guinea's export growth performance then was as poor as that of sub-Saharan Africa (see Table 1.3). But in the 1980s exports of some commodities expanded again. Between 1980 and 1984 the volumes of log and palm oil exports doubled and quadrupled, respectively, and the volume of gold exported in 1985 and 1986 was twice that of earlier years. Given the much greater export volume in the 1980s compared with the 1960s, one might expect to have seen substantial investments in place that were able to provide permanently higher and growing incomes.

Figure 1.1
Index of volumes of exports of selected crops, Papua New Guinea, 1958-86 (million kina, valued at 1980 export unit values)

Source
Papua New Guinea, National Statistical Office, *Summary of Statistics and Abstract of Statistics*, Port Moresby, various issues.

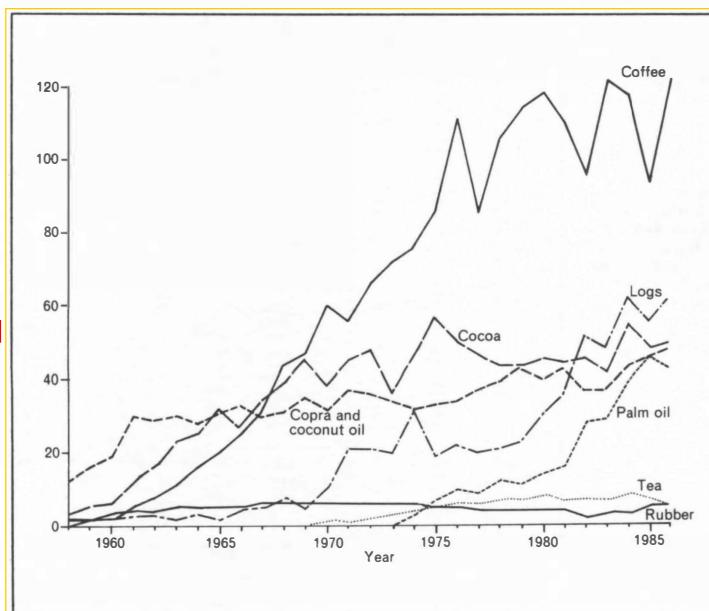


Figure 1.2
Index of aggregate volume of exports of major agricultural products^a and of copper, Papua New Guinea, 1958-86 (million kina, valued at 1980 export unit values)

^aCoconut products, coffee, cocoa, palm oil, rubber and tea.

^bFor copper ore and concentrate a price of K500 per tonne is used. This was close to the average unit value in 1979, 1981 and 1982, compared with the historically very high value of K601 in 1980.

Source

Based on data from Bank of Papua New Guinea, *Quarterly Economic Bulletin*, Port Moresby, various issues

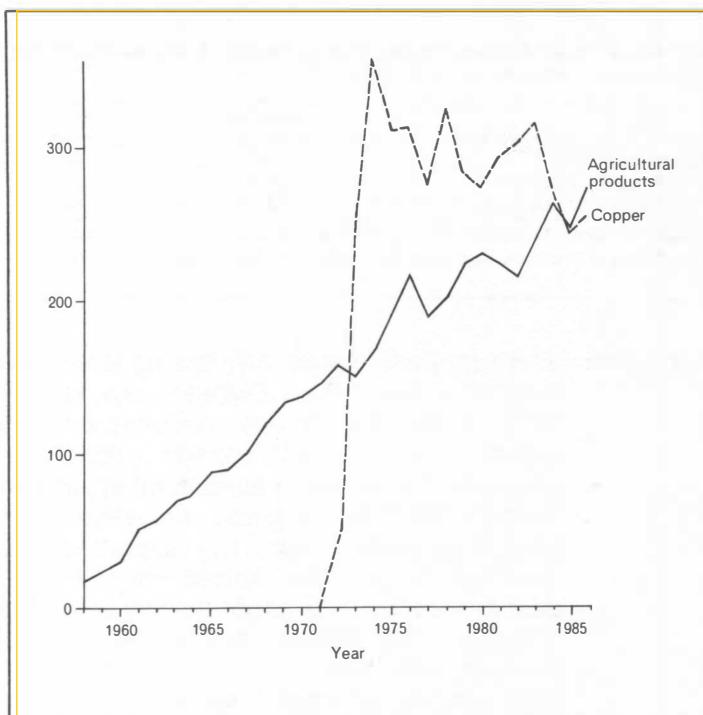
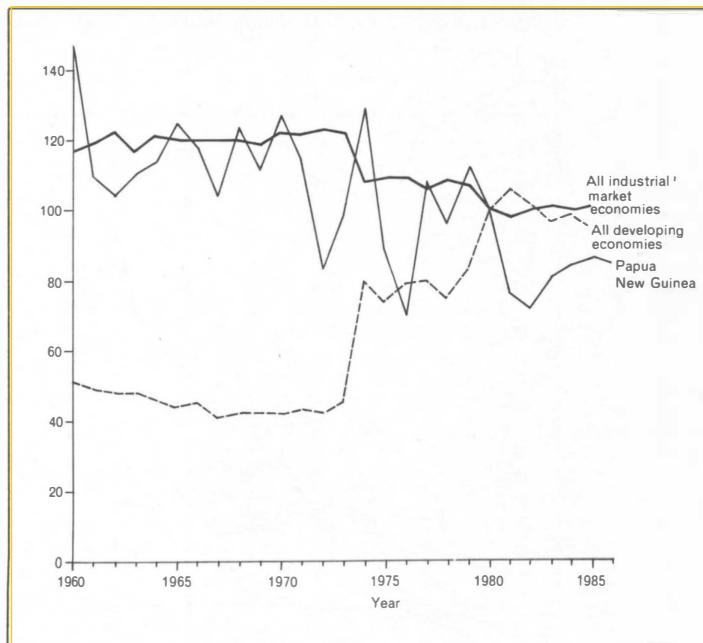


Figure 1.3
Terms of trade for Papua New Guinea, all developing economies and all industrial market economies, 1960-86
 $(1980 = 100)$

Sources

UNCTAD, *Handbook of International Trade and Development Statistics*, Geneva, 1986 supplement; Bank of Papua New Guinea, *Quarterly Economic Bulletin*, Port Moresby, various issues



**Table 1.3 Growth in export volume, Papua New Guinea and other developing economies, 1965-86
(per cent per year)**

	1965-73	1973-80	1965-80	1980-86
Papua New Guinea	32.4 ^a	0.0 ^b	12.8	3.2
Middle income economies	5.3	4.8	3.2	4.6
Low income economies	2.0	4.7	2.7	6.5
Sub-Saharan Africa (excl. S. Africa)	15.0	0.1	..	-3.4
Indonesia	9.6	2.0
Malaysia	4.4	10.2

^a1965-74.

^b1974-80.

Sources: World Bank, *World Development Report*, New York, Oxford University Press, 1988:191, 242; Bank of Papua New Guinea, *Quarterly Economic Bulletin*, Port Moresby, various issues.

Long term deterioration in terms of trade is only a partial explanation for slow growth

A part — but only a small part — of the reason for export volume growth not boosting incomes is that Papua New Guinea suffered a less favourable trend in its external terms of trade than other developing countries. During the 1960s and 1970s, the country's terms of trade fluctuated around a flat trend. However, between 1979 and 1982 they deteriorated substantially and had recovered only a little by 1986. This contrasts with the experience of other developing countries which, on average, have enjoyed a substantial improvement in their terms of trade since 1970. Even industrial economies — hit by rising energy import prices in 1973-74 and 1979-80 — suffered only a modest worsening in their terms of trade compared with Papua New Guinea (Figure 1.3). The fluctuations in prices have varied considerably within the export commodity group, however, with peaks and troughs for individual commodities sometimes coinciding and sometimes offsetting each other (Figure 1.4). The net effect of changes in the country's terms of trade can be seen in Table 1.4. Despite the deterioration in the terms of trade between 1965 and 1986, it was nonetheless possible in 1986 to buy ten times as many imports as it was in 1965 or three times as many as in 1970, given the growth in export volume.

Increased indebtedness suggests excessive consumption

The declines in real incomes in Papua New Guinea since the mid 1970s have not been matched by similar declines in consumption, resulting in increased indebtedness during the 1980s. The total overseas debt outstanding in the latter half of the 1970s averaged about one-quarter of GDP, but by the mid 1980s it averaged more than three-quarters of GDP. The debt service ratio has worsened even more, rising from around 4 per cent of exports in the 1970s to an estimated 50 per cent in 1986 (Figure 1.5). As it happens, only part of the increased indebtedness is being channelled into investments. The growing consumption-driven part of the debt burden is thus postponing the time when Papua New Guinea can phase down its dependence on foreign aid from Australia and elsewhere.

Table 1.4 Indexes of export volume, terms of trade and export value, Papua New Guinea, 1965-86
(1965 = 100)^a

	Export volume	Terms of trade	Value of exports in terms of imports
1965	100	100	100
1970	325	103	335
1974	1250	103	1290
1980	1250	80	1000
1986	1550	68	1060

^aExport volume index multiplied by the terms of trade index, divided by 100.

Sources: Derived from data in Bank of Papua New Guinea, *Quarterly Economic Bulletin*, Port Moresby, various issues; and Papua New Guinea National Statistical Office, *Summary of Statistics and Abstract of Statistics*, Port Moresby, various issues.

Figure 1.4
Indexes of prices^a for major exports of Papua New Guinea, 1966-87
(1977 = 100)

^aPrices are in domestic currency terms and so include the effect of exchange rate changes. The copper prices are London quotations published by the International Monetary Fund.

Source
Papua New Guinea, National Statistical Office, *Summary of Statistics and Abstract of Statistics*, Port Moresby, various issues; International Monetary Fund, *International Financial Statistics*, Washington D.C., 1987.

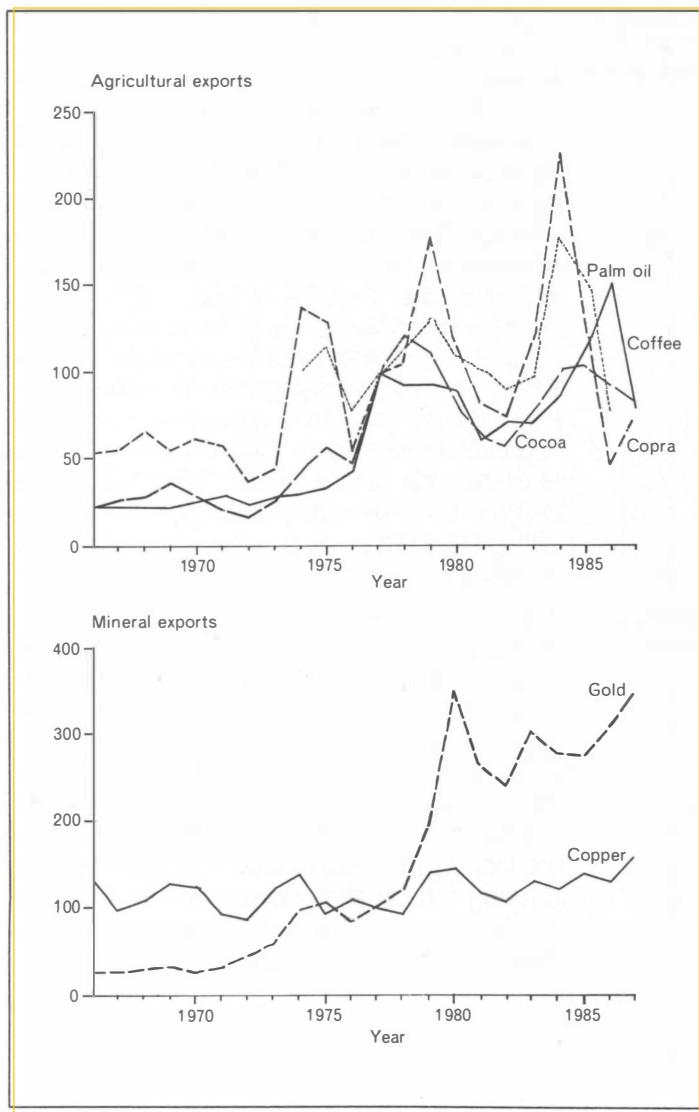


Table 1.5 Food and agricultural production in Papua New Guinea and other developing economies, 1975-86 (1975 = 100)

	<i>Food production^a</i>		<i>All agricultural production</i>	
	Total	Per capita	Total	Per capita
Papua New Guinea				
1975	100	100	100	100
1980	109	95	113	98
1986	124	93	127	95
All developing economies (excl. China)				
1975	100	100	100	100
1980	115	101	114	101
1986	136	105	134	103
East Asian developing economies (excl. China)				
1975	100	100	100	100
1980	116	103	116	104
1986	142	112	141	112
Indonesia				
1975	100	100	100	100
1980	127	114	128	115
1986	168	135	169	135
Malaysia				
1975	100	100	100	100
1980	127	114	121	108
1986	164	127	147	114

^aNot including beverages.

Source: Food and Agriculture Organization, *Production Yearbook*, Rome, 1986.

Figure 1.5
Foreign indebtedness,
debt service and foreign
investment, Papua New
Guinea, 1975-87 (per cent)

^aDebt outstanding as per
cent of GDP

^bAs per cent of exports

^cAs per cent of GDP

Source
Papua New Guinea, National
Statistical Office, *Balance of
Payments Statistics*, Port Moresby,
various issues; Asian Development
Bank, *Economic Survey of Papua
New Guinea*, Manila, August 1987.

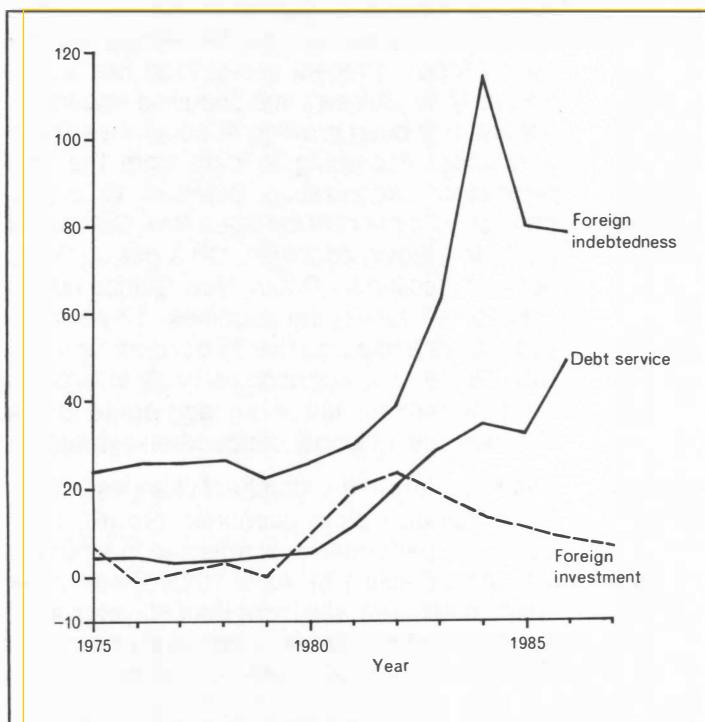


Table 1.6 Social development indicators, Papua New Guinea and other developing economies, 1985

	Papua New Guinea	Low income economies	Middle income economies
Life expectancy at birth (years)	52	60	62
Infant mortality (per 1000 live births)	68	72	68
Population growth rate (% p.a., 1980-86) ^a	2.3	1.9	2.3
Persons per physician (1981)	15,600	6050	4950
Persons per nurse (1981)	950	3900	1400
Daily per capita calorie supply	2180	2340	2730
Daily per capita protein supply (grams)	46	57	
Gross primary school enrolment (as % of population in primary school age group)			
total	64	99	104
male	73	110	109
female	58	88	101
Gross secondary school enrolment (as % of population in secondary school age group)	14	34	49
Number enrolled in tertiary education (as % of population aged 20-24 years)	2	2	14
Foreign aid per capita (\$US)	74	5	11
% of GDP	12	2	1

^aAs mentioned in the note to Table 1.1, there is considerable uncertainty as to the actual population growth rate in Papua New Guinea.

Sources: World Bank, *World Development Report*, New York, Oxford University Press, 1987 and 1988; Asian Development Bank, *Economic Survey of Papua New Guinea*, Manila, August 1987.

Increasing reliance on imported food

In addition to being concerned about overall poor growth, the government of Papua New Guinea is also worried by the lack of growth in the staple food sector and the increasing reliance of the country on imported food. In recent years, food has accounted for one-fifth of all Papua New Guinea's merchandise imports, and the volume of food imports has been growing at about 4 per cent per annum since Independence. According to data from the United Nations Food and Agriculture Organization, between 1975 and 1986 food production grew only 24 per cent in Papua New Guinea compared with 36 per cent in all developing countries. On a per capita basis this represents a 7 per cent decline for Papua New Guinea compared with a rise of 5 per cent for all developing countries, 12 per cent for East Asian market economies and a massive 35 per cent for Indonesia (Table 1.5). Papua New Guinea has not done as badly in expanding its non-food agricultural production but even aggregate agricultural production has declined since Independence when expressed in per capita terms.¹

Social development indicators falling behind also

Before turning to the structural changes that have accompanied Papua New Guinea's slow economic growth, it is worth noting that the economic performance is reflected in a number of social development indicators (Table 1.6). As of 1985, life expectancy at birth was only 52 years, compared with more than 60 years in developing countries as a group — and despite no higher infant mortality than in other developing countries. This is due partly to inadequacies in the health care system,

¹ There is considerable uncertainty associated with Papua New Guinea's population and subsistence food production estimates. However, a careful study by Shaw (1984) concludes that per capita food production may well be declining and at best it would be increasing only very slowly. See also Goodman, Lepani and Morawetz (1985: Ch.4).

one indicator being the very small number of physicians in the country, and also to the low calorie and protein intake in some regions. School enrolments are also much lower than in other developing countries (especially for females) and, on a per capita basis, Papua New Guinea still ranks as one of the world's most aid-dependent economies. While most of these indicators represent a substantial improvement compared with a decade or so ago, they suggest that health, education and food intake are below the standards of other developing countries.

Structural changes

Pre-1970s: a dual economy of subsistence agriculture and foreign, monetized enclaves

Prior to the 1970s Papua New Guinea was a dualistic economy. Close to 90 per cent of the population was involved in subsistence agriculture and was only just beginning to earn and use cash. The monetized part of the economy was closely linked with the Australian economy. A small enclave of large-scale plantations owned by foreign corporations or individuals provided most of the export earnings, budgetary grants from Australia funded most government services, Australian currency was used, and the majority of Papua New Guinea's external trade was with Australia. The average income per capita was in the mid-range for developing countries, but about three-quarters of estimated gross domestic product was spent by the small, affluent enclave. Thus it is not surprising that Papua New Guinea was more agrarian in terms of employment than other developing economies with the same average income per capita. In the early 1960s only one in ten workers in Papua New Guinea had jobs outside of agriculture, compared with one in three for other middle income countries.

Papua New Guinea in the 1960s was also more agrarian in terms of agriculture's share of exports than other developing economies with similar levels of per capita income. Its relatively strong comparative advantage in agriculture is explained by the low population density (16 hectares per capita in 1970 compared with a global average of 3 hectares), poorly developed labour skills and urban infrastructure for attracting foreign industrial capital, and the absence at that time of known, commercially viable mineral deposits (see Anderson 1983).

Since 1960s: agriculture's share of GDP declining; fall in subsistence food production

Despite the fact that per capita income has not grown much in Papua New Guinea since the 1960s there have been quite marked structural changes during the past two decades. The most obvious changes are the decline in relative importance of agriculture as mining activities have grown, increased dependence of the economy on foreign trade, and increasing monetization of rural activities. Agriculture's share of GDP was more than 40 per cent in the 1960s, but it fell to around 30 per cent in the mid 1970s. Exports of goods and services amounted to less than 20 per cent of GDP prior to the early 1970s but have accounted for about 45 per cent of GDP in recent years. Meanwhile, subsistence food production has fallen from more than one-quarter to less than one-seventh of total GDP and from nearly two-thirds to less than one-half of agricultural GDP.

Table 1.7 Sectoral shares of gross domestic product, Papua New Guinea and other economies, 1965-86
(per cent)

	Share of GDP at current prices from Industry incl. Agriculture mining (Mining) (Manufacturing) Services				Exports as % of GDP	GNP per capita (1985 \$US)
Papua New Guinea ^a						
1965-68	42	15	(-)	(5)	43	18
1969-72	38	21	(1)	(6)	41	20
1973-76	31	31	(11)	(7)	38	42
1977-80	34	27	(12)	(9)	39	44
1981-83	33	23	(9)	..	44	38
1986	34	26	(9)	(9)	40	45
Low income economies (excl. China and India)						
1965	41	18	na	(10)	41	19
1986	38	20	na	(11)	42	14
Lower middle income economies						
1965	30	25	na	(15)	45	15
1986	22	30	na	(17)	48	21
Upper middle income economies						
1965	18	37	na	(21)	45	18
1986	10	40	na	(25)	50	22
Industrial market economies						
1965	5	40	na	(29)	55	12
1986	3	35	na	(23)	62	17
Indonesia						
1965	56	13	na	(8)	31	5
1986	26	32	na	(14)	42	21

^aPapua New Guinea data are for fiscal years beginning 1 July until 1976, and for calendar years thereafter.

Sources: World Bank, *World Development Report*, New York, Oxford University Press, 1988; Papua New Guinea, National Statistical Office, *National Accounts Statistics*, Port Moresby, various issues.

The inter-sectoral changes in the economy of Papua New Guinea are unusual in a number of respects. First, while the agricultural sector of an economy is expected to decline in relative importance with economic growth at home and abroad, this decline is expected to be slower in slower growing economies. Yet in the slow growing economy of Papua New Guinea the agricultural sector's relative importance in GDP has, if anything, declined faster than in other developing countries (Table 1.7). Second, the rate of decline of agriculture, forestry and fishing's share of exports has been dramatic in Papua New Guinea. Until the early 1970s more than 90 per cent of the country's exports were from the primary sector (mainly agricultural) but, since the mid 1970s, that share has been only half as large (Table 1.8). It is true that similar rates of decline have occurred in other resource-rich developing countries, especially oil-exporting countries such as Indonesia. But what is remarkable about Papua New Guinea's export structure, compared with that of other middle income countries, is the extreme dominance of agriculture earlier and the continuing unimportance of manufacturing.

**Table 1.8 Sectoral shares of merchandise exports, Papua New Guinea and other economies, 1960-86
(per cent)**

	Agriculture, forestry and fishing	Fuels, minerals and metals	Manufactures
Papua New Guinea			
1960	92	-	8
1965	90	-	10
1970	96	-	4
1975	38	56	6
1980	52	46	2
1986	40	54	6
Low income economies (excl. China and India)			
1965	69	25	6
1986	47	21	32
Lower middle income economies			
1965	63	29	8
1986	34	38	28
Upper middle income economies			
1965	39	39	22
1986	16	25	59
Industrial market economies			
1965	22	9	69
1986	12	8	80
Indonesia			
1965	53	43	4
1986	21	58	21
Malaysia			
1965	59	35	6
1986	38	26	36

Sources: World Bank, *World Development Report*, New York, Oxford University Press, 1983 and 1988; United Nations, *Yearbook of International Trade Statistics*, New York, various issues.

Table 1.9 Shares of selected commodities in total exports, Papua New Guinea, 1958-86 (per cent)

	Coconut products	Coffee	Cocoa	Palm oil	Forest products	Copper and gold	Other	Total
1958-62	48	5	9	-	9	-	29	100
1963-67	35	16	15	-	8	-	26	100
1968-72	24	18	11	-	7	4	36	100
1973-77	7	15	9	1	4	51	10	100
1978-82	6	17	8	3	5	49	12	100
1983-86	6	15	7	5	8	40	19	100

Sources: Papua New Guinea National Statistical Office, *Summary of Statistics and Abstract of Statistics*, Port Moresby, various issues.

Changing pattern of agricultural exports

Also, within the agricultural sector there have been considerable changes in the structure of exports. One set of changes has been in the relative importance of different cash crops (Table 1.9). Around 1960, coconut products contributed almost one-half of all export earnings, compared with only about 6 per cent in the 1980s. Coffee and cocoa exports began in the late 1950s and contributed 30 per cent of all exports in the 1960s and early 1970s, and still contribute between 20 and 25 per cent. Palm oil exports began in the mid-1970s and

Table 1.10 Share of subsistence food production in GDP and in private expenditure, Papua New Guinea, 1961-80^a (per cent of value)

	Agricultural GDP	Total GDP	Total private expenditure
1961-64	46
1965-68	63	26	42
1969-72	63	24	38
1973-76	57	18	34
1977-80	41	14	26

^aFiscal years beginning July 1 up to 1976, calendar years thereafter.

Source: Papua New Guinea National Statistical Office, *National Accounts Statistics*, Port Moresby, various issues.

Table 1.11 Indigenous (smallholders') share of total production of various export crops, Papua New Guinea, 1969-83^a (per cent)

	Cocoa	Coffee	Copra	Palm oil	Rubber
1969-72	28	72	35	0	1
1973-76	39	74	42	65	5
1977-80	52	69	47	61	13
1981-83	64	71	55	52	16

^aFiscal year beginning July 1 up to 1976, calendar years thereafter.

Sources: Papua New Guinea National Statistical Office, *Rural Industries*, Port Moresby, various issues; C.C. Goldthorpe, *Plantation Agriculture in Papua New Guinea*, Port Moresby, Institute of National Affairs, 1985.

accounted for 5 per cent of earnings by the mid 1980s. Meanwhile, rubber's share of exports has fallen from around 8 per cent in the early 1960s to less than 0.5 per cent today.

Monetization of agriculture

Another set of changes within the agricultural sector has been the increasing monetization of the sector (see Fisk 1964). This has occurred with respect to both outputs and inputs. On the output side, villagers have shown a clear tendency to market an increasing proportion of their output for cash. They have devoted a larger share of their productive resources to cash-earning exotic enterprises (for example, export tree crops and broiler production) rather than expanding their marketable surplus of traditional staple foods. There is also a significant production and consumption of betel nut for cash. Shaw (1984) estimates urban and rural sales of betel nut in the early 1980s to have been of the order of K15-20 million. In the 1960s little more than one-third of the assessed value of agricultural output (including forestry and fishing) was marketed for cash, whereas by 1980 that share had grown to about 60 per cent. In terms of total GDP the value of non-marketed agricultural production declined from 26 per cent in the late 1960s to 14 per cent in the late 1970s. This is reflected in the share of subsistence food production in total private consumption which fell from 46 per cent in the early 1960s to 26 per cent in the late 1970s (Table 1.10). It is also reflected in the increasing proportion of export crop production being supplied by indigenous smallholders (Table 1.11).

An important consequence of the structural change from subsistence to cash cropping is that a growing share of agricultural output is becoming susceptible to domestic and international market forces, and hence also to market interventions by government.

Agriculture still the major employer in PNG economy

Despite the development of mineral production and exports, Papua New Guinea's economy is still more agrarian than the average low income economy in terms of employment. As much as three-quarters of the workforce is still engaged in agriculture compared with little more than one-half in the average lower middle income economy. And whereas the service sector employs about one in three workers in developing countries as a whole, it employs less than one in seven of Papua New Guinea's workers (Table 1.12).

Agricultural productivity improving but only slowly

In addition to agriculture's share of employment in Papua New Guinea being comparatively large, the rate of decline of that share has been relatively slow. This contrasts with the above average rate of decline in agriculture's share of GDP and suggests that labour productivity in agriculture relative to other sectors has not been growing as rapidly in Papua New Guinea as in other developing countries. Both land and labour productivity in agriculture have been improving in absolute terms in Papua New Guinea, but not nearly as fast as has been occurring in the agricultural sectors of neighbouring developing countries. Agricultural output per agricultural worker and per hectare in 1985 was 30 and 40 per cent above that of 1970 for Papua New Guinea while for Indonesia and Malaysia it was between 70 and 85 per cent higher (Table 1.13).

Features to be explained

Need to explain slow growth, rapid structural change and decline in food and agricultural productivity

This brief comparative overview of growth and structural change in Papua New Guinea's economy raises a number of questions. They include the following:

- Why is it that, despite the mining boom, the average income in Papua New Guinea has not grown, in sharp contrast to countries such as neighbouring Indonesia and Malaysia?
- Why has the speed of structural change in this slow growing economy been above the developing country average?
- In particular, why has food and agricultural production per capita declined?

The last question is especially important because what happens to the agricultural sector is going to affect the welfare of the vast majority of the population, given the continuing dominance of agriculture as an employer and as the main source of staple food. The agricultural sector is not separate from the rest of the economy, however. On the contrary, what happens in the product and factor markets of other sectors will soon feed back to the agricultural sector, and vice versa. Even the subsistence sector producing perishable (non-tradable) products is affected by changes in the market for tradable goods. It is therefore necessary to examine agriculture's changing role in the economy in an

Table 1.12 Sectoral shares of employment, Papua New Guinea and other economies, 1960-80

	Agriculture	Industry	Services
Papua New Guinea			
1960	89	4	7
1965	87	6	7
1980	76	10	14
Low income economies (excl. China and India)			
1960	82	7	11
1965	79	8	13
1980	71	10	19
Lower middle income economies			
1960	71	11	18
1965	65	12	23
1980	55	16	29
Upper middle income economies			
1960	49	20	31
1965	45	23	32
1980	29	31	40
Industrial market economies			
1960	18	38	44
1965	14	38	48
1980	7	35	58
Indonesia			
1960	75	8	17
1965	71	9	20
1980	57	13	30
Malaysia			
1960	63	12	25
1965	59	13	28
1980	42	19	39

Source: World Bank, *World Development Report*, New York, Oxford University Press, 1983 and 1987.

Table 1.13 Land and labour productivity in agriculture, Papua New Guinea and other developing economies, 1970-85 (1970 = 100)

	Agricultural output	
	Per agricultural worker	Per hectare
Papua New Guinea		
1970	100	100
1975	104	111
1980	110	124
1985	118	140
All developing countries		
1970	100	100
1975	106	112
1980	111	127
1985	122	149
Indonesia		
1970	100	100
1975	118	118
1980	146	153
1985	185	168
Malaysia		
1970	100	100
1975	125	127
1980	145	149
1985	173	178

Source: Food and Agriculture Organization, *Production Yearbook*, Rome, 1986.

inter-sectoral, open economy framework. The purpose of the next chapter is to use such a framework and draw on standard economic theory to help understand the recent structural changes that have been summarized above. Then attention is turned to a number of policies and public investment decisions which have influenced not only those structural changes but also the overall rate of economic growth and development.

2

Reasons for the structural changes

The previous chapter identified a number of unusual features of the structural changes that have taken place in the course of Papua New Guinea's economic development. This chapter seeks to explain the more important of these. It begins by examining why agriculture typically declines in a growing economy. It then examines one set of reasons why agriculture did not decline at a slower rate in Papua New Guinea than in other developing countries, despite the country's slow economic growth, and why food production grew so slowly.

Why agriculture declines relatively as an economy grows

A helpful model of a two-sector, closed economy

It is clear from Table 1.7 that agriculture declines in relative importance as an economy grows. To understand why this happens it is simplest to proceed in stages. Consider first a closed economy with only two sectors, agriculture and non-agriculture. If productivity growth is occurring equally rapidly in both sectors, supply curves would shift out at the same rate, as in Figure 2.1. Here we assume the two supply curves coincide initially, and hence they also coincide subsequent to the productivity growth. But because people typically spend a declining proportion of their income on food as their incomes increase, demand grows less for agricultural products than for other goods. Thus the demand curves are shown in Figure 2.1 to shift to the right at different rates in the two sectors. The net result of these two sets of changes is as follows: output of both sectors rises, but less so for agriculture, and the price of agricultural products falls relative to the price of non-agricultural products. Hence the share of agriculture in aggregate national product falls.

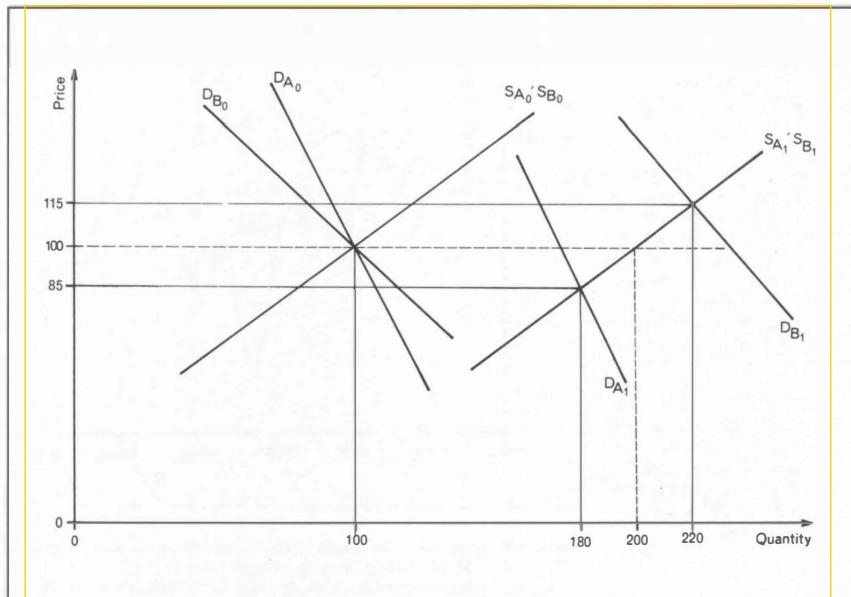
In the illustrated example, agriculture initially contributed $(100 \times 100) = 10,000$ units to GDP, as did the non-agricultural sector, so that agriculture's share of GDP was 50 per cent. After the equi-proportional productivity growth has taken place in the two sectors, the increase in the quantities supplied would be the same if prices for the two sets of goods remained unchanged. However the growth in incomes that results from this productivity growth leads to the demand for agricultural goods shifting less than that for non-agricultural goods. Equilibrium in the two markets requires that agricultural output expands only 80 per cent and non-agricultural output 120 per cent, and that the price of agricultural goods falls to 85 while that of non-agricultural goods rises to 115 in the case illustrated. Thus agriculture's share

¹ This section draws heavily on Johnson (1973: Ch.4) and Anderson (1987), where the arguments are laid out more fully.

Figure 2.1
Changes in the supply of and demand for agricultural and non-agricultural goods in a growing economy

D_A Demand for agricultural goods
 D_B Demand for non-agricultural goods
 S_A Supply of agricultural goods
 S_B Supply of non-agricultural goods

Source:
 Adapted from D.G. Johnson,
World Agriculture in Disarray, London, Fontana, 1973:Ch.3



of GDP becomes: $85 \times 180 / (85 \times 180) + (115 \times 220) = 38$ per cent, compared with 50 per cent initially.

In a growing world economy, international prices of farm products decline

This model is appropriate not only for a closed national economy but also for the world economy as a whole. That is, it suggests that international prices for agricultural products relative to non-agricultural products, are likely to decline over time as the world economy grows. This is indeed what has happened, as can be seen from Figure 2.2.²

— which reduces agriculture's share of GDP

But what about the situation of a small open economy such as Papua New Guinea's, which faces external terms of trade that are determined from outside? If the terms of trade for agriculture are declining over time — as they have been, according to Figures 1.1 and 2.2 — then even if there is no economic expansion in Papua New Guinea the share of agriculture in GDP, measured at international prices, will be declining. The same will be true even if the agricultural sector is expanding, so long as its rate of expansion is not sufficiently faster than the non-agricultural sector to offset the decline in relative agricultural prices.³

Share of non-tradables in GDP keeps growing

The above model assumes all products are tradable internationally. In reality, however, a large part of each economy involves the production and consumption of non-tradable goods and services. These are items for which the costs of overcoming barriers to trading internationally — especially transport and, in the case of perishable foods, spoilage costs — are prohibitively expensive. The price of non-tradables is

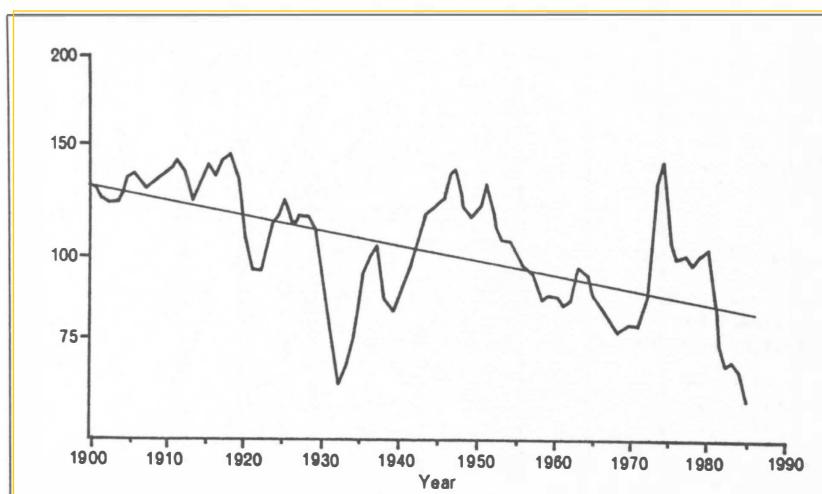
2 See also the evidence in Spraos (1980), Sapsford (1985) and Grilli and Yang (1988), as well as the specific trends for Papua New Guinea in Figure 2.3.

3 The regression equation reported in the footnote to Figures 2.2 suggests agricultural value added during this century would have had to grow at an average rate of more than 0.5 per cent per year just to offset the decline in agriculture's terms of trade.

Figure 2.2

Real international prices
for agricultural products,
1900-85* (1979-81 = 100)

*Weighted average of international prices in US dollars for grains, livestock products, sugar, beverages, vegetable oils, bananas, fibres, rubber, tobacco, hides and skins and timber, deflated by the quality-adjusted US producer price index for industrial goods, with weights based on the share of each commodity in the value of world trade in 1979-81. When the logarithm of this relative price index (P) is regressed against time (T), the equation obtained is $P = 0.25 - 0.0051T$ ($R^2 = 0.48$; t -value = -8.8).



Source: K. Anderson, 'On why agriculture declines with economic growth', *Agricultural Economics* 1(3):195-207, 1987; based on data provided in E.H. Grilli and M.C. Yang, 'Primary commodity prices, manufactured goods prices, and the terms of trade of developing countries: what the long run shows', *World Bank Economic Review* 2(1):1-48, 1988.

determined by domestic demand and supply conditions because, unlike tradables, in equilibrium the quantity of non-tradables demanded has to equal the quantity supplied. The conclusion that agriculture's share of GDP is likely to decline over time is even stronger if it can be demonstrated that the share of tradables in GDP is also likely to decline in growing economies.

— which further reduces agriculture's share of GDP

Available evidence suggests that the income elasticity of demand for services (which make up the vast majority of non-tradables) is well above unity in developing countries and tends to converge toward unity as incomes grow (Lluch, Powell and Williams 1977; Kravis, Heston and Summers 1983; Summers 1985; Theil and Clements 1987). That is, for developing countries any increase in income leads to a more than proportionate increase in the demand for services, which in turn means the demand for tradable goods grows less than proportionately. So, if productivity growth is equally rapid for non-tradables and tradables, but demand for non-tradables expands more rapidly than productivity — while demand for tradables expands less rapidly than productivity — the price and quantity of non-tradables relative to tradables will both increase. In that case the share of tradables in GDP will decline. Since we have already demonstrated that within the tradables sector it is likely that agriculture's share of production will decline, it now seems even more likely that agriculture's share of total GDP (tradables plus non-tradables) will decline over time. For that not to happen in a small open economy, agricultural productivity growth has to be substantially greater than productivity growth not only in the non-agricultural tradables sector but also in the non-tradables sector, so as to offset the decline in the relative price of agricultural goods.

Tradable substitutes for indigenous food keeps down its price

A qualification may be considered necessary for Papua New Guinea, however, because many of the foods produced by subsistence agriculture are perishable and hence cannot be traded internationally. In fact, though, these foods face competition in urban markets from substitute foods which are tradable. Examples include canned or dried fruits and vegetables as substitutes for the fresh product, and rice or other grains as substitutes for sweet potato. Hence, if the prices of the perishable indigenous foods were to rise, the quantity of them demanded would fall greatly in the presence of competition from tradable substitutes, other things being equal. Thus their prices move closely in line with those of tradable substitutes, rather than independently of them.

Therefore it is not surprising that agriculture's share of GDP has declined in Papua New Guinea during the past fifteen years, despite the slow growth in GDP. But why did agriculture's share decline even faster than in other developing countries, to the point that food production per capita has actually fallen?

Why Papua New Guinea's staple food sector has performed poorly

Big increase and then fluctuations in Papua New Guinea's export prices and earnings

During the past three decades there have been periods when Papua New Guinea's export sectors have been booming because of growth in their output and/or increases in the prices of their products. For example, the value of Papua New Guinea's exports in terms of its imports more than trebled between 1970 and 1974, primarily because of export volume growth. That value then dropped for two years when export prices declined, but recovered during 1977-80 before slumping again in the 1980s as export prices fell once more (Table 1.4). The changes in export earnings are reflected in changes in the effective exchange rate, although the decline in the latter was arrested by an increase in net overseas borrowings between 1981 and 1984 (Table 2.1).

The reason a boom in export earnings or other inflows of foreign funds boosts the real value of a country's currency and affects other sectors is as follows. As explained in Box 2.1, the greater availability of foreign currency means individual exporters and/or the government can spend more. Insofar as some of that spending is on non-tradable products, their price will rise relative to that for tradables (a real exchange rate appreciation). As a result resources will move from the tradables sector to non-tradables. That is, the agricultural sector is destined to grow less rapidly than it otherwise would while there is a boom in mineral exports.

Table 2.1 Nominal and real effective exchange rates and external debt, Papua New Guinea, 1974-86
(1980 = 100)

	<i>Effective exchange rate^a</i> Nominal	Real	External debt outstanding as % of GDP
1974	99	111	23
1975	98	103	24
1976	98	100	26
1977	93	92	26
1978	92	91	26
1979	99	97	23
1980	100	100	25
1981	103	103	30
1982	102	102	39
1983	92	95	63
1984	94	101	115
1985	81	87	80
1986	77	85	79

*Weighted average for the end-of-year value of one kina in terms of the currencies of Australia, Japan, Federal Republic of Germany, the United Kingdom and the United States, using their 1980 share of exports plus imports in Papua New Guinea's trade as weights. Consumer Price Indexes are used to obtain real effective exchange rates. Prior to January 1, 1976 the Papua New Guinea currency was pegged to the Australian dollar.

Sources: Compiled from data in Bank of Papua New Guinea, *Summary of Statistics and Abstract of Statistics*, Port Moresby,

Box 2.1: Effects of a boom in one export sector on other sectors

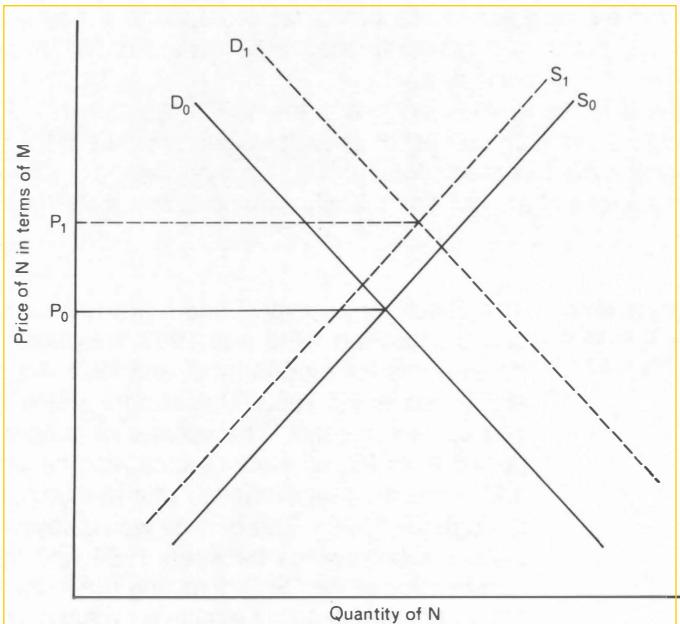
To examine the reasons for the poor performance of staple food production in Papua New Guinea, it is useful to conceptualize a disaggregated model of the economy involving five sectors: export mining, export crop agriculture, import-competing staple food agriculture, import-competing manufacturing and services, and non-tradable goods and services.

What are the effects of a boom in one of the export sectors (B) on the other tradable sectors as an aggregate (L) and on the non-tradable sector (N)? When real export receipts expand - for example, when the country is exploiting a newly developed mine - real income in the country increases. When that income is spent, either by exporters, by the government from its extra tax receipts, or by taxpayers if the government were to lower its tax rates following the export boom, part of it will be spent on non-tradables. (The same occurs as a result of a foreign aid grant.) That is, the demand for N shifts to the right in Figure 2.3, from D₀ to D₁. This change has been called the spending effect of the boom (Corden 1984).

There is also a resource movement effect associated with the boom. Since resources are attracted to the booming export sector from the other sectors, including from the non-tradables sector, the supply curve in Figure 2.3 shifts up and to the left, from S₀ to S₁.

The net result of these two effects is that the relative price of non-tradables must rise, that is, the country experiences a real exchange rate appreciation. Since the shift in the supply curve is likely to be small relative to the shift in the demand curve - because the enclave nature of the mining project ensures it attracts few mobile resources from the rest of the economy, particularly after the construction stage - the quantity of non-tradables produced and consumed is likely to rise also.

Figure 2.3
The market for
non-tradables in
a booming
economy



The non-booming tradable sectors (L) therefore lose mobile resources both directly, as resources are attracted into the booming export sector, and indirectly, because the real exchange rate appreciation weakens the international competitiveness of the L sectors and the likely increase in non-tradables output will require resources from the L sectors. This is a further reason why agricultural production in Papua New Guinea did not expand much in the 1970s following the opening up of the Bougainville copper mine. Indeed, the effect began a little before copper exports started in 1973, because capital to develop the mine was required from abroad earlier and its inflow strengthened the country's real exchange rate even before the export boom. This investment boom effect on the exchange rate is discussed in Corden (1982).

Numerous qualifications to the above analysis could be made. Relaxing various implicit assumptions about factor mobility (inter-sectorally or internationally), factor price flexibility and the absence of government controls on the economy can lead to slightly different outcomes (see Corden 1984; Garnaut and Baxter 1983; Bevan, Collier and Gunning 1987). But by and large, the above conclusion, that the agricultural and manufacturing sectors in Papua New Guinea will grow less rapidly as a consequence of the mining boom, remains intact.

What happens within the group making up a lagging sector? In Papua New Guinea the (largely subsistence) staple food sector is very labour intensive compared with the export tree crop sector and the manufacturing sector. If labour is the only inter-sectorally mobile resource in the lagging sector then the mining investment and export boom will cause the labour supply in L to be reduced relative to the (assumed fixed) supply of land and capital. This will cause the labour intensive

suggests it is especially likely that the staple food sector will shrink more than the export tree crop and manufacturing sectors. Indeed it may even be that the latter sectors expand as a consequence of the mining boom, even though as an aggregate the L sectors contract.

This is in fact what happened in the 1970s. As shown in Figure 1.1 and Table 1.5, export tree crop production growth slowed down from the mid 1970s but not to the same extent as staple food production; and Table 1.7 shows that the manufacturing sector's share of GDP actually expanded in the 1970s.

**Real exchange rate effects
on agriculture reversed at
times of a mining export
slump**

The effects of an export boom are reversed when there is an export slump. Between 1980 and 1982 the price of copper and gold in US dollar terms fell by one-third, and fell further in the mid 1980s after a slight recovery in 1983. This decline was even steeper in terms of the yen or deutschmark. The volume of copper ore and concentrate exported from Papua New Guinea also declined after 1982-83 (Figure 1.2). Thus the real exchange rate has been under pressure to decline through the 1980s. The decline was delayed by the massive growth in overseas borrowings between 1980 and 1984 — in part to finance construction at the Ok Tedi mining site in the early 1980s. But between 1984 and 1986 the real effective exchange rate depreciated by 16 per cent (Table 2.1). A consequence of the depreciation was that other tradable sectors became more competitive. This, together with developments in international commodity markets, is reflected in the increases in kina prices of agricultural export products from 1981. As is evident from Table 2.2, only part of these increases is due to changes in the US dollar prices in international commodity markets; the rest is due to the US dollar-kina exchange rate depreciation. Those kina price increases stimulated agricultural exports in the mid 1980s: as shown in Figure 1.2, the volume of agricultural exports increased 27 per cent between 1982 and 1986.

**Pressures on agricultural
sector from mining boom
may continue in 1990s**

It is clear that developments in one sector of the economy can rapidly affect other sectors. The agricultural sector in Papua New Guinea — as in all countries — is continually under pressure to decline in relative importance because the relative demand for agricultural products tends to expand less rapidly than their relative supply. Moreover, in Papua New Guinea the agricultural sector was under additional pressure to decline in the 1970s because of the inter-sectoral effects of the mining boom. The latter pressure reversed in the mid 1980s, which encouraged some growth in agricultural exports. But if the prospective mining developments for the next decade come to fruition, the value of Papua New Guinea's mineral exports could multiply several times in the 1990s (Table 2.3), putting even more competitive pressure on the agricultural sector.

**Why has the growth of
export earnings failed to be
reflected in higher per
capita income?**

While these phenomena go some way towards explaining why the agricultural sector has declined in relative importance in Papua New Guinea, the following question remains. Why have investments from the increased income associated with long-term expansion in export

Table 2.2 Indexes of international prices of coffee, cocoa, copra and palm oil, in kina and US dollars, 1981-86^a (1981 = 100)

	<i>Coffee</i>		<i>Cocoa</i>		<i>Copra</i>		<i>Palm oil</i>	
	kina	\$US	kina	\$US	kina	\$US	kina	\$US
.981	100	100	100	100	100	100	100	100
.982	118	108	90	84	91	83	88	78
.983	116	110	122	102	151	131	96	88
.984	143	122	162	115	277	187	176	128
.985	184	115	167	109	166	102	150	88
.986	249	147	149	100	56	52	76	45

The kina prices are for Papua New Guinea unit export values; the US prices are those quoted in New York or European ports.

Sources: Papua New Guinea National Statistics Office, *Abstract of Statistics*, Port Moresby, various issues; International Monetary Fund, *International Financial Statistics*, New York, 1987.

Table 2.3 Current and prospective mineral developments, Papua New Guinea, 1971-97

	Bougainville (copper, gold, silver)	Ok Tedi (copper, gold)	Misima (gold, silver)	Lihir (gold)	Porgera (gold)	Iagifu (oil, gas)
Construction start	1971	1981	1987	1989	1989	..
Production start	1973	1985	1990	1993	1993	1996
Profits start	1973	1991	1992	1995	1997	..
Reserves of ore (million tonnes)	640	350	45	700	80	100 million barrels
Grade of ore						
copper (kg/tonne)	4.2	7.0	-	-	-	-
gold (g/tonne)	0.4	0.3	1.4	3.2	4.7	-
silver (g/tonne)	1.2	-	20.0	-	-	-
Total investment (million kina)	280 (to 1991)	1320 (to 1991)	175	450	670	1100
Mine life (years)	26	19	10	15-20
Annual production volume (tonnes)						
copper	170,000	160,000	-	-	-	-
gold	15	3	6	28	22	-
silver	40	-	100	-	-	-
Potential export value by mid 1990s (million kina p.a.) ^a						
copper (K1000/tonne) ^a	170	160	-	-	-	-
gold (K10,000/kg) ^a	150	-	60	280	220	-
silver (K200/kg) ^a	8	-	20	-	-	-
oil and gas	-	-	-	-	-	..
Total	328	160	80	280	220	..
Government revenue (million kina p.a. average)	41	..	25	90	60	..

Valued at the prices shown in parentheses, which are roughly 1986 prices.

Source: Authors' calculations based on a variety of sources.

Table 2.4 Copper ore grade, mining costs, prices and earnings, Bougainville Copper Ltd, 1972-87

	Ore grade Copper (%)	Gold (gm/tonne)	Operating costs per unit of concentrate produced (1972=100)	Export price for copper concentrate (1972=100)	Company earnings before taxation Million kina	Total assets	As % of Shareholder funds
1972	0.76	0.77	100	100	28	6	19
1973	0.73	1.03	103	158	159	32	70
1974	0.70	1.02	119	169	181	33	68
1975	0.64	0.80	148	137	59	12	20
1976	0.64	0.87	162	157	62	13	20
1977	0.61	0.90	169	158	42	9	14
1978	0.60	0.82	156	168	70	15	22
1979	0.55	0.75	203	254	162	31	55
1980	0.46	0.50	281	286	123	16	21
1981	0.51	0.59	301	218	43	6	7
1982	0.47	0.60	285	210	29	4	5
1983	0.46	0.55	294	261	102	13	17
1984	0.42	0.48	356	248	27	4	5
1985	0.42	0.42	313	249	47	6	8
1986	0.42	0.48	313	259	74	10	13
1987	0.41	0.43	319	315	144	18	25

Source: Bougainville Copper Ltd, *Annual Report*, Port Moresby, 1987.

earnings in the mid 1970s, not delivered a permanently higher level of income per capita? Neighbouring Indonesia experienced a similar (though proportionately larger) export boom in the 1970s — and a similar slump after the early 1980s — which also resulted in a major decline in the relative importance of its agricultural sector (Table 1.7), and for similar reasons (Warr 1985). However, Indonesia invested much of its expanded petroleum revenue in agricultural development and also reduced many of the disincentives which government policies had previously imposed on farmers. As a result, even though Indonesia's agricultural sector has declined in relative importance, its food and agricultural production per capita has expanded enormously (Table 1.5).⁴

Failure of mineral profits to grow Perhaps part of the reason for the low income growth is that the mineral profits available to be taxed have not been large except in a few years. The ore grade for Bougainville Copper Ltd has steadily declined during the past 15 years, and the company's fuel and labour costs have risen substantially. As a result the operating cost per unit of copper concentrate trebled during the first decade of commercial production. The export price for concentrate has not kept pace with the increases in mining costs, and so Bougainville Copper's earnings before taxation have been modest except in 1973-74, 1978-80 and 1987 (Table 2.4).

4 In contrast to Indonesia, Nigeria has adjusted rather poorly to its oil boom and recent slump; see, for example, Pinto (1987). The recent adjustment experiences of some other developing countries are analysed in Bevan, Collier and Gunning (1987), Cuddington (1988) and Devarajan and de Melo (1987).

Incentives and public investment policies have not helped agriculture

Much of the remaining explanation for sluggish overall economic growth in Papua New Guinea — and especially for the slow growth in food and agricultural production — has to do with the fact that policies affecting incentives and public investments have not been as conducive to economic growth as they might have been. As the economy becomes monetized and the share of international trade in GDP grows, these policies become more important. Thus it is to an examination of Papua New Guinea's policies that we now turn.

Policies affecting agricultural incentives

3

Factor market distortions

The markets for the three primary factors of production — land, financial capital and labour — are all influenced to a great extent by government policies in Papua New Guinea. In the case of agricultural land there is a problem of too little efficient government intervention, while for the financial capital and labour markets the problem is too much, or the wrong kind, of intervention. The overall effect of government policies is to reduce incentives to retain and improve resources in agriculture, including subsistence/smallholder farming.

Agricultural land

Land use pattern unusual in Papua New Guinea

Papua New Guinea is abundantly endowed with land relative to population. In 1985 it had 11 hectares per capita, or more than four times the average for developing countries. Its use of that land shows a very different pattern from that in other countries, however. While Papua New Guinea has more than three times as many hectares per capita planted to permanent crops as the average developing country, and six times as many hectares still in forest form (columns 3 and 5 of Table 3.1), it has only a small area — representing less than 0.3 per cent of its total land area — that is regularly used for annual crops or animal grazing. On a per capita basis, the area used for these latter purposes is less than one-twentieth that of other developing countries (columns 1 and 2). Thus agricultural land (excluding forests) per farm worker is less than one-tenth that of other developing countries, and has been declining over time (column 7). The land area used for agriculture increased 8 per cent between 1970 and 1985, but this growth rate was little more than half the rate at which the number of agricultural workers increased.

Much of Papua New Guinea's forest land is too mountainous to convert to arable land, but a great deal more than is currently used could be put to agricultural uses. To begin to understand why so little is used for agricultural purposes it is helpful to examine first the systems of land rights in Papua New Guinea and then the economic pressures for changing those systems.

Table 3.1 Land availability per capita, Papua New Guinea and other developing economies, 1970 and 1985 (hectares)

	Land available						Agricultural land per agricultural worker (7)	
	Agricultural use			Sub-total (4)	Forest and wood (5)	Total agricultural, forest and woods (6)		
	Arable (1)	Permanent pasture (2)	Permanent crops (3)					
Papua New Guinea								
1970	.007	.037	.136	.18	15.93	16.11	.41	
1985	.008	.025	.101	.13	10.91	11.04	.39	
All developing economies (excl. China)								
1970	.32	.85	.04	1.21	2.50	3.71	4.84	
1985	.25	.60	.03	.88	1.72	2.60	4.12	

Source: Food and Agriculture Organization, *Production Yearbook*, Rome, 1986.

Systems of land rights

Traditional right to land usage

Property rights to land in Papua New Guinea are determined on the basis of the *as graun* principle. This principle provides the person who first cleared and used a piece of land with rights over that property, and those rights are shared with, and inherited by, that person's descendants (Giddings 1981). Feder and Noronha (1987) refer to a similar principle in land tenure systems in sub-Saharan Africa: the person who first cleared the land, referred to as *Maître Du Feu* (the Master of Fire), was regarded as the original proprietor and his rights to the use of the land were transferred to his descendants. In both Papua New Guinea and Africa the use of fire as a land clearing mechanism is a common technology. In the African case, if there were no direct lineages from the original proprietor, permission to use the land was obtained from the chief and the rights to use continued as long as the farmer continued to live in the village and recognized the jurisdiction of the chief. The residence requirement in Papua New Guinea is similar. With prolonged migration away from the village there is a fear that the rights to land may become eroded, so individuals typically wish to return to their *plaies* from time to time in order to preserve such rights.

Customary ownership of land areas

Where land has been relatively abundant, the slash-and-burn technology of shifting cultivation meant that access to land was usually not difficult and was usually acquired through groups. Such group activity, often on a clan or kinship basis, led to a system of customary ownership of land within which individuals acquired hunting and cultivation rights to particular pieces of land. However, where land was not as abundant and where customary ownership prevailed, there have been, and still are in the Highlands, disputes between clans over the ownership of land.

Legal recognition of customary rights introduced

During the period when Papua New Guinea was an Australian Trust Territory, a number of existing attitudes towards land ownership, use and transfer were reinforced by the Administration in various pieces of land legislation. The Australian Administration before Independence

was acutely aware of the importance of land to the Papua New Guineans, so the legislation was aimed at giving legal recognition to that fact and protecting customary land rights. In particular, the Administration took the view that all unalienated land was regarded as being in customary ownership until it was clearly established, following the procedures laid down in the legislation, that the land was unoccupied and unclaimed.

The principal pieces of legislation passed during the period before Independence included the Land Ordinance 1962-1969, the Land Titles Commission Ordinance 1962-1968, the Land (Tenure Conversion) Ordinance 1963-1967, Lands Registration (Communally Owned Land) Ordinance 1962, and the New Guinea Land Titles Restoration Ordinance 1951-1968. The specific purposes of these various land legislation decisions were to:

- determine the ownership of land held on a group basis;
- register such communal rights;
- provide for the conversion of tenure from customary ownership to individually registered titles;
- restrict dealings in customary land;
- acquire compulsorily land for public purposes and for particular development purposes; and
- establish an independent judicial tribunal to determine and protect the rights to land.

Since Independence many of these pieces of legislation have remained in force. Morris (1981:9) refers to the Land Act 1962 provision that 'a native has no power to sell, lease or dispose of native land otherwise than to natives in accordance with native custom'. The consequences of the legislation are such that the transfer of title to customary land is difficult.¹

Transfer of land titles more difficult in Papua New Guinea

Land ownership and transfer rights provided by the colonial powers in Africa were not dissimilar (Feder and Noronha 1987). The major colonial powers — the United Kingdom, France, Belgium and Portugal — were of a similar view to the Australian Administration that all occupied land was held in communal tenure. This meant that individuals had only user rights to land without the power to sell or mortgage it. Moreover, the existence of a tribal system with hereditary chiefs provided a convenient vehicle for the colonial powers to make the chiefs, in effect, trustees for existing and future generations. Papua New Guinea does not have a system of hereditary chiefs so far as the tribal or clan groupings are concerned, so the use of tribal chiefs as trustees — which might simplify land use and transfer — is not available in Papua New Guinea. Instead agreement has to be reached more by consensus than by fiat.

¹ Relatively little land has been alienated in Papua New Guinea. Morris (1981) suggests that one per cent of all available land has been alienated as freehold land, mainly in the plantation sector. Land which has been alienated by the State under leasehold terms (ranging up to 99 years) accounts for about another two per cent of the total. About 10 per cent of arable area is alienated land held by Government, of which about 60 per cent is not in productive use. Thus customary land still accounts for the vast majority of available land in Papua New Guinea.

There is considerable variation in the precise nature of customary ownership of land in Papua New Guinea, but generally the proprietary interest rests with a land holding group, and individuals within that group have limited rights of use for varying periods. Usually rights of ownership to land use are acquired by birth into such a land holding group, and acquisition of such rights is not contingent on the death of a group member.

Economic pressures for change

The traditional forms of transfer and inheritance of customary land, while they provide everyone with 'some land, employment, means of support, and security' (Eaton 1981:15), are coming under increasing pressure. The cost of not having secure mechanisms for smoothly acquiring and transferring land ownership and use is increasing with the growth in rural populations, the development of cash (especially perennial) cropping, the availability of new technologies, the change in the value of land due to infrastructural developments such as new roads, and the newly emerging preference of some individuals to see their own children succeed them as owners of land which they have developed.

The Australian Administration in its Report of 1969-70 was aware that customary land tenure is not satisfactory for economic progress because of its frequent lack of flexibility needed to encourage land development. A system which gives clear and transferable title to land is likely to provide greater incentives for progress (1971:83).

Attempts at reform of land policy based on several principles

In an attempt to remove some of the rigidities in land acquisition, transfer and use in Papua New Guinea, the Administration set up a number of principles as the basis for land policy. These were:

- the long-term objective of introducing a single system of land holding regulated by statute and providing for secure individual registered titles;
- the government working through the relevant departments having the sole authority to issue and register land titles;
- land subject to native custom remaining subject to native custom until it is taken out of such custom by acquisition or by a process of tenure conversion to an individual registered title;
- any acquisition to be accompanied by compensation;
- land held under native custom not to be acquired outside native custom except by the Administration;
- land to be acquired by the Administration only if the indigenous owners are willing to sell and in the opinion of the Administration the land is not required by them;
- conversion of title to occur only if those who have an interest in the land under native custom consent to conversion; and
- the services of Land Titles Commissioners to be used to investigate ownership of land held under native custom which was proposed to be acquired, to settle disputes about land ownership held under

native custom, and to investigate the rights held under native custom for any land which was proposed to be converted to individual title.

Few legal conversions have occurred

Notwithstanding these principles, there have been very few legal conversions of titles to individuals, as long protracted disputes over compensation necessarily result when consensus is required by all who have an interest in a particular piece of land.

— but informal transfers of land usage are beginning

However, informal mechanisms have been developed or are emerging to facilitate the transfer of land usage at least. For example, there are complex arrangements which allow one community or individual temporary or seasonal use of another community's land. According to Knetsch and Trebilcock (1981:41):

Part of the explanation for the growth in non-customary, direct dealings (of dubious legality) in customary land appears to be a chronic inability on the part of the Department of Lands to develop flexible and expeditious procedures to govern the intermediation role assigned to the central government by the existing provisions of the Lands Act.

Feder and Noronha (1987) show that this informal market development is precisely what one would expect, but that it is far from an optimal outcome because, without legal title, the land price or rent is discounted for risk so that there is a divergence between the social and market values for land. In addition, as discussed in the next section, the less enforceable a land ownership or rental contract the less valuable it is as collateral for the purposes of obtaining credit.

Limits to freehold acquisition

Freehold and leasehold land transfer in Papua New Guinea also confronts institutional rigidities. For example, there is a constitutional prohibition on the acquisition of freehold land by non-nationals. This diminishes its value as collateral to any lending institution, as does the fact that acquisition by nationals may be inhibited by social pressures where the nationals who acquire the land may come into conflict with other land groupings.

Leasehold land transfers restricted to nationals

The prime example of restrictions on leasehold land is the decree by the National Executive Council in 1974 that the leasehold interest in plantation properties could no longer be transferred to non-nationals. The legislation, which was enacted as the Plantation Redistribution Scheme, was aimed at increasing participation by Papua New Guineans in ownership of large plantations. The intention was that any plantations which were compulsorily acquired were to be reallocated to the descendants of the customary land owners. While there were some exemptions, the major tree crop industries of copra, cocoa and coffee were covered by the legislation. There is little doubt that the Plantation Redistribution Scheme seriously inhibited improvements in productivity in the plantation sector. In addition, leasehold land transfer is slowed down by the requirement that it be subjected to detailed step-by-step ministerial approval. This delay adds substantially to the cost of transferring a lease. Goldthorpe (1985) mentions the existence of some 200 derelict estates abandoned by their owners, and suggests that the lost

cocoa and copra production from these abandoned estates would be worth between 65 and 90 million kina per year.

Current policies are dampening land values and investment

In summary, there are major impediments to the efficient use and transfer of available land in Papua New Guinea. The small fraction of agricultural land that is freehold or leasehold cannot be sold to non-nationals, and nationals are inhibited in purchasing such titles for fear of conflict with other groups who may claim customary right to that land. In any case, such transfers are subject to inordinate bureaucratic delays, so the effective saleable value of the land is driven close to zero. This provides little incentive for existing or prospective owners to invest in land, especially in long-term ventures such as replanting perennial tree crops. Similarly, long-term investments in improving the productivity of customary land are discouraged by the absence of secure tenure and of the right to sell improved land for capital gain.²

Even the initial investment of clearing forest land is discouraged by this system, which helps explain why so little has been permanently cleared to date.

Pressure for reform will only come if agricultural probability is increased

The greater the profitability of land use, the more incentive there would be both to find alternative methods of land use transfer and to expedite the process of issuing formal titles to land. Subsequent chapters discuss some of the reasons for the low profitability of agriculture in Papua New Guinea and hence the low intensity of pressure for reform in the land tenure system. The rest of this chapter is concerned with the prices of the other key factors of production, namely financial capital and labour, which are also reasons for the low profitability of agriculture.

Financial capital

Land tenure affects capacity to borrow

Since few farmers in either advanced or developing economies are able to fund the whole of the capital formation on their farms through internal savings, they have to make use of a financial intermediary. The collateral typically provided as security for the loan is their land. However, a prerequisite of any such development is a clear certificate of title of land ownership. If this is lacking then the financial institutions will be less willing to advance credit and/or will require a risk premium in terms of a higher interest rate. With less credit available, or credit available only at higher interest rates, farm investment will be less, and productivity growth curtailed. Thus, increases in farm productivity will be less likely to occur in Papua New Guinea where land titles are typically not available. This critical inter-connection between secure land tenure and the credit market is illustrated in Figure 3.1.

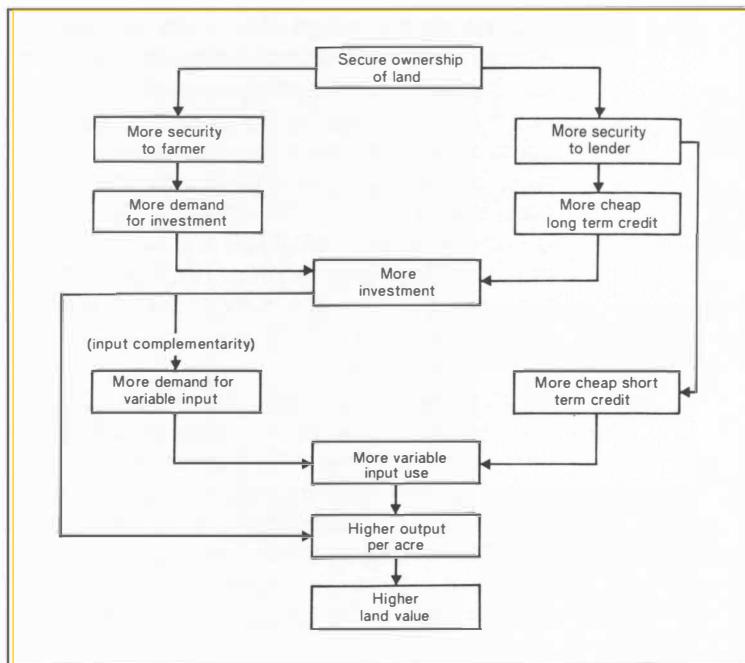
Agriculture Bank's novel lending practices

The Agriculture Bank of Papua New Guinea and the Papua New Guinea Banking Corporation both have been innovative in attempting to overcome the difficulties associated with uncertainties surrounding land titles. For many of its early loans the Agriculture Bank was prepared to accept as security an unsupported guarantee from people

² For a more detailed discussion of the effects of land tenure on agricultural productivity, see Feder and Naronha (1987) and Feder et al. (forthcoming).

Figure 3.1
Inter-connections
between secure land
tenure and the credit
market

Source:
G. Feder and R. Noronha, 'Land rights systems and agricultural development in sub-Saharan Africa', *World Bank Research Observer* 1(2):143-70, July 1987.



in the village. Such a guarantee required an assessment as to the capacity of the guarantors to meet the guarantee should it be necessary. In its early days the Bank relied heavily for this on the extension officer (*didiman*) from the Department of Agriculture and Livestock. This often required the detailed preparation of the project by the *didiman* who then became a de facto loans officer for the Bank. At the same time the *didiman* took on the responsibility to see that the loans were repaid on time and it is arguable that such a role was counter to the objectives of the *didiman* as a rural extension officer. Now the Agriculture Bank is developing its own trained extension staff to supervise lending and repayment, but the use of such specialist skills will necessarily add to the cost of lending since previously neither the *didiman* nor his employer was charging the Bank for his services.

The criteria used by the Agriculture Bank in assessing loan requests related to the size of the project relative to the potential borrower's management abilities, the cash flow from the project which might then service the loan, and the equity contributed by the borrower. In many cases, since cash equity was not available, the Bank insisted on what became known as 'sweat equity' where through his own labour the potential borrower had already developed the property to a certain extent.

Clan Land Usage Agreement

In lending for the development of land held under customary title the Agriculture Bank devised the Clan Land Usage Agreement. This agreement described the piece of land in question and the clan leaders undertook to grant the borrower the right to use that land. The agreement as such has no legal standing but it is an innovation aimed at

overcoming the lack of secure title for customary land. The Papua New Guinea Banking Corporation makes use of a similar agreement in its lending policy. Under an agreement with the Banking Corporation there is a statement that the rights to use are granted under tribal law and custom and the land is charged in favour of the Banking Corporation while there is an outstanding debt on it. There is also provision for a provincial government officer to certify that the Land Usage Agreement is compatible with tribal law and custom, and for recording the use in provincial land use records. Under the agreement, the Bank secures repayment by having a number of clan leaders who not only guarantee the loan but also accept that, if default occurs, no further loans would be made to the clan.

The Clan Land Usage Agreements have been widely used in the development of nuclear estates with respect to coffee and cocoa. In such circumstances, the lack of secure title may be offset to some extent by the use of management agencies, both public and private, to ensure that the commitments which are entered into under the loan are met. The management agencies participate directly in the control and management of the operation of the project and may be responsible for the operation of the estate's bank account.

Credit Guarantee Loan Scheme and the provision of credit subsidies

In a further attempt to overcome the uncertainties surrounding the lack of secure title to land, the Papua New Guinea Banking Corporation and the government introduced in 1977 a Credit Guarantee Loan Scheme. The scheme now encompasses not only the Banking Corporation but all commercial banks in Papua New Guinea. The guarantee by the government is for 80 per cent of the debt outstanding at any one time, and there is an element of subsidy by the government as well. The scheme is restricted to citizens and to corporations which are predominantly owned and managed by nationals and which are first-time borrowers. The maximum loans are K10,000 for individuals and K50,000 for companies. The scheme has been successful to the extent that some 120 otherwise ineligible enterprises have been able to borrow K2.3 million since the scheme was introduced. The limited size of the scheme, however, has meant that its effectiveness in overcoming the rigidities surrounding land rights in Papua New Guinea has been only minor.

While these innovations by financial institutions have gone some way toward reducing the inefficiencies associated with the absence of secure land tenure arrangements, they introduce another inefficiency insofar as they have an element of subsidy in the provision of credit. Both the early scheme of the Agriculture Bank, which involved unpaid use of the Department of Agriculture's didiman, and the more recent Credit Guarantee Loan Scheme, which involves explicit government subsidies, are ensuring that farmers face private prices for credit that are lower than prices the country as a whole faces when borrowing on the international capital market.

Pressure for concessional interest on rural loans exists also

In addition, the government also pressures banks to provide loans to agriculture at concessional rates, even when little or no collateral is provided. The pressure on the Agriculture Bank is strongest, but

Table 3.2 Interest rates by type of loan, Agriculture Bank of Papua New Guinea, 1981

Type of loan	Rate (% p.a.)
Agricultural loans	
disadvantaged areas, up to K100,000	5.0
palm oil	10.0 to 11.0
other, under K10,000	8.0 to 8.5
other, over K10,000	9.0 to 10.5
Commercial and industrial loans	
under K10,000	11.5
over K10,000	12.5 to 14.5
equipment finance	20.0

Source: M.T. Skully, *Financial Institutions and Markets in Papua New Guinea*, Working Paper No.85/4, Canberra, National Centre for Development Studies, Australian National University, 1985:39.

exists to some extent also for commercial banks. The extent of the concessions is indicated by the fact that in 1981 the Agriculture Bank's loans to agriculture were provided at interest rates ranging from 5 to 11 per cent (Table 3.2), when the weighted average interest rate charged by commercial banks was 15.6 per cent. The degree of subsidization is even larger than these interest rate differentials suggest, however, because the much higher cost of establishing and administering rural, as distinct from urban, loans is met largely by the bank rather than by the customer.³

Are credit subsidies a 'good thing'?

Are agricultural credit subsidies a 'good thing'? The conventional wisdom has been that farmers, especially small farmers, deserve agricultural credit subsidies. The argument is typically expressed in terms of both efficiency and equity objectives. The efficiency argument is often that the free market would provide too little credit for agriculture because of the risky nature of the long-term investments involved, and/or that usurious interest rates are charged in those markets where there is only one lender in the vicinity. The equity argument is simply that because many farmers are small they are therefore poor, and cheap credit is one way in which they can be subsidized to produce their way out of poverty.

Weaknesses in the efficiency/equity arguments for credit subsidy

Neither argument stands up to close scrutiny, however. If agricultural investment is more risky than other types of investment and society is risk averse, then it is socially optimal to invest less in agriculture than if it were characterized by the same degree of risk as other enterprises. There is therefore no market failure to be overcome here. Nor is there market failure with respect to the monopoly provision of loans in a village so long as there are no barriers to entry by other potential lenders. The fact is that many rural settings are too small in aggregate to attract more than one lender. Hence that lender has a natural, not a

³ One loan officer suggested that, on average, at least a further 10 percentage points should be added to the interest rate for agricultural loans as compared with urban loans to cover the higher cost of lending in rural areas. Thus, since virtually no commercial bank loans are at interest rates above 17 per cent, and the average non-rural loan is at a rate of about 15 per cent, loans to agriculture must involve a very considerable concession (in real terms, including transaction costs).

contrived, monopoly. Even though he may enjoy high profits, they are not high enough to attract a second lender and so are still the lowest one can expect. If a second lender did enter such a naturally monopolized market, by definition one or both would make losses unless subsidized. The interest rates charged in such isolated markets attract attention because of their large absolute size, particularly for small loans. But when the transaction costs are properly accounted for, it usually turns out that the net rate of interest received by the lender is close to the market rate. That is, the rates are not usurious at all.

Small farmers tend not to receive subsidized loans

The equity argument, that a cheap credit policy for small (or, in Papua New Guinea's case, indigenous) farmers helps the poor to participate in the development process, also has little merit. Credit is like any other good in that the lower the interest rate, the larger the quantity demanded. If a bank is forced by the government to provide some loans at concessional rates to a target group, the bank would be rational to limit the funds available for such purposes — since they need to be cross-subsidized by other customers — and to provide those loans to their least costly customers in the (often loosely defined) target group. Normally this means a small number of large loans will be made, rather than a large number of small loans, to reduce transactions (including risk) costs. That is, the concessions will tend to be enjoyed by the largest farmers in the target group. To cover the cost of this concessional lending, depositors will receive less interest and/or other borrowers will have to pay higher interest rates. And the latter group will include all the smaller farmers who were unable to obtain a concessional loan: for them the subsidy scheme has had the effect of raising, rather than lowering, interest rates.⁴ Even if the government used its scarce resources to subsidize the banks permanently in a bid to avoid this division into eligible receivers and less eligible non-receivers of the concessional loans, the likely outcome is that more large loans would be provided to the eligibles (larger farmers) without many of the less eligibles necessarily graduating to become eligibles.

The allocation and distribution of loans in PNG agriculture

What evidence is there in Papua New Guinea for such behaviour by lending institutions? The two institutions making significant loans to the agricultural sector are the commercial banks and the Agriculture Bank. Together they account for about 90 per cent of all lending. The Agriculture Bank is subsidized directly in the sense that the government passes on the low-interest loans it receives from international concessional lending institutions such as the World Bank. In addition, the Agriculture Bank receives direct capital grants from the government on which it pays no dividend. By 1984 these grants had accumulated to a total of K29.3 million, slightly more than the value of the concessional loans the government had received from overseas (K28.6 million). During the 1980s, about 60 per cent of Agriculture Bank loans have been allocated to agriculture compared with about 25 per cent of (a much larger volume of) loans by commercial banks.

⁴ See Gonzales-Vega (1977) for an elaboration of this argument. Related issues are discussed in McKinnon (1973) and Braverman and Guasch (1986).

Table 3.3 Industry distribution and average size of rural loans by the Agriculture Bank of Papua New Guinea, 1967-84

	Share (%) of all agricultural loans during 1967-84	Average value of approved loans, 1981-84 (kina)
Coffee	24	68,500
Cocoa	20	57,400
Palm oil	15	1,900 ^a
Cattle	13	10,200 ^a
Pigs and poultry	11	26,100
Rubber	4	21,700
Other agriculture	23	8,000
Total	100	14,000

^aMuch larger in earlier years.

Source: Agriculture Bank of Papua New Guinea, *Annual Report and Financial Statements*, Port Moresby, various issues.

Most loans go to industries involving large producers

It is revealing to examine the distribution of loans by the Agriculture Bank summarized in Table 3.3. (Unfortunately, similar data for commercial banks are not available.) Since its inception in 1967, the Agriculture Bank has lent one-quarter of its funds to coffee producers, another quarter to cocoa and palm oil producers and a further quarter to livestock producers. This concentration on lending to the small subset of enterprises which tend to involve farmers who are at the upper end of the income distribution for rural producers is certainly not inconsistent with the predictions of the above theory.

Moreover, the average size of the loans shown in Table 3.3 hardly suggests that most of the loans are going to smallholders. Even though about three-quarters of the coffee and cocoa in Papua New Guinea is produced by smallholders, they would be receiving only a small fraction of the loans provided to those industries if the average loan is of the order of K60,000.

— and to the wealthier provinces

Because of the uneven geographic distribution of the key industries, this lending pattern also ensures that most of the funds since 1967 have gone to only a few provinces: 22 per cent to Western Highlands and Eastern Highlands (primarily coffee), 27 per cent to New Britain, North Solomons and New Ireland (primarily cocoa and palm oil) and 26 per cent to Port Moresby and Morobe (primarily intensive livestock). These also happen to be by far the most wealthy regions of Papua New Guinea.

More efficient credit suppliers are crowded out

A further effect of subsidies via the government's Agriculture Bank is to crowd out potentially more efficient suppliers of credit. One piece of evidence for this supposition is provided in Table 3.4. With the fall in coffee and cocoa prices in 1981 and the projected further decline in 1982 and 1983, the Agriculture Bank cut back its lending programs for both enterprises. The number of loan approvals and the total value of loans approved in 1982 were each about one-third that of 1981. A somewhat smaller cutback occurred in 1985. In both instances, how-

Table 3.4 Agricultural loans approved by the Agriculture Bank and by commercial banks, Papua New Guinea, 1980-86 (million kina)

	Agriculture Bank ^a	Commercial banks ^a	Total
1980	11(51)	50(30)	61
1981	15(61)	27(24)	42
1982	5(60)	46(31)	51
1983	11(59)	49(21)	60
1984	14(72)	43(14)	57
1985	8(64)	61(16)	69
1986	19(63)	58(26)	77

^aThe agricultural sector's share of total lending is shown as a percentage in parentheses.

Source: Bank of Papua New Guinea, *Quarterly Economic Bulletin*, Port Moresby, various issues.

ever, the commercial banks expanded their lending so that the aggregate volume of lending increased.

Removing concessions would expand rural lending

If the concessional lending activities of the Agriculture Bank were withdrawn, along with pressure on the commercial banks to provide some concessions to farmers, the likelihood is that banking services would expand rather than contract in rural areas. Certainly there would no longer be cheap loans, but this would only harm better-off farmers who are net borrowers. Other borrowers might even enjoy a drop in the effective interest rate at which they can borrow. Also, with an expansion in the number of commercial bank branches and agencies in rural areas (e.g. at post offices), together with their ability to offer depositors a higher interest rate in the absence of concessions on loans, there would be greater opportunities and incentives for rural people to deposit surplus funds in the banks, thereby expanding the total resources available for lending. Furthermore, these benefits from such a reform would grow over time as the commercialization of agriculture expands, providing both extra depositable funds as well as extra demand for loans to purchase modern inputs.

In summary, there seems to be no valid efficiency argument for subsidizing agricultural credit, and the equity argument turns out to be not simply invalid but perverse in that subsidized credit tends to help larger producers and wealthier regions at the expense of poorer people and areas. Furthermore, subsidies via the government's bank appear to be crowding out commercial bank activity in rural areas and reducing the overall level of both deposits and loans by rural people, particularly smallholders. Clearly these subsidies and related distortions need to be removed if the financial market is to perform its vital role in the rural development process and enhance the well-being of smallholders.

Labour

Distortions in the labour market: the inefficiencies and inequities of the minimum wage system

The labour market in Papua New Guinea is distorted in ways that stifle agricultural development and generate inefficiency and inequity, perhaps even more than the divergences between social and private values in the land and finance markets. The key source of distortion is

the minimum wage system, which was inherited from Australia and ensured, at least until 1983, that the minimum wage kept up with inflation.⁵ Urban minimum wages doubled in real terms between 1972 and 1976 and through indexation have remained close to the 1976 level ever since. Rural minimum wages, on the other hand, have changed little in real terms during the past 15 years and have been less than 40 per cent of the urban minimum since Independence (Figure 3.2). The urban minimum wage in the late 1970s was double that in Malaysia and Western Samoa, four times that in the Philippines and Thailand and almost ten times that in Indonesia and Sri Lanka (McGavin 1986:152), even though average per capita incomes in those countries are not greatly different from those of nationals in Papua New Guinea. The fact that there are very high recorded unemployment rates in towns and villages (Table 3.5) suggests that there are many (especially young) people seeking those highly paid jobs. Not all of those job seekers would be idle, of course. In the village they would probably be partially employed at least, but in the cities many young people are idle and contribute to the 'rascal' or law-and-order problem there.

Figure 3.2
Real minimum weekly
wages, rural and urban,
Papua New Guinea,
1972-86*

*In 1970 kina, using the 'all
groups' consumer price index
as a deflator.

Source
P.A. McGavin, *The Labour Market
in Papua New Guinea: a survey
and analysis*, Discussion Paper
No.24, Port Moresby, Institute of
National Affairs, 1986:150,153.



5 Partial indexation has applied since March 1983. For details of the wage-setting system in Papua New Guinea, see Colclough and Daniel (1982) and McGavin (1986).

Table 3.5 Recorded unemployment rates, Papua New Guinea, 1980 (per cent)^a

	Males	Females	Combined males and females
National average	16
Rural			
village	30	53	35
non-village	3	9	3
Urban total	9	12	9
Port Moresby			
15-19 years	23	20	..
20-24 years	7	4	..
25-44 years	4	3	..
Lae			
15-19 years	23	25	..
20-24 years	8	6	..
25-44 years	5	6	..
Madang			
15-19 years	26	29	..
20-24 years	10	6	..
25-44 years	5	6	..

^aThose seeking wage employment as a percentage of the sum of those in wage employment and those seeking wage employment.

Source: P.A. McGavin, *The Labour Market in Papua New Guinea: a survey and analysis*, Discussion Paper No.24, Port Moresby, Institute of National Affairs, September 1986:32-5, drawing on data from the 1980 Census.

High minimum wages and subsidies for credit lower the demand for labour relative to capital

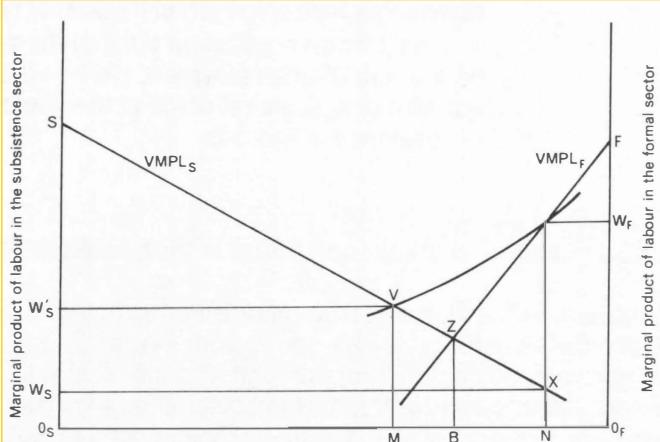
Setting wages above equilibrium levels on the one hand, and subsidizing financial capital on the other, seems contrary to the government's goal of trying to create more jobs. Both raise the price of labour relative to capital and thereby encourage the substitution of Papua New Guinea's relatively abundant factor, labour, for its scarcest factor, financial capital. These distortions therefore must reduce overall economic growth. But how do they affect the agricultural sector in particular? To answer this question it is helpful to sketch the following model of Papua New Guinea's labour market.

The minimum wage in the rural sector can be ignored because it has been about 65 per cent below the urban minimum wage and, according to McGavin (1986:153), about 20 per cent below the average wage paid in rural areas in the early 1980s. (Even if the rural minimum wage was above the equilibrium wage it is the latter which would tend to be paid because the cost of enforcing the minimum wage in rural locations would be prohibitively expensive for the government.) It is possible to think of the labour force being employable in two sectors: the agricultural sector and the formal sector which comprises the Public Service, mining, manufacturing and services. The theoretical model is developed in Box 3.1.

Box 3.1 Effects of high minimum wages on the agricultural sector

Assume both the agricultural and formal sectors use sector-specific factors of production (land, capital) that are fixed in supply. Suppose the total number of workers in the economy is indicated by the length of the horizontal axis in Figure 3.3. The vertical axes show the value of the marginal product of labour (VMPL) — the left-hand axis for the agricultural sector and the right-hand axis for the formal sector. Both value of marginal product of labour (VMPL) curves are downward sloping; that is, we assume that each additional unit of labour combined with a given stock of land and/or other capital will be less productive than the preceding unit of labour.

Figure 3.3
The labour market in Papua New Guinea



The optimal allocation of labour from the viewpoint of maximizing national product would be for $O_S B$ units of labour to be employed in the agricultural sector and $B O_F$ units in the formal sector (assuming there are no domestic divergences and that product prices are exogenous). With that allocation, both sectors would pay the same wage BZ . Total agricultural output is then represented by the area $O_S B Z S$ and total output of the formal sector by $O_F B Z F$. B is the optimal allocation because if one unit of labour moved from one sector to the other — slightly to the right or left of B — the output of the enlarged sector would increase by less than the fall in the output of the contracted sector valued at current prices.

What are the effects of the government enforcing or condoning a minimum wage in the formal sector that is greater than BZ , say W_F ? In that case only $O_F N$ units of labour would be employed in the formal sector at that wage. If all the other labour, $O_S N$, was employed in agriculture the wage in that sector would fall to W_S . Agricultural output would increase by $BNXZ$, but output in the formal sector would fall by $BNYZ$. Thus national product would be lower by XYZ , even when everybody is fully employed.

Agricultural wages and urban employment: the shift to the towns

If the formal sector wage is well above the agricultural wage, workers will be encouraged to seek one of the high paying jobs in the formal sector, especially if it is located in a large town and they expect to get greater non-pecuniary benefits from an urban lifestyle than from a rural one. If formal sector jobs turn over steadily, agricultural workers may perceive that the probability that they will succeed in getting a job depends on the size of the urban unemployment pool relative to the number employed in that sector at the wage W_F . The simple assumption made by Harris and Todaro (1970) is that the expected urban wage is the weighted average of the earnings of the urban employed and unemployed. In this case, the equilibrium outcome will involve O_{FN} units of labour being employed in the formal sector at wage W_F , but fewer than O_{SB} being employed in agriculture because some workers will prefer to wait in an urban unemployment pool in the hope of obtaining a high wage job in the formal sector.

The precise equilibrium point in the presence of the Harris-Todaro type of urban unemployment will be where the expected urban wage equals the agricultural wage at the wage level W_s in Figure 3.3. This is developed in Box 3.2.

Box 3.2 Labour market equilibrium in the presence of urban unemployment

Equilibrium in the Harris/Todaro situation is obtained in Figure 3.3 by drawing a rectangular hyperbola, in the space with origin O_F (assuming the earnings of unemployed people are zero), through Y to intersect with $VMPL_s$ at V . This gives an agricultural wage of W_s and agricultural employment O_{sM} . It also yields an unemployment pool of MN . Assuming those unemployed workers earn nothing — presumably they are supported financially by their extended family — then the total wage earnings of the formal sector, O_FNYW_F , when spread over the entire non-agricultural workforce, yields an expected wage of MV which is equal to the agricultural wage W_s .

Thus the enforcing or condoning of a high minimum wage in the formal sector, if Harris-todaro behaviour is common, reduces national product by more than just the area XYZ in Figure 3.3, because agricultural production is also reduced by the area $MNXV$. Whether agricultural production is greater or less in the presence of a high minimum wage and Harris-Todaro unemployment than in their joint absence — whether M is to the left or right of B — and hence whether W_s is above or below the equilibrium wage BZ , depends on the elasticity of the curve for the marginal product of labour in the formal sector over the range Y to Z . If that formal sector's elasticity exceeds unity, agricultural output is increased by these phenomena and so the agricultural wage is reduced. However if that elasticity is less than unity, agricultural output is reduced and the agricultural wage is increased.

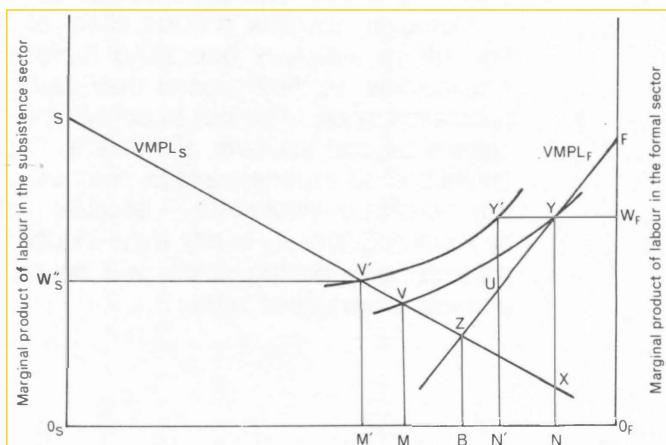
The economic loss from enforcing high minimum wages is likely to be even greater than the area XYZ plus area MNXV in Figure 3.3. One of the extra costs is that of policing the payment of minimum wages in the formal sector. Another is the negative externalities associated with a large pool of unemployed in the towns and cities, such as violence, robbery, etc., and the associated policing activities.

If the government wanted to reduce the urban unemployment problem, but was unprepared to lower the minimum wage in the formal sector, subsidizing urban activities may not provide a solution. Indeed, such assistance may exacerbate the problem by reducing aggregate employment and output even further. This can be seen from Figure 3.4 in Box 3.3.

Box 3.3 Employment and output effects of an urban wage subsidy

If a subsidy of UY' is paid to urban employment per worker, formal employment would increase by NN' units. But expected urban wages would also increase. The new equilibrium point would be at V' , with reductions in agricultural employment of MM' and agricultural output of $MM'V'V$. Whether aggregate employment and output go up or down depends on the slopes of the marginal product of labour curves. The steeper the curve for the formal sector relative to that for the agricultural sector, the more likely that employment and output will decline; that is, that NN' is less than MM' and that $NN'UY'$ is less than $MM'V'V$. The likelihood of aggregate output declining is even greater if, instead of intervening with an urban employment subsidy, the assistance to urban activities was provided by a blunter policy instrument such as a production subsidy or, even worse, by protection from import competition via a tariff or import quota. This is because of the additional by-product distortion costs associated with these second or nth-best instruments (Corden 1974).

Figure 3.4
The labour market with a subsidized urban sector



**Possible ways of reducing urban unemployment:
subsidize agricultural labour**

A certain way to reduce urban unemployment and expand output would be to subsidize labour in the agricultural sector. This would reduce the intersectoral wage differential and hence bring some urban unemployed back to the land, reducing the unemployment pool. The opportunity cost of this extra labour for the agricultural sector would be zero. For example, in Figure 3.3 if a subsidy of XY was paid to each unit of labour in the agricultural sector, the wage received in that sector would equal that in the formal sector, W_F , so there would be no unemployment. The extra MN units of labour formerly unemployed but now employed in agriculture would generate extra output represented by area $MNXV$, which is a pure gain. In addition, there would be a further gain due to reduced violence and its associated costs in the towns and cities.

— or invest in rural education and improve rural living conditions

It may not be feasible to provide direct subsidies to subsistence labour because of high disbursement costs. Nonetheless, much the same result could be achieved by investing public funds in rural education, health and infrastructure so as to make life in the villages more attractive and hence raising real incomes indirectly — and at the same time boosting overall economic growth (see Chapter 7). A somewhat blunter instrument would be an export subsidy for agricultural output. Alternatively, investing in technical progress in either sector would reduce unemployment, as can be seen by shifting the VMPL curve for the expanding sector towards the axis for the other sector in Figures 3.3 or 3.4.

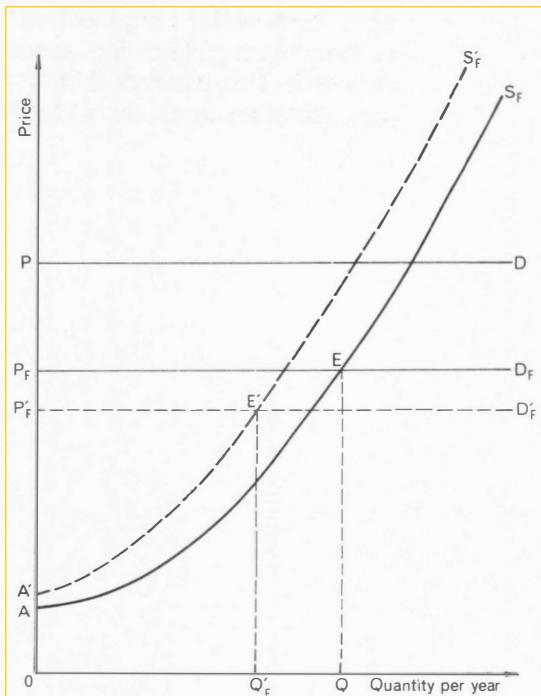
Numerous qualifications to this analysis can be made, and have been made in the literature (see, for example, Corden and Findlay (1975) and Khan (1980)). Nonetheless, the conclusion remains that high minimum wages in the formal sector reduce aggregate output, and possibly also agricultural output and employment. Also, assistance to non-rural activities may exacerbate rather than reduce urban unemployment as well as decreasing agricultural output and employment. This latter point is taken up in the next chapter.

Moreover, there is another effect of high urban wage laws on agriculture which is becoming increasingly more important to smallholders as they expand their cash cropping and their use of purchased inputs. This has to do with the cost of handling inputs and outputs beyond the farm. Farmers in Papua New Guinea are price takers both as exporters and as purchasers of inputs. This means that any increase in input costs — because higher wages have to be paid by supplying firms — or any wage-induced increase in transportation/processing/marketing costs, will be passed on to farmers. This analysis is developed in Box 3.4.

Box 3.4 Effects of higher input costs on farmers

In terms of Figure 3.5, an inflation of input costs shifts the farmers' supply curve from S_F to S'_F . An increase in costs of getting their output to its final market shifts the farmers' derived demand curve from D_F to D'_F , even though the demand for the good in its ultimate market, D , and its price, P , is unchanged. Instead of supplying Q_F and receiving the price P_F , farmers only supply Q'_F at the lower price (net of increased marketing costs) of P'_F . Gross revenue is thus reduced from $OPFEQ_F$ to $OP'_FE'Q'_F$ by the higher marketing costs associated with the high minimum wage, and net revenue or producer surplus is reduced from P_FEA to $P'_FE'A'$. This is clearly another way in which agriculture is harmed by high minimum wages in the non-rural sectors, and one that will become increasingly costly to smallholders as they become more integrated into the monetized economy.

Figure 3.5
Effects of increased urban wage costs on the quantity produced and price received by farmers



The far-reaching effects of wage distortions

The distortions in Papua New Guinea's labour market due to high minimum wages in non-rural sectors are both inefficient and inequitable. They are inefficient in that they reduce overall output and employment. They also have possibly reduced agricultural output and employment, including through their effect on the costs of marketing farm inputs and outputs. Moreover, they are inequitable in that they raise the incomes of those lucky enough to obtain a high paying job but they lower the average wage in the rest of the workforce, including those unemployed. In addition, they induce urban unemployment and its attendant law and order problems.

Together with subsidies for financial capital these wage distortions encourage the substitution of capital for labour in the formal sector of the economy, thereby causing excessive use of Papua New Guinea's scarcest resource. At the same time, the distortions are adding to the differential that exists already between the price of labour relative to capital faced by largeholders as compared with smallholders in the agricultural sector. Largeholders have higher transaction costs in hiring and supervising plantation labour but lower transaction costs in obtaining credit. This differential in turn has implications for the demand for agricultural research, discussed in Chapter 6.

4

Distortions in product markets

All countries have policies which alter product prices and thereby affect both the allocation of resources to various industries and sectors and the pattern of consumer spending. Some policies are introduced with the aim of encouraging a particular industry, either to satisfy national development objectives or to placate a special interest group in return for its political support. Other policies are introduced simply to raise government revenue. Typically, however, all such price-distorting policies have much wider ramifications than are envisaged by their proponents or by the government which introduces them. The previous chapter discussed some of these effects in relation to markets for the primary factors of production. The purpose of this chapter is to focus on the effects on agriculture of policies affecting relative product prices. In doing so, the issue of taxation is inevitably raised and so tax policies also need to be considered.

The first part of the chapter examines policies which affect agricultural product prices directly. These include food import barriers and minor export taxes on tree crops. However, they are only part of the story because agriculture is affected also, in indirect but nonetheless major ways, by policies which effectively tax or subsidize other sectors and by exchange rate policy which alters the price of tradable products relative to goods and services that are not tradable internationally.

Agricultural product price distortions

The minor contribution of export taxes

Unlike many other primary-exporting developing countries, Papua New Guinea does not impose heavy taxes on its agricultural exports. Since Independence, export taxes have amounted to no more than 2.5 per cent of the value of agricultural exports and have contributed only about 2 per cent of central government internal revenue. Thus coffee, cocoa, coconuts, palm oil and the like are directly affected very little by agricultural pricing policy in Papua New Guinea. Production of food other than coconuts, however, is an import-competing activity and so is affected directly by the government's policies towards imports.

Import duties have risen substantially

In the 1970s import duties were not large on average, representing between 3 and 6 per cent of the total value of all imports. During the 1980s, this percentage has been increasing, from 8 per cent in 1980 to 12 per cent in 1984 and 1985. By 1986 most goods imported into Papua New Guinea, except those specifically designated duty free, were subject to a general import levy of 7.5 per cent of value, on top of which there are additional duties. As a result of this escalation, import

duties were contributing around 22 per cent of all internal revenue by the mid-1980s, compared with around 15 per cent in the 1970s.

The effects of non-tariff import barriers are common

Perhaps more important than the average import tax is the dispersion of tariffs across commodities and the prevalence of non-tariff import barriers including quantitative restrictions and some prohibitions. These import restrictions provide a wide range of effective rates of protection. In addition, like tariffs they implicitly tax consumers insofar as they raise domestic prices, again to varying extents.

Imports of some food are allowed but many are banned

From 1986 restrictions on rice, mutton flaps and canned fish imports were lifted because these foods had become important items in the diet of people with cash purchasing power. Cheap cuts of beef for canning and wheat for milling also are allowed in duty free for processing by domestic firms. However, many other major foods faced import bans, the intention being to raise food self-sufficiency and encourage domestic production. These include fresh fruits and vegetables — except for limited quantities into Port Moresby which is somewhat isolated from domestic producers of these products — as well as sugar, eggs, pork, poultry, beef prime cuts, canned meat and flour.

Promotion of domestic food production and self-sufficiency: a mixed result

These import bans raise the extent of gross food self-sufficiency in the country. Also, they have encouraged the development of some new agricultural industries, notably sugar cane, and the intensive production of broilers, eggs and pork using modern grain-feeding techniques. They have been less successful in raising the share of traditional vegetables and fruits that are marketed because the latter face high domestic transport costs relative to their value. Also, these protective policies have made only a minor contribution to net self-sufficiency of livestock and poultry products. This is because

- those industries depend on feedgrains which have to be imported;
- feedgrains have a relatively high landed (cif) import price because shipment volumes are small;
- feedmixing is more costly in Papua New Guinea than elsewhere;
- feed is a large component of production costs (two-thirds in the case of broiler production); and
- feed conversion ratios are still high in Papua New Guinea, except in broiler production where the technical efficiency of producers has increased dramatically during the past decade (Jarrett and Anderson (1988)).

For all these reasons it is possible that almost as much foreign exchange is being spent on importing the feed ingredients for the modern livestock sector as would be spent if the final product were to be imported from a low-cost supplier.

Import restrictions indirectly harm agricultural exports

Even if these policies were judged to be worthwhile for food self-sufficiency reasons, two other considerations need to be kept in mind. One is that, while these policies promote import competing activities in agriculture, they are reducing the resources available for producing those export agricultural products in which Papua New Guinea has a

stronger comparative advantage. Rural labour, agricultural land and financial capital that is attracted to these protected activities could be more profitably employed in other activities, including agricultural exports.

— and reduce the welfare of consumers

The second consideration has to do with consumers of food. Restrictions on food imports both raise the price of food and reduce the quantity, quality and variety of food nutrients available to the population. A very sizeable proportion of the population, including many of the people in rural areas, are net buyers of food, that is, they spend more on buying food than they earn through selling produce from their garden. These people are adversely affected by policies which restrict food imports. And since poorer people tend to spend a larger share of their income on food than richer people, this form of implicit taxation affects poor people relatively more. It affects them not only directly but also indirectly in the sense that a less nutritious diet weakens their health and hence lowers their labour productivity and raises their medical expenses, given their relatively low state of health (see Table 1.6).

Case study: import barriers on meat products

To illustrate some of these points, it is instructive to examine the trend in Papua New Guinea's meat markets. During the 1970s, meat consumption rose substantially as diets changed with increased urbanization and monetization, so that by 1979 total meat consumption in Papua New Guinea slightly exceeded the developing country average at about 16 kg per capita per year (Table 4.1). Much of that consumption growth was due to the increased availability and declining real prices of imported beef, canned meat and chicken. Then, around 1982, the import quotas introduced in 1975 were replaced by prohibitions on imports of high-quality beef, chicken and canned meat (but not mutton flaps). The reduction in available supplies combined with a fall in real GDP per capita in Papua New Guinea resulted in an overall fall in meat consumption from 16 to 13 kg per capita. It would have fallen much more had it not been for the availability of imported mutton flaps, per capita consumption of which has quadrupled during the 1980s. But had chicken been freely importable, its price would have been almost half what it was in the mid 1980s, in which case consumers would have had a cheaper — and a less fatty — alternative to mutton flaps, and overall meat self-sufficiency would have been little different insofar as imported chicken is a substitute for imported mutton. Similarly, the banning of canned meat imports has done little to affect meat self-sufficiency as the new domestic canning industry still has to import most of its meat, not to mention its machinery and all the tin cans. From the viewpoint of consumers this trade policy has meant higher prices for canned meat and a reduction in the variety of brands available.

Disappointing overall economic effects of food import restrictions

Certainly some jobs have been created in the industries protected by these food import policies. For example, the Ramu sugar project is providing the country's sugar needs, about 2000 tonnes of beef is marketed each year as a result of the government's cattle development projects, close to 10,000 tonnes of chicken meat is now being produced domestically per year, and so on. But none of these projects

Table 4.1 Per capita consumption of (and self sufficiency in)^a various meats, Papua New Guinea, 1971-86 (kg per capita)

	Unprocessed beef	Chicken ^a	Mutton	Pork	Canned meat	Other processed meat	Total ^a
1971-74	1.2	1.1(5)	0.9	0.3	2.8	3.9	10.2(6)
1975-78	2.0	2.1(24)	0.6	0.2	3.5	4.5	12.9(11)
1979	2.8	2.7(31)	1.1	0.2	4.2	5.1	16.1(10)
1980	2.3	3.0(58)	1.4	0.3	3.3	4.2	14.5(13)
1981	1.9	3.3(80)	1.7	0.3	2.7	3.7	13.6(20)
1982	1.8	2.8(94)	2.2	0.3	1.5	3.9	12.5(25)
1983	2.1	2.6(95)	2.5	0.4	2.3	4.4	14.3(23)
1984	2.2	2.4(96)	3.2	0.4	1.6	3.6	13.4(23)
1985	2.1	2.5(97)	3.1	0.4	1.1	4.0	13.2(24)
1986	2.5	2.6(97)	4.6	0.4	1.7	3.3	15.1(22)

^aNumbers in parentheses are domestic production as a percentage of domestic production plus imports.

Source: F.G. Jarrett and K. Anderson, *An Economic Review of the Broiler Industry in Papua New Guinea*, Report prepared for Niugini Table Birds Pty Ltd, Lae, 1988.

looks close to becoming internationally competitive in the foreseeable future. The protected domestic price of the less-refined sugar produced by Ramu was about three times the world price in the mid 1980s; many smallholders in the beef industry have found their managerial skills are insufficient to allow them to compete with larger producers, even at highly protected prices, so an increasing proportion of output from this industry is being supplied by largeholders; and while the broiler industry in Papua New Guinea is becoming more technically efficient in terms of mortality rates and feed conversion ratios, it can continue to do so only by increasing shed sizes which means that production would be in the hands of fewer, but larger, suppliers. In short, the number of employment opportunities created by the government's food import restrictions is smaller than was originally envisaged, and may well be much less than the number of jobs lost through diverting resources away from more-efficient industries.

Non-agricultural product price distortions

Questionable economic results of import restrictions on manufactured goods

Import restrictions and prohibitions apply to many manufactured goods also. While Papua New Guinea's tariffs may not be as high and uneven as that of some other developing countries, together with quantitative import restrictions they have become increasingly more protective since Independence. Yet, like food import restrictions, they may contribute little to the objectives of saving foreign exchange and boosting employment. It is more likely that they are counterproductive in achieving these objectives.¹ As was pointed out in the previous chapter on

¹ For more discussion of the issue in the Papua New Guinea context, see, for example, Whalley (1982), Hughes (1984) and Goodman *et al.* (1985). It is discussed in more general terms and for other developing countries in, for example, Little *et al.* (1970), Balassa and Associates (1971), Krueger (1978, 1983), Clements and Sjaastad (1984), Lal and Rajapatirana (1987) and Bautista (forthcoming). Agricultural exporting developed economies also have suffered from import substitution policies, as the experiences of Australia and New Zealand have shown. See, for example, Anderson and Gamaut (1987).

wages policy, it is quite possible that protecting urban industries in the presence of a high minimum urban wage may even exacerbate the problem of unemployment.

From the viewpoint of the agricultural sector, an import-substituting industrialization strategy is undesirable for two reasons. First, it bids up the price of intersectorally mobile resources such as labour and (if its international mobility is restricted) financial capital, so raising the cost of agricultural production. Second, insofar as it reduces the demand for foreign exchange, it raises the value of the kina relative to what it otherwise would be. This lowers the price in kina terms that farmers receive for their tradable products, just as happens when the exchange rate strengthens because of foreign capital investment in and exports from the country's mines (as discussed in Chapter 2). Thus agricultural producers earn less because of both higher production costs and lower gross receipts. This reduces their incentive not only to produce today but also to invest in agriculture for future output growth.

Not all policies aimed at boosting manufacturing output have had this adverse effect on agricultural production, however. Papua New Guinea, like many primary-exporting countries, has from time to time required some primary products to be processed to some extent before being exported. This typically has the effect of reducing aggregate exports of that product group (primary plus processed) because of the uncompetitiveness of the processing activity. As a result, the exchange rate depreciates and this raises the kina value of exports of other tradable sectors. Insofar as these policies apply to non-agricultural primary products the agricultural sector would expand as a result.

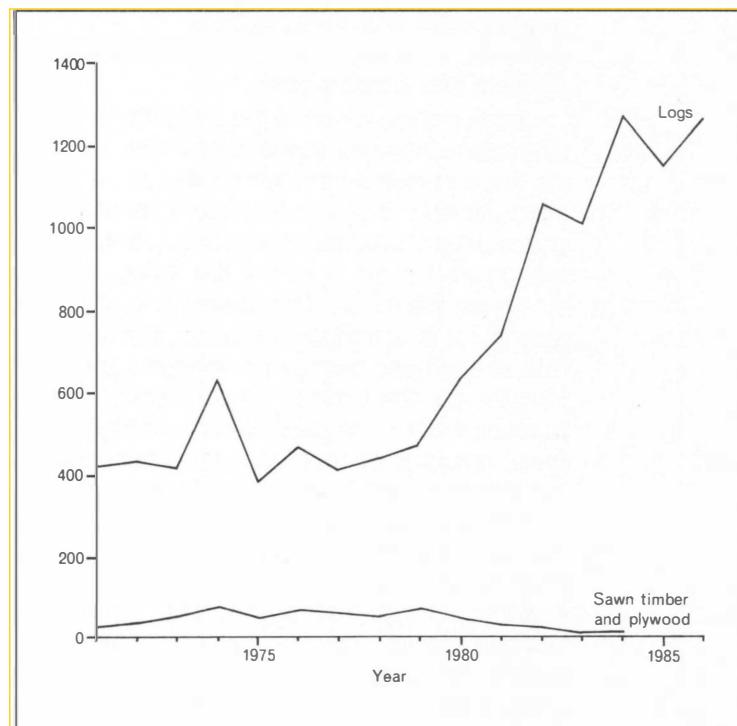
Case study: the forest products industry

A clear example of the effects on exports of this form of regulation is provided by Papua New Guinea's forest products industry. During the 1970s the government required forest industry investors to establish facilities for processing logs into sawn timber, plywood, chipboard and the like, rather than expand their log exports. Processing costs are high by international standards, however, because of Papua New Guinea's high wage structure and because of the large number of species in the country's natural forests so that economies of scale in processing are difficult to obtain. In addition, many timber-importing countries have no tariffs on logs but tariffs on processed timber. These tend to be higher the greater the degree of processing. The effect of this structure of escalating tariffs in the international market for timber products is to depress the price exporters can receive for processed timber relative to that for logs. Together these factors made it extremely difficult for firms to process logs profitably in Papua New Guinea, and some firms who endeavoured to do so in the 1970s have since simply abandoned their plants to avoid further losses.

In response to this disappointing performance, the government decided in 1979 to change its policy to allow increased exports of logs. The response by producers was immediate and dramatic. After being static for a decade, the volume of log exports trebled between the late 1970s and mid-1980s (Figure 4. 1). It is true that, when firms were no longer required to process timber before exporting it, the exports of

Figure 4.1
Volume of log and other
forest product exports,
Papua New Guinea,
1971-86 ('000 square
metres)

Source
Papua New Guinea, National
Statistical Office, *Summary of
Statistics and Abstract of
Statistics*, Port Moresby, various
issues.



sawn timber and plywood declined (as did woodchip exports, not shown in Figure 4.1 because the volume data are not available for all years). However as Figure 4.2 shows, the increased value of log exports far outweighed the decreased value of processed timber products, so that forest products doubled their share of total exports (from 4 to 8 per cent — see Table 1.9). Moreover, since the firms in the industry were so much more profitable they were providing more tax revenue and employing more people.²

The immediate effect of this return to a more efficient forest policy is to reduce the earnings of the agricultural sector to the extent that the expansion in log exports reduces resources available for agriculture and causes the kina to appreciate. In the longer run, however, it may expand the availability of resources for agriculture in so far as land cleared by loggers is subsequently used for agricultural purposes. This may turn out to be an additional positive effect of the government's forest policy reversal.

² For a more detailed discussion of forest policy in Papua New Guinea, see Fraser (1981) and the proceedings of a seminar held by the Institute of National Affairs (1983).

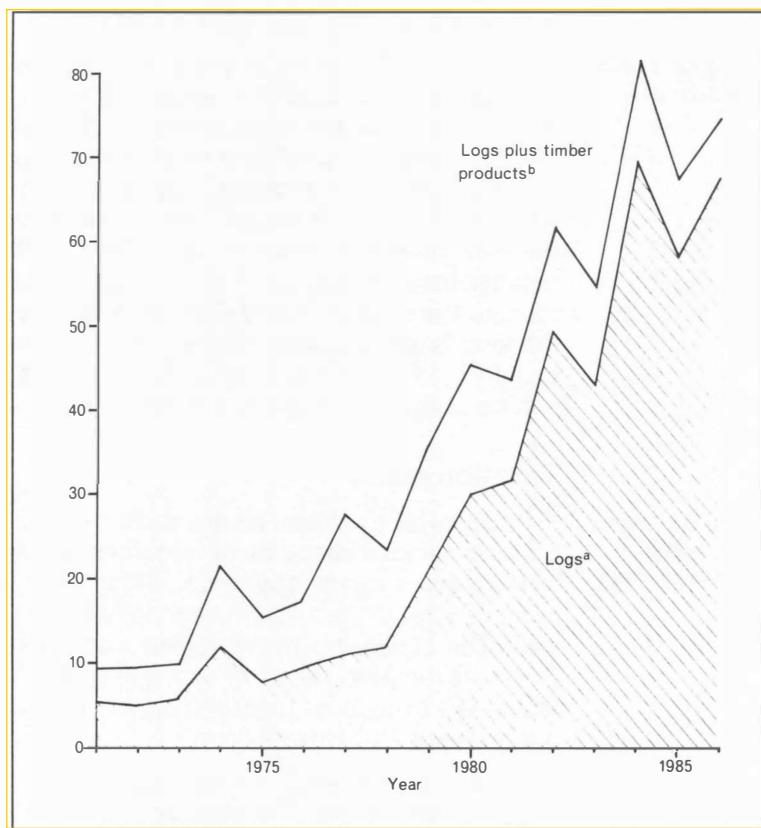
Figure 4.2

Value of log and other forest product exports,
Papua New Guinea,
1971-86 (million kina)

^aStandard International Trade Classification 242.

^bStandard International Trade Classification 243 and 63.

Source
Papua New Guinea, National Statistical Office, *Summary of Statistics and Abstract of Statistics*, Port Moresby, various issues.



Exchange rate policy

The 'hard kina strategy'

From Independence until the early 1980s, the government pursued what became known as the 'hard kina strategy' as a key element in its macroeconomic policy.³ The aim was to maintain relatively low inflation with free convertability of the kina, to maintain a strong balance of payments and to keep the level of foreign debt manageable without having the value of the kina depreciate against trading partners' currencies. This was perceived to be necessary to promote economic and political stability. In the absence of exchange controls and with wages indexed to the cost of living, this in effect required the government to use public expenditure and the inflow of foreign aid to maintain balance of payments equilibrium. The policy held firm through the 1970s, but when the terms of trade and balance of payments situation deteriorated during 1980-82 the government's approach changed. In early 1983, it depreciated in step with the Australian dollar and since then the kina has been allowed to depreciate gradually against a trade-weighted basket of currencies, in nominal terms as well as in real

³ Discussion of exchange rate and other macroeconomic policies is brief here because it is available in detail elsewhere. See, for example, Dahanayake (1981), Garnaut and Baxter (1983), Valentine (1987) and Guest (1987c).

The high kina value harms agricultural exporters

terms after adjusting for differences in the inflation rates of Papua New Guinea and its trading partners (Table 2.1).

The pre-1983 'hard kina strategy' had the effect of keeping down the domestic price of tradables relative to non-tradables compared with what might have prevailed otherwise. In that sense agricultural exporters, along with producers of other tradable products not subject to quantitative trade restrictions, may have been harmed by this strategy (Corden 1981), even though they would have shared with others the benefits of macro stability which this policy provided. The real depreciations in the value of the kina since 1983 have helped to redress this situation somewhat, although it is not clear to what extent the kina is still overvalued given the substantial deterioration in the country's terms of trade since 1979 and its mounting foreign debt service obligations (Figures 1.3 and 1.5).

Taxation policy

Need to expand internal sources of tax revenue before reliance on foreign aid can fall

Differential tax treatment across sectors of the economy can also affect the inter-sectoral allocation of resources, as can inter-sectoral differences in government spending. Since Independence, internal tax revenue has covered little more than half of the government's expenditure. The continuing heavy reliance on foreign grants and loans to cover the remaining share of expenditure is something the government would like to reduce. Unless spending is cut this means finding new internal sources of tax revenue.

Current sources of internal revenue

The sources of internal revenue receipts are summarized in Table 4.2. Total internal revenue receipts now amount to just over one-fifth of GDP, up from one-sixth prior to Independence. The share provided by personal income tax in the mid 1980s was about 28 per cent, which is much the same as in the 1970s. Non-mining company taxes, on the other hand, supply around 11 per cent now compared with 16 per cent in the 1970s and about 20 per cent in the 1960s, while the contribution of mining company taxes via the Mineral Resources Stabilization Fund (MRSF) drawdowns also have declined substantially. And, as noted earlier, during the 1980s import taxes have been creeping up in importance, from 16 per cent in 1980 to 23 per cent in 1986. However, prior to and immediately following Independence they were much more important. Export taxes continue to contribute only around 3 per cent.

Disappointing tax contribution of the mining sector

Given the perceived promising potential contribution of mining to government revenue and hence to general welfare, it is of interest to examine its actual contribution. Details are provided in Table 4.3. The high contribution from MRSF drawdowns (payments to public account) of the mid 1970s, of up to 20 per cent of all internal revenue, was achieved again only once in the subsequent decade, in 1981. The average contribution for the 10 years to 1987 was 10 per cent. There has been some build up in the MRSF over this period, however, so receipts into the Fund are a more appropriate indicator of the mining sector's capacity to contribute. During the period 1974-75 to 1981 those receipts averaged over 20 per cent of what internal revenue

Table 4.2

Central government expenditure and internal sources of tax revenue, Papua New Guinea, 1965-86^a (million kina and per cent)

	1965 to 1969	1970 to 1974	1975 to 1979	1980	1981	1982	1983	1984	1985	1986
Total government expenditure (% of GDP)	162 (44)	273 (31)	463 (33)	635 (37)	689 (41)	707 (40)	785 (40)	823 (39)	864 (38)	930 (38)
Total internal revenue (% of GDP) (% of government expenditure)	59 (16)	102 (16)	251 (18)	344 (20)	382 (22)	384 (22)	411 (21)	473 (22)	512 (22)	538 (22)
Share of internal revenue ^b from										
Personal income tax	25	28	28	22	24	28	30	28	26	27
Company tax ^c	19	16	16	15	13	12	12	11	14	11
Import taxes	37	27	18	16	17	20	21	21	20	23
Export taxes	-	-	2	3	1	1	1	3	3	3
Excise taxes	13	13	15	13	12	13	13	12	12	12
MRSF drawdown ^d	-	10	12	16	21	10	5	6	6	3
Other	6	16	9	15	12	16	18	19	19	21
Total	100	100	100	100	100	100	100	100	100	100

^aFiscal years beginning 1 July until 1977, calendar years thereafter.^bPer cent.^cExcludes mining company taxes which enter indirectly via MRSF drawdowns.^dThe Mineral Resources Stabilization Fund is where Bougainville Copper Ltd's company tax, dividend withholding tax and dividends on government equity are paid. The government draws on this Fund ostensibly to obtain a more even flow of mining tax receipts through time than would occur if payments were made directly into consolidated revenue.Sources: Papua New Guinea National Statistical Office, *National Accounts Statistics*, Port Moresby, various issues; C.D. Thac and D. Lim, 'Papua New Guinea's tax performance, 1977', *World Development* 12(4):451-9, April 1984; Bank of Papua New Guinea, *Quarterly Economic Bulletin*, Port Moresby, various issues; *Budget Documents* 1988.

would have been in the absence of MRSF drawdowns, *ceteris paribus*. But during 1982 to 1987 that contribution averaged only 7 per cent, amounting to only 1 or 2 per cent of GDP. This rather minor contribution of the mining sector in the 1980s has been a disappointment. The recovery in the price of copper concentrate at the end of the 1970s — which was necessary to cover the rapid rise in mining costs — turned out to be short-lived (Table 2.4). As a result, profits and therefore taxes from Bougainville Copper Ltd have been low throughout the 1980s, and those from Ok Tedi have yet to begin.

Personal income taxes are confined to urban wage earners

Much of the central government's personal income tax revenue is received from expatriates, though that contribution will tend to dwindle if the government's indigenization of the workforce continues any further. Less than a quarter of a million nationals (salaried public servants and the like) pay most of the rest of the personal income tax. That is, the vast majority of nationals who are involved in semi-subsistence smallholder agriculture pay no income tax at all. Presumably the government has judged that the cost of collecting taxes from this group would exceed the revenue raised.

Table 4.3 Mineral Resources Stabilization Fund operations and North Solomons royalty receipts, 1975-87 (million kina)

	1975 ^a	1976 ^a	1977 ^a	1977	1978	1979	1980	1981	1982	1983	1984	1985	1986	1987
MRSF receipts														
Company tax	9.1	54.1	15.6	20.5	13.5	23.1	73.4	51.7	19.6	16.2	39.3	15.2	18.0	5.1
Dividend withholding tax	8.6	3.1	3.0	1.1	2.7	6.0	12.7	6.7	1.4	1.6	5.2	2.0	5.4	6.4
Dividend on govt equity	13.9	5.0	5.1	2.0	4.6	10.2	21.4	10.7	2.3	1.9	7.6	3.0	6.9	10.1
Other receipts	-	0.7	0.8	0.2	0.3	0.1	1.2	2.3	2.1	5.3	3.4	3.5	5.7	4.0
Total	31.6	62.9	24.6	23.8	21.1	39.4	108.7	71.4	25.4	25.0	55.5	23.7	36.0	25.6
(% of GDP)	(3)	(6)	(2)	(4)	(1)	(2)	(6)	(4)	(1)	(1)	(3)	(1)	(2)	(1)
(% of central govt internal revenue)	(18)	(29)	(11)	(22)	(8)	(17)	(32)	(19)	(7)	(6)	(12)	(5)	(7)	(4)
MRSF payment to public account	31.6	45.0	35.0	17.0	31.0	38.5	56.6	81.4	40.0	21.0	29.7	32.1	14.0	55.0
(% of central govt internal revenue)	(18)	(20)	(16)	(16)	(11)	(16)	(16)	(21)	(10)	(5)	(6)	(6)	(3)	(9)
End-year balance in MRSF	-	17.9	7.5	14.3	3.4	4.3	56.4	46.4	31.8	35.8	61.7	53.3	75.3	45.9
Royalty receipts by North Solomons Provincial Government from Bougainville Copper Ltd	3.1	2.3	2.5	0.8	2.1	2.8	4.2	3.7	3.4	4.7	5.4

^aFiscal years beginning July 1. The MRSF did not become fully operational until 1975-76, so the 1974-75 payment was made directly into consolidated revenue.

Source: Papua New Guinea, Department of Finance, *Estimates of Revenue and Expenditure*, Port Moresby, various issues.

Taxes on trade could provide more revenue

In this situation, it is tempting to look to trade taxes as a source of revenue. This raises the question of what is an optimal trade policy regime for raising a given amount of tax revenue. It is not appropriate to analyse this issue in detail here as it needs to be considered as part of overall tax policy.⁴ Even so, two points are worth making. First, many quantitative barriers and prohibitions on Papua New Guinea's trade could become a source of additional tax revenue simply by converting these non-tariff barriers into tariff barriers. Even if their trade-restricting effects remained unchanged, they would be likely to boost customs revenue substantially. If the protection levels on the most protected items were to be lowered somewhat, the revenue collected from the larger volume of imports could be even greater. In addition, there would be efficiency gains from reducing the average level of protection and the dispersion in the tariff structure.

The advantages of taxing exports rather than imports

The second point is more radical. Would it be more efficient to use export rather than import taxes in Papua New Guinea? Traditionally, economists have argued vigorously against high taxes on agricultural exports of developing countries because of the efficiency losses involved,⁵ but in a situation where high barriers to imports are in place

⁴ Among recent analyses of tax policy in Papua New Guinea are the studies by Mathews (1980), Neild (1980), Bird (1984) and Collins (1985).

⁵ For a discussion of this literature and of the politics of this policy issue in the African context, see Bates (1981).

those efficiency losses are occurring anyway. A tax on imports is equivalent to a tax on exports, in that both forms of tax encourage import-competing production at the expense of production of exportables.⁶ There could be a number of economic advantages to be gained from a complete overhaul of the trade policy regime which involved removing all barriers to imports and replacing them with a flat rate of tax on exports. One obvious advantage would be the lower cost of collecting export taxes. Already the administrative machinery is in place to collect, say, a 10 per cent levy, while savings could be made from eliminating the customs service which collects import duties. Second, the wide dispersion of rates of protection to import-competing producers would disappear, so there would be additional efficiency gains from reallocating resources among the import-competing industries. Third, if the government made it clear that import restrictions were to be available no longer, fewer resources would be spent on lobbying for this costly form of intervention. Finally, it would be seen as a more equitable form of taxation not only because it would remove the unequal rates of import taxation but also because smallholder tree crops exporters, who currently pay no direct taxes other than the 2.5 per cent export levy, would be seen to be making a larger direct tax contribution, although in fact they are already currently being taxed implicitly, as mentioned earlier, by the policy of import restrictions.

The policy of a uniform export tax could be fine-tuned, for example by using Ramsey's (1927) optimal trade tax rule to exploit any differences between commodity markets in terms of their supply and demand characteristics, but in Papua New Guinea's case such differences are probably insignificant. Of more importance is the need to ensure that investment incentives to mining companies are not reduced.⁷

Another concern might be that such a policy change would remove differences in import barriers which reflected differences in the desired degrees of consumption taxation of imported luxury items. This can be remedied easily by placing an explicit consumption tax at the desired rate on luxury items. Such a tax also has the advantage over an import tax of not encouraging domestic production of such non-necessities, since an import tax is equivalent to a consumption tax and a production subsidy on the good concerned.

Conclusions

The need to reduce distortions imposed by trade and exchange rate policies

Papua New Guinea is not alone among developing countries in harming agriculture through export taxes, through protection to non-agricultural industries, and through maintaining an overvalued currency (Krueger, Schiff and Valdes 1988). Indeed it may well harm its agricultural sector much less than occurs in other developing countries. This does not alter the fact, however, that Papua New Guinea could enliven its agricultural sector — and indeed the economy

⁶ On the symmetry between import and export taxes, see Lemer (1936). Clements and Sjaastad (1984) provide empirical estimates for a number of developing countries of the extent to which import taxes are borne by exporters.

⁷ The complexities of extracting rents by taxing mineral production/exports are analysed in, for example, Garnaut and Clunies-Ross (1983) and Lloyd (1985).

as a whole — by reducing the distortions to producer and consumer incentives which its trade and exchange rate policies impose. Allowing the kina to move closer to its equilibrium level would encourage the production of tradables (including agriculture) relative to non-tradable goods and services. Replacing quantitative import restrictions and prohibitions with import tariffs would raise government revenue. If the tariffs on the most restricted items were set at levels that were less restrictive than current import barriers, there would be two additional beneficial effects. The efficiency of resource allocation within the import-competing sector of the economy would improve, and agricultural (and other) export sectors would be more able to exploit their comparative advantages because of fewer resources being attracted to uncompetitive import-replacement industries.

Would replacing import barriers with a low uniform export tax be wise?

An even more radical change would involve replacing all import restrictions with an export tax. As more direct forms of taxation become less expensive to collect, so the need for trade taxes as a means of raising government revenue would diminish and hence the rate of export taxation could be lowered gradually over time. This form of taxation, it should be reiterated, would need to be a substitute for, rather than an addition to, import restrictive policies if it were not to discriminate against agriculture. There are two major weaknesses in such a proposed policy change. One is that the source of its major economic benefit — the removal of differing rates of price distortion for different importables — is also the source of the main advantage of the present policy regime from the viewpoint of politicians, namely, that it can be used to disperse political favours to politically supportive vested interests. The second and related weakness is that, if import taxes were less than fully reduced to offset the resource reallocation effect of raising export taxes, the outcome would involve an even more inefficient use of resources, especially if the dispersion in import tax rates across industries were to increase. If there is a reasonable probability of the latter occurring, it would probably be better simply to stay with the existing trade policy and work towards reducing the average level and the dispersion of import duties and phasing out quantitative import restrictions.

5

Agricultural stabilization policy

The two previous chapters have been concerned with policies which directly affect the trend level of prices to which producers respond. This chapter is concerned with policies which alter the fluctuations in product prices around trend levels, that is, with price stabilization schemes. Papua New Guinea has stabilization schemes for cocoa, coffee, copra and palm oil (for smallholders only), as well as for mineral export earnings. After discussing the stated objectives of these schemes this chapter examines the potential gains and losses from them in Papua New Guinea. It concludes that, contrary to conventional wisdom, these stabilization schemes may well be unnecessary for macroeconomic stability and at the same time they are a disincentive to agricultural production and growth. In particular they may reduce the welfare of smallholders.

Objectives of agricultural stabilization policy

Commonly-stated reasons for operating stabilization schemes
— to smooth out fluctuations affecting the wider economy

The usually stated reason why Papua New Guinea operates stabilization schemes for agriculture and minerals is that the year-to-year fluctuations in the country's export earnings, when passed on to producers, would 'seriously disrupt progress towards broad development goals' (Guest 1987a:1). According to this view the transmission of large fluctuations in export earnings to the domestic economy would generate instability in the demand for non-tradables and thereby make it difficult for firms to plan. The spending of government tax revenues would also be difficult to manage. In addition, there would be upward pressure on wages in periods of high export earnings as trade unions sought a share in the boom. Because of downward rigidity in wage setting, this would be difficult to reverse when export earnings fell. Thus

from a macro point of view, the commodity stabilization funds have a contributory role towards management of aggregate demand for domestic and imported goods and services so as to complement the normal fiscal and monetary instruments practised by the Government (Kiele 1987:4).

— to stabilize producers incomes

While macroeconomic stabilization has been the most frequently stated objective of these schemes since Independence, it was not always so. The copra price stabilization scheme introduced in 1946, and the scheme for coffee which came into effect in 1966, were both aimed at stabilizing producers' incomes. This was to be achieved by placing a levy on the export price in high-price years and drawing from

the fund into which those levy receipts were deposited in low-price years. The same type of arrangement operates for the cocoa and palm oil schemes, introduced in 1974 and 1983 respectively.

How successful have the schemes been in achieving these two stated objectives and how do their effects compare with those of alternative policy instruments? As a prelude to addressing these questions, it is helpful to examine the extent to which the variation in agricultural export earnings is due to fluctuations in prices rather than quantities.

Sources of variation in agricultural export earnings

Variations in export earnings arise because of variations in prices and/or quantities sold. It is clear from Figures 5.1 and 5.2 that both price and quantity for Papua New Guinea's major agricultural export crops have fluctuated substantially.¹ To determine the relative importance of these two sources of fluctuations, it is helpful to make use of the statistical technique shown in Box 5.1.

Box 5.1 Statistical technique for analysing variance in export earnings

If there is no significant stockholding, export earnings are given by $E = PQ$ where E is export receipts, P is the unit value of exports and Q is the quantity of exports. Following techniques developed by Burt and Finley (1968), Goldberger (1970) and Houck (1973), the variance of export earnings can be partitioned into that arising from prices, quantities and the covariation between price and quantity, using the relationship

$$V(E) = \bar{Q}^2 V(P) + \bar{P}^2 V(Q) + 2 P Q \text{ cov}(PQ)$$

or $V(E) = A + B + C$ where $V(E)$, $V(P)$, $V(Q)$ are the total variation in export earnings, the variation arising from price movements and the variation arising from quantity movements, respectively. $\text{Cov}(PQ)$ is the interaction, or covariance, between price and quantity and \bar{Q} and \bar{P} are mean quantity and mean price, respectively.

The complex terms denoted A , B and C provide the basis for estimating the direct contribution of price and of quantity to the variation in export earnings. However, because the covariance term C reflects the contribution of P and Q jointly, it has to be allocated to one or other. Two alternative allocations, both to some extent arbitrary, have been used by previous authors. One involves allocating the covariance term C equally between price and quantity. The effect of price is

then given by $A + \frac{C}{2}$ and that of quantity by $B + \frac{C}{2}$. The other simply ignores C

$$A+B+C$$

$$A+B+C$$

and calculates the direct effect of price as $A/(A+B)$ and that of quantity as $B/(A+B)$.

¹ As shown in Table 1.8, these four export items accounted for two-thirds of the country's total export receipts in the 1960s and more than half of the non-mineral export earnings in the 1970s and 1980s.

Since stability usually means reducing the variability around some long-term trend, the deviations around trend are the basis for analysis. Hence linear trends were fitted to the price and quantity data in Figures 5.1 and 5.2 relating to exports of coffee, cocoa, copra and coconut oil. The fluctuations around those trends are proportionately much larger for prices than for quantities, as is clear from the results presented in Table 5.1. It is true that, insofar as the fluctuations in quantities were dampened by the stabilization schemes, the evidence in Table 5.1 overstates the relative importance of price instability. Even so, the extreme dominance of price instability suggests that stabilization schemes which focus on export price stability could contribute to increased stability in payments to producers of the commodities listed. As will become clear, however, this does not necessarily mean that such schemes are desirable.

Figure 5.1

Fluctuations in the unit values of coffee, cocoa and coconut products exported from Papua New Guinea, 1961-86 (kina per tonne)

*Fiscal years beginning 1 July to 1976, calendar years thereafter.

Source

Papua New Guinea, National Statistical Office, *Summary of Statistics and Abstract of Statistics*, Port Moresby, various issues.

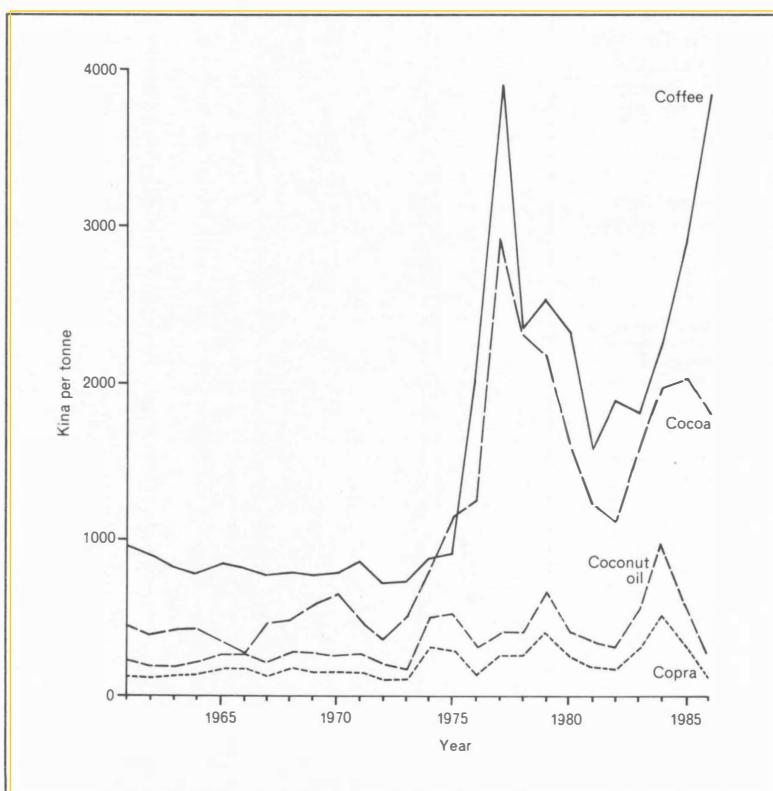


Table 5.1 | Sources of variation in agricultural export earnings, Papua New Guinea, 1961-85 (per cent)^a

	Price	Quantity
Coffee	86(85)	14(15)
Cocoa	86(92)	14 (8)
Copra	99(88)	1(12)
Copra oil	82(93)	18 (7)

*The numbers in parentheses were calculated using the expression $A/(A+B)$ for the price effect and $B/(A+B)$ for the quantity effect. The other numbers used the expressions $(A+C/2)/(A+B+C)$ for price and $(B+C/2)/(A+B+C)$ for quantity. See Box 5.1 for details and the definitions of A, B and C.

Sources: Compiled by the authors using data from Papua New Guinea National Statistical Office, *Rural Industries*, Port Moresby; and Bank of Papua New Guinea, *Quarterly Economic Bulletin*, Port Moresby, various issues.

Figure 5.2
Fluctuations in the
quantities of coffee, cocoa
and coconut products
exported from Papua
New Guinea 1961-86
('000 tonnes)^a

^aFiscal years beginning 1 July to 1976, calendar years thereafter.

Source
Papua New Guinea, National
Statistical Office, *Summary of
Statistics and Abstract of
Statistics*, Port Moresby, various
issues.

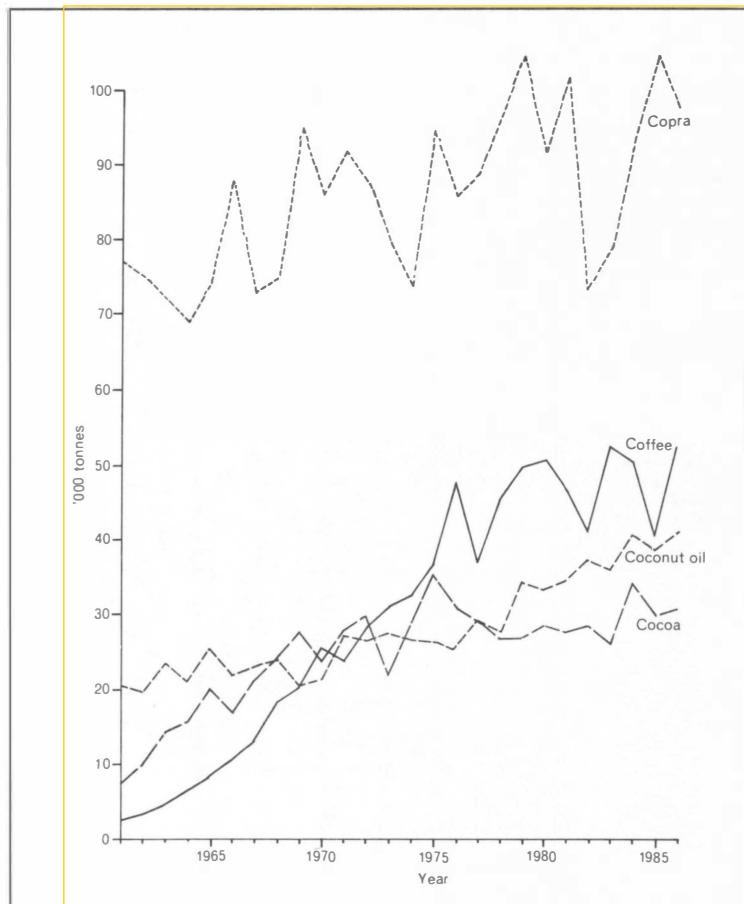


Table 5.2 End-year balances in agricultural stabilization funds, Papua New Guinea, 1975-86 (million kina)

	Coffee	Cocoa	Copra	Palm oil	Total	Annual change	Annual change as % of adjusted money supply (M3) ^a
1975	3.7	0.4	6.4	-	10.5	-	-
1976	6.8	4.4	2.5	-	13.7	3.2	1.2
1977	46.4	32.3	4.1	-	82.9	69.2	19.4
1978	63.6	48.9	3.4	-	115.9	33.0	9.6
1979	83.8	60.2	13.8	-	157.8	41.9	9.9
1980	94.9	61.9	7.5	-	164.3	6.5	1.6
1981	90.3	53.7	1.7	-	145.7	-18.6	-4.4
1982	92.1	44.6	0.1	-	136.8	-8.9	-2.0
1983	85.3	44.9	0.7	-	130.9	-5.9	-1.1
1984	82.1	46.0	24.2	7.9	160.2	29.3	5.0
1985	83.5	47.1	23.6	11.6	165.8	5.6	0.9
1986	116.9	40.9	4.6	8.4	170.8	5.0	0.7

^aAdjusted M3 includes Bougainville Copper Ltd deposits in the Mineral Resources Stabilization Fund but not agricultural stabilization fund deposits. That is, this percentage is the extent to which M3 would expand if the agricultural stabilization deposits were not made.

Source: Bank of Papua New Guinea, *Quarterly Economic Bulletin*, Port Moresby, various issues.

Contribution of schemes to macro stability

Schemes have little effect on money supply

It has been argued, for example by Guest (1987a), that the agricultural stabilization funds are a significant part of the total money supply in Papua New Guinea. During the past decade, their end-year deposits have averaged around 20 per cent of M3. What is relevant, however, is how much the money supply would have differed if the change in the end-year deposits of those funds had not taken place, assuming other things remained unchanged. The final column of Table 5.2 shows that this change since 1975 has been very small (no more than 5 per cent) except during the period of extraordinarily high coffee prices in the late 1970s. So in aggregate terms the agricultural stabilization funds have made little difference to the broad money supply.

Mismatch of changes in export earnings and changes in stabilization funds

Also worth noting from the point of view of macro stabilization is that there is a somewhat imperfect match between the change in export earnings and the change in stabilization deposits. This results partly because of lags in the change in the levies following an export price change, and partly because the quantity of exports is also varying with changes in seasonal conditions and, with a lag, in response to price changes. The data in Table 5.3 for coffee illustrate the point. The 1976 price for coffee was more than double that for 1975. Also the quantity of coffee exported rose by 30 per cent, partly in response to the price rise. As a result, the value of coffee exports in 1976 was three times, or K67 million more than in 1975. Yet only K3 million was added to the coffee stabilization fund. The 1977 changes in the export value and fund deposit were much more closely matched, but in 1978 when the price of coffee fell 40 per cent, the levy was still in place and fund

Table 5.3 Changes in the price and quantity of coffee exports and in the coffee stabilization fund, Papua New Guinea, 1975-86

	<i>Change in coffee exports^a</i>			
	Price (kina/ tonne)	Quantity ('000 tonnes)	Total value (million kina)	Change in coffee stabilization fund ^a (million kina)
1975	48 (5)	2 (7)	4 (12)	.. (..)
1976	1134 (120)	11 (30)	67 (200)	3 (84)
1977	1800 (87)	-11 (-23)	43 (43)	40 (582)
1978	-1539 (-40)	9 (24)	-36 (-25)	17 (37)
1979	185 (8)	4 (8)	18 (17)	2 (32)
1980	-201 (-8)	1 (3)	.7 (-5)	11 (13)
1981	-748 (-32)	-4 (-8)	-45 (-37)	-5 (-5)
1982	315 (20)	-6 (-13)	4 (5)	2 (2)
1983	-90 (-5)	11 (28)	17 (22)	-7 (-7)
1984	430 (24)	-2 (-3)	19 (20)	-3 (-4)
1985	652 (29)	-10 (-20)	4 (3)	1 (2)
1986	953 (33)	13 (31)	87 (74)	33 (40)

^aPercentage changes are shown in parentheses.

Sources: Papua New Guinea National Statistical Office, *Summary of Statistics*, Port Moresby, various issues; Bank of Papua New Guinea, *Quarterly Economic Bulletin*, Port Moresby, various issues.

deposits grew by a further 37 per cent. Deposits continued to grow in 1979 and 1980 when the coffee price remained fairly stable, and then they were drawn down by only K5 million when the price of coffee fell by one-third and coffee export receipts declined by K45 million in 1981. Export receipts recovered during the next three years, growing nearly 50 per cent in total, yet more money was paid out of the fund than was deposited over this period.

Failure of stabilization funds to offset fluctuations in the economy

Clearly the agricultural stabilization funds are doing little to offset fluctuations in the macro-economy and in the money supply due to changes in export earnings, and may even be exacerbating the situation.² In any case, since contributions to the funds represent such a small part of the total money supply, there is no reason why the government cannot simply rely on conventional fiscal policy instruments to achieve macroeconomic stabilization.

Forced savings effect of stabilization funds may have dampened investment in agriculture

Moreover, by using first-best macro policy instruments rather than commodity stabilization schemes, growers would have more funds available for investment in agriculture or elsewhere, instead of effectively being forced to save at bank interest rates. The average balance in the funds during the ten years to 1986 exceeded K140 million, which is equivalent to one-quarter of total value added in agriculture. There is no equivalent form of forced saving in the non-primary sectors of the economy, and the degree of forced saving in the mining sector due to the Mineral Resources Stabilization Fund is much smaller (deposits for which averaged only one-eighth of total value added in mining during

² Incidentally, the Mineral Resources Stabilization Fund also appears to be providing little stability to the macroeconomy. Bougainville Copper Ltd's taxes paid into the Fund each year have fluctuated only slightly more than government drawdowns from the Fund (Guest 1987b).

Table 5.4 Changes in the total value of exports and of stabilization fund deposits for coffee, cocoa and coconut products, Papua New Guinea, 1976-86 (million kina)

	<i>Coffee</i>		<i>Cocoa</i>		<i>Copra and coconut oil</i>		<i>Palm oil</i>	
	Gross	Net of fund deposits	Gross	Net of fund deposits	Gross	Net of fund deposits	Gross	Net of fund deposits
1976	69.0	65.9	11.0	7.0	-4.7	-0.8	na	na
1977	43.2	3.6	47.2	19.3	14.5	12.9	na	na
1978	-36.2	-53.4	-23.3	-39.9	1.9	2.6	na	na
1979	18.0	-2.2	-4.6	-15.9	30.3	19.9	na	na
1980	-6.5	-17.6	-12.0	-13.7	-27.4	-21.1	na	na
1981	-44.5	-39.9	-12.3	-4.1	-7.6	-1.8	na	na
1982	3.6	1.8	-2.3	6.8	-7.0	-5.4	na	na
1983	16.9	23.7	9.6	9.3	19.0	18.4	na	na
1984	18.6	21.8	25.7	24.6	45.8	22.3	39.5	31.6
1985	3.8	2.4	-6.2	-7.3	-33.0	-32.4	-2.5	-14.1
1986	86.5	53.1	-4.6	1.6	-35.7	-16.7	-31.1	-39.5
Average absolute change	31.5	25.9	14.4	13.6	20.6	14.0	24.4	28.4
Mean (arithmetic average) change	15.7	5.4	2.6	-1.1	-0.4	-0.2	2.0	-2.0

Sources: Papua New Guinea National Statistical Office, *Summary of Statistics*, Port Moresby, various issues; Bank of Papua New Guinea, *Quarterly Economic Bulletin*, Port Moresby, various issues.

1976-86). Thus the agricultural stabilization funds are probably dampening considerably the degree of investment in export-oriented agriculture relative to other sectors, unless it can be argued that any price stabilizing effects of the funds boost investment more than this forced saving has reduced it.

Contribution of schemes to producer welfare

All four crops for which there are stabilization schemes are almost exclusively exported. The only exception is coconuts, where a small proportion of production is consumed domestically. In this situation, the effects of the schemes on the welfare of domestic consumers can be ignored. Also, because Papua New Guinea contributes such a small share (no more than three per cent) of world exports of these products, it is a price-taker in the international market. Producers face a set of almost perfectly elastic demand curves. These two facts make it relatively simple to analyse the welfare effects of the country's agricultural stabilization schemes.

Schemes reduce fluctuations in export receipts but not by much

First, to what extent have the schemes stabilized producers' export incomes? A crude way of examining this is to compare gross export receipts with receipts that are net of the change in stabilization fund deposits, as in Table 5.4.³ For coffee, cocoa and coconut products during the period 1976 to 1986, the average absolute variations in net export receipts were 18, 6 and 32 per cent respectively below varia-

³ The fact that part of the change in fund deposits is due to interest earned on the balance each year has had to be ignored here because of lack of data on interest income.

Table 5.5 Changes in the unit value of coffee exports before and after the stabilization fund levy/subsidy, Papua New Guinea, 1976-86

	Change in unit value of coffee exports (kina /tonne)	Net of stabilization fund levy/subsidy ^a
	Gross	Net of stabilization fund levy/subsidy ^a
1976	1134	1070
1977	1800	730
1978	-1539	-1915
1979	185	-222
1980	-201	-418
1981	-748	-650
1982	315	271
1983	-90	40
1984	430	493
1985	652	618
1986	953	324
Average absolute change	732	614
Mean (arithmetic average) change	263	31

^aAssuming all of the change in fund deposits is due to the levy on, or subsidy to, the price received by producers.

Sources: Papua New Guinea National Statistical Office, *Summary of Statistics*, Port Moresby, various issues; Bank of Papua New Guinea, *Quarterly Economic Bulletin*, Port Moresby, various issues.

tions in gross export receipts, while for the first three years of the palm oil scheme the variation in net export receipts was 16 per cent greater than the variation in gross export receipts.

— and they slow the growth in growers' export receipts

What are the other effects of the scheme on producer welfare? One is that producers' net export receipts grew less than they would have without the schemes over this period, assuming the schemes themselves did not affect the long run trend in supply (see below). The final row of Table 5.4, showing the mean (arithmetic average) change in receipts between 1976 and 1986, indicates the extent to which the growth in producers' receipts has been dampened. For coconut products, there has been virtually no growth in either gross or net receipts. For both cocoa and palm oil, however, receipts net of fund deposits have been growing at about K4 million per year less than gross receipts, and for coffee the difference is about K10 million per year. This reflects the fact that the funds (other than for coconuts) have been accumulating since Independence.

A closer look at the scheme for coffee

Can it be assumed that long run trends in supply are unaffected by the schemes? Insofar as production is positively correlated with the price received (an upward sloping but not vertical supply curve) and new investments in expanding output are negatively correlated with price fluctuations, stabilization of prices will have dampened fluctuations in production and raised the long run trend rate of growth of production. As it happens, though, producer prices have not been stabilized very much by the schemes because of the way the schemes have been operated. In the case of coffee, for example, stabilization levies have dampened the average annual fluctuation in the producer price by only

16 per cent on average during 1976 to 1986, an annual average fluctuation of K614 per tonne instead of K732 (Table 5.5, final row). Even if the short-run price elasticity of supply were as high as 0.125, this would dampen quantity fluctuation by only 2 per cent (16×0.125). While this quantity effect means that the comparisons drawn from Table 5.4 may underestimate the impact of the schemes on stabilizing export revenue and overstate their negative impact on growth in export earnings, the extent of exaggeration is likely to be very small.

Negative effects of price stabilization on producers' net revenue

Even if the schemes had been successful in dampening price fluctuations substantially, producers should be aware that such price stabilization would reduce their net revenue in two ways. First, their incomes would be reduced insofar as the trend level of prices is lowered by the schemes as a result of funds accumulating, and as already mentioned this has certainly happened in Papua New Guinea. In the case of coffee, for example, producer prices rose on average by only K31 per tonne per year between 1976 and 1986, whereas they would have risen by K263 per tonne per year without the scheme (Table 5.5). And second, even if the trend level of prices was not affected, producers' net revenue would be lowered simply because the supply curve is not vertical (Oi 1961). This point is illustrated in Box 5.2.

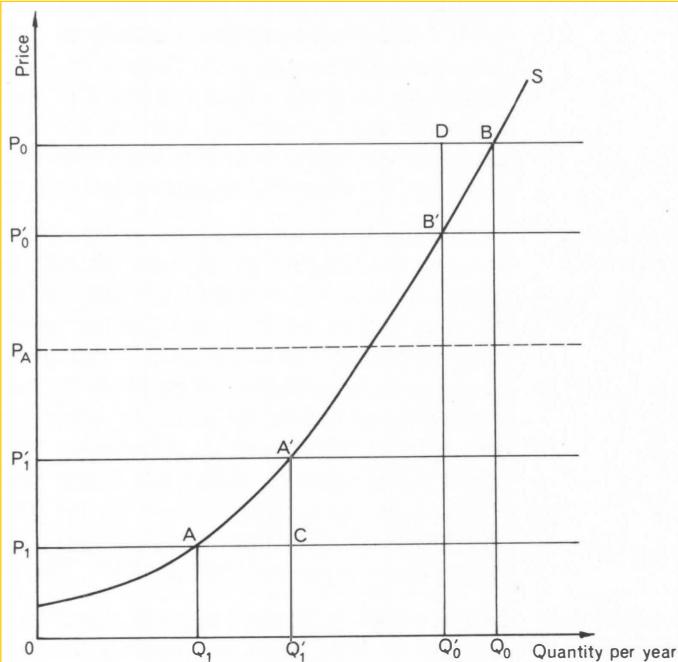
Market uncertainties lead to conservative price-setting rules and subsequent inequities

Export prices in practice are not as well behaved as depicted in Figure 5.3. Rather, they fluctuate unevenly around an unknown long run trend. This means that during any given period, there is considerable uncertainty facing the stabilization authority. If the scheme is to be self-financing, the authority will tend to err on the conservative side and keep producer prices lower on average than would otherwise be the case. As shown earlier, this is certainly what has happened in Papua

Box 5.2 Effects of price stabilization schemes on producer welfare

Suppose the export price in the long run averages P_A in Figure 5.3, but each year the price fluctuates from P_0 to P_1 . Then if S is the country's supply curve the quantity produced without a stabilization scheme would be either Q_0 or Q_1 . If a stabilization scheme is introduced which results in producer prices of P_0' and P_1' , then the quantities supplied would be Q_0' or Q_1' . When the export price is at P_1 , the scheme would induce producers to spend an extra amount $Q_1 Q_1' A'A$ on inputs but would provide extra gross revenue of $Q_1 Q_1' A'A$ plus $A'A P_1' P_1$ because of the price support from the stabilization fund. The net gain to producers in low-price years is thus $A'A P_1' P_1$. In a parallel manner, however, producers lose area $B'B P_0 P_0'$ from the scheme's dampening of the price in high-price years. In the high-price years the area $P_0 P_0' B'D$ would be transferred into the fund and in the low-price years the area $P_1 P_1' AC$ would be transferred out. Given that there are administrative costs in operating the scheme which the fund needs to cover, it is clear that producers must lose from such schemes in the absence of subsidies. In the case where $P_0 P_0' = P_1 P_1'$, the net loss amounts to area $A'C$ plus area $BB'D$ plus administrative costs. The more elastic (less steep) the supply curve, the greater is the loss to producers and hence the nation.

Figure 5.3
Export of price
stabilization on
producer welfare



New Guinea since Independence. The accumulated surpluses have to be disbursed sometime in the future, and there is no guarantee that the producers who contributed to the surpluses when levies were imposed will be the recipients when those funds are eventually disbursed.⁴ So the schemes are likely to generate inequities as well as inefficiencies for producers. When assessing the benefits to producers of reductions in price fluctuations, it is important to consider these inequities as well as the fact that it is not certain that the authority would be capable of bringing about such reductions in price fluctuations.

— as well as dampening incentives to invest during periods of high export prices

There is a common presumption that one of the benefits of reduced price fluctuations for growers and the nation is that there will be more investment in agriculture because of a less uncertain environment. Suppose, however, there is a prolonged period of high export prices which were unforeseen by the authority and hence were passed on to growers only in a muted and delayed manner. Producers in countries not operating stabilization schemes would have more incentives to expand output, undertake investments and improve their competitiveness through greater productivity gains than would producers in Papua New Guinea. During a subsequent period of prolonged low prices, on the other hand, producers in Papua New Guinea would not be given as much incentive to divert resources to other, now more socially

⁴ This lottery aspect of price stabilization schemes is discussed in Friedman (1954).

profitable activities and yet, observing low prices in international markets, they would be no more inclined to invest to improve long-term productivity than would producers in other countries. Thus it is not at all certain that the presence of these schemes will attract more investment resources to export crops. Indeed, it may even result in less investment.

Why have stabilization schemes?

Minimal benefits of agricultural price stabilization

To summarize, this analysis suggests that agricultural price stabilization schemes operating in Papua New Guinea have made little if any contribution to macroeconomic stabilization, and in any case the monetary and fiscal policy instruments in place could accommodate agricultural export earning fluctuations and be more efficient than stabilization schemes for achieving this macro objective. At the same time, these schemes have imposed on growers a form of forced savings which, it can be argued, has reduced the degree of investment and productivity growth in export-oriented agriculture. Moreover, the stabilization schemes have done very little to stabilize producers' incomes from agricultural exports and have reduced their average export earnings.

Why then are these schemes operating? Why not have growers invest their earnings in high price years and draw on these investments in low price years? One possible explanation is that the government feels people would consume rather than invest in high price years, if not for their own sake then because of *wantok* obligations.⁵ However, this paternalistic motivation is not relevant for largeholders and nuclear estates run by management agencies. Furthermore, the experiences of developing countries as a group does not support the view that economies will grow less rapidly the more unstable their export earnings (Lim 1976, Michael 1977).

Stabilization schemes may favour largeholders, at the expense of smallholders

A final point to make is that it is likely that the supply curve for smallholders is much more price elastic than that for largeholders. According to the analysis in Box 5.2, this would mean that largeholders would lose less from price stabilization than smallholders. In addition, largeholders tend to have shares in the firms which process the agricultural raw product prior to export. When producer prices are stabilized, the throughput of these plants is also more stable, which raises the plants' average profitability. Thus largeholders may gain overall from stabilization schemes, even if smallholders lose. If the government is genuinely interested in boosting the welfare of smallholders, it may need to reassess the presumed virtues of price stabilization schemes.

⁵ See Bauer and Paish (1954) for a similar comment. (*Wantok* is pidgin for people having a common language).

Public investment in the rural sector

6

Agricultural research and extension

Investment in research and extension: the key to increasing agricultural productivity

An important determinant of the comparative advantage of the agricultural sector, and of industries within that sector, is the extent and success of past investments in the production and dissemination of new technologies through agricultural research and extension. If productivity growth occurs less rapidly in agriculture than in other sectors, this will contribute to the relative decline of agriculture in a small open economy. Slow productivity growth in agriculture will be especially debilitating to the sector if there is a decline in agriculture's terms of trade in the international market place. This may be because of economic growth elsewhere in the world, as there has been in the long run (see Figure 2.2). Or it may be because there is a boom in one of the other tradable sectors of the domestic economy, as there has been with mining in the case of Papua New Guinea (see Chapter 2).

Land is under-utilized in Papua New Guinea

Papua New Guinea is abundantly endowed with agricultural land relative to population, having more than four times as many hectares per capita as developing countries as a whole (Table 3.1). However only a very small proportion of that land is being used for cropping or pasture: less than 2 per cent has been permanently cleared of native timber. It is true that much of the country's forest land is too mountainous or otherwise unsuitable for converting to arable land, but a great deal more than is currently used could potentially be put to agricultural uses.

— due to problems of land tenure, high input costs, low output prices

Some of the reasons for land remaining in its forest state have already been discussed. One is that land tenure is difficult to secure. Another is that input costs are high (high rural wages for largeholders, high real costs of obtaining finance for smallholders). A third reason is that output prices for Papua New Guinea's export crops are kept artificially low by protection and stabilization policies and in addition they have been lowered in kina terms by the exchange rate appreciation associated with the mining boom.

Public investments which enhance quality and quantity of resources in agriculture

This chapter and the next are concerned with a fourth set of factors which interact with the previous three, namely, public investments which can improve the profitability of agriculture and thereby enhance both the amount of resources employed in agriculture (particularly land) and the productivity of those resources. The relatively slow growth in land and labour productivity in agriculture in Papua New Guinea, reported above in Table 1.13, suggests this is an area deserving close scrutiny.

Productivity growth is typically defined as an increase in output per unit of (one or all) inputs. However it is misleading to suggest that this simply comes about, for example, by transferring technologies

developed overseas to the local environment. In fact, increasing output per hectare or per person requires local investment (Schultz 1964). In this chapter the focus is on investment in the production and dissemination of new, lower-cost means of combining land, labour, financial capital and other inputs to generate agricultural output. The next chapter examines investments in improving the quality of the labour force in rural areas.

History of investment in agricultural innovations¹

Traditional Melanesian agriculture was not devoid of innovation

Innovation in Melanesian agriculture has its origins in the beginning of agriculture itself. Traditional crop varieties have evolved through the selection of new cultivars as adaptation to local environments occurred — a classic case of learning by doing. According to Denoon and Snowden (1981), Melanesians possessed and understood a wide range of food plants for thousands of years, and could easily have added cultivation to their foraging activities. That capacity is further stressed by Vasey (1981) who traces the development of the major agricultural systems of Papua New Guinea. These were essentially woody fallow systems where the undergrowth is slashed, the trees cut down, the debris burnt and mixed vegetable gardens established. Traditionally, men carry out the heavy work of clearing, burning and breaking up the large soil clods but thereafter women take over. The gardens are usually based on the stable root crops (sweet potato, taro and yams) along with a wide variety of other crops. In the more water-logged areas of Papua New Guinea, sago is the major staple grown.

Enormous range of plant varieties and uses in subsistence agriculture

As a result of centuries of adaptation and improvement there is now a very extensive range of crops grown both for food and medicinal purposes. Carman (1980) lists almost eighty food crops that are planted in gardens on New Britain, ranging from staples through green vegetables to fruit and nuts. In addition, at least twenty-five plants have been grown for medicinal purposes. Knowledge of such plants is apparently widespread throughout Papua New Guinea. Holdsworth and N'Drawii (1973) document the extensive use of plants for medicinal purposes in Manus Province. Bulmer (1982) lists some twenty-eight species of traditional cultivated food plants involving some 120 cultivars, including more than forty each for sweet potato and taro alone. In addition to the knowledge of plants, Papua New Guineans have developed an extensive knowledge of soil management — including fertility control, tillage practices, irrigation and drainage (Wood and Humphreys 1982). Kesavan and Aburu (1982) also suggest that Papua New Guineans were aware of the need to conserve the genetic diversity in their plants and were able to select cultivars for particular purposes, including the development of soft bananas for babies. The traditional knowledge systems relating to the use and conservation of natural resources, in addition to those specific to agriculture, are discussed in Morauta et al. (1982).

¹ Much of this and subsequent sections draw on the more detailed analysis in Jarrett (1986).

**'Poor but efficient'
agriculture**

There is no question that the evolving knowledge systems on which traditional agriculture has been based have served Papua New Guinea well in terms of providing for basic food needs. This is a classic case of 'poor but efficient' (Schultz 1964) traditional agriculture.

***Ad hoc innovations in
commercial agriculture***

The learning by doing mode has also been important in the plantation sector where commercial pressures are of greater significance. Tea growing in Papua New Guinea has had a chequered career but the industry has been materially assisted by the development of a mechanical tea picker. The difficulties of obtaining an adequate labour supply in the tea-growing areas induced the development of this labour saving device. This innovation was mainly the result of trial and error by growers themselves with support from specialized engineering groups. In a similar vein, a prototype dehusking machine for coconuts has been developed in East New Britain.

***The development of
formalized agricultural
research***

Despite these developments in both the smallholder and plantation sectors, innovations which rely solely on the learning by doing mode are inadequate once a country embarks on the path of modern economic development. As tree crops became more important earners of foreign exchange and as cash cropping expanded to supplement activities in village gardens, innovation generated from learning by doing was supplemented by formalized agricultural research and extension carried out by institutions specifically developed for those purposes. Indeed, the national returns from such formal science-based investments continue to increase because the stock of basic scientific knowledge is expanding rapidly around the world. Ruttan (1983) believes that the fundamental reason for the differences in agricultural productivity growth between countries is the differing degrees to which they under-invest in science-based agricultural research.

***Links between science and
agriculture***

The early work of the chemists Davy, Liebig and Lawes highlighted the linkage between chemistry and agricultural practice and resulted in the development of fertilizers as well as complex agricultural chemicals used for plant and animal protection. The principles of genetics, first enunciated by Mendel in 1866, led plant scientists towards a directed selection of new cultivars with improved characteristics. At the same time, the link between science and agriculture increased public awareness of further links between education, science and agricultural practice and led to the development of publicly funded institutions — universities, research institutes, government departments — which would facilitate the generation of agricultural innovations.

***Research and innovations
by farm supply industries***

In the advanced industrial economies, the farm sector has come to rely on an increasing proportion of non-farm produced inputs. In many cases, improved technology is embodied in these inputs. The farm supply industries have themselves turned to funding agricultural research and development, and farmers have been the recipients of the changed technology. Firms supplying agricultural chemicals, veterinary medicines and farm equipment have become increasingly important sources of agricultural innovation. Pratt (1980) estimates that 50 per cent of agricultural research and development in the United States is

carried out by private agencies with particular emphasis on proprietary technology where the gains from the innovation can be captured in the form of royalties and patents. Even in Papua New Guinea, where the farm supply industries have not developed to anywhere near the extent that they have in the industrial countries, the export tree crops sector at least relies on the innovations generated by private firms. The adoption in Papua New Guinea of chemicals such as the fungicide Ridomil and the weedicide Roundup are the result of privately funded research in overseas countries. While there is, as yet, relatively little use of fertilizer in the smallholder production of cocoa and coffee, there is significant usage on large holdings. In the field of mechanical innovations, at least one firm in Papua New Guinea is adapting imported farming equipment to fit local conditions.

*Smallholders as
'technology takers',
largeholders as
'technology makers'*

Many of the chemical and mechanical innovations arising from privately funded research and development are based on commercial criteria related to potential profitability. Such innovations may owe little, if anything, to input from smallholders in Papua New Guinea who may have very little awareness of the potential role their needs can play in influencing the types of innovations which are produced. As Bieri, de Janvry and Schmitz (1972:802) indicate 'they are not only price takers but, on the whole, also technology takers'. Largeholders, on the other hand, are aware of the potential role of agricultural research and development in developing innovations. This has conditioned their willingness to support research from industry funds to the point where, in Papua New Guinea, coffee, cocoa, copra and palm oil research is now being partially funded by means of a levy on all producers of these commodities. Also, in the case of some of the export tree crops which are subject to further processing, the processors of the raw material may support research. In Papua New Guinea the definitive epidemiology of vascular streak dieback in cocoa by Keane (1972) was the result of post-graduate work done at the University of Papua New Guinea, with funding support from the Confectionery Manufacturers of Australia. Similarly, in Ghana and Nigeria, the International Office of Cocoa and Chocolate (a manufacturers' organization) supports research.

*International technology
transfers and the
introduction of new crops*

Another source of innovation for any one country is the direct transfer of technology from other countries. At any time there is a stock of agricultural innovations and scientific knowledge which is potentially transferable from one country to another. In general, knowledge is often a free good. However, access to knowledge is not free because there are costs in searching for the knowledge and the success of any search is related to the capacity to identify the sources of information which are relevant for local agricultural practice. Many countries have benefited from direct transfer. In the United States agriculture had access to a stock of knowledge, as well as the proprietary artefacts, which the European settlers brought with them. Moreover, they benefited from the indigenous crops and practices which had already been developed by the American Indians. Australian agriculture, by contrast, because of different environments, benefited relatively less

from such direct transfer and considerable local research and development and adaptation had to take place before the innovation slotted successfully into the local environment. Agriculture in Papua New Guinea certainly has benefited from international technology transfers. Palm oil material from Malaysia and sugarcane varieties from Australia are examples. Another example is the modern broiler industry, which has adopted the technology used in industrial countries (Jarrett and Anderson 1988). In addition, new varieties of vegetables were introduced, evaluated for local performance, and eventually grown in village gardens. In a longer time frame, the original varieties of coconut, cocoa and coffee were all introduced to Papua New Guinea from overseas.

Economics of Investing In agricultural Innovations

Issues concerning the allocation and degree of investment

Like all investment, the rate of return to additional investment in agricultural research and extension is likely to fall as the level of investment expands. The question of what is the appropriate level of such investment for the various agricultural crops is a very complex one, and one which cannot be answered in detail here. However, it is possible to consider some of the elements that would make up such an answer. Specifically, the following issues are addressed, at least qualitatively:

- Is Papua New Guinea under-investing in agricultural research?
- Is the allocation of research resources between agricultural industries appropriate?
- To what extent should the government be providing research funds?
- Are the proportions of research expenditure in public and private institutions optimal?
- Are the types of innovations produced of benefit to both largeholders and smallholders?
- Is the government investing the right amount of resources in agricultural extension?

Too little research Investment In aggregate

Low levels of investment in agricultural research

In 1986 and 1987 the Department of Agriculture and Livestock in Papua New Guinea spent K5.2 million per year on crop and livestock research and development. That is equivalent to about 0.5 per cent of the gross value of agricultural production. This is well below the proportions for developing countries and for industrial countries, which in 1980 were close to 1 per cent and 2 per cent, respectively (Judd, Boyce and Evenson 1986). It is true that the private sector also has invested in agricultural research in Papua New Guinea, but in the past this has amounted to only about one-third of government expenditure (ISNAR 1982:100). Thus the sum of both public and private spending is still probably well below 1 per cent of the value of agricultural output.

Another way to assess the level of investment in agricultural research in Papua New Guinea is to compare the number of

Table 6.1

Agricultural research manpower relative to agricultural output, Papua New Guinea and other economies, 1980

	Scientist-years per \$US10 million of agricultural production
Papua New Guinea	0.72
Low income economies	1.40
Middle income economies	2.40
Industrial market economies	1.85
East Asia	5.72
Southeast Asia	2.07

Sources: M.A. Judd, J.K. Boyce and R.E. Evenson, 'Investing in agricultural supply: the determinants of agricultural research and extension investment', *Economic Development and Cultural Change* 35(1):77-114, Table 4, 1986; for Papua New Guinea, International Service for National Agricultural Research (ISNAR), *Review of the Program and Organization for Crops Research In Papua New Guinea*, The Hague, 1982. Calculated from scientist-years data (ISNAR 1982:100) using 1980 agricultural GDP divided by 0.9 as the value of agricultural production.

scientist-years of time spent in research, deflated by the value of agricultural output. In 1980 Papua New Guinea had seventy scientists working full time on agricultural research, according to ISNAR (1982:100). Assuming that value added is 90 per cent of the value of agricultural (including subsistence) production, this is equivalent to 0.72 scientist-years per \$US10 million of output. Again this is less than half the investment intensity of other developing countries and only a small fraction of that undertaken in neighbouring East and Southeast Asian countries (Table 6.1).

Papua New Guinea missing out on benefits from agricultural research

This, together with the large amount of empirical evidence showing that industrial countries and, even more so, developing countries seriously underinvest in agricultural research, suggests that Papua New Guinea could benefit greatly by investing much more in this area. The evidence for other countries, as summarized for example in Evenson and Kislev (1975) and Arndt, Dalrymple and Ruttan (1977), shows — almost without exception and regardless of the measurement methodology used² — that there are very high social rates of return to further investment in agricultural research.

Need to assess efficient allocation of research between products

Variation in the degree of underinvestment in research

There is circumstantial evidence to suggest that in Papua New Guinea, as in other countries, the degree of underinvestment in different crops varies greatly. In the absence of detailed data for rate of return on investment calculations, Boyce and Evenson (1975) propose a simple criterion for suggesting whether research resources are being allocated efficiently between products. On the assumption that the cost of making a worthwhile discovery is comparable across products, their method is to compare research expenditure per dollar's worth of production of each crop.

² Qualifications concerning the methodologies used are discussed by Lindner and Jarrett (1978) and Norton and Davis (1981), among others.

Table 6.2 Agricultural research and extension manpower resources, by crop, Papua New Guinea, 1980 (person-years)

Crop activity	Department of Agriculture and Livestock	Other research groups	Total
Export crop research			
Cocoa	2.50	2.50	5.00
Coconut	1.70	-	1.70
Coffee	0.75	2.75	3.50
Palm oil	1.05	5.25	6.30
Rubber	0.75	0.50	1.25
Tea	2.00	-	2.00
Sub total	8.75	11.00	19.75
Other product research			
Bananas/cassava	0.80	-	0.80
Feed	0.55	-	0.55
Flowers	2.00	-	2.00
Fruit, nuts, spices	1.45	-	1.45
Pulses	0.50	0.25	0.75
Pyrethrum	1.00	-	1.00
Rice	1.70	-	1.70
Sugar	0.20	2.00	2.20
Sweet potato	3.15	2.00	5.15
Taro (aroids) and yams	1.55	2.00	3.55
Vegetables	1.50	0.25	1.75
Sub total	14.40	6.50	20.90
Non-product-specific research			
Biometrics	1.20	-	1.20
Entomology services	1.00	-	1.00
Farming systems	2.40	4.83	7.23
Land use services	8.50	3.00	11.50
Pathology services	2.85	0.25	3.10
Soil and plant analyses	3.22	-	3.22
Storage, processing	2.00	-	2.00
Sub total	21.17	8.08	29.25
Other			
Administration	16.03	-	16.03
Extension/liaison	8.65	-	8.65
Sub total	24.68	-	24.68
Total	69.00	23.75	92.75

Source: International Service for National Agricultural Research (ISNAR), *Review of the Program and Organization for Crops Research in Papua New Guinea*, The Hague, 1982:100.

Detailed data on research expenditure by product are not available for Papua New Guinea. However, the International Service for National Agricultural Research (ISNAR) has compiled categorized estimates of the number of person-years of research and extension effort expended in 1980, which can be used as a rough guide to different types of research expenditures. These are summarized in Table 6.2. While it is difficult to obtain value of production data for individual crops, a suitable figure for the main export crops can be used for the value of exports since almost all of their domestic production is exported. Thus for the first six crop activities in Table 6.2, it is possible to compute the number of person-years of research per million kina of exports. These

Table 6.3 Research intensity for selected export crops and other agricultural products, Papua New Guinea, 1980 (person-years per million kina of production)^a

	Department of Agriculture and Livestock	Other research groups	Total
Cocoa	.054	.054	.108
Coconut products	.037	.000	.037
Coffee	.007	.026	.033
Palm oil	.076	.378	.454
Rubber	.211	.141	.352
Tea	.253	.000	.253
Average, export crops	.039	.049	.088
Average, non-export crops	.037	.017	.054
Average, all agriculture ^b	.038	.025	.063

^aProduction value for the six export crops shown is assumed to equal the average annual value of exports of those products during 1979-81, which in total mounted to K224 million.

^bProduction for all agriculture is assumed to equal the average annual value of market and non-market value added (GDP) in agriculture during 1979-81 divided by 0.9 (which is the assumed value-added share of output), namely K614 million. Hence the value assumed for agriculture excluding the six export crops is K390 million. Research person-years for all agriculture excludes extension, administration and non-product-specific research. Because of lack of data, livestock research is not included.

Sources: Table 6.2 and Papua New Guinea National Statistical Office, *Summary of Statistics*, Port Moresby, various issues.

are reported in Table 6.3. The rest of agriculture can then be handled as a residual, as explained in the notes to that table.

Underinvestment in crop research for coffee and coconuts

By this simple criterion it would appear that, among the export crops, the degree of underinvestment in research in Papua New Guinea is greatest for coffee and coconut products and least for palm oil and rubber. A thirteen-fold difference between the research intensities for these crops suggests that there is a serious misallocation of research resources between the various export commodities. A similar inference might be made with respect to the low research intensity for non-export crops. However, since there are significant economies of scale in agricultural research (Evenson 1969), one might expect it to be optimal to conduct no research on minor non-export crops, which would lower the desirable research intensity for this group of products.

There has been some recognition of the apparent imbalance in research expenditure between the main export crops. In Volume 1 of the National Development Plan of 1986, there are proposals to more than treble the Department of Agriculture and Livestock expenditure on coffee research during 1986-90 and to increase by a factor of 2.5 the expenditure on cocoa and coconut research. In particular, the potentially large scale losses from the outbreak of coffee rust in 1986 underscore the need for further coffee research. It remains to be seen whether these proposed increases in research funding materialize.

To date, private funds for cocoa, copra, coffee and palm oil research have been collected via a levy on producers. These levies in 1988 were K22 per tonne of wet beans for cocoa, K0.92 per tonne for copra, K18 per tonne of green beans for coffee and K0.65 per tonne of fresh fruit bunch for palm oil. At 1984-87 average unit export prices, these

levies represent 1.3 per cent of the price for cocoa, 0.4 per cent for copra, 0.7 per cent for coffee and 0.2 per cent for palm oil. These are relatively small levies by international standards. In Brazil, for example, the levies for cocoa and coffee are more than three times those in Papua New Guinea.

While a closer analysis of data on the amount and product distribution of research expenditure in Papua New Guinea would be helpful, it is clear from this cursory overview that total expenditure on agricultural research falls far below the optimal level, and that the existing expenditure is not well distributed across different products.

Who gains from agricultural research?

To assess the appropriateness of government funding of research and the optimal mix of public and private sector research, it is necessary to address the issue of who gains from investment in agricultural research. The knowledge generated from research can lead either to process innovations (reducing unit production costs) or to product innovations (enhancing the quality of the product). In terms of conventional economic analysis, the former shifts down the supply curve, the latter shifts up the demand curve. Insofar as the demand curve is a curve at the farm level, derived from the consumer demand curve (the vertical distance between these two demand curves being the costs of transportation, processing, wholesaling and retailing), innovations in marketing will also have important distributional effects. Since process innovations are likely to dominate in Papua New Guinea, what follows will focus primarily on them.³

The effects on the market for a particular product whose unit costs of production have been lowered are depicted in Figure 6.1 in Box 6.1.⁴

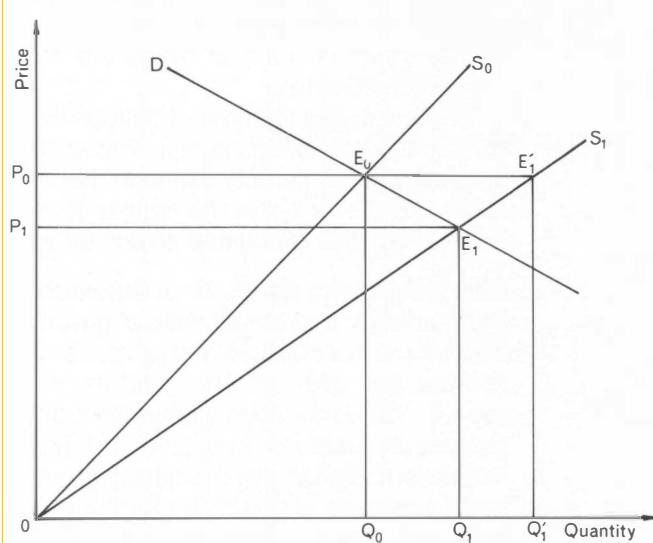
Box 6.1 Market effects of a process innovation

Prior to the innovation, D and S₀ are the domestic demand and supply curves. Once the innovation has been adopted, producers are prepared to supply a larger quantity at each price level, so the supply curve shifts to S₁. If this was a non-tradable product, so that in equilibrium the quantity supplied had to equal the quantity demanded domestically, then P₀ and Q₀ would be the initial price and quantity transacted. Following the adoption of the new technology, P₁ and Q₁ would be the outcome. The gain in consumer welfare is represented by area P₀E₀E₁P₁, and the change in producer welfare is P₁E₁O - P₀E₀O. The net gain to the country is therefore E₀E₁O. Clearly the country as a whole is better off, and consumers are better off so long as the demand curve is downward sloping. Producers may gain or lose, but they will be better off the flatter (more elastic) is the demand curve. Also, they are likely to gain more the larger the share of their production that is consumed in their own household.

³ For more detailed analyses of the distributional effects of agricultural research, see Edwards and Freebairn (1981, 1982 and 1984) and Freebairn, Davis and Edwards (1982).

⁴ Hayami and Herdt (1977) and Alauddin and Tisdell (1986) provide detailed analyses of cases involving subsistence production.

Figure 6.1
Market effects of a
process innovation



Producers are the main beneficiaries of agricultural research

For many of Papua New Guinea's staple foods the domestic demand curve is probably fairly elastic because of the availability of exotic substitutes. For example, imported rice or wheat flour are increasingly being preferred to staples such as sweet potato or taro. Similarly, imported canned fruit and vegetables are often considered more convenient than the local fresh alternative. Thus the benefits of innovation would be shared between producers and consumers and it is quite possible that the bulk of the gain would go to producers rather than to consumers.

In the case of an export crop, the distributional outcome is clear. Since Papua New Guinea is a price taker in international markets (its share of world exports for each of its major export crops is no more than 3 per cent), any shift in its supply curve will have a negligible effect on the international price level. Thus if, in Figure 6.1, P_0 was the export price, the quantity produced would increase from Q_0 to Q_1' following the adoption of the new innovation, with the gain $E_0E_1'Q_0$ accruing exclusively to producers. Even if there were some domestic consumption of the product in question, domestic consumers would be unaffected as they would continue to pay the export price P_0 .⁵

This brief analysis suggests that producers are likely to be the major — and, in the case of export crops, the exclusive — beneficiaries of cost-reducing agricultural research. It therefore follows that producers

⁵ There is the possibility that the innovation produced in Papua New Guinea is applicable in other countries also and so leads to a significant shift in the world supply curve which reduces the world price. This is unlikely to be important, however, because for Papua New Guinea most of the gains from research accrue from adapting ideas developed elsewhere to the specific environmental conditions of Papua New Guinea.

should pay for that research, unless it can be demonstrated that there are some additional benefits to others that are not captured in Figure 6.1.

Government's role

— collection of levies from producers

What should be the government's role in agricultural research? Even when producers benefit more than consumers from innovations there is still a role for the government in agricultural research, for two reasons. First, for many types of process innovations the gains from research are difficult to capture. This is especially so in plant breeding, where a new high-yielding variety, once released, can be propagated easily. Capturing the gains from research is less difficult for chemical and mechanical innovations where private firms have access to the patent system with royalties to recover costs of research and development. Where the free-rider problem is significant, there is a role for the government in collecting levies from producers to fund research. This is a simple matter in the case of export crops which are channelled through a small number of processing/exporting points. It may be prohibitively expensive to collect a levy from either producers or consumers of many staple food crops, however, in which case the government may consider it worthwhile to fund such research from consolidated revenue rather than see little or none undertaken.

— establishment of research/teaching links

The second reason for government involvement in agricultural (and other) research is that there are often externalities associated with such activities. The reason universities become involved in applied agricultural research is that applied research often has spillover benefits both to more fundamental scientific research and to teaching. Sometimes, agricultural research stations can be located adjacent to a tertiary education institution to take advantage of these externalities, especially if the stations are in the public rather than the private sector.

— ensuring that research needs of smallholders are not overshadowed by those of capital-intensive largeholders

There is a further reason why the government may prefer to have research conducted in the public sector, particularly for tree crops which are grown by both largeholders and indigenous smallholders. Since the factor prices faced by largeholders often differ markedly from those faced by smallholders (see Chapter 3), technologies could be generated which are much more appropriate for one group than for the other. For example, rubber research in Malaysia has been biased towards selecting for breeding those high-yielding trees which use fertilizer and growth stimulants but require less labour because they have low tapping intensities. The new technologies save land and labour but are intensive in their use of cash inputs and skilled management and so are more appropriate for largeholders than smallholders (Barlow and Peries 1977; Barlow and Jayasuriya 1984). If it were judged that such a bias is undesirable and is more likely to result from private rather than public research institutions, this may be a further reason for setting up public agricultural research stations.⁶

⁶ There are, however, reasons why a public research institution may be rather inefficient at delivering appropriate technologies for smallholders. See, for example, Pray (1979, 1983), Anderson (1981) and Jarrett (1986).

Degree of public v. private investments research

With these considerations in mind, it is clear that the amount of agricultural research that should be publicly funded, and the proportion of research that should be conducted in public rather than private research institutions, involve a degree of subjective judgement by the government. Even so, on the latter point (the proportion of research undertaken in the public sector), it is instructive to examine the data in Table 6.2. About 35 per cent of research manpower, excluding extension and administration, is employed in private research centres. When extension and administration are included, the private share is 26 per cent. This compares with an average for Asia in 1974 of 28 per cent of agricultural research manpower in the private sector (Boyce and Evenson 1975), so in aggregate Papua New Guinea would appear to be not greatly different from neighbouring countries in this respect.

— apparent scope for much more in private sector

When attention is focused on individual export crops, however, there appears to be cause for concern. There are no a priori reasons why the proportion of palm oil and coffee research undertaken in the private sector (83 and 79 per cent, respectively) should be any greater than for the other tree crops. If that were to be taken as the benchmark, it suggests a much larger proportion of the total research budget for the other export crops might be offered to the private sector rather than kept in the public sector. Indeed, there are already signs that producers recognize this. A Cocoa and Coconut Research Institute has recently been established at a government experiment station at Kerevat, to be funded primarily by a levy on cocoa producers because of the complementarity between cocoa and coconut production.

— and for research to be given priority over extension in future investment expansion

Extension investment: how much and by whom?

According to Table 6.2, about one-eighth of all research and extension workers in the Department of Agriculture and Livestock are employed in extension/liaison activities. In addition, many extension officers are employed by the nineteen provincial governments. The Organic Law of 1977 provided for agricultural research, specialist technical training, marketing and planning activities to remain with the national bureaucracy but for agricultural extension to become a provincial responsibility. Thus, for the country as a whole, the share of research and extension manpower in extension work is perhaps as much as one-fifth or more. This is higher than in Southeast Asia where, in 1974, only one-eighth of research and extension manpower was devoted to extension (Boyce and Evenson 1975). Moreover, in Southeast Asia, returns from further investments were much lower in extension than in research even at that low share of one-eighth (Evenson and Kislev 1975). Together this evidence suggests that, in expanding research and extension resources, priority should be given to research.

National research and regional extension: the need for closer linkages

The deficiencies in the top-down nature of the research and extension process in Papua New Guinea, where research is a function of the national government and extension is a function of the provincial governments, were revealed with the outbreak of coffee leaf rust in 1986. The central and provincial governments were unable to mobilize quickly and effectively the necessary resources for a research and extension program to counteract the likely serious consequences of

the spread of coffee leaf rust. So the central government established the Coffee Development Agency which is a joint enterprise between the national government, the Coffee Industry Board and the five provinces where coffee production is concentrated. The funds for the agency were obtained by a levy of K0.1 per kilogram of green coffee with an initial injection of K1.8 million from the national and provincial governments. The Coffee Development Agency realized the need to begin the campaign against coffee leaf rust at the local level, that is, to adopt a bottom-up approach in which the concerned villages are involved directly. The villages are to appoint coffee managers who are chosen from the village community and who will receive a payment to begin a leaf rust control program in their own coffee gardens and serve as a nucleus to advise neighbouring farmers. The village coffee managers will be supervised by 220 district managers covering the major coffee producing areas. These in turn will be supervised by five assistant general managers. Regional managers are to be chosen from the existing provincial extension services and by general recruitment allied with training courses run by the authority.

A joint operation between the national and provincial governments is also envisaged in the cocoa and coconut smallholder rehabilitation and extension project. This project combines the services of four regional cocoa and coconut co-ordinators from the Department of Agriculture and Livestock with the support of the provincial extension staff. While the rehabilitation project does not have the same urgency as the outbreak of coffee leaf rust, it does represent at least a beginning of the development of linkages between the national government and the provincial Departments of Primary Industry. Such linkages are essential as long as research is a function of the national government and extension a function of the provincial governments.

Problems arising from the division of research and extension

The number of people employed in an activity is not necessarily a good indicator of the value of the services provided. As it happens, the splitting of extension from research — transferring extension responsibilities to the provincial governments — has led to a marked deterioration in the quality of extension services, as well as to a reduced flow of information from farmers back to researchers. This problem, which is discussed in more detail in McKillop, Williamson and Associates (1982), Kern et al. (1984) and Jarrett (1986), is also highlighted in a major review by the World Bank (1981). This review concluded that 'The operation of the extension services in the field left much to be desired. Many staff were engaged in a range of activities only marginally related to extension work, there were only a limited number of extension programs, and there was little supervision of extension activity.' It recommended the re-establishment of an Extension Division within the national Department of Agriculture and Livestock to provide regional support units to assist provincial extension officers, as well as the withdrawal of provincial extension officers from non-extension activities.

Table 6.4

**Estimated costs of the agricultural support services project, Papua New Guinea, 1987-91
(million kina)**

	1987	1988	1989	1990	1991
Coordination	0.76	0.76	0.30	0.25	0.25
Extension and training	1.11	0.96	0.96	0.96	0.96
Plantation management	0.04	0.49	0.49	0.49	0.49
Livestock services	0.25	0.27	0.27	0.29	0.29
Crop development	0.56	0.77	0.77	0.77	0.77
Crop research	0.81	0.57	0.50	0.50	0.50
Quarantine services	0.16	0.17	0.20	0.23	0.26
Total	3.69	3.99	3.49	3.49	3.52

Source: Papua New Guinea Department of Finance and Planning, *Budget Document No.3*, Port Moresby, 1987.

Agricultural support services project slow to develop

Following the World Bank's review, funds were provided for an agricultural support services project. This project was expected to involve 136 national and twenty-four expatriate staff in research, education and training, extension support, economics and planning, agricultural project development and regulatory services. The emphasis on extension and training is evident from the budgeted costs of the project shown in Table 6.4. Unfortunately, however, the implementation of the project, in the sense of recruiting the necessary professional and support staff, has not proceeded as rapidly as would be required to revitalize the activities of the Department of Agriculture and Livestock. Only a handful of appointments had been made by 1987 and some of the loan has been cancelled.

Increasing role for the private sector in providing extension services

Given the poor performance of the public sector in delivering extension services, and the emergence of non-government research institutions (in part because of that poor performance), perhaps more of the extension work should be left to the private sector. Indeed that has already begun to happen, both for export tree crops and for broilers (Jarrett 1986; Jarrett and Anderson 1988). In any case, since these services are of direct benefit to producers it could be argued that producers should pay for them.

Where to invest extra resources

Very little of Papua New Guinea's available land is currently used for crops or pasture. A number of reasons for that have been canvassed in earlier chapters, and a further reason has been explored in this chapter, namely the low level and quality of agricultural research and extension investment.

Changing social and demographic factors mean more investment must go into increasing the quality of available resources

The traditional methods of food production in Papua New Guinea, which have evolved over many centuries of learning by doing, provide a classic case of 'poor but efficient' agriculture that has served the country well in the past. However, in an environment where population growth has accelerated because of reduced warfare and improved health care, and where villagers' aspirations to purchase marketed goods have increased faster than their cash incomes, new forms of

investment are required to enhance the quality of available resources. Investing in agricultural research and extension services has proven elsewhere to be one such source of economic growth with a very high rate of return.

More investment needed for research, especially into coffee, coconuts and non-export products

In Papua New Guinea, this area of investment leaves much to be desired. First, it would appear that the overall level of investment in agricultural research and extension is well below the optimal level. That is, further investment in this area is likely to provide a very high (though not necessarily immediate) return in terms of expanded agricultural and national income. Second, the present investment appears to be poorly allocated.⁷ Too little is going to research relative to extension, and of the research expenditure probably too little is going to the main export crops of coffee, coconuts and, to a lesser extent, cocoa relative to palm oil, rubber and tea. Nor is enough going to research into non-export products.

Some research could be done in the private sector

This does not necessarily mean the government should greatly expand its public research and extension activities, at least for export crops. It may be more appropriate for the government to facilitate the collection of levies from export producers for the expansion of producer-owned research and extension institutions. The same may be true for the livestock industries. Indeed, the modern broiler industry in Papua New Guinea provides a good example of what can be achieved (Jarrett and Anderson 1988).

Profitability of research on staple food crops is unclear

With respect to staple food crops, the prognosis is less clear-cut. Gains from research on staples that are non-tradable (because of their perishability) are likely to be shared by producers and consumers, with producers gaining a larger share the lower the proportion of production that is marketed. But the costs of collecting levies or tax revenue from producers or consumers of these low value products, in order to finance research on them, are probably prohibitive. The pertinent question is whether the government should fund research and extension on traditional staples out of consolidated revenue. Carrad and Bourke (1985) believe more research on sweet potato, taro and sago is warranted. On the other hand, empirical work based on a model developed by Davis, Oram and Ryan (1987) suggests the returns from such research is likely to be much lower than from research on major crops.

Villagers themselves show more interest in increasing cash cropping than in improving subsistence crops

In this connection, the sensitive issue of food self-sufficiency arises. Many politicians and other leaders in Papua New Guinea believe it is morally wrong or shameful for the country to import food. However, this apparent concern has not been matched by extensive investments in staple food crop research, it may simply be a mask for protecting various groups involved in new import-replacing food industries.⁸ Moreover, villagers themselves have not sought such research. A study of eight highland villages concluded that villagers in this survey

⁷ Both this and the previous finding are not surprising given the long term nature of agricultural research and the relative strengths of the relevant vested interest groups. See Anderson (1981) and Rose-Ackerman and Evenson (1985).

⁸ For example, the recommendation by ISNAR (1982) to establish two food crop research centres, one for the highlands and one for the coastal areas, as part of the planned expansion of agricultural research and extension activities, has not been implemented as quickly as was originally envisaged.

had a very strong desire for cash. There was very little interest in new subsistence crops to supplement their diets (Harris 1975). The same conclusion is reached by Kern *et al.* (1984) in studies in the provinces of Milne Bay, East New Britain, Southern Highlands and West Sepik, which indicated the same emphasis on the cash economy, markets and infrastructure. The Food and Agriculture Organization/United Nations Development Program (1983) commented that there appeared to be little political pressure coming from rural areas for resources to be devoted to food production. Demands most voiced by the rural people were for better roads, improved communications and higher incomes from cash crops. Morauta claims

one is forced to conclude that demand for improvements in subsistence food production generally takes second place to the demand for cash incomes and increased government services. Furthermore I suspect that many people feel that improvements to subsistence food production, in so far as they are desirable, must be sought through their own efforts (Morauta 1983:156).

These examples would seem to indicate that there is a strong desire by villagers to become more involved with cash crops rather than with traditional staples.

Since (i) the returns from further research investment in tropical export crops are likely to be much larger than from research into traditional food staples, (ii) the urban population appears to prefer the protein rich foods available through imports, and (iii) farmers prefer to expand into cash cropping for export, it would seem sensible to spend the scarce funds available for research and extension on enhancing the country's comparative advantage in tropical tree crops and continuing to use the export revenue so generated to pay for some imports of preferred foods.

7

Other investments in human capital and infrastructure

While an expansion in investments in agricultural research undoubtedly will contribute to agricultural and overall economic development in Papua New Guinea, its contribution would be very much greater if it were accompanied by an expansion of public investments in the quality of rural labour and rural infrastructure. This chapter focuses on the overall level and distribution of public expenditure in four areas where the government can facilitate economic and social development: education, health, transportation, and the maintenance of law and order. The purpose of the chapter is to show some of the ways in which a reallocation of government spending to these areas, or even a redistribution of current levels of spending within these sectors, could contribute substantially towards the government's policy objectives, especially the raising of incomes of the more than 80 per cent of the population living in rural areas.

Education

Strong relationship between education and economic development

Improvements in the quality of the workforce have long been recognized as a key source of economic growth. Adam Smith drew attention to education as a profitable investment activity two centuries ago in his *Wealth of Nations*. More recently, T.W. Schultz was awarded the Nobel Prize in economics for his work in highlighting the contribution that investments in the health and skills of people could make to economic development and poverty alleviation. He stressed in particular the importance of investing in rural people in developing economies such as Papua New Guinea's. He and his students have demonstrated clearly that education in rural areas makes two key contributions. First, it makes farmers more adept as managers adjusting to changes such as fluctuations in prices or the introduction of new farm technologies. Second, and perhaps more importantly, it improves rural people's capacity to cope with moving out of agriculture (see, for example, Welch 1970; Huffman 1974; Schultz 1971, 1975, 1980; Jamison and Lau 1981). Farmers who are better educated earn higher incomes because they are quicker and better at making use of new technologies and adjusting their input and output mixes to take advantage of changes in relative prices. In addition, those (usually younger) members of rural households who choose to seek a non-farm job — for example, because of a lack of farm land — tend to find work faster and earn a higher income the better their education. The latter point is especially important in Papua New Guinea's case because most of

tomorrow's non-agricultural workers are the children in rural areas today. In addition, education makes a number of more subtle contributions, perhaps the most important being that children tend to be healthier and do better at school — and subsequently in the workforce — the more educated their parents, especially their mother. So even if women spend less time in the workforce outside the home than men, they contribute very significantly to the country's development through the environment they provide for their children, and more so the better educated they are (Psacharopoulos 1988; Psacharopoulos and Woodhall 1985).

Several important questions need addressing

Among the important questions which need to be addressed when assessing the appropriateness of Papua New Guinea's expenditure on education are the following:

- Is there evidence to show that incomes are positively correlated with education in Papua New Guinea?
- Is Papua New Guinea underinvesting in education?
- Is the allocation of expenditure between primary, secondary and tertiary education appropriate?
- Is there balance in the allocation of expenditure between rural and urban areas, between males and females, and between provinces?
- Is there scope for improving the efficiency of supplying educational services and/or raising the quality of those services?

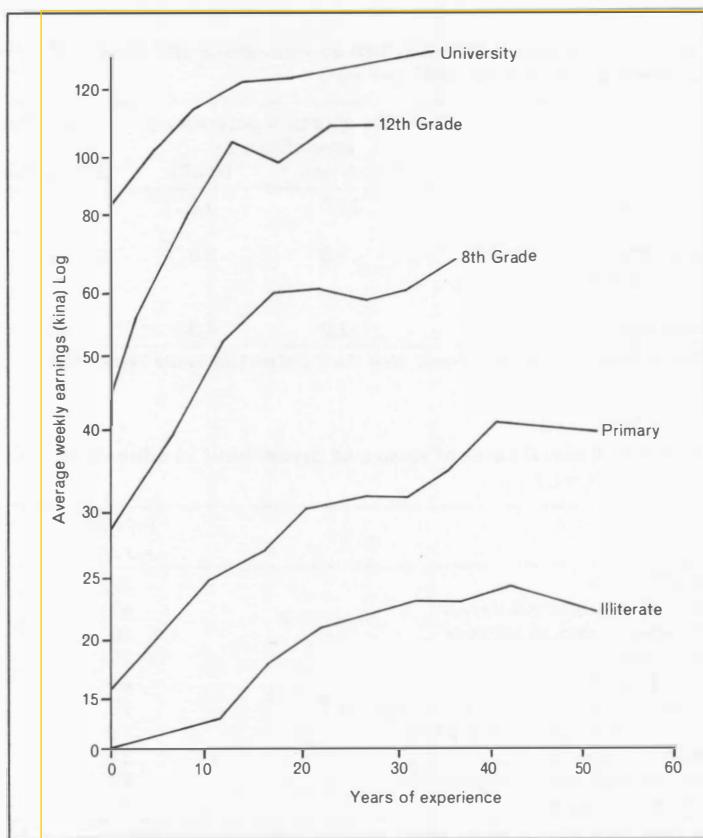
While it is not possible to answer all these questions in detail here, at least a beginning is made.

Close correlation of income with level of education

The answer to the first question is a definite affirmative, at least for wage earners in Papua New Guinea. A recent study by Gannicott (1987), which examines incomes of groups with different levels of education and experience, shows that (i) the more education people have when starting work, the greater their income; and (ii) as their work experience increases, the benefit from greater education tends to increase (see also Bray and Smith 1985: ch.1). These results are summarized in the age/earnings profiles shown in Figure 7.1. The intercepts on the vertical axis, which represent starting incomes, are higher the more education people have, and so too are the average slopes of the lines shown, which represent the rates of increase in people's incomes as they gain work experience. While similar data are not available for Papua New Guinea's non-wage earners, who dominate the rural sector, the very extensive empirical evidence from many other developing countries suggests the same pattern is likely to exist among them, and is likely to become more pronounced the more subsistence farmers become integrated into the cash economy and exposed to new production technologies and changing marketing opportunities (see, for example, the literature cited in Jamison and Laua 1981).

Figure 7.1
Age earnings profiles,
Papua New Guinea, 1979
(national only)

Source
Based on K. Gannicott, *Education in Papua New Guinea: a case study in wasted resources*, Islands/Australia Working Paper No. 87/19, Canberra, National Centre for Development Studies, Australian National University.



Levels of government investment in child education is high by developing countries standards

Currently, a relatively small proportion of school-age children in Papua New Guinea are receiving formal education. As a proportion of the relevant age group, the country's primary school enrolment ratio is only two-thirds that of other developing countries, and its secondary school enrolment is less than half as large as the developing country average (Table 1.6). This alone might suggest Papua New Guinea is underinvesting in formal education, except that one needs to keep in mind that mass education in the country is a recent phenomenon. At present, the central government is spending a relatively large share of its budget on education compared with other developing countries. In 1986 that share was 17 per cent, but in earlier years since Independence it has been as high as 20 per cent (compared with 13 per cent in 1975). Since Papua New Guinea's central government accounts for a larger share of GNP than governments in most other developing countries, this means public expenditure on education as a percentage of national income in Papua New Guinea is high, in fact more than double that for developing countries as a whole (Table 7.1). It is unlikely that private expenditure on education in other developing countries is so much larger than in Papua New Guinea that it would offset this difference in public spending.

Table 7.1 Central government expenditure on education and health, Papua New Guinea and other developing economies, 1986 (per cent)

	Share of central government expenditure on:		Central government expenditure as % of GNP		
	Education	Health	Education	Health	Other
Papua New Guinea	17.0	9.6	5.9	3.3	25.6
Low income economies (excl. China and India)	9.8	3.6	2.0	0.8	18.0
Middle income economies	11.2	4.8	3.1	1.3	23.1

Source: World Bank, *World Development Report*, New York, Oxford University Press, 1988.

Table 7.2 Private and social rates of return to investment in education, Papua New Guinea, 1979 (per cent, nationals only)

	Private return	Social return
Primary/illiterate	29	20
Incomplete primary/illiterate	42	23
Primary/incomplete primary	20	17
Secondary/primary	16	11
Grade 7/primary	24	18
Provincial high 'force out' grade 8/grade 7	15	12
Provincial high grade 10/grade 9	13	10
Grade 11/grade 10	14	11
National high grade 12/grade 11	22	3
University/secondary	11	1

Source: K. Gannicott, *Education in Papua New Guinea: a case study in wasted resources*, Islands/Australia Working Paper No.87/19, Canberra, National Centre for Development Studies, Australian National University.

Rates of return to investment in education difficult to estimate

To better assess whether Papua New Guinea is underinvesting or overinvesting in education, it is helpful to examine the rates of return that might be expected from further investment. The private investment costs incurred by an individual — or more likely the family of the student — include not only direct costs for fees, books, etc. but also, and more importantly, the indirect cost of income foregone during the period of study. Typically, the private rate of return on these costs will exceed the social rate of return since the student does not pay the full cost of tuition (both recurrent and capital). Ideally, one should include the 'consumption' benefits of education to the individual in calculating the private rate of return, and in estimating the social rate of return any externalities to society from having a better educated population should also be included. In practice, however, these are difficult to quantify, so one simply needs to keep in mind that both rates of return will be underestimates.

— but appear to be very high at the primary level

One set of estimated rates of return, calculated by Gannicott (1987), is summarized in Table 7.2. These estimates refer to Papua New Guinea nationals, and show the marginal rates of return a student could expect in 1979 from going one more rung up the education ladder. For ex-

Table 7.3 Social rates of return to education, Papua New Guinea and other developing countries, circa 1979 (per cent)

	Primary	Secondary	Post-secondary
Africa	26	17	13
Asia	27	15	13
Latin America	26	18	16
Papua New Guinea	20	11	1

Source: Table 7.2 and G. Psacharopoulos, 'Returns to education: a further international update and implications', *Journal of Human Resources* 20(4):583-604, Fall 1985.

ample, some primary schooling rather than none is estimated to yield a private rate of return of 42 per cent per year for the rest of the student's life — an extremely worthwhile investment. Even for students already well into primary school, the private rate of return from going on to complete his/her primary education is estimated to be still as high as 20 per cent. The social rates of return from primary and early secondary schooling, while less than the private rates, are still high compared with alternative investments the government might make.

— and to decrease with higher levels of education

Notice, though, that the marginal rates of return tend to be less, the higher the student's education. This partly reflects the greater opportunity cost of the more educated student's time, as depicted in Figure 7.1. But it also reflects the higher cost of tuition at the more advanced stages, both in terms of fees paid by the student and — especially at the national high school and tertiary levels — in terms of the residual cost of tuition and scholarships met by the central government.

Aid directed at education not going to the primary level where it is most needed

How do Papua New Guinea's rates of return compare with those of other countries? Table 7.3 suggests the social rates of return in other developing countries are, as in Papua New Guinea, highest at the primary level and lowest at the tertiary level. It also suggests they are a little higher than in Papua New Guinea at the primary and secondary levels, but that at the tertiary level Papua New Guinea's rate of return is extremely low by international standards. In a recent study on Australian aid for education in the Pacific, Throsby and Maglen (1988) estimated that 64 per cent of aid allocations were at the tertiary level, with 16 per cent to primary and secondary levels and 14 per cent to vocational and technical education. In their view, the acute problems in education in the Pacific are in the primary and secondary school sectors and in teacher training, the shortage of trained teachers being seen as a major constraint on educational development.

In short, these estimates show Papua New Guinea on the one hand to be underinvesting in education less than other developing countries overall (lower overall social rates of return), but on the other hand to be devoting more resources than other developing countries in supporting upper secondary and tertiary education at the expense of more elementary education. This emphasis on resources to upper secondary and tertiary levels is reinforced by Australian aid to education.

Table 7.4 Recurrent expenditure per equivalent full-time student, Papua New Guinea, 1973 and 1983 (kina/student)

Level of education	1973	1983
Primary	90	154
Provincial high school	318	357
Secondary vocational	299	728
Upper secondary	1047	2005
Primary teachers' college	1181	1417
Technical college	..	3910
University	4615	7907

Source: K. Gannicott, see Table 7.2.

Another recent empirical study by McGavin and Ross (1988) provides further support for this conclusion.

Very high costs in providing tertiary education a major cause of relatively low rates of return

The key reason for the low rates of return to upper secondary and tertiary education, despite the higher income it promises for the student, is the extremely high cost of providing that level of education relative to elementary and vocational education. The annual cost per student of providing education in Papua New Guinea in 1983 was K150 at the primary level, K360 at the provincial high level and K730 at the vocational high school level. However, at the upper secondary level it was K2000, and at the university level K7900 per student. Moreover, these cost differences between elementary and advanced education have widened considerably since 1973 (Table 7.4). Presently, the expenditure per student at the university level in Papua New Guinea is more than double that in Australia. This reflects the fact that the staff/student ratio in Papua New Guinea is more than double Australia's and that a larger proportion of students in Papua New Guinea have to live away from home for their advanced education and the government subsidizes their living costs as well as travel to their home villages during vacations. Yet, despite this high level of government support for advanced education, the output of first-degree graduates is depressingly small and that of higher-degree graduates is almost non-existent. In the context of staffing agricultural research agencies in Papua New Guinea, the International Service for National Agricultural Research (1982) predicted that, by the end of 1987, there would be a need for nine national scientists with Master's degrees for the research staff of the Department of Agriculture and Livestock, as well as twenty-two undertaking Master's programs and three in Ph.D. programs. Yet, in 1988, there was not a single national with a Master's degree working in agricultural research, there were six candidates undertaking Master's programs overseas and there were no Ph.D. candidates in training.

Need for expenditure reallocation between education levels

Clearly, there is considerable scope for reallocating some of the government's expenditure toward more education at the elementary levels. In 1986, only 52 per cent of the central government's education budget went to the primary level compared with 16 per cent to secondary

Table 7.5 Community school enrolment ratio by province, Papua New Guinea, 1977 -85

Province	Proportion of 7-12 years age group in school (%)		Pupil/teacher ratio for grades 1-6 (%)	Per capita income rating ^a
	1977	1985	1981	1980
Western	58	51	39	1
South Highlands	48	51	31	1
West Highlands	50	51	32	3
Enga	41	52	32	2
Madang	52	58	32	3
West Sepik	62	59	30	1
Simbu	51	60	30	2
Morobe	52	61	33	2
East Highlands	42	63	35	3
Gulf	60	67	32	1
Oro	57	67	31	3
East Sepik	60	72	34	2
Milne Bay	68	73	31	1
North Solomons	64	73	30	4
West New Britain	72	75	29	4
National Capital District	61	75	35	4
Central	65	79	32	2
East New Britain	100 ^b	80	30	4
Manus	57	84	31	3
New Ireland	76	86	26	4

^aProvinces are categorized into one of four groups (1 = lowest income, 4 = highest income) according to estimates of cash agricultural income per capita reported in Goodman et al. (1985, Table 4.2).

^bFigure for East New Britain is high partly because children under 7 years of age go to school in that province.

Sources: *National Education Strategy*, Monograph No.9, Port Moresby (1979) for 1977 data; Papua New Guinea Department of Education, *Staffing and Enrolment Statistics*, Port Moresby, 1986 for 1985 data; R. Goodman, C. Lepani and D. Morawetz, *The Economy of Papua New Guinea: An Independent Review*, Canberra, Development Studies Centre, Australian National University, 1985, Table 4.2 for income ratings.

and 26 per cent to tertiary (and 6 per cent for overheads), even though 87 per cent of the students are at the primary level and only 1 per cent are in tertiary institutions. Expenditures by provincial governments and private organizations (predominantly church based) counter this bias to some extent, but a very substantial imbalance remains.

Rural and female participation rates are below average

This relative neglect of elementary schooling harms rural children proportionately more than children in the towns and cities because relatively few children from rural households reach the tertiary level. Also, within the rural sector there are considerable disparities between provinces in the extent of participation in education. Table 7.5 shows that, in 1977, the primary school enrolment ranged from a low of 41 per cent in Enga Province to a high of 100 per cent in East New Britain. Participation had increased considerably by 1985 but there was still a wide range in participation rates, from 51 to 86 per cent. The enrolment ratio is highest in the richest provinces (see the final column of Table 7.5), but the lowest enrolment ratios are not only in the poorest provinces. This suggests the existence of annual fees of between K5 and K10 per student is probably not a major reason for differences in participation. The fact that the lowest enrolment ratios are in the

Highlands suggests distance and travel time may be more important explanations. Perhaps surprisingly, the primary pupil/teacher ratio in Table 7.5 shows relatively little variation between provinces. Insofar as this is an indicator of the quality of education, it suggests that there are smaller inter-provincial differences in quality than in quantity of primary school education in rural areas. In addition, the difference between male and female participation rates has narrowed since Independence: nationally, the proportion of girls enrolled rose from 35 to 43 per cent in primary schools and from 31 to 36 per cent in high schools between 1973 and 1983.

Concern over quality of education with indigenization of school sector

The overall quality of the educational services provided in Papua New Guinea has been a cause of some concern as the government's policy of indigenization of all public services takes effect. As Goodman *et al.* (1985:175) noted, by 1976 all teachers in primary community schools were nationals. Since then, the proportion of provincial high school teachers who are nationals has risen from around one-third in 1983 to more than three-quarters, while in community teachers' colleges it has risen from 16 to 37 per cent over that period. If the skills of these nationals are lower than those of the expatriate teachers they are replacing, there may be cause for concern about the quality of the educational services that will be provided by the public sector in the future.

Use of agricultural extension as a means of providing non-formal adult education

An additional means of boosting human skills is to make more use of non-formal adult education. As discussed in the previous chapter, agricultural extension services contribute in this way in the rural sector. To some extent, these services compensate for the fact that many of today's farmers in Papua New Guinea — particularly women — received little or no formal education as children. Unfortunately, though, the approach adopted by extension officers was not always skill-enhancing. There is a tendency for extension workers to short cut the education process. That is, they develop farm management plans, rather than teaching farmers methods of planning. This is one reason why extension workers have never been able to implement a farm management extension program reaching the masses of farmers (Maunder 1963).

The history of agricultural extension in Papua New Guinea would tend to substantiate Maunder's findings. An extension officer (*didiman*) began by introducing village smallholders to new commodities and then added the managerial skills needed to market the output. The *didiman* originally acted as a decision-maker in the sense of taking the decision to participate in the project. On the second visit, often in the role of loan officer for the bank financing the project, more of the managerial function was taken over and thereafter the smallholder came to regard the project as the *didiman's* rather than his own, and moreover blamed the *didiman* if the project failed.

Importance of local individual Initiatives In aiding agricultural development

There are certainly examples in Papua New Guinea where individual initiative in management functions has been taken at the village level. Some of these initiatives were fostered by churches and by Agricultural

Councils or Women's Associations. However, the examples are relatively few and far between and they tend to have a short life history. Typically, they rely heavily on the human skills and initiatives provided by a few people who assume a temporary leadership role, and once that leadership role is no longer assumed the initiatives tend to fade or collapse.

Bottom-up versus top-down agricultural extension is highly desirable

Even so, such initiatives are to be encouraged since the development of a bottom-up based agricultural extension service with its focus on adult education — and particularly directed at women — may contribute more to agricultural development in smallholder agriculture than reliance on a top-down direction from the national to the provincial to the district to the individual farmer. Far too often the hierarchical structure of national and provincial governments means that extension information passes from secretary to deputy to assistant secretary to director to deputy director before it finally reaches the district officer who has to interact with the farmer in a way that makes sense to the farmer concerned. In such circumstances, the district officers often feel disenchanted in the performance of their extension duties since they are a long way removed from the source of the knowledge they are disseminating. Moreover, the reverse flow of information from farmers through the district officers back up to the research scientist in the laboratory is virtually non-existent.

Health

High levels of spending on health

As with education, the central government is spending a substantially larger share of its budget on health care services in Papua New Guinea than is the case in many other developing countries. In 1986, that share was almost 10 per cent, up from 5 per cent in 1975, which represents 3.3 per cent of GNP or about three times the developing country average (Table 7.1). As a result of this high level of spending, and the government's conscious policy to improve basic health services in rural areas, there has been a substantial improvement since Independence in health service staff per capita (Table 7.6). While Papua New Guinea still has less than half as many doctors per capita as the average developing country, it has perhaps twice the average number of nurses per capita, according to data compiled by the World Bank (1988:278).

Marked improvement in the nation's health

This improvement in health care services, together with the reduction in tribal warfare, no doubt contributed to the increase in the average life expectancy from 40 to 50 years between the 1971 and 1980 censuses. Infant and child mortality rates halved over the same period. Although these indicators are still poor compared with many other developing countries (see Table 1.6), the extent of improvement in the nation's health since the early 1970s is quite considerable.

Serious diseases still prevail, malnutrition an important health problem

Nevertheless, major diseases remain, and their relative importance has not changed much (Table 7.7). Respiratory diseases will continue to head the list while rural people continue to sleep around smoky fires in poorly ventilated houses. Malaria remains endemic in coastal areas

Table 7.6 Indicators of the availability of health services, Papua New Guinea, 1973 and 1984^a

	1973	1984 ^a
Population per		
Hospital/health centre bed	220	215
Health centre	17,380	7,030
Aid post	1,540	1,470
Doctor	17,740	11,700
Health extension officer	16,090	9,360
Nurse	1,720	1,280
Aid post orderly	1,540	1,460
Health inspector	-	37,540
Per cent of population more than 2 hours from an aid post	14	7

^aOr latest data available.Source: R. Goodman, C. Lepani and D. Morawetz, *The Economy of Papua New Guinea: An Independent Review*, Canberra, Development Studies Centre, Australian National University, 1985:165.

and occurs seasonally in the Highlands, and gastro-intestinal problems are reducing only slowly because of the lack of improvement in nutrition and water quality. Malnutrition is still listed as one of the five most important health problems, which underscores the inter-relationship between agricultural development and well-being. Pregnancy complications arise in part because most of the orderlies at the aid posts are male, so women hesitate to contact them.

Health care structure vulnerable to breakdowns when skilled personnel leave

As part of the government's primary health care strategy, efforts are being made to disseminate more information on health care through the three-tiered structure of the health care system: aid posts at the village level, health centres and sub-centres at the district level, and hospitals in the larger towns. For the strategy to succeed there is a need not only to deliver pertinent information on how diseases may be prevented but also to involve the local community in maintaining and improving its own health. Unfortunately, as with large scale agricultural extension projects, this type of large scale health project depends critically on the skills of the personnel involved and the project often degenerates when those skilled people leave. Meanwhile, the local community frequently has become indifferent to attempts at encouraging self-help actions and adopts the view that the delivery of health care information is something the government should provide.

Need for closer supervision of village-based health workers

A related problem that arises with the hierarchical structure which characterizes the delivery of health services — and again there is a parallel in the dissemination of agricultural extension information — has to do with the inadequate supervision of those working at the village level. Just as the *didiman* complains about the lack of interest by his supervisors, so the aid post orderlies complain that there is little interest by senior officers of the health service in the work they do and in providing the necessary resources to carry out that work. In principle, the aid post orderly is expected to live in the village community and to spend part of the time working in his own garden. The orderly is

Table 7.7 Importance of major diseases in Papua New Guinea, 1974 and 1985

Disease	<i>Order of importance</i>	
	1974	1985
Respiratory disease	1	1
Malaria	2	2
Gastro-intestinal	3	3
Pregnancy complications	7	4
Malnutrition	4	5
Tuberculosis	5	6
Injury/violence	6	7
Sexually transmitted diseases	10	8
Leprosy	8	9
Skin diseases	9	10
Psycho-social	11	11
Dental	12	12
Degenerative	13	13

Source: Papua New Guinea National Planning Office, *Medium Term Development Strategy - National Health Plan*, Port Moresby, 1985.

expected to return to a base hospital once a month and to be visited by a supervisor from the hospital every three months. In practice, however, the system often breaks down because of failure in communications associated with lack of supervision.

Need to identify health problems and create a selective primary health care strategy

The lesson from this experience would seem to be that more emphasis on targeted small scale health projects should be investigated. For example, work by Walsh and Warren (1979) suggests that relatively simple techniques such as the provision of clean water and sanitation are the most effective ways to reduce the infant mortality rate. They therefore recommend that a selective primary health care strategy be adopted to concentrate on particular areas and particular age groups, especially women in their childbearing years.

Expenditure on hospitals should be reallocated in favour of dispersed urban health centres

Finally, one item in Papua New Guinea's health budget is conspicuously large, namely, hospital expenditures. Almost half of the central government's health expenditure is on hospitals, which is about twice the share in neighbouring countries of East and Southeast Asia (Richardson 1986). Given that most observers believe the weakest link in the delivery of health services is at the interface between the aid post and the village population, some reallocation of funds away from hospitals may be warranted. Goodman *et al.* (1985:167) suggest this could be accommodated by expanding the number of urban health centres so that they can provide (at considerably lower cost) those services which are currently the responsibility of overcrowded outpatient departments of hospitals. They also suggest, incidentally, that the government consider contracting more of the primary health services and the training of orderlies to the churches, who are able to provide those services at lower cost than public authorities.

Transportation

High transport costs are a burden on producers and consumers

In a lightly populated country such as Papua New Guinea, with its difficult terrain and numerous outer islands, transport and handling costs necessarily play a large role in the economy. The exporter of cash crops bears the full burden of these costs, since he cannot pass them on to his customers overseas. As was discussed in Chapter 3 with respect to wage costs in marketing agricultural exports, the higher transportation and handling costs the lower the price received by producers and the smaller the quantity they will export (see Figure 3.5). That is, transport costs are just like an export tax, except that they do not generate revenue for the government. For staple food crops sold in the villages and towns, the consumer shares the burden of the transport cost with the producer, but the larger that cost the worse off they both are and the smaller the volume and proportion of staple food that is marketed. For these reasons, reducing the cost of transportation to and from rural areas can have a major impact not only on rural development (Howe and Richards 1985) but also on the retail price and availability of indigenous food in urban areas and hence on overall food self-sufficiency. It might be argued also that easing the cost of transport between urban centres and rural areas would encourage more outmigration of people from agriculture and so exacerbate urban unemployment problems. The latter does not necessarily follow from the former, however, since lower fares would also make it easier for migrants to return to their village should they have difficulty obtaining a job or otherwise become disenchanted with urban life.

Road network is extremely limited

The two most important transport and handling costs affecting the agricultural sector have to do with roads and ports. (Air transport is very well developed and provides an extensive, if expensive, passenger service to virtually all areas of the country.) At present, Papua New Guinea has only about 19,000 kilometres of trafficable roads over its land area of almost half a million square kilometres. Only 6 per cent of these roads are sealed. They tend to be fairly evenly distributed on a per capita basis across provinces (Table 7.8). Apart from the Highlands Highway connecting Lae with Mt Hagen, the road network has developed essentially as extensions from roads in the larger towns, such as Port Moresby, Lae, Rabaul and Kieta, or as a result of upgrading patrol roads which were established in rural areas during the period of the Australian Administration to facilitate access to the more remote villages.

Transport costs likely to be more effectively reduced by road maintenance than by new road construction

Small though the road system is, it does cover the more densely populated areas, and about two-thirds of the population is within reach of a road. Whether extensions of the road network would be socially profitable is a moot point. Unlike investments in agricultural research and education, investments in new roads immediately provide clearly visible signs of government activity and for that reason are attractive to politicians. Goodman *et al.* (1985), however, are fairly sanguine about increased investments in extending the road system. They cite engineering studies which show that none of the proposed new roads or

Table 7.8 Provincial distribution of trafficable roads and population, Papua New Guinea, 1980 (per cent)

Province	Kilometres of roads	Population
Morobe	13	10
East Highlands	13	9
East and West Sepik	12	11
Central (incl. National Capital District)	10	10
West Highlands	9	9
North Solomons	9	4
East and West New Britain	7	7
South Highlands	5	8
Northern	4	3
Milne Bay	3	4
Gulf	2	2
Other	13	23
Total	100	100

Sources: Roads data are from the Papua New Guinea Bureau of Statistics, *Transport and Communication Bulletin*, Port Moresby, 1980. Population data from the Papua New Guinea National Statistical Office, 1980 Census, Port Moresby.

road sections, including the road linking Port Moresby to Lae and a road from the Highlands to Madang on the north coast, would provide a sufficiently high return to warrant the investment. On the other hand, further investment in maintaining and upgrading the existing network may well yield a high return. However, activity is much less glamorous than new road construction and so has less political appeal, even though it would do much to reduce the cost of transporting goods to and from rural areas.

Similarly, maintaining existing ports is more profitable than developing new ones

As with roads, Papua New Guinea can afford few ports, despite its long coastline and many outer islands. In addition to Kieta, which services Bougainville Copper Pty Ltd, there are nine important ports serving the rural sector, all controlled (with seven others) by the Papua New Guinea Harbours Board (Table 7.9). A recent study suggested that, as with roads, the building of new ports in the foreseeable future would not be economically justified but the rehabilitation and further development of these nine ports would yield quite high internal rates of return, ranging from 13 per cent per year at Kimbe to 56 per cent at Madang (Goodman et al. 1985:161). For areas not serviced by these ports, the alternative in the absence of roads would have to be barges operating from collection points to the main ports.

Ownership and operation of facilities — public or private?

Physical facilities at the major ports are divided between public — through the Harbours Board — and private ownership. Many of the privately owned facilities are in the hands of firms which are engaged also in international and coastal shipping as well as wholesale and retail distribution in Papua New Guinea. Gilman (1983:88) points out that, 'The Harbours Board, it is believed, would like to extend its jurisdiction, whilst coastal operators are wary of this, and point to the fact that facilities under their own control are cheaper and more

Table 7.9 | Distribution of exports by port, Papua New Guinea, 1981 and 1986 (per cent by value)

	Total exports 1986	Agricultural exports, 1981			
		Coffee	Cocoa	Coconut products	Palm oil
Kieta	33	-	49	8	-
Lae	22	100	4	1	-
Port Moresby (air)	16	-	-	-	-
Rabaul	7	-	44	50	-
Kimbe	3	-	-	-	88
Port Moresby (sea)	2	-	-	-	-
Madang	1	-	3	13	-
Kavieng	-	-	-	12	-
Oro Bay	-	-	-	-	12
Alotau	-	-	-	3	-
Wewak	-	-	-	2	-
Other	16	-	-	11	-
Total	100	100	100	100	100

Source: Papua New Guinea National Statistical Office, *International Trade Statistics*, Port Moresby, various issues.

'convenient'. According to Trebilcock, the Harbours Board receives no direct subsidies from the government, but distortions in the provision of services exist since 'substantial cross subsidization by some categories of services to other categories of services is acknowledged to occur' (Trebilcock 1982:125). In contrast to the previously mentioned study of the economic feasibility of redeveloping some of the Board's ports, Trebilcock goes on to say, 'Officials with the board suggested that 11 out of the 16 ports operated by the Board would be closed down if purely economic considerations governed. However, political and social considerations have led the government to decide to maintain these ports' (Trebilcock 1982:125).

Labour practices add to costs

Labour for stevedoring and cargo handling is provided typically by village gangs employed on a rotational basis. According to Gilman (1983), this method is efficient in the sense that it exploited the discipline of the normal social structure of the village, and led to relatively few problems on the waterfront. However, in Port Moresby where there is a permanent workforce, the potential for incorporating restrictive labour practices is quite high. In part, Gilman attributes this to

the transplanting of the Australian waterfront tradition to Papua New Guinea which is very much to be regretted. The Australian waterfront is one of the most expensive in the world, both in terms of direct costs and also slow ship turn-around, delays and dislocation generally. It is bad enough in Australia and a disaster for Papua New Guinea (Gilman 1983:91).

Public shipping enterprises a disappointment

Some years ago the Papua New Guinea government, concerned with what it perceived as excessive coastal shipping freight rates, undertook the operation of a publicly funded shipping enterprise through the Papua New Guinea Shipping Corporation Pty Ltd. However, the venture was unsuccessful despite government subsidies. Eventually the

Corporation was placed in receivership and, according to the budget statement for 31 December 1987, would be sold. Deregulating the coastal shipping market and encouraging competition among private companies probably offers the best hope of rationalizing existing operations and keeping down coastal freight rates.

Transport costs remain a heavy burden on the rural sector

Clearly, transportation costs will remain an important burden on the Papua New Guinea economy in general and the rural sector in particular. However, because transportation looms so large an item in the cost of production, it is more important for Papua New Guinea than for many other developing economies that its policies do not unnecessarily add to transportation and handling costs.

This last point applies not only to land and sea transport but also to air services. Both passenger and freight services by air are more expensive than they need to be simply because of over-regulation of that traffic. Lower costs would help the rural sector not only through lowering the fares villagers pay as passengers but perhaps also, in the longer run, through boosting rural export industries such as floriculture and international tourism.

Law and order

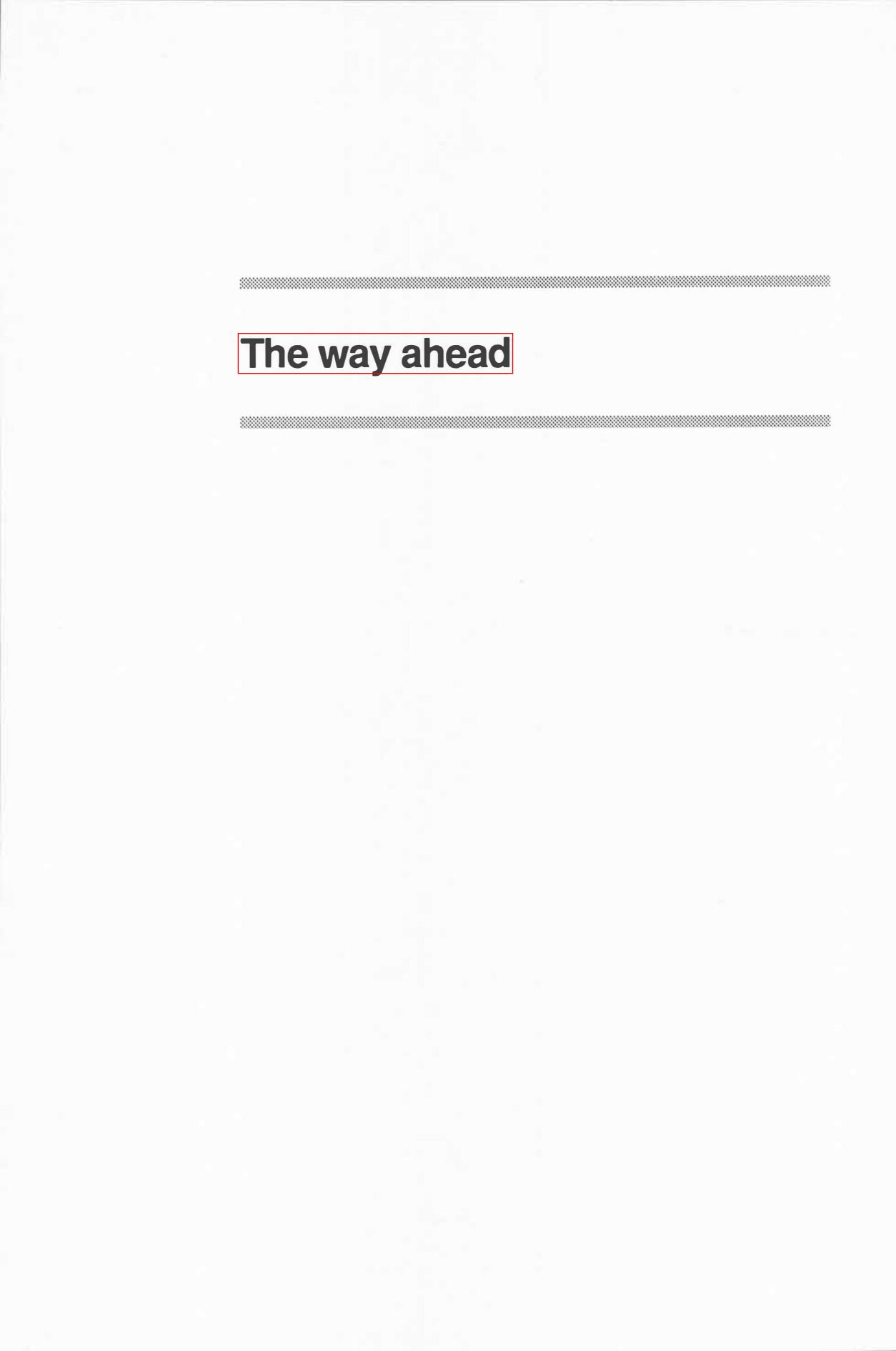
Growing problem of urban/rural crimes

A critical factor in the development of any society is the maintenance of law and order. This has proved to be difficult in Papua New Guinea in recent years for a complexity of reasons related to the uneasy coexistence of two quite different sets of legal traditions in an environment where old values are crumbling and new ones are only just beginning to take their place (see Clifford, Morauta and Stuart 1984). The problem is exacerbated by large differences between rural and urban wages, which encourage immigration to the towns where insufficient employment opportunities lead to unrest. But the problem is not confined to the towns. Of major concern to coffee growers is the increasing incidence of robberies on the Highlands Highway during the harvest season when buyers carry large amounts of cash. This raises substantially the insurance premiums paid by buyers and thereby reduces the price they are able to offer growers. Since it is only the smallholders who sell for cash on the highway, they bear the cost of these robberies.

High costs associated with breakdown of law and order

The government's provision of services aimed at maintaining law and order suffer from the same deficiencies as those aimed at providing agricultural extension, and education and health services; namely, poor training, lack of management skills, poorly articulated policies, and inadequate supervision and implementation of policies. Investing more public resources into this area is essential because without it the cost of providing other critical services escalates. For example, teachers and nurses are less prepared to be posted to rural areas where rape and robberies occur. Also, it has proved more and more difficult in the current environment to attract expatriates required in fields such as agricultural research and training of teachers, doctors and nurses. Given the importance of these activities for Papua New Guinea's development, especially in rural areas, not to mention the

peace of mind of the population at large, the need to better maintain law and order cannot be overemphasized.



The way ahead

8

Conclusions

The paradox of many advantages yet poor economic performance

Lessons from the recent past

In many respects Papua New Guinea is a lucky country, to use the term coined for Australia by the author Donald Horne. It is abundantly endowed with natural resources; it has a multi-party democratic political system which since Independence in 1975 has delivered peaceful transfers of power via the ballot box; and it has recently discovered more gold and petroleum reserves and is attracting the foreign capital to develop them in ways which make it the envy of many developing countries.

Yet, despite these advantages, the economy overall — and the dominant agricultural sector in particular — has performed rather poorly in the past 15 years and living standards for the vast majority of the population in rural areas have not improved noticeably. If Papua New Guinea is to make the most out of its future opportunities, including another minerals export boom in prospect for the 1990s, the reasons for the lack of per capita income growth since Independence need to be identified and remedies sought.

Certainly the external terms of trade have not favoured Papua New Guinea: in 1986 the price of its exports relative to its imports was only two-thirds the levels of 1965, 1970 or 1974. However, this adverse trend was minor relative to the huge growth in the volume of exports. Even after adjusting for the terms of trade deterioration, Papua New Guinea's exports in 1986 were able to buy three times as many imports as in 1970 and ten times as many as in 1965.

Associated with this export growth there has been substantial adjustment of the structure of Papua New Guinea's economy. Agriculture in Papua New Guinea has declined more in its contribution to GDP, employment and especially exports than in the average developing economy, and there have been substantial adjustments to the mix of both outputs and inputs within the agricultural sector.

Rapid growth in real export receipts and rapid structural adjustment typically are symptomatic of rapid incomes growth. Why, then, has there been so little change in the prosperity of the vast majority of Papua New Guineans, particularly those in rural areas?

Reasons behind agriculture's poor performance

It is not difficult to explain agriculture's relative decline, given the growth of the mining sector. As shown in Chapter 2, this is what tends to happen in any economy as it develops and especially when one of the other tradable sectors is booming. Agriculture's poor performance in absolute terms is what needs explaining.

— government policies largely to blame

This study suggests that a large part of the problem of slow growth may well be due to government policies. Distortions to factor and product markets have reduced efficiency in the use of resources, and public investment policies have been less than ideal in expanding the quantity, and enhancing the quality, of various forms of infrastructure and capital, especially human capital in rural areas.

— slowness to deal with land tenure issues

A major impediment to agricultural development is the insecurity of land tenure. Without land-use rights that can be passed to descendants, farmers are hesitant to make long term investments in improving the land they are farming. As well, financial institutions are less forthcoming with loans when a land title cannot be offered as collateral. The government needs to make a much bigger investment in finding ways to improve the security of customary land tenure and to speed up the process of issuing new titles and transferring existing titles to alienated land.

— rural credit policy disadvantageous for smallholders

The difficulty smallholders have in borrowing for investment, in the absence of a land title for collateral, has been compounded by the government's rural credit policy, even though the objective of that policy is to lower the cost of rural lending. Because banks are required to subsidize agricultural loans, it is in their interest to limit their concessional rural lending and to provide the subsidized loans only to their least risky and least costly customers, who tend to be large borrowers with secure collateral. Other borrowers — including many smallholders — are forced to borrow in the residual market at higher interest rates than would prevail in the absence of this rural credit policy.

— minimum urban wage policy attracts people to towns and encourages substitution of capital for labour

Wages, too, are grossly distorted. High urban minimum wages encourage people to move to the towns in search of a highly paid job. The migrants who are unsuccessful in finding work are less able to make a productive contribution to the economy, and a minority of them actually make a negative contribution through anti-social behaviour. In addition, high wages, especially when coupled with subsidized finance, encourage firms to substitute capital for labour and so fewer jobs are available. The minimum wage is not as rigidly tied to the consumer price index now as it was prior to 1983, but a further decline in the real minimum wage is needed to reduce the inefficiencies and inequities caused by this unfortunate inheritance from Australia.

— distorting effects of import restrictions also have harmed agriculture

Papua New Guinea is not as interventionist in its product markets as many other developing countries, but it seems to be gradually raising its import barriers just as other developing countries are seeing the wisdom of liberalizing their trade regimes. Agriculture in Papua New Guinea is not directly taxed very much relative to many other primary-exporting countries. But it is adversely affected indirectly, but nonetheless importantly, by trade barriers aimed at boosting manufacturing activity. There are a number of barriers to food imports which are diverting resources from low cost to high cost rural enterprises, the effects of which have probably been to reduce overall agricultural GDP and certainly to raise the cost of purchasing food and to reduce the variety of nutrients available for consumption. They have done little to

raise the country's food self sufficiency level when one takes account of the feedgrains and low price beef cuts imported in response to the ban on imports of high-price beef cuts, tinned meat and chicken meat.

— the 'hard kina' strategy and the need for further devaluation

Of even greater significance than trade policies in dampening agricultural growth has been Papua New Guinea's 'hard kina' strategy for managing the exchange rate. Insofar as this exchange rate policy has held up the value of the kina, it has raised the price of non-tradable goods and services relative to the price of tradables. The real depreciations since 1983 have gone some way towards easing this disincentive for agriculture, but further devaluation may be warranted unless the country's terms of trade improve markedly.

— inadequacies of agricultural price stabilization schemes

Another policy lesson from Papua New Guinea's experience is that agricultural price stabilization schemes are flawed. The schemes used for the major export tree crops have contributed little towards stabilizing the macro economy, which is one of their major objectives, nor have they been successful in enhancing producer welfare. Producers' gross receipts have fluctuated less because of the schemes but the average level and growth in those receipts have been reduced by them. Moreover, by dampening incentives to innovate and to expand during long periods of high export prices, these schemes have probably reduced rather than encouraged more investment in export agriculture.

— underinvestment in agricultural research

In the area of public investment, the evidence suggests that some reallocation of funds would yield high returns. There is clear underinvestment in agricultural research, though the government's role might be more one of ensuring producers contribute to research funds than of subsidizing and/or undertaking that research, particularly with respect to export crops. Even within the existing budget, much could be gained by reallocating funds between the various types of agricultural research.

— rural education and health lacking in government funding at elementary level

Within the education and health budgets, too, gains in terms of both efficiency and equity could be obtained by reallocating spending towards more elementary schooling and towards more small scale health care services. The social rates of return from further investments at the basic end of the spectrum of education and health services are far higher than at the advanced end. It is the poorer people in rural areas who would gain most from such a reallocation: improvements in managerial skills and health of rural people over time would contribute substantially to future productivity growth in the rural sector and the economy generally.

Policy Implications

Distortions in capital, labour and land markets must be reduced

The clearest policy implication of the study may be unoriginal but it is nonetheless fundamental, namely, the need to get prices right. Removing the subsidies to rural credit would raise, not lower, the amount of credit used by the bulk of farmers and at the same time would expand the opportunities for rural people to participate in the financial market

as depositors. Facilitating the erosion in real terms of artificially high urban wages would expand employment opportunities in both urban and rural areas. And streamlining the issuing and transferring of land titles would encourage the development and better utilization of both existing and new agricultural land. That is to say, there is ample scope to improve output simply by allowing existing resources to be used more efficiently through policy changes aimed at reducing distortions in the capital and labour markets and enhancing the efficiency of the land market.

Freeing up product and foreign exchange markets vital for boosting output

Getting prices right in the product markets and in the market for foreign exchange would similarly boost output through allowing resources to gravitate to the enterprises where they can be used most productively. In practice this means restricting imports less and allowing the kina to move towards, and remain closer to, its equilibrium value vis-à-vis other currencies. Simply converting all quantitative trade restrictions to explicit trade taxes would be a useful beginning, as it would generate extra trade tax revenue for the government. Then lowering the highest of those taxes would not only boost trade tax revenue even further (because the volume of imports would expand) but also would discourage production in the most protected and least competitive enterprises. A much more radical proposal is to replace all import restrictions with a uniform export tax and to impose consumption taxes on imported luxuries. The latter would be no more disadvantageous than the former from the viewpoint of export industries, and yet it would have a number of advantages from society's viewpoint. The most important of these are lower costs of administering trade restrictions and fewer opportunities for potential import-replacing producer interest groups to seek favours from the government.

Need for critical appraisal of price stabilization schemes

The analysis in Chapter 5 suggests the need to look critically at the export commodity price stabilization schemes. If they are doing little to help stabilize the macro economy or to reduce producer uncertainty, and yet are reducing the average levels of producer receipts and discouraging expansionary investment during long periods of high international prices, they may not be worth keeping.

Investment in export crop research needs expanding

Another major policy implication of the study is the need to ensure that investments in various forms of capital and infrastructure are yielding the highest rewards possible, subject to fulfilling equity goals. Public investments have a habit of crowding out private investments in many instances, so the government need become involved only when gaps appear, and even then it is sometimes possible to intervene only minimally. A case in point is agricultural research. Governments, arguably, are no better than the private sector in undertaking such research. However, the government does have an important role in ensuring all producers, including smallholders, contribute towards funding such research. The free-rider problem can easily be overcome by making use of the existing export tax collection service to levy funds from producers. It would appear that more expenditure on agricultural research would yield a very high return, although perhaps more so for some products (particularly coffee, coconuts and cocoa) than others.

Encouraging producers to raise research levies and to establish more producer-owned research institutes (with associated private extension services) is all that may be required of the government to revitalize this fundamental agricultural development activity.

Health and education – need for reallocation of funds downwards and greater care in the delivery of these services

The question of whether other fundamental activities, such as providing health and education services, ought also to be privatized has not been addressed in this study. What has been shown is that a much higher return could be generated from current levels of expenditure in these areas simply by reallocating some public funds towards more elementary schooling and health care services. Care is needed, however, in the implementation of schemes to deliver these services to rural areas. Ultimately it is the quality of the services provided that matters, not simply the amount of money spent.

Transport expansion and regulation not necessarily the answer to reducing transport costs

Given the rugged terrain, long coastline and low population density of Papua New Guinea, transport costs necessarily loom large. For that reason investment in transport infrastructure and regulation of markets for transport services are important determinants of (especially rural) people's productivity and real incomes. Expanding substantially the road and port networks apparently is not economically justified in the foreseeable future, but further investments in maintaining and improving selected existing facilities may well be. And the numerous policies aimed at regulating air and coastal shipping services might well be reconsidered since, even if the free market outcome is seen to be less than ideal, it may be preferable to the regulated alternative.

Need for more collection and publication of economic statistical data

Finally, on the role of government, the quality of policy analysis suffers from a dearth of statistical information. The return from investing more government resources in the collecting and timely publishing of additional basic data on the economy is probably extremely high.

Priority areas for further research

This study is very much a broad brush view of the implications for agriculture of Papua New Guinea's economic growth, structural changes and economic policies. In skimming the surface of numerous issues, it raised implicitly many more questions than it answered. Even if it does no more than stimulate further policy analysis, however, the study will have achieved its purpose. With that in mind, an appropriate way to conclude is to suggest some of the areas which might be given high priority by subsequent researchers.

Alternative tax structures

One pressing import need is an analysis of alternative tax structures. The heavy reliance on import trade taxes and the smallness of the contributions of company taxes, of government revenue from mining, and of personal taxes from the vast majority of the population are cause for concern. Would the replacement of the plethora of import restrictions with a uniform relatively low export tax improve the efficiency and equity of taxes on trade? Is there scope for raising more company tax revenue, particularly from mining? The resource allocative and income distributional implications of alternative tax structures

need to be explored, giving due consideration to the administrative and other deadweight costs of using different tax instruments.

Detailed booming sector analysis needed

With the possibility of another large mining boom in the 1990s, there is need for a careful analysis of the dynamic effects on the economy of the first two major mining projects (Bougainville from the late 1960s, Ok Tedi from the early 1980s). The economic theory of the effects of booming sectors is now well developed. Also, the experiences of many other economies which enjoyed mining booms have now been analysed, so that comparisons between theirs and Papua New Guinea's experiences would be possible.¹ One would hope that such comparisons could shed more light on why so little of the gain from mineral export growth in Papua New Guinea has filtered through to the population at large.

Land tenure alternatives need to be explored

Land tenure is a critical issue in agriculture. Given the sensitivity of the issue of alienating customary land, there is a need to explore various alternatives to alienation that are more in keeping with traditional values and yet can give greater security of tenure to land users.

Government investment prioritizing requires ex ante empirical analysis

As an aid to selecting investment priorities, continuing empirical research is required which can illuminate the investment areas of highest returns within the major spending categories of the government's budget. The evidence presented above suggests there would be substantial scope for redirecting spending within the education, health and agricultural research/extension categories, but more careful ex ante empirical analyses are required to improve those suggestions, and to be able to rank priorities better across categories.

Effective rates of assistance/taxation could be calculated

At present there are no systematic empirical estimates of the effective rates of assistance/taxation afforded the different sectors by government policies in Papua New Guinea. The methodology for undertaking the task is now well documented.² Such an exercise is a beginning in the process of understanding the extent of resource reallocation in the economy due to those policies. While it cannot provide the same amount of information as could a general equilibrium model of the economy, it is nonetheless a beginning and, as with the other suggestions for empirical work mentioned above, it adds transparency to policies and thereby allows for more informed debate in the policy-making process.

1 See the survey by Corden (1984), and the papers in Lloyd (1985) and Neary and van Wijnbergen (1985), for example.

2 See, for example, Australia's Industries Assistance Commission (1987).

References

- Agriculture Bank of Papua New Guinea, *Annual Report and Financial Statements*, Port Moresby.
- Alauddin, M. and Tisdell, C., 1986. 'Market analysis, technical change and income distribution in semi-subsistence agriculture: the case of Bangladesh', *Agricultural Economics*, 1(1):1-18.
- Anderson, K., 1981. 'Politico-economic factors affecting public agricultural research investment in developing countries' in M.A. Bellamy and B.L. Greenshields (eds), *The Rural Challenge*, London, Gower for the International Association of Agricultural Economists:162-8.
- , 1983. 'Economic growth, comparative advantage and agricultural trade of Pacific rim countries', *Review of Marketing and Agricultural Economics*, 51(3):231-48, December.
- , 1987. 'On why agriculture declines with economic growth', *Agricultural Economics*, 1(3):195-207, June.
- and Garnaut, R., 1987. *Australian Protectionism: Extent, Causes and Effects*, Sydney, Allen and Unwin.
- Arndt, T.M., Dalrymple, D.G. and Ruttan, V.W. (eds), 1977. *Resource Allocation and Productivity in National and International Research*, Minneapolis, University of Minnesota Press.
- Asian Development Bank, 1987. *Economic Survey of Papua New Guinea*, Manila, August.
- Australia, Industries Assistance Commission, 1987.
- Australian Administration of Papua New Guinea, *Report 1969-70*.
- Balassa, B. and Associates, 1971. *The Structure of Protection in Developing Countries*, Baltimore, Johns Hopkins University Press.
- Bank of Papua New Guinea. *Abstract of Statistics*, Port Moresby.
- . *Quarterly Economic Bulletin*, Port Moresby.
- . *Summary of Statistics*, Port Moresby.
- Barlow, C. and Peries, O.S., 1977. 'On some biases in the generation of technologies by rubber research institutes', *Journal of the Rubber Research Institute of Sri Lanka*, 54:445.
- and Jayasuriya, S.K., 1984. Bias towards the large farm subsector in agricultural research. The case of Malaysian rubber, paper presented at 28th Annual Conference of Australian Agricultural Economics Society, Sydney, 7-9 February.
- Bates, R.H., 1981. *Markets and States in Tropical Africa: The Political Basis of Agricultural Policies*, Berkeley, University of California Press.
- Bauer, P.T. and Paish, F.W., 1954. 'The reduction of fluctuations in the incomes of primary producers: further reconsidered', *Economic Journal*, 64:704-29.
- Bautista, R.M., 1987. *Production Incentives in Philippine Agriculture: Effects of Trade and Exchange Rate Policies*, Research Report 59, Washington D.C., International Food Policy Research Institute.
- (forthcoming). 'Regional survey: Asia' in *Trade and Macroeconomic Policies: Impact on Agriculture in Developing Countries*, Washington D.C., International Food Policy Research Institute, ch.9.
- Bevan, D.L., Collier, P. and Gunning, J.W., 1987. 'Consequences of a commodity boom in a controlled economy: accumulation and redistribution in Kenya, 1975-83', *World Bank Economic Review*, 1(3):489-514, May.
- Bieri, J., de Janvry, A. and Schmitz, A., 1972. 'Agricultural technology and the distribution of welfare gains', *American Journal of Agricultural Economics*, 54(5):801-8, December.
- Bird, R., 1984. *The Allocation of Taxing Powers in Papua New Guinea*, Port Moresby, Institute of National Affairs.
- Bougainville Copper Ltd, 1987. *Annual Report*, Port Moresby.
- Boyce, J.K. and Evenson, R.E., 1975. *National and International Agricultural Research and Extension Programs*, New York, Agricultural Development Council.
- Braverman, A. and Guasch, J.L., 1986. 'Rural credit markets and institutions in developing countries: lessons for policy analysis from practice and modern theory', *World Development*, 14(10 and 11):1253-67.
- Bray, M. and Smith, P. (eds), 1985. *Education and Social Stratification in Papua New Guinea*, Melbourne, Longman Cheshire.
- Bulmer, R.N.H., 1982. 'Traditional conservation practices in Papua New Guinea' in L. Morauta, J.

- Pernetta and W. Heaney (eds), *Traditional Conservation in Papua New Guinea: Implications for Today*, Monograph No.16, Port Moresby, Institute of Applied Social and Economic Research:59-78.
- Burt, O.R. and Finley, R.M., 1968. 'Statistical analysis of identities in random variables', *American Journal of Agricultural Economics*, 50:734-44.
- Carman, K., 1980. *A Study in Subsistence Agriculture*, Extension Bulletin No.12, Port Moresby, Department of Agriculture and Livestock.
- Carrad, B. and Bourke, R.M., 1985. *Farming Systems Research in Papua New Guinea*, Discussion Paper 85-1, Port Moresby, Department of Agriculture and Livestock.
- Clements, K.W. and Sjaastad, L.A., 1984. *How Protection Taxes Exporters*, Thames Essay No.39, London, Trade Policy Research Centre.
- Clifford, W., Morauta, L. and Stuart, B., 1984. *Law and Order in Papua New Guinea*, Port Moresby, Institute of National Affairs.
- Colclough, C. and Daniel, P., 1982. *Wage incomes and wage costs in Papua New Guinea: challenges for adjustment, distribution and growth*, National Planning Office, Port Moresby and Institute for Development Studies, University of Sussex, Brighton, U.K. (mimeo.).
- Collins, D., 1985. *Designing a Tax System for Papua New Guinea*, Port Moresby, Institute of National Affairs.
- Corden, W.M., 1974. *Trade Policy and Economic Welfare*, Oxford, Clarendon Press.
- , 1981. 'Exchange rate protection' in R.N. Cooper et al. (eds), *The International Monetary System Under Flexible Exchange Rates*, Cambridge, Ballinger Press.
- , 1982. 'Exchange rate policy and the resources boom', *Economic Record*, 58(160):18-31, March.
- , 1984. 'Booming sector and Dutch disease economics: survey and consolidation', *Oxford Economic Papers*, 36:359-80.
- and Findlay, R., 1975. 'Urban unemployment, inter-sectoral capital mobility and development policy', *Economica*, 43(16):59-78, February.
- Cuddington, J., 1988. 'Fiscal policy in commodity-exporting LDCs'. Background paper for the World Bank, *World Development Report 1988*, Washington D.C.
- Dahanayake, P.A.S., 1981. 'Hard currency strategy in a developing country: the case of Papua New Guinea' in P.A.S. Dahanayake (ed.), *Post-Independence Economic Development in Papua New Guinea*, Monograph 19, Port Moresby, Institute of Applied Social and Economic Research:185-206.
- Davis, J.S., Oram, P.A. and Ryan, J.G., 1987. *Assessment of Agricultural Research Priorities. An International Perspective*, Canberra, Australian Centre for International Agricultural Research.
- Denoon, D. and Snowden, C. (eds), 1981. *A Time to Plant and a Time to Uproot*, Port Moresby, Institute of Papua New Guinea Studies.
- Devarajan, S. and de Melo, J., 1987. 'Adjustment with a fixed exchange rate: Cameroon, Côte d'Ivoire, and Senegal', *World Bank Economic Review*, 1(3):447-87, May.
- Eaton, P., 1981. 'Land policies and rural development' in *Land Policy and Economic Development in Papua New Guinea*, Port Moresby, Institute of National Affairs.
- Edwards, G.W. and Freebairn, J.W., 1981. *Measuring a Country's Gains From Research: Theory and Application to Rural Research in Australia*, Canberra, Australian Government Publishing Service.
- and —, 1982. 'The social benefits from an increase in productivity in a part of an industry', *Review of Marketing and Agricultural Economics*, 50(2):193-210, August.
- and —, 1984. 'The gains from research into tradable commodities', *American Journal of Agricultural Economics*, 66(1):41-9, February.
- Evenson, R.E., 1969. The contribution of agricultural research and extension to agricultural production, Unpublished Ph.D. dissertation, University of Chicago.
- and Kisley, Y., 1975. *Agricultural Research and Productivity*, New Haven, Yale University Press.
- Feder, G. and Noronha, R., 1987. 'Land rights systems and agricultural development in sub-Saharan Africa', *World Bank Research Observer*, 1(2):143-70, July.
- , Onchan, T., Chalamwong, Y. and Hongladarom, C. (forthcoming) *Land Policies and Farm Productivity in Thailand*, Baltimore, Johns Hopkins University Press.
- Fisk, E.K., 1964. 'Planning in a primitive economy: from pure subsistence to the production of a market surplus', *Economic Record*, 40(90):156-69, June.
- Food and Agriculture Organization, 1986. *Production Yearbook*, Rome.
- , United Nations Development Program, 1983. Profile and planning study for subsistence food production, Port Moresby, Rome and New York, (mimeo.).
- Fraser, A.I., 1981. *Issues in Papua New Guinea Forest Policy*, Port Moresby, Institute of National Affairs.
- Freebairn, J.W., Davis, J.S. and Edwards, G.W., 1982. 'Distribution of research gains in multistage production systems', *American Journal of Agricultural Economics*, 64(1):39-46.
- Freidman, M., 1954. 'The reduction of fluctuations in the incomes of primary producers: a critical comment', *Economic Journal*, 64:698-703.
- Gannicott, K., 1987. *Education in Papua New Guinea, A Case Study in Wasted Resources*, Is-

- lands/Australia Working Paper, No.87/19, Canberra, National Centre for Development Studies, Australian National University.
- Garnaut, R. and Baxter, P., 1983. *Exchange Rate and Macroeconomic Policy in Independent Papua New Guinea*, Pacific Research Monograph, Canberra, Australian National University.
- and Clunies-Ross, A., 1983. *Taxation of Mineral Rents*, London, Oxford University Press.
- Giddings, R., 1981. 'Beyond the land courts: dispute settlement on land distribution' in *Land Policy and Economic Development in Papua New Guinea*, Port Moresby, Institute of National Affairs.
- Gilman, S., 1983. *The Economics and Regulation of Coastal Shipping in Papua New Guinea*, Port Moresby, Institute of National Affairs.
- Goldberger, A.S., 1970. 'Statistical analysis of identities: comment', *American Journal of Agricultural Economics*, 52(1):154-5, February.
- Goldthorpe, C.C., 1985. *Plantation Agriculture in Papua New Guinea*, Port Moresby, Institute of National Affairs.
- Gonzales-Vega, C., 1977. 'Interest rate restrictions and income distribution', *American Journal of Agricultural Economics*, 59(5):973-6, December.
- Goodman, R., Lepani, C. and Morawetz, D., 1985. *The Economy of Papua New Guinea: An Independent Review*, Canberra, National Centre for Development Studies, Australian National University.
- Grilli, E.R. and Yang, M.C., 1988. 'Primary commodity prices, manufactured goods prices, and the terms of trade of developing countries. What the long run shows', *World Bank Economic Review*, 2(1): 1-48, January.
- Guest, J., 1987a. The Cocoa, Coffee and Copra Price Stabilization Funds in Papua New Guinea's Post Independence Macroeconomic Policy Framework, Port Moresby, Bank of Papua New Guinea (mimeo.).
- 1987b. 'Problems in managing the Mineral Resources Stabilisation Fund', *CIPEC Quarterly Review*:25-35, October-December.
- 1987c. *Macroeconomic Situation: Prospects and Policy in Papua New Guinea*, Working Paper 87/8, Canberra, National Centre for Development Studies, Australian National University.
- Gupta, D. and Polume, S. (eds), 1984. *Economic Policy Issues and Options in Papua New Guinea*, Canberra, National Centre for Development Studies, Australian National University.
- Harris, G.T., 1975. *The Role of the Agricultural Extension Officer: A Study in Eight Highlands Villages*, Extension Bulletin No.9, Port Moresby, Department of Agriculture and Livestock.
- Harris, J.R. and Todaro, M.P., 1970. 'Migration, unemployment and development: a two-sector analysis', *American Economic Review*, 60(1):126-42, March.
- Hayami, Y. and Herd, R.W., 1977. 'Market price effects of technological change on income distribution in semisubsistence agriculture', *American Journal of Agricultural Economics*, 59(2):245-56, May.
- Holdsworth, D.K. and N'Drawii, C.S., 1973. 'Medicinal and poisonous plants from Manus Island', *Science in New Guinea*, 1(34):11-16.
- Houck, J.P., 1973. 'Some aspects of income stabilization for primary products', *Australian Journal of Agricultural Economics*, 17(3):200-13.
- Howe, J. and Richards, P. (eds), 1985. *Rural Roads and Poverty Alleviation*, Boulder, Westview Press.
- Huffman, W., 1974. 'Decision-making — the role of education', *American Journal of Agricultural Economics*, 56(1):87-97, February.
- Hughes, H., 1984. *Industrialization, Growth and Development in Papua New Guinea*, Port Moresby, Institute of National Affairs.
- Institute of Applied Social and Economic Research, 1979. *National Education Strategy*, Monograph No.9, Port Moresby, Institute of Applied Social and Economic Research.
- Institute of National Affairs, 1983. *Proceedings of a Public Seminar on Issues in Papua New Guinea Forest Policy*, Port Moresby, Institute of National Affairs.
- International Monetary Fund (IMF). *International Financial Statistics*, Washington D.C.
- International Service for National Agricultural Research (ISNAR), 1982. *Review of the Program and Organization for Crops Research in Papua New Guinea*, The Hague, Netherlands.
- Jamison, D.T. and Laua, L.J., 1981. *Farmer Education and Farm Efficiency*, Baltimore, Johns Hopkins University Press.
- Jarrett, F.G., 1986. *Innovation in Papua New Guinea Agriculture*, Port Moresby, Institute of National Affairs.
- and Anderson, K., 1988. An Economic Review of the Broiler Industry in Papua New Guinea. Report prepared for Niugini Table Birds Pty Ltd, Lae.
- Johnson, D.G., 1973. *World Agriculture in Disarray*, London, Fontana.
- Johnson, H.G., 1964. 'Toward a generalised capital theory approach to economic development' in *The Residual Factor in Economic Growth*, Paris, Organization for Economic Cooperation and Development.
- Judd, M.A., Boyce, J.K. and Evenson, R.E., 1986. 'Investing in agricultural supply: the determinants of agricultural research and extension investment', *Economic Development and Cultural Change*, 35(1):77-114, April.

- Keane, P.T., 1972. Aetiology and Epidemiology of Vascular-Streak Dieback of Cocoa, Unpublished Ph.D. thesis, University of Papua New Guinea.
- Kern, R.K., Geroro, W., Underwood, D. and Kemp, M., 1984. *Research-Extension Linkages in the Agricultural Information System in Papua New Guinea*, Port Moresby, Department of Agriculture and Livestock.
- Kesavan, V. and Aburu, K., 1982. 'Conservation of plant genetic resources' in L. Morauta, J. Pernetta and W. Heaney (eds), *Traditional Conservation in Papua New Guinea: Implications for Today*, Monograph 16, Port Moresby, Institute of Applied Social and Economic Research:379-84.
- Khan, M.A., 1980. 'The Harris-Todaro hypothesis and the Heckscher-Ohlin-Samuelson trade model: a synthesis', *Journal of International Economics*, 10(4):527-47.
- Kiele, J., 1987. 'Commodity price stabilisation schemes for Papua New Guinea's major crops — some macroeconomic considerations' in B. Brogan and J. Remenyi (eds), *Commodity Price Stabilisation in Papua New Guinea*, Port Moresby, Institute of National Affairs:3-11.
- Knetsch, J. and Trebilcock, M., 1981. *Land Policy and Economic Development in Papua New Guinea*, Port Moresby, Institute of National Affairs.
- Kravis, I.B., Heston, W. and Summers, R., 1983. 'The share of services in economic growth' in F.G. Adams and B.G. Hickman (eds), *Global Econometrics*, Cambridge, The MIT Press.
- Krueger, A.O., 1978. *Foreign Trade Regimes and Economic Development: Liberalisation Attempts and Consequences*, Cambridge, Ballinger for the NBER.
- , 1983. *Trade and Employment in Developing Countries*, Vol. 1 Synthesis and Conclusions, Chicago, University of Chicago Press.
- , Schiff, M. and Valdes, A., 1988. 'Measuring the impact of sector-specific and economy-wide policies on agricultural incentives in LDCs', *World Bank Economic Review*, 2(3), September:255-72.
- Lal, D. and Rajapatirana, S., 1987. 'Foreign trade regimes and economic growth in developing countries', *World Bank Research Observer*, 2(2):189-218, July.
- Lerner, A.P., 1936. 'The symmetry between import and export taxes', *Economica*, 3(11):306-13, August.
- Lim, D., 1976. 'Export instability and economic growth: a return to fundamentals', *Oxford Bulletin of Economics and Statistics*, 38(4):311-22, November.
- Lindner, R.K. and Jarrett, F.G., 1978. 'Supply shifts and the size of research benefits', *American Journal of Agricultural Economics*, 60(1):48-58, February.
- Little, I., Scitovsky, T., and Scott, M., 1970. *Industry and Trade in Some Developing Countries: A Comparative Study*, London, Oxford University Press for the Organization for Economic Cooperation and Development.
- Lloyd, P.J. (ed.), 1985. *The Economics of the Mineral Sector*, Sydney, Allen and Unwin.
- Lluch, C., Powell, A.A. and Williams, R., 1977. *Patterns in Household Demand and Savings*, London, Oxford University Press.
- Mauder, A.H., 1963. 'Extension programme development' in *Reviews, Papers and Reports of the Agricultural Extension Conference*, Melbourne, Commonwealth Scientific and Industrial Research Organization.
- McGavin, P.A., 1986. *The Labour Market in Papua New Guinea: A Survey and Analysis*, Discussion Paper No.24, Port Moresby, Institute of National Affairs, September.
- McKillip, Williamson and Associates, 1982. *DPI manpower and Training Review*, Port Moresby, Government of Papua New Guinea.
- McKinnon, R.I., 1973. *Money and Capital in Economic Development*, Washington, Brookings Institution.
- Mathews, R., 1980. *Problems of Tax Reform*, Port Moresby, Institute of National Affairs.
- Michaely, M., 1977. 'Exports and growth: an empirical investigation', *Journal of Development Economics*, 4(1):49-53, March.
- Morauta, L., 1983. The social cultural and political context in Food and Agriculture Organization/United Nations Development Program, Profile and planning study for subsistence food production, Port Moresby, Rome and New York, (mimeo.).
- , Pernetta, J. and Heaney, W. (eds), 1982. *Traditional Conservation in Papua New Guinea: Implications for Today*, Monograph 16, Port Moresby, Institute of Applied Social and Economic Research.
- Morris, A.L., 1981. 'Land related financing problems in Papua New Guinea' in *Land Policy and Economic Development in Papua New Guinea*, Port Moresby, Institute of National Affairs:13-18.
- Neary, J.P. and van Wijnbergen, S., 1985. *Natural Resources and the Macroeconomy*, Cambridge, MIT Press.
- Neild, R., 1980. *Tax Policy in Papua New Guinea*, Port Moresby, Institute of National Affairs.
- Norton, G.W. and Davis, J.S., 1981. 'Evaluating returns to agricultural research: a review', *American Journal of Agricultural Economics*, 63(4):685-99, November.
- Oi, W.Y., 1961. 'The desirability of price instability under perfect competition', *Econometrica*, 29(1):58-64, January.
- Papua New Guinea, Bureau of Statistics, 1980. *Transport and Communication Bulletin*, Port Moresby.

- , Department of Education, 1986. *Staffing and Enrolment Statistics*, Port Moresby.
- , Department of Finance, 1987, 1988. *Budget Documents*.
- , *Estimates of Revenue and Expenditure*, Port Moresby, various issues.
- , National Planning Office, 1985. *Medium Term Development Strategy — National Health Plan*, Port Moresby.
- , 1986. *National Development Plan*, Vol.1., Port Moresby.
- , National Statistical Office, 1981. *1980 Census*, Port Moresby.
- , *Abstract of Statistics*, Port Moresby, various issues.
- , *Balance of Payments Statistics*, Port Moresby, various issues.
- , *International Trade Statistics*, Port Moresby, various issues.
- , *National Accounts Statistics*, Port Moresby, various issues.
- , *Rural Industries*, Port Moresby, various issues.
- , *Summary of Statistics*, Port Moresby, various issues.
- Piggott, R.R., 1978. 'Decomposing the variance of gross revenue into demand and supply components', *Australian Journal of Agricultural Economics*, 22(3):145-57, December.
- Pinto, B., 1987. 'Nigeria during and after the oil boom: a policy comparison with Indonesia', *World Bank Economic Review*, 1(3):419-46, May.
- Pratt, M., 1980. 'Agriculture's future and the three legged stool', *Agricultural Engineering*, 51(2).
- Pray, C., 1979. 'The economics of agricultural research in Bangladesh', *Bangladesh Journal of Agricultural Economics*, 2(2):1-34, December.
- , 1983. 'Private agricultural research in Asia', *Food Policy*, 8(2):131-40, May.
- Psacharopoulos, G., 1985. 'Returns to education: a further international update and implications', *Journal of Human Resources*, 20(4):583-604, Fall.
- , 1988. 'Education and development: a review', *World Bank Research Observer* 3(1), January.
- , and Woodhall, M., 1985. *Education for Development: An Analysis of Investment Choices*, New York, Oxford University Press for the World Bank.
- Ramsey, F.P., 1927. 'A contribution to the theory of taxation', *Economic Journal*, 37:47-61.
- Richardson, J., 1986. Health and health care in Papua New Guinea: problems and solutions, paper presented at the Human Resources Development Workshop, Canberra, National Centre for Development Studies, Australian National University, 28-29 August.
- Rose-Ackerman, S. and Evenson, R.E., 1985. 'The political economy of agricultural research and extension: grants, votes and reappointment', *American Journal of Agricultural Economics*, 67(1):1-14, February.
- Ruttan, V.W., 1983. *Agricultural Research Policy*, Minneapolis, University of Minnesota Press.
- Rybaczynski, T.M., 1955. 'Factor endowments and relative commodity prices', *Economica* 22:366-41, November.
- Sapsford, D., 1985. 'The statistical debate on the net barter terms of trade between primary commodities and manufactures: a comment and some additional evidence', *Economic Journal*, 95(379):781-8, September.
- Schultz, T.W., 1961. 'Investment in human capital', *American Economic Review*, 51(1):1-17, March.
- , 1964. *Transforming Traditional Agriculture*, New Haven, Yale University Press.
- , 1971. *Investment in Human Capital*, New York, Columbia University Press.
- , 1975. 'The value of the ability to deal with disequilibria', *Journal of Economic Literature*, 13(3):827-46, September.
- , 1980. 'Nobel lecture: the economics of being poor', *Journal of Political Economy*, 88(4):639-51, August.
- Shaw, B., 1984. *Agriculture in the Papua New Guinea Economy*, Port Moresby, Institute of National Affairs.
- Skully, M.T., 1985. *Financial Institutions and Markets in Papua New Guinea*, Working Paper No.85/4, Canberra, National Centre for Development Studies, Australian National University.
- Spraos, J., 1980. 'The statistical debate on the net barter terms of trade between primary commodities and manufactures', *Economic Journal*, 90(357):107-28, March.
- Summers, R., 1985. 'Services in the international economy' in R.P. Inman (ed.), *Managing the Service Economy*, New York, Cambridge University Press.
- Thac, C.D. and Lim, D., 1984. 'Papua New Guinea's tax performance, 1969-1977', *World Development*, 12(4):451-9, April.
- Theil, H. and Clements, K.W., 1987. *Applied Demand Analysis: Results from System-wide Approaches*, Cambridge, Mass., Ballinger.
- Throsby, C.D. and Maglen, L.R., 1988. 'Australian aid for education in the Pacific', *Pacific Economic Bulletin*, 3(1):39-42, June.
- Treibelcock, M., 1982. *Public Enterprises in Papua New Guinea*, Port Moresby, Institute of National Affairs.

- United Nations. *Yearbook of International Trade Statistics*, New York.
- United Nations Conference on Trade and Development (UNCTAD), 1986. *Handbook of International Trade and Development Statistics*, Geneva.
- Valentine, T.J., 1987. *Some Critical Problems in the Papua New Guinea Financial System*, Working Paper 87/7, Canberra, National Centre for Development Studies, Australian National University.
- Vasey, D., 1981. 'Agricultural systems in Papua New Guinea' in D. Denoon and C. Snowden (eds), *A Time to Plant and a Time to Uproot*, Port Moresby, Institute of Papua New Guinea Studies.
- Walsh, J.A. and Warren, A.S., 1979. 'Selective primary health care: an interim strategy for disease control in developing countries', *New England Journal of Medicine*, 301(18):967-74.
- Warr, P.G., 1985. 'Indonesia's other Dutch disease: economic effects of the petroleum boom' in J.P. Neary and S. van Wijnbergen (eds), *Natural Resources and the Macroeconomy*, Cambridge, Mass., MIT Press: 288-320.
- Welch, F., 1970. 'Education in production', *Journal of Political Economy*, 78(1):35-59, January.
- Whalley, J., 1982. *Foreign Trade Policies in Papua New Guinea*, Port Moresby, Institute of National Affairs.
- Wood, A. and Humphreys, G.S., 1982. 'Traditional soil conservation in Papua New Guinea' in L. Morauta, J. Pernetta and W. Heaney (eds), *Traditional Conservation in Papua New Guinea: Implications for Today*, Monograph 16, Port Moresby, Institute of Applied Social and Economic Research:93-114.
- World Bank, 1981. *Agricultural Services Review*, Papua New Guinea, Washington D.C., World Bank.
- , *World Development Report 1983, 1987, 1988*, New York, Oxford University Press.

Papua New Guinea has many of the signs of a newly-independent developing economy on the move. The spectacularly successful mining ventures of the past two decades are perhaps the most obvious indicators of progress, but some developments in plantation agriculture and other sectors have also been impressive.

Yet, despite these signs of economic progress, real income per person in Papua New Guinea has not grown, food production has possibly declined on a per capita basis, and urban unemployment has become serious in recent years.

Why have living standards and job opportunities not risen more during the past decade or so? In particular, why has agriculture performed poorly? If there is a further minerals export boom in the 1990s, what policy changes would be required to ensure that the majority of the population shares more in the benefits of the next boom?

This study addresses these questions by analysing first the reasons for past economic performance and structural changes and then examining government policies affecting the vast majority of the Papua New Guinea's population, namely, those living in rural areas.

Frank G. Jarrett is Emeritus Professor of Economics at the University of Adelaide. He has worked on agricultural policy issues in numerous developing countries as well as Australia, and been an advisor to a number of national and international agencies. He is author of *Innovation in Papua New Guinea Agriculture* (1986) and was a major contributor to the Baulderstone Report to the Australian Government on *Agricultural Policy: Issues and Options for the 1980s* (1982).

Kym Anderson is the Director of the Centre for International Economic Studies at the University of Adelaide and formerly a Research Fellow in Economics at the Australian National University. He has written extensively in the areas of international and development economics, including books on *The Political Economy of Agricultural Protection* (with Yujiro Hayami, 1986) *Australian Protectionism* (with Ross Garnaut, 1987) and *Changing Comparative Advantages in China* (1989).