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Macroeconomics, Financial Variables, and Computable General Equilibrium Models

SHERMAN ROBINSON*
University of California at Berkeley

Summary. — This paper surveys "micro-macro" computable general equilibrium (CGE) models that incorporate asset markets and product and factor markets. Recent models are designed to analyze the impact on economic performance and the distribution of income in developing economies of structural adjustment and stabilization programs implemented in response to macro shocks. These financial CGE models add a loanable funds market (incorporating a variety of assets) to a CGE model that already incorporates flow equilibria in product and factor markets. These financial models start from tradefocused CGE models and also draw on earlier work with micro- and macrostructuralist models in specifying the interactions between financial variables and the real side of the economy. The paper also compares these models to dynamic macro models, both short-run adaptive models with lagged adjustment mechanisms and longer-run, forward-looking models. The paper discusses the theoretical problems such models face in reconciling micro-focused CGE models with macro models incorporating dynamic behavior.

1. INTRODUCTION

In both developed and developing countries, computable general equilibrium (CGE) models have become a standard tool of policy analysts. The two strands of work, however, have been differently motivated. Past work in developed countries, with a few exceptions, has focused on efficiency questions in neoclassical welfare analysis—what might be called triangle counting. These models, by design, have stayed close to the neoclassical paradigm.[1] What are the efficiency losses due to distortionary tax systems? What are the efficiency gains from pursuing different trade policies? In contrast, past work on developing countries has focused on structural issues.

The earliest CGE models of developing countries—the Adelman-Robinson model of South Korea and the Taylor-Lysy model of Brazil—were designed to study the impact of alternative policy choices on the extent of poverty and the distribution of income.[2] Both models contained a number of macro variables. Both endogenized the aggregate price level, and the Adelman-Robinson model included the demand for money and a model of the loanable funds market. Much of the debate about these models centered on their macro features and how their choice of macro "closure" affected the results.[3] In the late 1970s, policy concern shifted to problems of structural adjustment. How should developing countries adjust to changes in the international environment, including increases in the price of oil and declines in the availability of foreign borrowing?

The literature on CGE models of developing countries divided into two categories.[4] One strand, articulated by Taylor, developed a series of "structuralist" macro models which traced their intellectual roots to Marx, Kalecki, Kaldor, and Keynes (Taylor, 1983). Features of these macro models were incorporated into "macro-structuralist" CGE models (Taylor, 1990). A second strand of work with CGE models started at the World Bank to study issues of structural adjustment in the medium term. These models, starting from the work of Dervis, de Melo, and Robinson (1982), were based on neoclassical real trade theory. While they incorporated a number of adjustment rigidities, such as import rationing and rent seeking, they included no macro variables such as interest rates or inflation. With strong roots in Walrasian general equilibrium and real trade theory, they can be seen as "neoclassical structuralist" CGE models.

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While trade-focused, neoclassical CGE models have been widely used to study issues of structural adjustment in the medium term and structural change in the longer term, there has been a continuing awareness of their limitations. In recent years, policy concern has come full circle, focusing on the impact of macro stabilization and structural adjustment packages proposed by the International Monetary Fund (IMF) and World Bank on poverty and the distribution of income.[5] Macro issues are again of particular interest, since major transmission mechanisms by which external shocks affect the economy are through changes in macro balances and financial variables. The recent work of Bourguignon, Branson, and de Melo (1989, forthcoming) represents an effort to integrate macro models with neoclassical, trade-focused CGE models. At the same time, macrostructuralist CGE models have also evolved, and the two strands of work appear to be moving closer together. I argue below that the group of "financial" CGE models, which start from the "maquette" model developed by Bourguignon, Branson, and de Melo, share many of the structuralist features of the models developed by Taylor and his associates.

In the next section, I briefly discuss the major features of the "standard" neoclassical, trade-focused CGE model. I then discuss some of the ways this framework has been used to analyze issues of structural adjustment, incorporating macro features in ways that involve minimal strain to the Walrasian paradigm. I then discuss the limitations of this approach and consider the alternative approach of incorporating financial variables directly into the CGE model framework. At each step, there are tradeoffs between empirical relevance and theoretical consistency—tradeoffs that have haunted macroeconomic theory since Keynes. Finally, I offer some tentative conclusions about where the balance lies in CGE models and where future research might fruitfully focus.

2. A NEOCLASSICAL, TRADE-FOCUSED CGE MODEL

Figure 1 presents a stylized social accounting matrix (SAM) which depicts the major links embodied in a CGE model.[6] The SAM defines eight balanced expenditure-receipt accounts for the major economic actors in the model. The "commodity" account keeps track of absorption, which equals the value of domestic products sold on the domestic market, D, and imports, M. The "activities" account represents producers. It pays out total revenue to factors of production and government (indirect taxes) down the column and sells goods on the domestic and foreign markets along the row. The column sum plus tariffs (T_m) equals gross domestic product (GDP)

	Expenditures							
			Factors of production		Institutions			
Receipts	Commodities	Activities	Labor	Capital	Households	Government	World	Capital
Commodities		A			C	G		I
Activities	D						E	
Factors:								
Labor		Y_L						
Capital		Y_K						
Institutions:								
Households			$Y_L - T_L$	$Y_K - T_K$				
Government	T_m	T_x	T_L	T_K	T_h			
Rest of world	M							
Capital account					S_h	S_g	BOT	
Total	Absorption	Total payments	Wages	Profits	Household income	Government revenue	Total imports	Savings and investment

h = households
g = governments

D = Production sold on domestic market
M = Imports
E = Exports
A = Intermediate goods
C = Consumption
G = Government demand
I = Investment
S = Savings

D_m = Tariffs
T_x = Indirect taxes
T_L = Labor taxes
T_K = Capital taxes
T_h = Household taxes
Y_L = Wages
Y_K = Profits
BOT = Balance of trade

Figure 1. *Archetypal social accounting matrix.*

at market prices. GDP at factor cost equals $Y_L + Y_K$. Balance in the first two accounts yields the standard absorption identity: absorption $= C + I + G = \text{GDP} + M - E$. The rest of the SAM maps income flows from value added to the major actors which, in turn, complete the circular flow by demanding goods in the product market. In addition to activities (producers), the model has four actors (or "institutions"): households, government, the rest of the world, and a "capital" account which handles savings and investment.

The CGE model explicitly simulates the behavior of every actor represented in the SAM and defines equilibrium conditions, and equilibrating variables, that determine row-column balance. The first row defines the domestic commodity market, with supply provided by domestic production and imports (column 1) and demand coming from the various actors. The second row defines the activities account. The third and fourth rows define the factor markets, with firms paying out Y_L and Y_K to factors of production. The "capital" account in the last row and column summarizes the "loanable funds" market, collecting savings along the row and purchasing capital goods in the column. Elaboration of this account is the major focus of financial CGE models. Before discussing the financial part of such models, I briefly discuss the major features of the real side.

(a) *The treatment of trade*

Virtually all trade-focused CGE models developed over the past decade, whether applied to developing or developed countries, share a common core theoretical specification that represents an extension of the neoclassical trade model incorporating tradables and nontradables. The theoretical framework starts from the Salter-Swan model, which classifies sectors as either purely tradable or nontradable. The Salter-Swan model, while theoretically elegant, suffers from two empirical problems. First, the tradable sector does not distinguish between exports and imports. Second, defining as nontradables only sectors for which there are no observed exports or imports implies that, empirically, nontradables constitute a very small share of GDP. Defining the real exchange rate as the relative price of tradables and a tiny bundle of nontradables will not permit realistic adjustment possibilities in an empirical model.

With only a few exeptions, trade-focused CGE models have extended the Salter-Swan model, incorporating the Armington (1969) specification and treating imports and domestic goods with the same sectoral classification as distinct goods with a specified elasticity of substitution in demand. Most models have also extended this specification to the export side, specifying that there is an elasticity of transformation in each sector between goods supplied to the domestic market and those supplied to the export market.[7] By differentiating exports, imports, and domestically produced goods sold on the domestic market, the CGE model effectively increases the scope of the nontradable sector. All domestically produced goods sold on the domestic market are defined as "semi-tradables" relative to both exports and imports and serve the role of nontradables in the Salter-Swan model.

The assumption of product differentiation on both the import and export sides is very appealing for applied models, especially at the levels of aggregation typically used. The specification is a theoretically clean extension of the Salter-Swan model and gives rise to normally shaped offer curves.[8] The effect is to endow the domestic price system in the model with a realistic degree of autonomy, partially insulating it from changes in the world prices of exports and imports and from changes in the exchange rate or protectionist policies (tariffs, subsidies, or quotas). Many single-country CGE models make the small-country assumption, fixing the world prices of exports and imports. It is straightforward, however, to add downward-sloping world demand curves for exports, which is an option in the maquette model. The effect is to specify both upward-sloping and downward-sloping demand curves for exports in each sector.

In applications, the import aggregation and export transformation functions have typically been specified as constant elasticity of substitution (CES) and constant elasticity of transformation (CET) functions, respectively. The model has seven prices associated with each sector: the world prices of exports and imports; their domestic prices, which are linked to world prices through the exchange rate, tariffs, and subsidies; and the prices of the domestic substitute, sectoral output (the CET aggregate), and the composite good (the CES aggregate). In effect, changes in the prices of imports and exports are not completely "transmitted" to the prices of domestic goods in the same sector categories. For a single-country model, the CES and CET functions capture the reasonable notion that it is not easy to shift trade shares in either export or import markets.

In single-country models, the CES formulation for the import-aggregation function has been criticized on econometric grounds.[9] It is certainly a restrictive form. It constrains, for example, the income elasticity of demand for imports to be one in every sector. In both single-country and multi-country models, it is time to explore other formulations, while maintaining the fundamental assumption of imperfect substitutability. Other functional forms are certainly available. Hanson, Robinson, and Tokarick (1990), for example, estimate sectoral import demand functions based on the almost ideal demand system (AIDS) formulation. They find that sectoral expenditure elasticities of import demand are generally much greater than one in the United States, results consistent with estimates from macroeconometric models.

The distinction between exports, imports, and semi-tradables is important because it determines the role of the real exchange rate in achieving equilibrium. In the CGE model, the exchange rate is a well-defined relative price. The model specifies a functional relationship between the balance of trade and the real exchange rate (the relative price of tradables and semi-tradables). This relationship is one of the crucial driving mechanisms determining how external shocks and stabilization policies will affect the real side of the economy. A financial CGE model may specify other relationships between the nominal exchange rate, interest rates, inflation, and the balance of trade, through, for example, portfolio adjustments and capital movements; but the model must also incorporate the link between the real exchange rate and the balance of trade.

(b) *Factor markets, product markets, and households*

Neoclassical CGE models assume profit-maximizing behavior by producers, utility maximization by consumers, and markets which clear through flexible adjustments in wages and prices. Given the focus on income distribution, the maquette and related models disaggregate the household sector and differentiate the factor market, especially the labor market. Given that adjustment will occur through market mechanisms, the model will capture distributional effects largely by specifying a detailed mapping from the functional distribution to the household distribution. Adelman and Robinson (1989) describe this mapping as the "extended functional" distribution, specifying in detail the factors of production owned by households. It is obviously crucial to specify as much detail as possible in order to capture the chain of causation that moves from shocks and policy responses, which largely hit product markets, through changes in wages, profits, and employment, and finally to the distribution of income.

While it is important to disaggregate households and factor markets, the more critical assumptions concern the working of the factor and product markets. Assuming profit maximization, flexible prices, and functioning markets implies that the economy will always operate at full employment. While macro shocks and adjustment policies may effect economic structure and the relative distribution of income, they will have almost no effect on aggregate GDP, real income, or welfare in the short to medium run.[10] This neoclassical CGE model cannot serve as the real part of a linked micro-macro model in which there can be major responses in aggregate supply.

Robinson (1989) defines a class of "micro structuralist" CGE models that assume that various markets do not work properly. There are assumed instead to be rigid wages or prices, restrictions on factor mobility, rationing, and nonprofit-maximizing behavior by firms. If a model is to incorporate the possibility of a significant response in aggregate supply to macro or policy shocks, then it must include microstructuralist features that permit the model to achieve an equilibrium at less than full employment (and/or full capacity). All the financial CGE models, which have a short- to medium-run focus, incorporate such features. It is certainly feasible to construct a microstructuralist CGE model with a well-defined (although less well-behaved) general equilibrium solution. Such models, however, strain the neoclassical paradigm. The underlying problem is that there is as yet no widely accepted theoretical reconciliation between the neoclassical general equilibrium model, with its assumptions about price flexibility and working markets, and macro models that incorporate responses in aggregate supply without specifying the underlying micro foundation. While the justification for including microstructuralist features in financial CGE models is empirically strong, the theoretical tension should also be recognized. One should proceed with caution and diffidence, adding only such micro complications as are needed to tell the macro story and keeping a clear view of the equilibrating mechanisms at work.

In sorting out the equilibrating mechanisms at work in a financial CGE model with microstructuralist features, it is important to determine whether the model is homogeneous: that is, is the real side "neutral" to the choice of numeraire? Many microstructuralist features can be captured by specifying various fixed relative prices, retaining the neoclassical CGE model's neutrality with respect to the numeraire. If not, however, then the financial CGE model will include the aggregate price level as an important variable affecting the real side of the economy.

While care is called for in extending the neoclassical CGE model to include microstructuralist features, financial variables, and nonhomogeneity, the benefits from such an extension are potentially significant.[11] In the neoclassical model, there is a strong separation between the real and financial sides of the economy. On the other hand, any interesting macro model postulates important links between financial and real variables, at least in the short to medium run. If money is always neutral, wages and prices are always flexible, and factor and product markets always clear, then there is little for macro economists to do.

3. MACRO CLOSURE AND THE NEOCLASSICAL CGE MODEL

The literature on macro closure has followed two different approaches to bringing macro features into a CGE model. In the first approach, relationships are specified among the macro aggregates, but their justification is based on macroeconomic theory outside of the CGE model. The CGE model is then "closed" in a manner that is consistent with the macro story. In a second approach, exemplified by the maquette, the CGE model is extended to include financial variables typically found in macro models (such as money, assets, and interest rates) and to expand the notion of equilibrium to incorporate the loanable funds market, assets, and expectations. The intent is to build financial CGE models which move beyond the Walrasian paradigm and directly incorporate macro phenomena.

In the first approach, in effect, the CGE model is forced to interact with a macro model, but the two models are kept as separate as possible. At one extreme, all the macro variables are specified as exogenous to the CGE model.[12] The macro model may be complex, very simple, or not even fully spelled out. This approach has been widely used in CGE models of developing countries and in a few models of developed countries.[13]

The neoclassical CGE model portrayed in Figure 1, for example, contains the three basic macro balances: balance of trade, savings-investment, and government deficit. In this model, all after-tax income accrues to the single household, which then splits it betwen savings and consumption. Government savings (S_g) is determined residually, equaling government revenue minus government expenditure. Foreign savings (the balance of trade) is specified exogenously. The result is a savings-driven macro specification which is called "neoclassical closure." The model has no independent investment equation — aggregate investment is set equal to aggregate savings.

In addition, the neoclassical model assumes full employment, so aggregate real income is fixed. While all the macro balances are in the model, there is really no room for any interesting macro behavior. There is no possible feedback from changes in macro aggregates to GDP and little scope for variation in the macro aggregates themselves. Given the assumed savings behavior, no special equilibrating variable is required to achieve savings-investment equilibrium. The model is specified only in terms of current flows and flow-equilibrium conditions.

While the neoclassical CGE model in Figure 1 contains macro aggregates, as must any economywide model, it is best seen as a neoclassical general equilibrium model of production and exchange. The addition of government, savings-investment, and the balance of trade are done in ways that retain the notion of flow equilibria and do not strain the Walrasian paradigm. While adequate for many purposes, this model must be extended considerably to provide a framework for a financial CGE model. Simply adding macro aggregates is not enough.

There are four equilibrium concepts that form the raw material of macro models. The first is flow equilibrium in product and factor markets. This notion is at the heart of the Walrasian general equilibrium model and its neoclassical descendants. The addition of foreign trade in the manner described above adds a market for exports and imports, with the real exchange rate (the relative price of tradables and nontradables) operating as the equilibrating variable.

A second equilibrium is that of flow equilibrium in the market for loanable funds. Neoclassical closure can be seen as specifying a simple loanable funds market in which supply depends on household income, the government deficit, and (exogenous) foreign capital inflow. Aggregate investment, which represents the demand for loanable funds, is assumed to equal supply. Achieving savings-investment equilibrium is equivalent to specifying how equilibrium is achieved between the supply and demand of loanable funds.

Third, there is equilibrium in asset markets. In this approach, one goes deeper into the loanable funds market and considers the assets which are being traded in that market. Equilibrium is then defined in terms of actors achieving a desired portfolio of assets, both in size and composition. Changes in desired portfolios will affect supply and demand in the loanable funds market, which will in turn affect macro balances in the CGE model. There is obviously a close relationship between the equilibria in the asset and loanable funds markets. In the long run, they must be consistent. In the short to medium run, however, one might well specify behavior in the loanable funds market that implies partial or lagged adjustment in the asset markets. This approach is taken in the maquette and related financial CGE models.

Finally, there is a notion of intertemporal equilibrium. Various actors are assumed to change their current behavior based on their expectations about the future course the economy will take. One can define various types of dynamic equilibrium models which incorporate notions of adaptive, model-consistent, or rational expectations. In adaptive models, actors form expectations based on observations of the past. The resulting models are time-recursive, or backward-looking, and can be solved sequentially. Consistent or rational expectations models are forward-looking and must be solved for all time periods simultaneously. The maquette and related financial CGE models are all time-recursive, adaptive expectations models. The view is that when modeling responses to a shock over the short to medium run (seven years in the maquette), it is empirically unrealistic to assume that actors achieve consistent expectations.

Most of the literature on macro closure of CGE models can be viewed as providing alternative specifications of flow equilibrium in the loanable funds market. While the maquette includes assets explicitly, these financial CGE models can also be seen as incorporating a disaggregated specification of the loanable funds market. Given the very simple — even simplistic — view of intertemporal equilibrium captured by these models, it is not clear that moving beyond specifying the loanable funds market to incorporate more complex portfolio adjustment models is worth the effort. Before discussing the nature of the loanable funds markets in the financial CGE models, it is useful to set the scene by considering alternative macro closures. While the equilibrating mechanisms specified in the maquette work through the loanable funds market, they can also be seen as involving different macro closures imposed on the CGE model.

(a) *Keynesian closure*

The first step to moving beyond the simple savings-driven, neoclassical model is to add an independent investment function. Analytically, the simplest approach is to make aggregate real investment exogenous. The macro closure question is then how the economy adjusts to generate the supply of loanable funds (savings) required to finance the specified level of investment. One approach, which is a keystone in the macrostructuralist literature and an option in the maquette, is to incorporate a Keynesian multiplier mechanism into the CGE model.

Since a full-employment model cannot incorporate a Keynesian multiplier, the first step is to specify a microstructuralist feature in the CGE model — the labor market no longer clears. In one version, firms are always assumed to be on their demand curves for labor, but the supply side of the labor market is rationed through unemployment. The real wage, however, remains an endogenous variable. Instead of varying to clear the labor market, it serves to drive the multiplier process. An increase in investment generates a requirement for more savings (loanable funds) which, given that savings are specified as a function of income, requires increased aggregate real income. Given that firms are always on their demand curves for labor, the only way to increase real income is to lower the real wage, generating an increased demand for labor. The real wage falls until real income is large enough to generate the savings required to finance the additional investment.

This Keynesian closure has two important properties. First, the model retains the property of neutrality with respect to choice of numeraire. If some aggregate price index is chosen as numeraire, a common choice in CGE models, the nominal wage will adjust. If the wage were chosen as numeraire, then the price level would adjust. In both cases, the equilibrating variable is the real wage. Second, the model has the property that any increase in employment requires a decrease in the real wage. This result occurs because producers are always assumed to be on demand curves for labor.

In another version of Keynesian closure, structuralist macro models have been specified which assume not only that the labor market does not clear, but also that firms do not maximize profits and hence do not hire workers based on the real wage. Taylor (1990) argues for this variant and specifies alternative output-supply and product-pricing behavior for firms. Drawing inspiration from Kalecki (1971), Taylor (1990, pp. 15–21) argues that output prices are set by firms as a markup on variable costs. The nominal wage is assumed to be fixed, and the firm hires labor (and uses capital capacity) in fixed proportions to output. Output is determined by demand. At the markup prices, firms supply whatever is demanded. In this model, an exogenous increase in investment demand also leads to an increase in output and income through a Keynesian multiplier process, but the real wage need not decrease as employment rises, as long as capacity exceeds output.

The two versions of the Keynesian multiplier have very different implications for the distributional impact of macro shocks that change aggregate real investment. The maquette allows, as options, the specification of a fixed nominal wage and markup pricing by firms. The model also endogenously determines the price level. It can thus capture the major equilibrating mechanisms at work in both versions of Keynesian closure. Since the distributional results will be very sensitive to which version is specified, it is important that the results from particular applications of the maquette be traced back to these causal mechanisms and that the specification be defended as empirically and theoretically reasonable in particular cases.

(b) *Macro closure and the balance of trade*

The balance of trade provides another source of savings, or injection into the loanable funds market. Since all trade-focused CGE models embody a functional relationship between the balance of trade and the real exchange rate, variations in the real exhange rate will have a strong effect on the loanable funds market. It is possible to specify a macro closure which works entirely through changes in the balance of trade. Devarajan and de Melo (1987) specify such a model for franc-zone African countries. In these countries, the local currency is tied to the French franc, so they have no independent monetary authority. In addition, it is reasonable to assume that real government expenditure and aggregate real investment are fixed exogenously. Given fixed tax rates, government revenue and private savings may not suffice to finance government expenditure and real investment. For these countries, it is assumed that any shortfall is financed by foreign borrowing. In effect, the French central bank finances the sum of the twin deficits.[14]

The neoclassical CGE model can be extended to capture these assumptions. Since real investment and government expenditure are fixed, the model is "investment driven" rather than savings driven. The demand for funds in the loanable funds market is essentially set exogenously. The balance of trade is now treated as an endogenous variable, providing the necessary injection into the loanable funds market to achieve savings-investment equilibrium. The nominal exchange rate is chosen as numeraire, reflecting the fact that the exchange rate in these countries is tied to the French franc. The domestic price level will then vary to achieve a real exchange rate that generates a balance of trade that achieves macro balance. The CGE model will thus solve for a flow equilibrium that is consistent with the asssumed macro behavior. The CGE model reflects the macro rigidities, in particular the government revenue constraint.

Given the macro assumptions, this model indicates that these countries might well react in a counterintuitive way to some standard policy packages. Consider, for example, the imposition of an export subsidy. The direct effect is to encourage exports, which should improve the balance of trade. The subsidy, however, represents expenditure by the government and, without any increase in taxes, will increase the government deficit. The increased deficit is financed by foreign borrowing, which will lead to a revaluation of the real exchange rate, and so counteract the effect of the subsidy. The net effect will certainly worsen the balance of trade and may actually reduce exports. The adverse revenue effect of the subsidy can easily overwhelm the beneficial relative-price effect.

In the Devarajan-de Melo model, the macro effects are purely compositional. The model has no microstructuralist features. Factors are fully employed, product and factor markets clear, and changes in macro aggregates will have little or no affect on aggregate GDP. In addition, the model is homogeneous. The equilibrating variable is the real exchange rate, and it does not matter whether the nominal exchange rate or the aggregate price level is chosen as numeraire. The model demonstrates the importance of macro effects which work through changes in the real exchange rate and the balance of trade, even with a neoclassical model of the domestic economy.

The maquette and related financial CGE models also allow the balance of trade to be determined endogenously and so can incorporate it as an equilibrating variable to achieve savings-investment balance. While the mechanisms at work are more complex, working through interest rate changes and portfolio adjustments, the causal links are essentially the same. The real exchange rate affects the balance of trade and hence macro balance. Again, it is important to note this potential link,which works through the loanable funds market, when analyzing the results of different macro policy scenarios.

The literature on macro closure demonstrates that neoclassical CGE models which contain no assets or money can still be useful in analyzing the impact of changes in macro aggregates on the economy. The marriage is an uneasy one, however. A macro model or scenario is forced onto the CGE model, which then traces out the structural implications of the assumed macro behavior. There are no optimizing agents at work that generate the macro behavior. While the macro links can be viewed as working through the operation of the loanable funds market, there are no financial variables that intermediate the operation of that market. While it is useful to view financial CGE models from the perspective of their macro closure, they do represent an advance in that they explicitly incorporate the loanable funds market and equilibrating financial variables.

4. A CGE MODEL WITH FINANCIAL FLOWS AND ASSETS

The second approach has sought to expand the CGE model to include features of macro models. An obvious step in this direction is to introduce assets and asset markets into CGE models. There are a few examples of such CGE models of developing countries. Lewis (1985) has a stylized model of Turkey that includes money and bonds, and a segmented loanable funds market that can capture elements of financial repression. Rosenweig and Taylor (1990) present a macrostructuralist CGE model of Thailand which incorporates asset markets. Feltenstein (1984) has a model of Argentina that also includes money and bonds. Benjamin (1989), Feltenstein (1986), and Feltenstein and Morris (1988) add simple dynamics. The first two use a two-period model and the third is a three-period model with perfect foresight and provision for the post-plan period. All these models introduce an interest rate as an equilibrating variable. These models are very stylized and are really designed to explore the implications of including asset markets in empirical CGE models. Their dynamic behavior is very limited. They do not include any uncertainty, and their specification of portfolio behaviour on the part of asset holders is very simple.

The maquette financial CGE model of Bourguignon, Branson, and de Melo (1989, forthcoming) is a recent example of a growing literature that seeks to extend this strand of work to provide more operational models that can be used to analyze the impact of structural adjustment programs over the medium run. Part of the task has been to apply the models more widely, in a comparative framework. The maquette in its standard form has been applied to archetypal economies and to three countries (Morocco, Indonesia, and Côte d'Ivoire). An extended version of the financial CGE model developed by de Janvry, Fargeix, and Sadoulet has been applied to Ecuador. Related, but distinct, financial CGE models have been built for Indonesia and Malaysia.[15]

The models are designed to explore the distributional impact of alternative stabilization and structural adjustment policy packages. While closer to the applied end of the model continuum than the earlier work, these models are still quite sylized. They run for seven periods, in a dynamically recursive fashion, with exogenous expectation variables. The maquette has three labor categories and six different household types, and the model determines their income and wealth in every period. The Ecuador model has seven households and three labor categories.

The real side of the model follows the CGE model in Figure 1 in its trade specification. It also incorporates a number of microstructuralist features, some of which were discussed above. Sectoral capital is fixed within each period and only adjusts across sectors over time with the installation of new fixed investment. Firms require working capital to produce in a fixed proportion to the nominal value of production. As discussed above, in one variant, nominal wages of various labor categories are assumed to be fixed, and unemployment is assumed in the corresponding labor markets. At the other extreme, it is possible to specify flexible wages and market clearing (full employment) in all labor markets. An intermediate specification is also possible, which incorporates an explicit Phillips curve, with partial adjustment of nominal wages over time to changes in the price level. It is possible to specify markup pricing in some sectors, with non-profit-maximizing supply behavior as discussed above. It is also possible to specify a fixed or floating exchange rate. There are thus potential feedbacks from shifts in macro variables to aggregate employment, capacity utilization, and output, incorporating the various macro closure scenarios discussed above.

The extension of the maquette described in Fargeix and Sadoulet (forthcoming) includes two important additional features in the real side of the CGE model. Fargeix and Sadoulet assume that productivity growth is embodied in capital. Thus, in their model, changes in the growth rate of the capital stock have a more dramatic effect on output than in the standard maquette. They also assume that the government engages in productive investment, and hence that part of government spending goes to increase the capital stock.

(a) *Assets and the loanable funds market*

The major new feature of these financial CGE models is in their specification of the loanable funds markets, with a variety of different assets including currency, demand deposits, time deposits, government debt, domestic bonds, foreign bonds, equity, real capital, and working capital (held by firms). To illustrate how the loanable funds market works in these models, Figure 2 shows a financial SAM (or FSAM) which includes a subset of the assets. The FSAM is expressed in flow terms, indicating the changes in the assets and liabilities of the various actors during a period. The notation follows Fargeix and Sadoulet (forthcoming), and the SAM can be seen as a simplified presentation of the major financial linkages in their model.

Like all SAMs, the FSAM is square, with each column sum equal to the corresponding row sum.[16] The standard SAM of Figure 1 is collapsed into the first column and row of the FSAM, while the capital account is expanded to include the capital accounts of four actors: firms, households, the government, and the rest of the world. There are five assets (capital goods, equity, money, domestic deposits, and foreign deposits), and the last five rows and columns set out the change in the balance sheets of the four actors with respect to these assets. The columns indicate the change in assets, while the rows indicate changes in liabilities.

The savings entries in the first column (which represent flows from current accounts to capital accounts) represent the injections of savings into the loanable funds market. In contrast to the case in neoclassical CGE models, these savings entries are sensitive to changes in interest rate. The investment entry in the first row represents total investment (or the purchase of capital goods) and is also a function of the interest rate. Balance requires that aggregate savings equals aggregate investment, and the rest of the FSAM describes the transformation of these loanable funds into different types of new assets. New investment (I) is assumed to be transformed into new capital stock held by firms ($I = \Delta K$). This simple FSAM ignores depreciation, and ΔK should be seen as including inventories and working capital as well as new fixed capital. In the financial CGE models, working capital is treated separately and provides an important mechanism by which interest rate changes affect costs and output supply.[17]

		Capital accounts				Change in assets				
	Current accounts	Firms	Households	Government	Rest of World	Capital goods	Equity	Money	Domestic deposits	Foreign deposits
Current accounts	SAM					I				
Capital accounts										
Firms	S_f					$-\Delta EQ$	ΔEQ		ΔBD_f	ΔBF_f
Households	S_h									
Government	S_g							ΔCU	ΔBD_g	ΔBF_g
Rest of world	BOT									
Change in liabilities										
Capital goods		ΔK	$-\Delta EQ_h$	$-\Delta EQ_g$						
Equity			ΔEQ_h	ΔEQ_g						
Money		$-\Delta CU_f$	ΔCU_h							
Domestic deposits			ΔTD_h							
Foreign deposits			ΔF_h	ΔFF	ΔNFD					
Total	SAM + savings	Change in net worth				O	New equity	New money	New loans	New loans

Δ = Change in
g = government
h = households
f = firms

SAM = Social accounting matrix
I = Real investment
S = Savings
BOT = Balance of trade (goods + nfs)
K = Capital stock
EQ = Equity
CU = Currency

TD = Domestic time deposits
F = Foreign exchange
FF = Foreign currency reserves
NFD = Net foreign deposits
BD = Domestic borrowing
BF = Foreign borrowing

Figure 2. *Archetypal financial social accounting matrix.*

The net worth of firms is assumed to increase by ΔK, and the firms issue new equity (ΔEQ) to reflect their increased net worth. This new equity is assumed to be owned by households and government (ΔEQ_h and ΔEQ_g). The maquette ignores equity, treating only real capital as a physical asset held by households. The simple FSAM effectively specifies a similar treatment. The equity account is really a pass-through account, moving the increased value of the capital stock of firms to their owners. There is no equity market and firms do not raise funds by selling new equity. If the equity were to be sold to households, then one would simply drop the negative change-in-equity entries in the FSAM. Changes in the assets of firms consist of changes in retained earnings (S_f), equity, and domestic and foreign borrowing (deposits or bonds). Since the change in assets is required to finance new investment and currency holdings (ΔCU_f), the FSAM indicates that firms can finance investment from retained earnings plus a mix of domestic and foreign borrowing.

Households use their savings (S_h) to purchase a mix of new assets. They are assumed to demand currency, domestic deposits, and foreign deposits. They receive new equity depending on their ownership of firms. In their portfolio, these assets are assumed to be imperfect substitutes. The mix of household demand for these new assets depends on the return on real capital (the rental rate), inflation, the domestic interest rate, and the foreign interest rate (corrected for exchange rate changes). There is a standard demand-for-money equation which depends on prices, income, and the interest rate.

Ignoring official reserve accumulation (ΔFF) for the moment, the government can choose to finance it deficit (if S_g is negative) through a mix of money creation (ΔCU), domestic borrowing (ΔBD_g), and foreign borrowing (ΔBF_g). The model thus allows inflationary finance through money creation, crowding out in the loanable funds market through domestic borrowing, or foreign borrowing, which will affect the real exchange rate and the balance of trade (following the Devarajan-de Melo approach to macro closure described above).

Balance for the rest of the world requires that the balance of trade (BOT) be financed by (net) foreign borrowing and reserve decumulation: $BOT = \Delta AF_f + \Delta BF_g - \Delta F_h - \Delta FF$. The models can be specified with either a fixed nominal exchange rate, in which case ΔFF adjusts residually, or a flexible exchange rate, in which case ΔFF is fixed. Note that with a fixed nominal exchange rate, the real exchange rate is not fixed, but will depend on what happens to the aggregate price level, which in turn depends largely on government policy with respect to changes in the money supply.

(b) *Real-financial interactions*

Coupled with the earlier discussion of microstructuralist features and macro closure, we can now analyze the major transmission linkages through which macro shocks and structural adjustment policies affect the model economy. Consider first the role of monetary policy. Through the money demand equation, changes in the money supply have a strong effect on the aggregate price level. Whether there is a strong effect on the real economy depends on the extent of nonhomogeneity in the economy. In the maquette, if a fixed (or partially adjusting) nominal wage is specified, there will be a strong link to aggregate employment. The effect on income distribution will be sensitive to the assumed behavior of firms. A markup pricing specification, as discussed above, weakens the link between the real wage and the demand for labor.

With a fixed exchange rate, any increase in the price level leads to appreciation of the real exchange rate and deterioration in the balance of trade. The concomitant increase in foreign capital inflows or reserve decumulation will reverberate through the loanable funds market, forcing portfolio adjustments, changes in real investment, or changes in the mix of government financing. There will also, of course, be changes in the sectoral structure of employment and output, which will affect the distribution of income.

With a flexible exchange rate and flexible wages, the real side of the maquette should be relatively insensitive to changes in the price level. The Fargeix-Sadoulet model, however, includes two additional links between inflation and the real side of the economy. Expected inflation, which is a function of past realized inflation, enters directly into the demand for investment function and in household demand for new foreign deposits (ΔF_h). Inflation is assumed to reduce the demand for new capital formation and to increase household demand for foreign deposits (capital flight). These two effects represent additional nonhomogeneous behavior and additional channels by which financial variables affect real behavior.

In the maquette, devaluation of the exchange rate and increased wage flexibility should largely ameliorate any negative effects of inflation on the real economy. In the Fargeix-Sadoulet model, however, these additional channels significantly increase the negative impact of inflation on the real economy (for example, through reduced investment and capital flight). Given the tradeoffs, their model will tend to favor policy packages that minimize inflation. A choice between these two specifications has to rest on a judgment about their theoretical validity and empirical applicability in particular cases. In the very long run, one would expect to observe wage, price, and exchange-rate flexibility and neutrality. In the short to medium term, however, there is evidence that inflation does lead to capital flight and to investor caution. There may be some question about functional forms and parameter values, but there is certainly empirical support for the Fargeix-Sadoulet view.

Consider next the role of the interest rate. Both supply and demand for loanable funds are sensitive to the interest rate. If the model were specified without any microstructuralist features and with a fixed balance of trade, the interest rate would adjust to clear the loanable funds market, reconciling savers' thrift and the real productivity of investment. There would be no real need to specify a variety of assets. The model could be thought of as exhibiting Fisherian closure. With the addition of microstructuralist features, the model can be seen as a Keynesian IS-LM model, with changes in the interest rate affecting both real output and the structure of the macro aggregates.

With an endogenous balance of trade, the interest rate can affect capital flows, the real exchange rate, the balance of trade, and hence the structure of production and employment. The crucial issue concerns the role of asset markets in determining the exchange rate. Two questions arise. First, how sensitive to changes in the interest rate is the desired structure of enterprise debt between domestic and foreign loans? Second, how sensitive to changes in the interest rate is the desired composition of household portfolios between domestic and foreign deposits (in other words, how substitutable are domestic and foreign deposits in the household's portfolio)? If the answer to either question is "very sensitive," then the next question is: how easy is it for actors to adjust the structure of their portfolios? If the answer is "very easy," then one should probably move to an explicit stock adjustment model.

With the exception of money demand, both the maquette and the Fargeix-Sadoulet model are expressed in terms of flows (changes in assets and liabilities) rather than in terms of stocks. The underlying assumption is that adjustments in asset holdings are made at the margin. Actors either do not wish or are unable to restructure their portfolios completely every period. Such assumptions seem reasonable when dealing with developing countries, which are characterized by very thin stock markets, limited use of government financial instruments, and limited ability of most actors to transact in foreign asset markets.[18] These financial CGE models seem empirically reasonable and theoretically defensible. Viewing the interest rate and the exchange rate as largely determined by flow equilibrium in the loanable funds market is a good approach. There is probably nothing to be gained by moving to a stock adjustment model, and then hedging it with constraints, lags, and partial adjustment mechanisms.

5. DYNAMICS AND TIME

The financial CGE models all incorporate very rudimentary dynamic behavior. The maquette and the Ecuador model specify a time-recursive, adaptive dynamics that is common in earlier CGE models of developing countries, although the earlier models did not have financial variables. These models all have a 5–10 year horizon, focusing on medium-run adjustment mechanisms. They seek to track the impact of stabilization and structural adjustment policies instituted in response to external shocks. They are not seeking to solve for long-run, steady-state growth paths. The models are solved annually, not quarterly, and so also are not designed to analyze short-run business cycles.

(a) *Adjustment and lags*

The behavioral specification of the financial CGE models discussed above is consistent with their annual dynamic behavior and medium-term focus. The microstructuralist features of the underlying real CGE model and the specification of portfolio behavior in the financial markets are designed to capture adaptive adjustments to macro shocks in product, factor, and asset markets over the medium term. Their explicit annual dynamics, however, require that these models capture adjustment processes that can be ignored in comparative static models. As they incorporate features from macro models, financial CGE models will also have to deal with issues of adjustment speeds and distributed lags that have long been characteristic of macroeconometric models.

A major strength of CGE models is that they are structural models, with explicit specification of market-clearing conditions and behavioral rules for every actor. Macroeconometric models, on the other hand, virtually all include many reduced-form and distributed-lag adjustment equations. The maquette and related models are much closer to a standard CGE model in this dimension than to a macroeconometric model. With the exception of the model of Malaysia by Demery and Demery (in this issue), none of the financial CGE models contains distributed-lag equations — all adjustments involve, at most, a one-year lag. The Malaysia model is an interesting exception in that it includes more features of standard macroeconometric models than the others. For example, it includes lagged endogenous variables (and hence exponential distributed lags) in both the aggregate investment and wage equations.

The problem with including distributed-lag adjustment mechanisms is that the number of parameters increases, as does the need to estimate them econometrically. With their traditional focus on comparative statics, the parameters of CGE models have typically not been estimated econometrically. Many parameters are point estimates using base-year share data, while various production and demand parameters (usually various substitution and transformation elasticities) are either "guesstimated" or taken from partial equilibrium econometric studies. The lack of complete and consistent time-series data sets has not been a major problem, since the models have not been used to track year-to-year changes. An empirical comparative-statics structural model requires good estimates of the various structural parameters, but it does not require time-series estimates as it does not seek to model the intertemporal adjustment mechanisms. For such models, time-series data would be preferable, permitting better validation methods, but can be seen as a luxury, not a necessity.

For financial CGE models, however, some time-series estimation is a necessity. The maquette is carefully formulated to minimize the need for parameters which determine intertemporal adjustments. In this sense, it is closer to standard CGE models than to macroeconometric models. Among the applications, the Malaysia model is closest to standard macroeconometric models. The Indonesia model by Thorbecke (in this issue) occupies a middle ground. Its specification is fairly close to the maquette, but it draws on time-series data for estimation of many of the parameters. While still far from an econometric model, it represents a major advance over earlier structural adjustment CGE models. The other financial CGE models all rely largely on point estimates and "guesstimates" for most parameters, even those determining the dynamic adjustment path.

The problem with not including distributed-lag adjustment mechanisms in a financial CGE model is that its dynamic behavior can easily be erratic or even unstable.[19] The financial CGE models based on the maquette are designed to explore the impact of stabilization programs in an environment where there is only one switch of regime. Actors have no need, for example, to react to a series of "stop and go" macro policies. In this environment, the lack of multiperiod lags in adjustment behavior should not be a serious problem.[20] The relatively short number of periods modeled (usually five periods after the shock) may not, however, give the model enough time to settle onto a new stable growth path, assuming such a path exists. None of the applications reports erratic dynamic behavior, so the choice of adjustment parameters must have sufficed for stable dynamic behavior. Nonetheless, it would be worthwhile to explore the longer-run dynamic properties of these models, if only to understand the pulls on the dynamic path during the five-year adjustment period.

(b) *Equilibrium dynamics*

In developed countries, macroeconomic theory in the 1980s has moved away from a concern with short-run cycles and unemployment and has focused more on long-run dynamic models. The Lucas critique and the rise of rational-expectations models have led to the development of macro models which seek to incorporate representative agents who maximize intertemporal objective functions subject to budget constraints. Assets and asset markets, of course, are important factors. Parsell, Powell, and Wilcoxen (1989) discuss the implications of this shift in theoretical focus for those wishing to incorporate macro phenomena in CGE models. They note that these new macro models can easily be placed within the theoretical framework of dynamic CGE models extended to include assets and asset markets. Dewatripont and Michel (1987) also suggest the need for such an approach and argue that it is the appropriate theoretical way to sort out the macro closure issue in CGE models of developing countries.

From the macro side, Parsell, Powell, and Wilcoxen take two empirical macro models of Australia and demonstrate how they can be seen as dynamic CGE models.[21] With both models, they simulate the effect over 30 years of a macro shock consisting of a reduction in the share of government expenditure in GDP maintained for five years.[22] The initial shock is assumed to be unexpected, but the resumption of government spending after five years is assumed to be correctly anticipated by all agents. Both models take about 10–15 years to settle on a new, stable, long-run growth path. They differ in their short-run behavior, largely because of differences in lag structures.[23] Their long-run behavior, however, is very similar and reflects their common roots in long-run, rational-expectations models. The lag structures are much more elaborate than those in the maquette, even ignoring the assumption of model-consistent expectations.

As Parsell, Powell and Wilcoxen interpret the results, the long-run impact of a cut in government spending in the two models works almost entirely through changes in the long-run stock of domestic debt held by foreigners. While this result is captured in the two models through changes in asset markets, it can also be interpreted in terms of macro closure. In effect, these models have a long-run version of the macro closure used by Devarajan and de Melo (1987) in their model of franc-zone countries, which was discussed above. In the long run, the reduction in government interest payments to foreigners (which fall because the reduction in the government deficit over the first five years leads to lower total government debt, part of which is held by foreigners) leads to an improvement in the balance of payments. In the steady state, exports are lower and domestic consumption is higher. One could have achieved the same effect in a CGE model without assets, but which assumed that a fraction of the government deficit was borrowed abroad. The point, however, is that this closure can be derived endogenously in a dynamic CGE model that draws from modern macro theory.

Currently, there are no long-run dynamic CGE models of developing countries along the lines suggested by Parsell, Powell, and Wilcoxen. Feltenstein and Morris (1988) have forward-looking consumers who maximize intertemporal utility functions which include expectations of future exchange rates. They state that their model incorporates perfect foresight, so it is presumbably solved so that consumers correctly forecast future exchange rates for the three periods within the plan horizon.[24] Desired private investment is also a function of expected future returns to capital and interest rates, which are also presumably solved to be dynamically model consistent.[25] Goulder and Eichengreen (1989, forthcoming) have developed a stylized long-run dynamic CGE model of the US economy which can be viewed as being in this tradition. The Goulder-Eichengreen model is quite small, but is run for many periods and does solve for steady-state growth paths. To date, they have used it to analyze the long-run impact of trade liberalization on the US economy. Given the very stylized nature of the model, it is hard to see it generating any serious policy conclusions. At this point, work with such models can, at best, indicate the empirical importance of various theoretical specifications.

While suggestive, these long-run macro models are of limited use in developing countries. Much of the current work with CGE models of developing countries is concerned with issues of short-run stabilization and structural adjustment. Long-run models which assume full employment and embody steady-state equilibria with rational (or model-consistent) expectations will miss most of the action. It should prove valuable, however, to be able to use CGE models as a laboratory for testing the empirical implications of new theoretical models. For this purpose, stylized numerical models may well prove useful in determining which theoretical effects are, in fact, empirically important and worth pursuing. They may well provide insights that assist in specifying forward-looking expectations in financial CGE models such as the maquette.

6. CONCLUSION

The last five years have seen important advances in the development of "macro-miro" CGE models. In particular, the maquette financial CGE model developed by Bourguignon, Branson, and de Melo, and the extension of that model by Fargeix and Sadoulet, represent significant advances in the modeling of the impact of macro shocks and structural adjustment policies on economic performance and the distribution of income. Theoretically, they represent an incremental step in moving from a neoclassical CGE model toward a macro model. They add a sophisticated specification of the loanable funds market to a CGE model which already incorporates flow equilibria in product and factor markets. They provide a richer model of the determination of aggregate investment and the balance of trade than do earlier CGE models used to analyze issues of structural adjustment.

The financial CGE models also draw heavily on earlier work with macro- and micro-structuralist models — especially the work of Taylor and his associates — in specifying the interactions between financial variables and the real side of the economy. Much has been learned from the literature on macro closure of CGE models. A great deal of interesting macroeconomic behavior can be captured in a model with no money or assets. Viewing the financial CGE models from a macro closure perspective helps clarify some of the major links between the real and financial sides of the models. The theoretical tension between the neoclassical paradigm and structuralist models is clearly evident, and some of the specifications (such as markup pricing models) are still controversial. While these financial CGE models represent progress, we are still far from a theoretical reconciliation between Walras and Keynes, and empirical models cannot help but reflect the theoretical gap.

The financial CGE models have a very limited specification of dynamic behavior and intertemporal equilibrium. While they introduce assets and loanable funds markets, they do not capture the sorts of expectations and dynamic consistency characteristic, say, of rational-expectations models. Their treatment is defensible given their focus on short- to medium-term adjustment to macro shocks, but there is also clearly a need to explore the empirical properties of multisector models that incorporate some of the features of long-run, dynamic equilibrium models. Preliminary work with stylized empirical models in this area is suggestive, but still far from providing any policy results.

Finally, the move to financial CGE models with explicit adaptive dynamic behavior increases the pressure on modelers to provide time-series econometric estimates of the many parameters determining the model's dynamic behavior. Of the current group of applications, the models of Indonesia and Malaysia pay the most attention to estimating parameters econometrically. The other applications all rely on more informal estimation methods. While these models make a serious attempt to capture the salient features of the particular countries, they take their place toward the stylized end of a continuum that starts with large applied models. They provide an interesting set of comparative policy laboratories, and the results provide insights about the effect of different policy choices on the distribution of income. While they inform the policy debate, one should be diffident about using the current models to give explicit policy advice to countries.

NOTES

1. For a survey of CGE models focusing on international trade and tax policies in developed countries, see Shoven and Whalley (1984).

2. Adelman and Robinson (1978) and Taylor *et al.* (1980).

3. See Taylor and Lysy (1979) and Adelman and Robinson (1988) for discussions of the macro properties of the two models. The term macro "closure" was coined by Sen (1963) and applied to CGE models by Taylor and Lysy.

4. For a survey of work on CGE models of developing countries, see Robinson (1989).

5. See Scobie (1989) for a review of recent work on this issue.

6. Pyatt and Round (1985) provide a good introduction to SAMs and a number of examples of their uses.

7. The maquette allows as an option the specification of perfect transformability between exports and domestic goods sold on the domestic market. In this case, the domestic-currency price of exports equals the price of the domestically produced goods sold on the domestic market. Coupled with an assumption of downward-sloping world demand curves for exports, the result is to increase the possibility of large, and unrealistic, international terms of trade effects arising from policy and macro shocks. See de Melo and Robinson (1989), who argue for the symmetric treatment of exports and imports as goods differentiated from domestic goods.

8. The theoretical properties of this model specification have been analyzed in detail by de Melo and Robinson (1989) and Devarajan, Lewis, and Robinson (1990, 1991). More recently, empirical CGE models have been developed which include product differentiation, imperfect competition, and scale economies. Devarajan and Rodrik (1989) and de Melo (1988) survey such models applied to developing countries.

9. See, for example, Alston *et al.* (1990).

10. In the long run, there can be some moderate effect through changes in the investment rate and hence the rate of growth of the capital stock.

11. Even with theoretical caveats, using a microstructuralist CGE model is a vast improvement over the treatment of the supply side in many macro models designed to look at issues of structural adjustment. Compare, for example, the simplistic treatment of the supply side in Khan and Knight (1981).

12. Or almost all. The CGE model still must satisfy Walras's Law and the various equilibrium conditions are not all independent. For an example of a CGE model which draws on a separate macro model to determine the macro-aggregates, see Hanson, Robinson, and Tokarick (1990). See also Robinson and

Roland-Holst (1988), who discuss macro multipliers in CGE models.

13. See Powell (1981), who describes how the Orani model of Australia was linked to a separate small macro model. Robinson and Tyson (1984) formally describe the notion of linking macro and CGE models and relate the idea to the literature on macro closure. Demery and Demery (this issue) follow this approach, linking an econometric macro model with a real CGE model of Malaysia. The development literature on macro closure is surveyed by Robinson (1989), Rattso (1982), and Taylor (1990).

14. Such a view may seem extreme. Consider, however, recent US history. While the macro story is more complex, the effect may well be the same. In effect, the United States has financed the federal deficit by foreign borrowing, with the Japanese playing the role of the French central bank. Similar stories might be told for other countries which borrow abroad to cover the government deficit.

15. The maquette is described by Bourguignon, de Melo, and Suwa in this issue. In addition to the application articles in this issue, see Thorbecke *et al.* (1990) (Indonesia); Roland-Holst (1990) (Indonesia, maquette); Bourguignon, Morrison, and Suwa (1990) (Morocco, maquette); Fargeix and Sadoulet (forthcoming) (Equador). My discussion below includes both the maquette and the extended version described in Fargeix and Sadoulet (forthcoming).

16. Taylor (1990) displays a distressing ten dency to present rectangular matrices which he describes as SAMs. One might as easily define a probability function whose integral differed from one!

17. This mechanism was included in early structuralist CGE models (Taylor, 1990).

18. The possibility of capital flight is included in the maquette and is probably better modeled in terms of stock adjustment. Fargeix and Sadoulet (forthcoming) specify an explicit model of capital flight, depending partly on inflation.

19. A single first-order linear difference equation cannot generate cycles, but these models represent systems of nonlinear first-order difference equations, which can generate cycles. In particular, the combination of markup pricing, a Phillips curve, and investment financing depending on lags might generate some interesting dynamic behavior.

20. In the maquette, for example, inflationary expectations are assumed fixed for the entire adjustment period, with no adaptive adjustment. Such a specification probably smooths the dynamic behavior and is defensible when considering only a single regime shift.

21. The two models are described in Murphy (1988) and McKibbin and Sachs (1991).

22. They solve the two models using CGE solution software developed for the Orani model.

23. As Parsell, Powell, and Wilcoxen (1989) note, these lag structures involve a number of essentially *ad hoc* specifications, similar to standard econometric models which estimate reduced-form lag structures.

24. The dynamic behavior thus exhibits "model consistent" expectations.

25. They also include an infinite-horizon, postplan period for which investors assume a constant, exogenous real rate of return on capital.

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