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Macro Models and Poverty Analysis: Theoretical Tensions and Empirical Practice

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This article reviews economy-wide, multisectoral models and the issues involved when using them to analyse macro-poverty linkages in developing countries. It explores the theoretical underpinnings for simple SAM multiplier models, real-economy CGE models, and real-financial CGE models. The latter represent an 'eclectic' approach, which strives to build models that integrate elements from CGE and macro-financial models, the alternative, more applied, 'ecumenical' approach being to keep these models separate but specify ways through which they can communicate. Due to limited knowledge about the data and processes, the ability of analysts to address short-run distributional issues is limited; we therefore expect most progress in the analysis of medium- and long-run issues, using both eclectic and ecumenical approaches.

1 Introduction

Macro issues are an important component of development strategies aimed at promoting growth, poverty reduction and other socio-economic objectives. They are also central when developing countries adjust to shocks such as droughts and drastic changes in oil prices. In policy analysis of issues with a macro dimension, it is necessary to draw on analytical frameworks that, on their own or collectively, capture how macro balances are affected by shocks and policies, and how the repercussions are transmitted to households, most importantly via factor employment and incomes.

Since the late 1970s, real computable general equilibrium (CGE) models have provided the dominant framework for economy-wide, multisectoral models.[1] They provide an attractive and natural framework for macro-poverty analysis, given their ability to link the macro and micro levels and account for how incomes and consumption of different household groups are affected by economic shocks and policy changes. For these and other types of economy-wide models, a social accounting matrix (SAM) can be seen as providing both the database and a logical framework. Other types of economy-wide multisectoral models include simple SAM multiplier models and, more recently, a growing number of CGE models that have been extended to

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1. Monographs giving a comprehensive treatment of CGE models include Dervis et al. (1982), Shoven and Whalley (1992), Dixon et al. (1992), and Ginsburg and Keyzer (1997). As of the early 1990s, Bandara (1991) provides a relatively comprehensive review of CGE models applied to developing countries, a substantial part of which is concerned with macro issues. Since the early 1990s, the number of applications has grown drastically.

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incorporate financial aspects. At the macro level, these CGE models differ considerably in size, time horizon, and the nature of the macro equilibria that they incorporate. At the meso and micro levels, they vary in terms of the approaches they use to generate information about poverty and inequality.[2] Sometimes they have been used in conjunction with complementary frameworks at the macro and micro levels. As a result of these differences across CGE models, these models also differ widely in terms of the kinds of policy issues that they can address – their 'domains of applicability'.[3]

The purpose of this article is to review basic features of economy-wide, multisectoral models and clarify the issues involved when choosing and designing models to address macro-poverty linkages in developing countries.[4] In Section 2, we discuss the role of SAMs in economy-wide modelling, their links to national accounts, their treatment of macro balances, and the properties of SAM multiplier models. Given the close link between SAMs and economy-wide models, relatively simple SAM multiplier models are confronted with the same set of macro issues as more elaborate models, in particular the question of how to specify the macro closure rules (for the government, savings-investment, and rest-of-the-world balances). In Section 3, we turn to the classic CGE model, which is limited to the real economy, focusing on the theoretical underpinnings of this model and its treatment of factor markets and macro balances. Section 4 considers extensions of the real CGE model to incorporate financial assets and related variables. We also provide a broader discussion of alternative approaches to the analysis of macro-poverty linkages. Section 5 provides a summary and concluding remarks.

2 SAMs and multiplier models[5]

A SAM is an extension of the input-output accounts that traces out the circular income flow including production activities, commodities, factors, domestic institutions – households, enterprises and government – and the rest of the world. The SAM framework provides the statistical underpinnings for multi-sector, multi-factor CGE models, much as the national accounts provide the data framework for macroeconometric models. Since a SAM includes all economic flows – indeed, provides the organising framework for the system of national accounts – and is organised around the accounts of all economic 'actors' in the economy, the aggregate national accounts and macro models based on them are necessarily also embodied in the SAM framework. The converse is also true: any SAM-based model must, of necessity, incorporate macro aggregates and, implicitly or explicitly, incorporate relationships among them. This implies that, in spite of their theoretical grounding in Walrasian

2. The term 'meso' (intermediate or middle) refers to the level between macro and micro at which the typical CGE model disaggregates the economy into activities, commodities, factors, and institutions, in which the number of elements are more than one but fewer than the full number of agents in the economy or observations in surveys.
3. For recent monographs surveying the macroeconomics of developing countries, including macro accounting systems, see Agénor (2004) and Rao and Nallari (2001).
4. This article is focused on the macro aspects of macro-poverty linkages. Lofgren et al. (2003) and Savard (in this volume) address different approaches to linking 'meso' results of economy-wide models to the household micro level.
5. For a major survey of issues related to SAMs, see Pyatt and Round (1985).

general equilibrium theory, CGE models invariably incorporate macro aggregates and macro issues.

A long-standing theoretical tension exists between Walrasian models, with their usual assumptions of price-clearing product and factor markets, and macro models with unemployment and very different notions of equilibrium.[6] The literature on CGE models is replete with debates about the macro properties of these models, and a number of different schools of thought have emerged concerning how one should incorporate macro features into these SAM-based models. No clear consensus has emerged, which is hardly surprising since the debate really concerns the theoretical divide between Walras and Keynes, and the micro foundations of macro models (or the lack thereof).

Table 1 presents a simple SAM, referred to as a macro SAM since it includes only macro aggregates and excludes intermediate inputs. Like all other SAMs, it is square, entries represent payments from column accounts to row accounts, and the corresponding row and column sums must balance since they represent the double-entry, receipt-expenditure accounts of the various economic actors. In the macro SAM, the row and column balances represent various macro balances in the national income and product accounts. Table 2 spells them out.

The SAM is a compact way to present the national accounts. Gross domestic product (GDP) at market prices (equation 1, Table 2) equals the value of production (GDP at factor cost) plus indirect taxes (T^X). The 'commodity' account represents the total supply and demand for commodities in the economy, including foreign trade. In the commodity account, it is possible to identify 'absorption' – the total supply of commodities for use in the economy and its sum (equations 2 and 3 in Table 2) – which provides a measure of aggregate welfare. As an 'actor' in the economy, the commodity account can be seen as a department store that buys domestically produced goods and imports (down the column in Table 1) and then sells them to other actors, including the rest of the world (across the row in Table 1). The 'rest of the world' is included as a separate actor, selling imports (M), buying exports (E), and saving the difference (referred to as foreign savings, S^F).

The SAM incorporates three macro balances, for the government, the rest of the world, and savings-investments. The macro balances are expressed as flows – the core SAM does not include asset accounts – and any macro relationship in this framework will be in flow terms.[7] In particular, the savings-investment (S-I) balance may be seen as representing the 'loanable funds' market. The account (and the related balance) collects savings from domestic and foreign institutions and spends these on capital goods (investment).

The SAM provides no information about who owns the capital goods that are being produced or in which sectors they are installed: investment demand in the SAM is by sector of origin, not sector of destination. While much of macro theory is concerned with these assets and their markets, SAM-based models need only incorporate the implications of assets for current flows across the different accounts. The literature

6. In a real CGE model, the equilibrium notions are limited to the markets for factors, commodities and loanable, funds whereas, in the macro literature, the equilibrium notions are extended to asset markets and expectations (Robinson, 1991: 1513). Also see Malinvaud (1977).
7. The SAM framework can be, and has been, extended to include asset and capital accounts. Taylor (2004) provides a textbook treatment of such 'financial' SAMs and discusses how they can be used in macro models.

includes a division between models focused on flow equilibria and those focused on equilibria in asset markets. Much of the SAM-based modelling literature has exploited a potential division of labour between modellers working with flows and those working with assets. But the division is somewhat artificial – flow and asset market equilibria are obviously linked – and there are theoretical tensions between the two approaches.

Table 1: Stylised macro SAM

	Activities	Commodities	Factors	Households	Government	S-I	RoW
Activities		D + E					
Commodities				C	G	I	E
Factors	GDP_{fc}						
Households			GDP_{fc}				
Government	T^X			T^H			
S-I				S^H	S^G		S^F
RoW		M					

Notes: C = consumption; D = production sold domestically; E = exports; G = government demand; GDP_{fc} = gross domestic product at factor cost = production = factor payments to household; I = investment demand; M = imports; RoW = rest-of-the-world account: S^F = foreign savings; S^G = government savings; S^H = household savings; S-I = savings and investment; T^H = direct taxes on households; T^X = indirect taxes.

Table 2: Balances in the macro SAM

1. $GDP_{mp} = GDP_{fc} + T^X = D + E$
2. $D + M = C + G + I$
3. $GDP_{mp} + (M - E) = C + G + I$
4. $GDP_{fc} = C + T^H + S^H$
5. $T^X + T^H = G + S^G$
6. $I = S^H + S^G + S^F$
7. $M = E + S^F$

Open-economy SAM-based models must 'explain' how balance is achieved in the three macro accounts. The SAM represents a closed, balanced system – all economic transactions are included – and models in this framework will incorporate Walras' Law in some form.[8] They need (indeed, only can) explain one less than the total number of accounts in the SAM. The task facing modellers, then, does not seem very difficult. A model that may include many sectors and factors, and is based on an elegant body of general equilibrium theory, must incorporate and determine two out of the three macro balances. Yet, how to achieve this apparently simple task has engendered a large and contentious literature.

8. In the SAM context, Walras' Law implies that the total value of all account receipts must equal the total value of all account outlays. If all accounts but one are known to be in balance, then the remaining account must also be in balance.

SAM multiplier models, pioneered by Richard Stone,[9] are typically based on SAMs that, compared with the SAM in Table 1, have been extended to have intermediate inputs and multiple accounts for activities, commodities, factors, and households. These models describe the behaviour of the different actors and their interactions across markets. The models assume that each actor whose account is given in the SAM behaves according to fixed (column) coefficients. For example, producers ('activities') demand inputs in fixed input-output coefficients, commodities are made up of domestically produced and imported goods in fixed proportions, factor income is distributed to households in fixed proportions, households consume and save in fixed shares of total income, and so forth across the SAM. In the context of these models, which assume that prices are exogenous, the column coefficients are real input-output coefficients (whenever there is a real commodity or factor counterpart to the payment, assuming that commodity prices and factor rents are normalised to unity) or expenditure shares (in the absence of real counterparts, as is the case for transfers between institutions).

In the SAM multiplier model, equilibrium is defined as row-column (or supply-demand) balance in all SAM accounts. In a setting where the prices paid or received by different accounts are uniform, row-column payment balance also represents real supply-demand balance. But not all the accounts can be included in the behavioural model; the model is overdetermined unless a subset of accounts is exogenous. The selection of exogenous accounts, typically some combination of the government, savings-investment, and rest-of-the-world accounts, determines the macro 'closure' of the model. In the resulting model, endogenous accounts are a linear function of the values of the exogenous accounts.

Comparative static analysis with SAM multiplier models involves changing in exogenous demands (column entries) and solving for the resulting changes in supplies and demands that balance all endogenous accounts. The term 'multiplier' is used because the changes in commodity accounts are generally larger than the exogenous shock. Given the SAM structure, it must also be true that the solution balances the sum of all the exogenous accounts. The imbalances of these exogenous accounts can be computed from the various SAM coefficients, but their separate balance must be achieved through some unspecified mechanism outside the endogenous part of the multiplier model. The model has no supply constraints: at fixed prices, all activities are assumed to be able to produce as much as is needed to meet the changed demand. Factor demands can be computed from the input-output factor coefficients, but output supply is not constrained by any limits on factor availability.

The richness of SAM multiplier analysis comes from its ability to trace out chains of linkages from changes in demand to changes in production, factor incomes, household incomes, and final demands. The analysis of growth linkages in developing countries has drawn on the related literature on the decomposition of these multiplier chains.[10] They have also been used to analyse distributional and poverty issues, since

9. For the major works by Richard Stone, see, for example, http://cepa.newschool.edu/het/profiles/stone.htm.
10. See Defourny and Thorbecke (1984) on the path decomposition of SAM multipliers. See also Pyatt and Roe (1977), Chapter 4, and Robinson and Roland-Holst (1988), who decompose total multipliers into direct and indirect components.

they explicitly trace out the impact of a macro shock in the exogenous accounts through to household incomes (see for example Thorbecke, 1991; and Round, 2003).

While the motivation for this work was not to analyse macro equilibrium, SAM multiplier models look very much like the simple Keynesian model where unemployment is assumed and output is determined by demand. SAM multiplier models will generate a demand multiplier equal to one over one minus the marginal propensity to consume – the Keynesian demand multiplier. A change in exogenous demand by the investment account will yield a multiplied, induced increase in income necessary to generate the increased savings to 'finance' the additional investment. The model is very simple: it does not have any supply constraints, price adjustments or explicit treatment of time or dynamics. This simplicity is also the source of its weaknesses: in particular, it is hard to think of any real-world economy without supply constraints. A key feature of CGE models, to which we turn next, is that they add the supply side and endogenise commodity and factor prices.

3 The classic CGE model, macro balances and closure rules

A classic CGE model is Walrasian in spirit, incorporating all the flows in the SAM, including production, distribution and demand, and determining equilibrium wages and prices by simulating the operation of all markets. Its key actors are producers and households. Producers maximise profits subject to available technology, output prices, and factor wages, whereas households maximise utility subject to income constraints determined by market prices and factor endowments. The model is an empirical special case of the neoclassical Arrow-Debreu general equilibrium model (Arrow and Debreu, 1954).

The supply and demand equations in the model are all homogeneous of degree zero in prices – double all prices and equilibrium production and demand does not change. In macro terminology, the model displays neutrality of money (a doubling of the money supply will double all prices without any changes in simulated real, price-deflated, quantities in production, consumption or trade). The model can only determine relative prices, making it necessary to choose some price or price index to define a numéraire that anchors the absolute price level. Alternatively, it is possible to introduce some mechanism that endogenously determines the absolute level of prices, such as a simple transactions demand for money plus a fixed (policy-determined) money supply, but this would not affect any relative prices or any real magnitudes.

For factors (for example, labour and capital), classic CGE models typically specify fixed supplies (at observed employment levels) and assume that markets 'clear' in that wages (or rental rates) adjust to achieve supply-demand equilibrium, i.e. aggregate employment is at the exogenous supply level. Other treatments are possible, including explicit modelling of labour-leisure decisions, endogenising the labour supply. If so, it is necessary to address whether there is full employment (i.e., no involuntary unemployment) and, if employment is less than full, to introduce additional mechanisms that bring about unemployment. Factor markets are also often segmented, limiting the mobility of factors across different production activities.[11] Without losing the feature of

11. For alternative treatments of labour markets in CGE models, see Roland-Holst and Maechler (1997) and Annabi (2003).

money neutrality, CGE models can incorporate structuralist features that deviate from the neoclassical model. At the micro level, such features typically operate via fixed relationships between nominal values (for example, wages in different production activities or wages relative to some price index), making it possible to replicate real-world phenomena such as unemployment and wage differentials across different production activities.

Like other open, economy-wide models, real CGE models inevitably include the three standard macro balances. Each combination of assumptions regarding how they are equilibrated effectively imposes a macro story on the CGE model. Specifying the macro closures of the CGE model is an essential part of the process of adapting a real CGE model for macro analysis. It is crucial to understand the implications of the different specifications for model behaviour, both when the real CGE model is used to generate macro results on its own and when it is used, formally or informally, in conjunction with a second model that enriches its treatment of assets and the macroeconomy. In the rest of this section, we discuss alternative treatments of these balances and how they are related to issues raised in macro theory.[12]

3.1 Foreign trade and the current account balance

Extending the classic Walrasian CGE model to incorporate foreign trade was a major part of the work programme in the development of CGE models. Various approaches were tried, but there is now a broad consensus on the general outline of an open-economy, 'trade-focused' CGE model. Such a model incorporates imperfect substitutability between domestically produced and imported goods, drawing on early work on specifying import demand functions by Armington (1969). The Armington insight was extended to the treatment of exports. Today, most open-economy CGE models allocate domestic demand across imports and domestic output on the basis of constant elasticity of substitution (CES) functions, and domestic output across exports and domestic supply using sectoral constant elasticity of transformation (CET) functions. By introducing degrees of substitutability and transformability, the model is a theoretically consistent generalisation of the standard Salter-Swan model, which assumes a rigid dichotomy between tradeable and non-tradeable commodities.[13]

While exports and imports can be accommodated in the real CGE model, the introduction of a new actor, the 'rest of the world,' raises the macro issue of how to handle imbalances in its current account, which records foreign-exchange inflows and outflows due to foreign trade, factor payments, interest payments, and institutional transfers (including migrant remittances). Among these, exports and imports are endogenous, whereas the other items tend to be fixed (in foreign currency). In stylised theoretical models, where non-trade flows are omitted, the current account and trade balances are identical. Trade theory usually evades the problem of current account (or trade) imbalances by assuming that they are zero. However, applied models must

12. For discussions of macro closure, see Sen (1963); Taylor (1990, 2004); Rattso (1982); Dewatripont and Michel (1987); Adelman and Robinson (1988); Robinson (1991) and Lofgren et al. (2002).
13. For the theoretical properties of the open-economy, 'trade-focused' CGE model, see de Melo and Robinson (1989); Devarajan et al. (1990, 1993); de Melo and Tarr (1992) and Thierfelder and Robinson (2003).

address the fact that, in actual data, this is not the case. The simplest solution, widely practised, is to assume that the current account balance is exogenous and the resulting flow of funds is given to (or taken from) the savings-investment account, as is the case in the SAM in Table 1. In macro theory (and in the real world), the current account balance is related to the operation of asset markets. Treating it as exogenous means that, for some reason outside the theoretical framework of the CGE model, which is limited to a flow equilibrium notion, the budget constraint of at least one actor includes an exogenous net asset change.[14]

A related issue that has to be addressed is how the account of the rest of the world is brought into balance, or equilibrated. As in the Salter-Swan model, open-economy CGE models include a new equilibrating variable, the real exchange rate, which is the relative price of traded and non-traded goods.[15] In the context of the CGE model, the exchange rate influences trade in commodities. It is not a financial variable, influencing trade in financial assets. The model includes an implicit functional relationship between foreign savings and the real exchange rate. For example, increasing foreign savings always yields an appreciation of the real exchange rate; the price of non-traded goods rises relative to the price of traded goods (exports and imports). Exports fall as producers shift production towards domestic markets and imports rise as consumers shift demand in favour of imports, bringing the current account balance into equilibrium at the new exogenous higher level of foreign savings.

3.2 Savings-investment balance

For the savings-investment (S-I) account, a simple mechanism for ensuring balance is to specify fixed savings rates for households and scale investment demand so that investment spending equals the value of savings. This is referred to as a savings-driven 'neoclassical' S-I closure. In the alternative 'Johansen' closure, investment demand is fixed while savings rates are adjusted endogenously.[16]

As with the introduction of the current account balance, these treatments are theoretically coherent within the flow-equilibrium specification of the CGE model. They still leave unexplained why households choose to save at fixed rates, why they save at all (if the model is static, more savings and investment reduce the resources available for consumption), and how they allocate their savings across different assets (including capital). From a pragmatic perspective, this may be acceptable, although not theoretically elegant. Moreover, adjustments in the model make it possible to address some of these issues in what may be a more satisfactory manner while staying within the flow structure of the real CGE model. For example, it is possible to make savings rates flexible in a manner that captures observed empirical regularities by including savings as an argument in utility functions (often done using utility functions associated

14. Similarly, the theoretical framework of the CGE model does not explain the values for the non-trade items on the current account, which typically also are fixed.
15. Alternative equilibrating mechanisms are possible, including the reversed assumption that foreign savings are flexible and the real exchange rate fixed. However, these treatments raise the same set of macro issues.
16. A closure of this type was used in the first CGE model, developed by Leif Johansen in the second half of the 1950s (see Johansen, 1974).

with the Extended Linear Expenditure System [ELES]) or by expressing savings rates as functions of per capita incomes or profit rates.[17]

3.3 Government balance

In most CGE models, the government mimics real world governments, collecting taxes, making and receiving transfer payments, and purchasing goods and services. Given that it is hard to see the government as being a utility-maximising actor, it is typically assumed to follow specified rules of behaviour.[18] Among the different alternatives, a common specification is that government expenditure, both consumption and transfers, is fixed in real terms; government revenue is determined by fixed tax rates; and government savings (the current surplus of the government) is determined residually as the gap between revenue and expenditure. Again, this rule-based treatment raises a number of macro questions. The model treats the government deficit or surplus as coming from or being fed into the loanable funds market without considering the specific mechanism through which this is achieved (for example, by printing money or by selling government bonds). The further repercussions of these changes in government savings depend on the rules imposed for the savings-investment and current account balances. Under an alternative closure rule, government savings may be fixed at some level that is achieved via endogenous adjustment of tax rates, in effect transferring any shock affecting the government budget to taxpayers.

3.4 Appropriate closure rules

Each of the three macro balances involves the introduction of a new flow equilibrium condition for which a closure rule needs to be specified, whereby closure rules are not necessarily independent of each other (as our discussion of the government balance above has shown). The appropriate choice between the different macro closures in the classic CGE model depends on the context of the analysis – the proposed domain of applicability for the model. If the model is for a single period and the purpose is to explore the equilibrium welfare changes of alternative policies, the preferred alternative may be a variant of the above-mentioned 'Johansen' closure that combines fixed foreign savings, fixed real investment, and fixed real government spending. Such a closure avoids the misleading welfare effects that appear when foreign savings and real investment change in single-period simulations; *ceteris paribus*, for the simulated period, increases in foreign savings and decreases in investment raise household welfare (and vice versa for decreases in foreign savings and increases in investment). This result is misleading since the analysis does not capture welfare losses in later periods that arise from a larger foreign debt and a smaller capital stock. With regard to government consumption, the classic model does not capture its direct and indirect welfare contributions; to avoid misleading results, it is also preferable in welfare analysis to keep it fixed in real terms.

17. For the ELES, see Bloningen et al. (1997).
18. There are exceptions in the public finance literature where government is treated as analogous to a household, with its own utility function. See Shoven and Whalley (1992).

On the other hand, both the neoclassical and Johansen closures seem extreme when looking at the historical experience of countries adjusting to macro shocks. If the analysis aims at capturing the likely effects of an exogenous shock or policy change in a given setting in order to explore the role for complementary policies, it is generally preferable to impose a closure that more closely mimics the real world, allowing the adjustment to macro shocks to be spread more evenly across the different components of consumption and investment (instead of letting either investment or private consumption absorb the shock, as was the case under the examples presented so far).[19]

The closures discussed so far all assume that there is no link between macro variables and aggregate employment. If fixed employment is assumed in the factor markets, the results of simulations with these closures will differ in terms of the composition of aggregate demand (across investment, private consumption, and government consumption), but have little or no effect on aggregate GDP. However, only a minimal change in model structure is required to specify a closure in which aggregate employment is linked to macro variables through a Keynesian multiplier process, a type of closure that has been advocated by Taylor (1990). In this Keynesian closure, investment is fixed in real terms. In the labour market (in one of the labour markets if labour is disaggregated), it is assumed that the real wage is flexible in a setting with unemployment. In this model, an increase in exogenous real investment (or in real government expenditure) will generate a fall in the real wage, and increases in labour demand, employment, incomes, and savings sufficient to finance the increased investment level – the Keynesian multiplier.

To summarise the discussion so far, in any open, economy-wide model, the introduction of the three macro balances is inevitable. Although theoretical strains are apparent, the classic CGE model, with its focus on relative prices and flow equilibria, permits a range of alternatives.[20] The analyst needs to assess what is appropriate, given the context of the analysis and empirical data.[21] Alternatively, following the lead of a growing number of analysts, one can think of models that incorporate assets (including money), interest rates, inflation, and a more complex treatment of expectations and dynamics. The research question is: to what extent should a policy analyst interested in macro-poverty linkages open up the model to include these and other features associated with the macroeconomic literature? And, given the long historical tension between micro and macro theory – Walras versus Keynes – how should such applied models be formulated? What are the trade-offs between gains in the form of richer insights and costs in the form of increased complexity and additional data requirements?

19. Lofgren et al. (2002: 15-16 and 40-41) includes the option of uniform relative adjustments in the three components of absorption: household consumption, government consumption, and investment.
20. Robinson (2005) develops a macro model that incorporates a wide range of closures and analyses how the closures condition the effects of macro shocks.
21. For example, with reference to the Keynesian closure discussed above, in the economy in question, do empirical data support the idea that, ceteris paribus, aggregate employment changes in the short run in response to real demand shocks? If so, under such employment expansions, has the real wage declined (necessary for employment expansion under this closure) or increased?

4 Reconciling CGE and macro models for poverty analysis

A real CGE model provides a good framework for analysing medium to long-run structural adjustment issues: the equilibrium effects of macro (and micro) shocks and policies that, by changing prices and market incentives, affect resource allocation and the structures of demand, production, and trade. However, other issues, especially short-run stabilisation problems, tend to involve stronger links between the financial and real sides of the economy. Real-world examples include changes in real wages and real capital rents in the context of outbursts of inflation and nominal wage rigidities, and changes in capacity utilisation and employment because of the impact of financial credit constraints. The existence of such real-financial links seriously strains the Walrasian paradigm underlying the classic CGE modelling framework, raising questions about whether CGE and macro modelling frameworks should be integrated and, if so, how. The debate on how to do this remains unsettled. According to our reading of the literature, three schools of thought have emerged. They may be labelled orthodox, eclectic, and ecumenical. Here we shall state their positions, discuss their relevance in the context of macro-poverty analysis, and draw some tentative conclusions for future research.

The orthodox school views the Walrasian CGE model as theoretically elegant and complete, and any attempt to insert additional macro features and financial variables simply corrupts it. CGE models should only be used to analyse issues of allocative efficiency, relative prices, and the structure of employment, production, and demand in an environment of well-functioning markets, using a model that stays close to a Walrasian view of the economy. Macro issues should be left to macro economists.[22] This line of thinking is becoming less influential and is clearly less relevant in the context of macro-poverty analysis.

The eclectic school, which has grown in influence during the past decade, appears to be more open-minded. In this view, one should build integrated models that incorporate the best elements from Walrasian CGE models and selected macro and financial models. The multisector CGE model can be used to provide the supply side of a dynamic macro CGE model that is much richer, including assets, interest rates, inflation, expectations, and other features drawn from modern macro theory that seem appropriate to the issues being analysed.[23] This literature is very active, and many macroeconometric models now include on the supply side a CGE module that has been adapted to be an adequate host for macro phenomena.

The third view, that of the ecumenical school, is to keep the CGE and macro-financial models separate but to specify ways through which the models can talk to one another (or, at a minimum, one of them, the macro model, talks to the other, the CGE model). For example, the models can be linked through variables that are endogenous in

22. Examples of work expressing this view include Whalley and Yeung (1984); Bell and Srinivasan (1984) and Srinivasan (1982).
23. Examples of work in this tradition include Bourguignon et al. (1991); Thorbecke (1991); Yeldan (1997); McKibbin and Wilcoxen (1998); Thissen (2000) and Agénor et al. (2003). Robinson (1991) and Thissen (1999) survey models which incorporate asset markets in a CGE framework. In these models, examples of areas in which money is non-neutral include the demand functions for money and investment.

one but exogenous in the other.[24] A macro model may treat the price level and various macro aggregates (including employment, investment, and consumption) as endogenous, and these variables may then be specified as exogenous variables in a CGE model. This requires that the CGE model be adapted to incorporate these effects, i.e. the design of closures for macro balances and factor markets that will make the CGE model behave in ways that reflect the outcomes of macro models. In addition, given that modellers working in this tradition tend to emphasise empirical more than theoretical aspects, the resulting models tend to include 'structuralist' features (like relative price rigidities and segmented markets) that deviate from the pure Walrasian, theory-driven approach. In these respects, the eclectic and ecumenical CGE approaches tend to be driven by similar considerations and include similar features. The ecumenical approach may be top-down or be extended to two-way communication by having the CGE model endogenously determine variables such as wages and prices, which are then taken as exogenous by the macro model. A key advantage of the ecumenical approach is that the two modelling systems are kept separate, permitting the modellers to avoid mixing two paradigms in a single model.

Drawing on this work, we expect research on macro-poverty linkages to make simultaneous progress along two lines. In the more academically oriented literature, eclectic experimentation with integrated, dynamic real-financial models will continue, yielding increasingly robust 'workhorse' models that can be used fruitfully in policy analysis. Research in this area will benefit from the current trend in macroeconomics away from rational expectations models towards models based on assumptions that are more plausible in developing countries. On the more applied side, addressing policy issues in 'real time', the ecumenical approach will still have much to recommend it; it is flexible in terms of macro and CGE approaches and their interactions. On the macro side, the models may range from sophisticated econometric models to simpler consistency models, like the World Bank's RMSM-X (Khan et al., 1990; Agénor, 2004). On the CGE side, the models used may be of the classical type or may evolve in structuralist and eclectic directions. Research along both lines will continue to benefit from improvements in software and data availability. The ecumenical approach may also be applied at the micro level, by linking the CGE model to household or firm microsimulation modules. If so, the analysis may be conducted using a three-layer structure.[25]

When designing and choosing among models for macro-poverty analysis, it is important to consider the users of the analysis, the structure of the economy that is being modelled, data availability, and the policy issues of interest. *Ceteris paribus*, simpler models are always preferred to more complex ones: they are easier to use, adjust, and understand, making their findings more convincing. The need to model asset markets and portfolio choice depends on the economic structure: the need is stronger in middle-income countries where significant numbers of households and private-sector firms hold a diversified asset and debt portfolio, including equity and foreign assets and

24. Robinson and D'Andrea Tyson (1984) formalised the approach, and Powell (1981) describes applications using the Orani model of Australia. The variant of this approach under which communication is one-way, from the macro model to the CGE model, is implicitly followed in the literature on structuralist macro models (Taylor, 1990 and 2004).

25. Bourguignon and Pereira da Silva (2003) argue that, at least under some circumstances, a three-layer structure may be the preferred approach.

debts. On the other hand, in low-income countries where only the government borrows abroad and stock markets are thin, the pay-offs from asset modelling are smaller. A lack of data limits the empirical value of including different features that underlie real-financial interactions (even if they may be important). For example, often little is known about the asset portfolios of different household groups, the speed and strength of their responses to changing relative returns, the nature of nominal wage rigidities (for example, for how long and to what extent do nominal rigidities prevent nominal wages in different parts of the labour market from adjusting in response to unexpected inflation?), or the processes through which different agents form expectations.[26] On the other hand, effective demand for specific data for policy analysis can speed up data improvements that make it possible to draw more definitive benefits from incorporating financial features in future work.

Different policy issues call for different models: a real CGE model may perform well in the analysis of policies that work through incentives and government investment in a setting with relative macro stability, whereas real-financial models are better at handling policies more directly related to financial issues, such as the consequences of alternative methods for financing government deficits or responses to a financial crisis.[27] However, given the difficulties involved (especially in the areas of dynamics, expectations formation, and missing data), we conclude that economic analysis is far from a detailed understanding of short-run distributional issues, especially when macro imbalances are severe. Macro analysis and the broader understanding that does exist – severe macro instability hurts growth and poverty reduction – will have to be the main guides to policy-making, while more disaggregated models can assist in the design of policies that have effects during a longer timeframe.

5 Conclusion

In this article, we have reviewed the SAM framework and three kinds of models for which SAMs provide a logical framework and a database: SAM-multiplier models, classic real-economy CGE models, and real-financial CGE models. SAM-based models with an appropriate disaggregation of households and their income sources contain necessary components for multisector, economy-wide analysis of macro-poverty

26. While stressing the importance of considering real-financial interactions in the analysis of many policy issues, in a review of real-financial CGE models, Thissen (1999: 9, 18, 22) notes that so far these models have been of debatable empirical value, in particular because of missing data (esp. for disaggregated households and production sectors) and the rudimentary treatment of expectations. In the same spirit, Ames et al. (2001: 18) observe that 'while changes in the money supply may affect real variables such as output and employment in the short run, they do so in a way that is at best uncertain and imperfectly understood'.
27. See for example, Adam and Bevan (1998) who compare the ability of different CGE models (ranging from a classic real model to a real-financial model with a complete set of asset markets) to analyse the impact of a temporary increase in the government deficit. They conclude that the classic real model significantly underestimates the real consequences of budgetary imbalances. They also find that (i) within the framework of a real model, minimalist adjustments (generating a positive relationship between government debt and the interest rate on this debt) provide a partial remedy; (ii) the issue of how best to model asset markets is unresolved due to various outstanding issues (including functional forms, parameter values); and (iii) more complex models tend to be much more fragile.

linkages. Given that the SAM-multiplier models make implausible assumptions about prices and supply constraints, we focused our attention on CGE models.

The ability of CGE models to analyse events at the macro end depends on their macro closures, i.e., their specification of mechanisms for achieving equilibrium in the three major macroeconomic balances (associated with the rest of the world, the government, and the loanable funds market). By including financial assets, and other features from the macro literature, real-financial models are able to generate a richer treatment of macro aspects, including the loanable funds market, sources of the non-neutrality of money, and real-financial interactions. However, due to limited information about the data and processes that underlie portfolio choice and expectations formation, the ability of CGE models to capture short-run adjustment issues and their distributional impacts remains limited. While it is clear that various sources of money non-neutrality matter in the real world, it is still unclear in what contexts the benefits (in the form of additional insights) from including them weigh more heavily than the associated costs in the form of data, complexity and additional research time. In the analysis of short-run adjustments issues, the pay-offs from using more aggregate macroeconometric models, possibly linked to a CGE model, should be higher.

We conclude that future research is likely to make progress along two lines, both with more of a medium- and long-run focus. At the more academic end, research will be based on integrated, dynamic real-financial CGE models (the eclectic approach of bringing together preferred aspects of the CGE and macro traditions). At the applied end, analysts will rely on the ecumenical approach of informally linking a CGE model to a macro model, letting the context determine the specifics. Increasingly, these CGE models will incorporate non-Walrasian, structuralist features, some of which may involve simple modelling of asset markets.

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