Chapter 4

Currently Used Methodologies

This section reviews the strengths, weaknesses, and common assumptions of the different model types used to assess impacts of structural adjustment programs.

Developing country economies have a number of distinctive features that influence the nature of models that are built to understand their behavior. One of these is a much greater magnitude of shocks (externally or internally caused, such as volatility of export prices or money printing binges by the government) compared to the developed countries - thus, double-digit inflation or depreciation rates are commonplace and triple digits are not unheard of, especially in the context of an adjustment program. Another such feature is relatively simple financial systems (though less so with every passing year). Another is a great variety of economic structures among different countries: for example, it makes a lot of difference whether the main export of the country is largely produced by small farmers, a handful of rich landowners, or largely foreign-owned firms doing resource extraction. Yet another is data paucity - while much data exists, it is often scattered among agencies, its coverage can vary greatly and merely putting enough data for a model together can be a major effort.

The large shocks together with poor data have important implications for modeling. Firstly, linear models are not plausible in view of the large impacts, and lack of data means that the shape of nonlinearities must often be derived from parables and stylized facts. It is thus perhaps not surprising that there is no agreement among different modelers regarding even the direction of certain impacts and causal connections, as we will see in this chapter.

Secondly, much as in quantum mechanics, high cost of getting data means that conservation laws, whenever they can be found, have to be milked for all they can yield. In quantum mechanics the conservation laws are called symmetries, in economics, accounting identities. Thus accounting and precise definitions of equilibria have a much larger importance in models of developing countries, both for cross-checking the data one has and for inferring data one does not have.

Four model types are commonly used to assess impacts of structural adjustment programs. First of all, there are the fixed ratio models RMSM-X and the Financial Programming Framework that are used by most World Bank and IMF country desk practitioners. These are very crude models and the validity of their equations has been empirically tested and shown to be very poor. They are not at present to the author's knowledge taken seriously by any research economist; however, their implicit assumptions still shape much of the debate around structural adjustment, in addition to guiding the back-of-the-envelope estimates that IMF country economists use as a starting point for negotiating new structural adjustment programs.

The two model types most popular for applied analysis of structural adjustment programs are econometric models and and CGE models. These are in a sense opposites: econometric models allow for rigorous significance testing but their theoretical limitations restrict them to comparatively few variables and simple, mostly linear equations. On the other hand, CGE models are constructed around a refined accounting framework and set virtually no limit to the amount and type of variables and functional relationships used. However, they are completely incapable of empirical verification, and a CGE model with virtually any behavior can be calibrated to any economy, with no way to distinguish between different causal stories[1]. Within CGE models, there are two major schools of thought, neoclassical and structuralist, distinguished by certain characteristic assumptions. The main assumption on which they differ is whether productive capacity is fully employed at all times, with all markets clearing through price adjustments (neoclassical) or whether market clearing through quantity adjustment has an important role to play as well (structuralist). We will discuss further differences between the two views in the body of this chapter.

Finally, microsimulation models are a recently fashionable methodology to assess finer-grained distributional impacts of changes in macro and sectoral variables. They work by specifying simple household behavior functions in response to these variables, and then estimate these functions for each of the households in a household survey. This is then used to represent impacts of macro variables on each of the households modeled. While the results are clearly not reliable on the individual household level, the households can then be grouped in various ways, and the group averages and intra-group distributions can be more robust. While microsimulation is a promising technique, such a model still needs a separate macro model to drive it, and will inherit the latter's weaknesses.

In the following, we discuss the strengths, weaknesses, and common assumptions of these models in more detail.

4.1 Fixed Ratio Models

Interestingly, although most World Bank and IMF rhetoric is based on the neoclassical tradition, the models the country desk practitioners still use in both institutions rely not on diminishing returns and flexible ratios (such as output per worker or output per unit of capital) of the neoclassical school, but on fixed ratios combined with accounting identities.

4.1.1 Key assumptions

The two most important fixed ratios are the capital to actual output ratio (known as the Incremental Capital Output Ratio, or ICOR) and the nominal output to money supply ratio (constant velocity of money). RMSM-X (Revised Minimum Standard Model - eXtended), the World Bank staple model, uses both; the IMF financial programming framework uses the constant velocity of money assumption and assumes that output is unaffected by the program.

4.1.2 Strengths

The main strength of these models is their simplicity, and the ability to fit together the key macro variables, namely national accounts, the balance of payments, and the government deficit.

[1]While it is possible to build models that to a large extent incorporate the virtues of both types without the drawbacks, as demonstrated e.g. by the Inforum models Meade [2002], these have to the author's knowledge never yet been used in the context of structural adjustment policies.

The models also provide simple, intuitive connections between three key policy variables, namely government deficit, total investment, and the exchange rate , and three key policy targets, namely balance of payments, domestic price level, and real GDP.

4.1.3 Main weakness

The main weakness of these models is that the simple, intuitive behavioral equations that are implied by the fixed ratios are not supported by the data.

The constancy of the capital/output ratio has been tested by Easterly [1997], who in a wide range of statistical tests found no evidence for constancy of the capital-output ratio. For instance, regressing Gross Domestic Product (GDP) growth on Gross Domestic Investment over GDP country-by-country (which should yield the ICOR by country), he found a positive and significant relationship in only 11 out of 138 countries tested. Other regressions were similarly disappointing. Similarly, Reinhart [1991] tested the assumptions of the RMSM-X model and found no support for the constancy of ICOR; the constant velocity of money hypothesis was rejected in about half of the countries in the sample, including Ghana.

Given the shaky theoretical foundations of the two models, it is not surprising that they are not taken too seriously even by the people using them. Thus, Mussa and Savastano [1999] in their discussion of how IMF conditionalities are formed admit that “[The] educated guess embodied in the performance criteria is typically an outcome of the negotiation with the authorities, not the result of rigorous statistical estimation”. However, when no explicit model is used one has to resort to a mental model, and the discussion on p.33 of Mussa and Savastano suggests that no influence of monetary and fiscal policy on output growth is still an implicit assumption, so that monetary and fiscal tightening are expected to reduce inflation while having no recessionary effects on output.

4.2 Statistical Macro Models

Much of the theoretical work done on the effects of adjustment policies takes the form of econometric models that rely on time series regression (country-specific or cross-country) to find behavioral coefficients. The most prominent of these is the model by Khan and Knight [1981, 1985] who estimated a small dynamic econometric model, estimated its parameters on a pooled cross-section time-series sample of 29 countries, and used the estimated model to conduct hypothetical policy experiments. The simulation of a typical IMF program produced a sharp price deflation in the first year, followed by a temporary burst of inflation; output contracted sharply in the first year, then rose above its full-employment level, and then gradually approached equilibrium.

4.2.1 Main assumptions

The main assumption of most econometric models it that the dependent variables are linear functions of the independent variables (possibly after appropriate transforms such as taking a logarithm) plus random noise. There is a variety of additional assumptions on the fine structure of the noise, used to draw conclusions from the errors in a given regression to statistical significance of its coefficients.

4.2.2 Strength

The main strength of econometric models is the ability to rigorously specify measures of confidence and significance of model results.

4.2.3 Weaknesses

Macro-econometric models have two major weaknesses. Firstly, they are comparatively data-hungry, in that they need many data points to come up with statistically significant estimates. Unfortunately, time series for individual developing countries are often too few and too short. On the other hand, cross-country regressions usually come up with non-significant coefficients due to large variations between countries.

Secondly, due to theoretical limitations most econometric models have few variables and few equations, most of them linear. Macro-econometric models have recently been used to "inspire" Computable General Equilibrium models [Ferreira et al. 2003], but to the author's knowledge they have never been integrated into a comprehensive accounting framework in the context of developing economies (the work of Inforum on industrialized countries shows that this is possible, but quite labor-intensive).

Thus, Haque and Khan [1998] conclude that the existing econometric models "don't capture the complex ways in which policy variables are related to the ultimate objectives of programs."

4.3 Computable General Equilibrium Models

Computable General Equilibrium (CGE) models are currently the dominant methodology for assessing distributional impacts of macro policies. The CGE model literature is rich in alternative formulations, somewhat fragmented, and full of sometimes quite subtle detail. Thus here we briefly touch upon the points that appear pertinent, without a claim for exhaustiveness.

The main organizing principle of CGE models is comprehensive tracing of nominal money flows through the economy, and determination of a set of prices and sectoral output levels that allow all markets to clear. During the past fifteen years or so, this focus on flows has been augmented by representation of asset stocks and financial markets.

4.3.1 Key assumptions

The defining assumption of CGE models is that of flow equilibrium in all markets, both in nominal and in real terms. This is expressed by calibrating each model to a Social Accounting Matrix (SAM) that is a complete description of nominal money flows inside the country and has to fulfill a balancing requirement. This balancing requirement is equivalent to a conservation law for money, that is, to the statement that money can be created or destroyed only in the financial sector or outside of the country.

As we will see below, CGE models allow to calibrate any causal story to any country's data. Thus, there are two distinct schools of CGE modeling, neoclassical and structuralist, each with its favorite set of key assumptions and causal stories. We discuss these in Section 4.4.

4.3.2 Strengths

The CGE technique has two main strengths. Firstly, the SAM structure is a mature accounting framework for integrating the various types of data and for tracing of economy-wide effects of policies.

Secondly, within that framework there is still a large scope for storytelling about specific parts of the economy and alternative causal mechanisms. The CGE literature of the past two decades is rich in alternative stories of how, for example, credit can impact real output. The variety of model formulations is large enough that we cannot cover it here, and have to refer the interested reader to Kraev [2003].

Computable General Equilibrium (CGE) methodology has over the past three decades developed quite a powerful toolkit for assessing distributional impacts of certain kinds of policies, in particular those working through relative prices. Combining CGE models with microsimulation techniques (covered below) allows to further extend the analysis from sectoral aggregates and representative household groups to cover substantially more detailed distributional impacts.

4.3.3 Weaknesses

The main weakness of CGE models is that they are fundamentally non-testable. The way a CGE is built is first to specify an a priori causal structure ("story") and then calibrate it to a Social Accounting Matrix of a given country. The behavioral parameters are hereby specified in a largely ad hoc manner. Thus any story can be calibrated to any country.

The traditional CGE models use a base year SAM to calibrate the share parameters of the model, and mostly use unrelated studies or guesstimates for the remaining behavioral parameters; in the best case (e.g. Demery and Demery 1991), some parameters are estimated from single-equation regressions. As CGE models also aim to represent medium-term equilibria, the time series they produce (if any) are typically only interpreted in qualitative terms.

There are two unfortunate results of this practice: firstly, models with very different behavior can be calibrated to the same data, with no ready measure of which formulation best describes a given country (see e.g. the controversy in Sahn et al. 1996, de Maio et al. 1999, Sahn et al. 1999). Second, even if one has settled on a given causal structure, the behavioral parameters cannot be directly calibrated to data. The usual solution are borrowing parameter estimates from unrelated studies, ad hoc sensitivity tests and "reasonable range" guesstimates, none of which seem very satisfactory.

A different way of addressing the uncertainty in free parameters is discussed by Harrison et al. [1993], who assume a priori probability distributions for all free parameters and proceed to do simultaneous sensitivity analysis on all of them, generating probability distributions for output variables. However, this approach seems to have two flaws that limit its use in applied models: firstly, the a priori probability distributions still have to be guesstimated, and secondly, doing a full unconstrained sensitivity analysis on all free parameters simultaneously is likely to produce a spread of end results so large as to be of no practical use.

Thus, until the CGE methodology is modified to allow for significance and quality-of-fit measures akin to those of econometrics, CGEs will remain little more than elaborate a priori stories, a medium for narrating the modeler's favorite theories in a consistent framework, but with little rational reason to prefer one such story to another.

The second major weakness of the CGE methodology is that due to its flow equilibrium core, it is not really comfortable with integrating stocks and stock-flow relationships. As stocks such as the money supply or the foreign currency reserves are clearly important in practice, most applied CGE models since 1990 have attempted to integrate them. However, all such attempts were largely ad hoc, compared to the standardized SAM framework for describing flows. Thus, there is a need for a formalism to represent financial stocks that is as clean as the SAM formalism, and integrates cleanly with the SAM to satisfy stock-flow relationships. In this thesis, we will introduce such a formalism.

4.4 The Major Theoretical Differences between Neoclassical and Structuralist CGE Models

There are at present two major traditions in CGE modeling. The neoclassical tradition tends to assume full employment of labor and capital, sectoral adjustments driven by relative prices, and aggregate price level driven by money supply. Structuralist tradition tends to assume quantity adjustments of output and cost-driven prices. Here we present the two traditions in more detail.

4.4.1 Neoclassical CGE Models

Neoclassical CGEs have their intellectual roots in Walras' model of the competitive economy [Walras 1984] and Solow's model of economic growth [Solow 1956]. Their motto is "sound theoretical foundations", mainly used to mean close adherence to Walras' model. Decaluwé and Martens [1988] summarize the structure of neoclassical CGEs as follows:

> Only relative prices matter, producers are profit maximizers facing non-increasing returns to scale, consumers are insatiable utility maximizers, and production factors are paid according to their marginal revenue productivity. The model's solution provides a set of prices, which, by making all these individual optimizations feasible and mutually consistent, clears all markets simultaneously.

Robinson [1989] gives a lucid and detailed description of "the" neoclassical model of an open economy.

In practice, the distinguishing assumptions of the neoclassical models are full capacity utilization, full employment[2] and prices determined by marginal productivity rules. Because of the full employment assumption, adjustment to a disturbance such as an export price shock takes place through reallocation of labor between productive sectors (driven by relative prices) without substantial changes in overall real output. Labor reallocation (and possibly new investment patterns over the longer term) change labor intensities and therefore labor productivity and thus wages in different sectors to match the new set of relative prices.

As the neoclassical economy always operates at capacity, the typical way to determine the level of investment (going back to Solow [1956]) is to set it equal to the level of savings (in real terms), known as the neoclassical closure. However, models in the neoclassical tradition also use other closures (for example an endogenous savings ratio that passively accommodates investment demand) though virtually always those with full employment.

[2]In view of the neoclassical school's emphasis on sound theoretical foundations, it is rather amusing that one of their main distinguishing assumptions, namely full employment, has no basis either in data or in general equilibrium theory. We will return to that point in Section 4.4.3.

The Walrasian framework also naturally dictates the mechanism determining the aggregate price level. Because of Walras' law (if all markets but one clear, so does the last one) one only needs $n - 1$ prices to clear all n markets in the model. "However, the behavioral assumptions are such that typically all the supply and demand functions are homogenous of degree zero in all prices. Thus, one is free to add an additional equation defining a numeraire price index, which defines a unit of account and has no effect on the equilibrium value of any real variable" [Robinson 1989]. This is typically (e.g. Agénor et al. [2000]) augmented with a simple macro model that gives a definition of money supply (e.g. as sum of domestic government liabilities, implicitly assumed to be all monetized, and foreign exchange reserves). One proceeds to define money demand as a multiple of the numeraire price level (calling the inverse of the proportionality constant the velocity of money), and sets money demand equal to money supply. Then government deficit and the balance of payments developments together determine the money supply, which in turn determines the aggregate price level. One way to look at this mechanism is to say that supply is given from the real side, and nominal aggregate demand determines the price level. Thus we have here a pure demand-pull model of price determination.

The interesting property of that whole mechanism is that neither government deficit, nor the money supply, nor the aggregate price level, have any impact on the full employment state of the economy. Neither are relative prices affected, unless the government uses the deficit spending to change the composition of demand. Thus in a Walrasian world, fiscal austerity reduces prices without incurring any recessionary impacts whatsoever.

The picture is somewhat complicated by introducing foreign trade, because once the domestic nontraded good aggregate price level is fixed with the above mechanism, the nominal exchange rate determines the relative price of exports and imports compared to nontraded goods ("the real exchange rate") which has real effects. Through this channel, movements in the domestic aggregate price level can influence the balance of payments and the composition of domestic output. However, this complication can be (and often is, e.g. in Devarajan et al. [1990]) easily circumvented by postulating a fixed balance of payments in foreign currency terms and letting the nominal exchange rate adjust to achieve that. The result is that the nominal exchange rate scales proportionally to the domestic aggregate price index, so that the real exchange rate remains unchanged.

The first neoclassical CGE was a model of Korea by Adelman and Robinson [1978]. Since then, there have been countless implementations of the basic framework for different countries, with essentially identical structure (Decaluwé and Martens [1988] provide an extensive review) . Worthy of note is the "123" model [Devarajan et al. 1990, 1993, Devarajan and Go 1998, Agénor et al. 2000] which reduces the framework to the bare essentials of the structure.

An early attempt to integrate financial markets into the neoclassical CGE model was made in a model of Turkey [Lewis 1985, 1992, 1994]. A substantially more advanced and influential model that incorporates many structuralist features is the maquette [Bourguignon et al. 1991, 1992]. The maquette is really a model template, that allows for variable employment for some sectors/labor types, and for markup pricing in some sectors; however, its treatment of the aggregate price level is strictly monetarist. The basic structure of the maquette has since been used in many applied models (see e.g. the whole issue containing Bourguignon et al. [1991]), so that at present the maquette is the most widely used framework to incorporate financial effects in a model with sectoral structure.

Almost all CGE models of industrialized countries are neoclassical (see e.g. the review of the models of NAFTA in Stanford [1992]). The structuralist CGE tradition has to date focused on developing countries, and its techniques are described below.

4.4.2 Structuralist CGE Models

The other branch of CGE models for developing countries is the structuralist school. While the "patron saint" of neoclassical CGE's is Walras, those of the structuralist school are Kalecki, Kaldor and Keynes [Kalecki 1971, Kaldor 1957, Keynes 1936]. The structuralist motto is "capturing the institutional specifics of the economy at hand". The leading figure of this tradition is Lance Taylor, who describes the structuralist techniques in Taylor [1991] and Taylor [2004]. True to their motto, the structure of individual structuralist models varies much more than that of their neoclassical counterparts, thus the description below refers to typical and frequent features, rather than to a uniform "structuralist model".

In contrast to the neoclassical models (that hinge on full capacity utilization and relative price-driven shifts in composition of output) structuralist models work mainly through quantity adjustment, often resorting to fixed ratios where a neoclassical model would have relative price dependence. The structuralist prototype is the model of Kalecki [1971], with employment and output freely adjusting to demand up to the maximum productive capacity of the economy (as would follow from perfect complementarity of labor and capital). As in this setup the marginal product of at least one of the factors of production is zero, marginal productivity pricing is abandoned in favor of markup pricing (price being equal to a markup over variable costs of production). The markup is usually constant when the economy operates below capacity, and is the adjusting variable once capacity is reached. In practice, many models such as Rosensweig and Taylor [1990] or Easterly [1990] effectively assume the maximum capacity to be infinite, focusing on short-term adjustments in output (often of recessionary nature).

Since in this model in an economy operating below maximum capacity the output adjusts freely to demand, there is really no place for demand-pull inflation, and money supply, while well-defined, has no particular role to play. To explain the occurrence of persistent inflation in most developing countries one then has to resort to some kind of cost-push formulation. The structuralist favorite is competing claims, for instance simultaneous indexation of wages and price determination as a fixed markup on wage costs, leading to a steady inflation spiral.

While early structuralist models had many attractive features representative of the developing country reality, such as variable capacity utilization and bottom-up price determination, they also made many stylized assumptions that were in their way no less restrictive than their neoclassical counterparts, such as constant wages and constant aggregate real investment. Even in relatively refined models such as Rosensweig and Taylor [1990] or Easterly [1990] the prices are still determined purely from the side of costs. However, structuralist models built since the late nineties such as Vos [1998] rely on a sector-dependent combination of price and quantity adjustments, meeting many of the criticisms of the early models.

4.4.3 Whose assumptions are better?

Given two schools with such different assumptions, it is natural to ask which of these assumptions, if any, are to be preferred. Note that neither school's position is logically indivisible - it is quite possible, and in fact quite useful, to mix and match assumptions from both schools. While, as we discussed before, the CGE methodology does not allow to empirically verify the assumptions of a model, still we can attempt to draw some preliminary comparisons here, with a view towards more empirical verification later in the thesis.

Full Employment vs. Output Adjustment

A frequent neoclassical claim is that quantity adjustment in the product markets only happens in the short term, while in the longer term price adjustment coupled with full employment can be expected to prevail [Robinson 1989, p.928]. The source for that is often claimed to be found in general equilibrium theory.

Unfortunately, reading up on the theory (Arrow [1974] and Tobin [1982]), shows that there is no reason to expect full employment to obtain even in the long run unless there are future and contingent markets for all commodities, a requirement presently (and in the foreseeable future) not technically possible in any economy, let alone those of developing countries. Thus the frequently heard neoclassical contention that full employment will automatically occur if markets are allowed to operate freely has no basis whatsoever even in general equilibrium theory, let alone in practice[3].

Thus variable and demand-driven output (with diminishing or constant returns to labor) is symptomatic not of the "short term" or "excess capacity", but rather of the behavior of particular sectors. A frequent heuristic associates variable output with "modern sector" and fixed (in the short term) output with "agriculture". That view is supported by the excellent data fit of demand-driven models of developed countries such as LIFT [Meade 2002] and also recognized in recent models of the neoclassical school such as the maquette [Bourguignon et al. 1991, 1992]. Models combining fixed-output (price-clearing) and flexible-output sectors are known as fix-flex models.

Nominal Price Determination

The neoclassical and structuralist views on the role of credit and money supply lead one to expect radically different responses to the same policy packages. Which one should we believe? The answer might lie in the classic quote from Keynes [Keynes 1925] that compares monetary policy to a string attached to the real economy: "you can pull on a string but you can't push on a string". The structuralist vision would then correspond to a string stretched taut, with credit supply being a limiting factor of production; and the monetarist view would be that of a limp string that can be pulled quite a way before much real impacts materialize.

If one puts the question that way, it would seem that the issue cannot be decided a priori: a given economy might better fit one of the two descriptions, and indeed switch between modes as a result of policy packages (for example, a harsh restriction of credit could conceivably push an economy from a capacity constrained excess-demand mode into a credit-constrained mode). Thus it would seem that to adequately address the relationship between credit and the real economy, a financial CGE model must also be capable of such an endogenous switch. Once a model is capable of different modes, one could compare the behavior of the model to the behavior of the actual economy and determine which of the mechanisms turns out to dominate, and thus turn a theoretical debate into an empirical one.

A recent example of such a model is a model of the impacts of fiscal deficit reduction in India Naastepad [2001, 2002b,a], capable of different "modes" and of endogenous mode-switching. In this model, depending on the policies applied and on the evolution of the economy, one particular constraint (demand, supply, or credit) may prove to be binding, and correspondingly price behavior will correspond to either the structuralist or the monetarist model of the role of credit and price formation.

[3] In a sense, this can be regarded as a case of missing markets, but this insight is not much help in practice as the necessary markets would involve futures in every conceivable commodity conditional on every possible future state of the world.

Summing up, one can expect different sectors within the same country to be either supply-constrained at full employment of productive capacity, or to work below maximum capacity with output driven by demand. Likewise, the relative strength of demand-pull and cost-push factors in price formation is an empirical question. The two model traditions provide us with a valuable vocabulary of possible model formulations, but we will have to go beyond the CGE methodology to decide which of these are actually applicable to Ghana during the period we are interested in.

The following section provides an overview of an extension to macro/sectoral models that promises a greater insight into distributional impacts of a given change in macro behavior.

4.5 Microsimulation Models

"Microsimulation" refers to modeling of income and consumption of distinct individuals or households, instead of resorting to representative household groups (RHGs) as the traditional CGE models do. The idea goes back to Orcutt [1957], but was not used for analysis of macro-poverty links until the late nineties. Davies [2003] provides a review of microsimulation in other contexts.

Starting with Cogneau [1999], a number of models attempted to use microsimulation for analysis of macro-poverty links by combining the well-tested CGE apparatus with the micro data provided by one or several household surveys. This was approached in two different ways, top-down and integration.

The top-down approach solves a traditional CGE with a limited number of household groups, and then uses a microsimulation model to generate household behavior that reproduces the output of the CGE model. The specification of the microsimulation model can range from simple prorating as in Bussolo and Round [2003] to models econometrically estimated from a household survey that endogenize the labor supply choices of each household, such as Bourguignon et al. [2003] and Ferreira et al. [2003].

The integration approach, represented by Cogneau and Robilliard [2000] and Cockburn [2002], uses the individual households directly in the CGE instead of representative households. This approach appears more promising than top-down for several reasons: it comes closer to the vision of general equilibrium in Arrow [1974]; it has the potential for household heterogeneity to have impacts on sectoral and macro aggregates; and, according to Cockburn [2002], it presents "very little technical difficulty".

While CGE/microsimulation models appear to be a promising methodology for assessing fine-grained distributional impacts of macro policies, one should not forget that a CGE/micro model, be it top-down or integrated, is subject to the same choices and weaknesses as other CGE models, especially as regards choice of closure and validation.

If the closure of a CGE/micro model is not a good description of the country in question, the model is in danger of giving finely disaggregated, false results (of the models mentioned here, only Bussolo and Round [2003] conduct systematic closure exploration, and of the rest, only the model of Ferreira et al. [2003] has a modular structure that would easily permit such exploration.)

Validation is another chronic problem of CGE models that is inherited by CGE/micro models. Of all the models discussed, only Ferreira et al. [2003] compare the model predictions to a later household survey, concluding "we cannot claim that this approach [can] predict the distributional outcomes of [...] policy packages with any accuracy".

An interesting potential of CGE/micro models would be in addressing gender-related distributional issues; however, to the author's knowledge, that has not yet been attempted, possibly in part because most survey data is still household-level, not individual-level.

Summing up, microsimulation is a promising extension of the CGE technique for assessing fine-grained distributional impacts, but we should not expect it to address any of the other weaknesses of CGE models that we have discussed.

4.6 Summary

This chapter has reviewed the major types of models used to evaluate macro and distributional impacts of structural adjustment programs. Briefly, the fixed-ratio models are not useful at all because of their reliance on assumptions not supported by the data. Econometric models can provide measures of confidence for their output but are not by themselves well equipped to handle the large amount of variables and the nonlinear relationships needed to understand distributional impacts. CGE models use a well-developed Social Accounting Matrix formalism that allows them to cleanly handle large amount of flow variables and nonlinear relationships, but lack an equally clean formalism for describing stocks and stock-flow relationships. Furthermore, the practice of calibrating the CGE models to data for one year and guesstimating the remaining parameters allows any CGE model to be calibrated to any country, making empirical comparison of the quality of fit of different CGE models impossible.

From this list of strengths and weaknesses we can see some properties of an adequate methodology: to allow validation of behavioral relationships (measures of significance etc.), it should use data time series rather than just data for an individual year; to allow representation of macro as well as sectoral effects, it should be based on a comprehensive accounting framework; this accounting framework should combine the well-tested SAM technique for tracing flows with an equally clean formalism for describing financial stocks and stock-flow relationships (flow-of-funds).

In Chapter 6 we describe how our approach addresses these requirements; first, however, Chapter 5 introduces some accounting concepts useful for that discussion.