Financial Computable General Equilibrium Models of Developing Countries: A Critical Assessment

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Abstract

In recent years computable general equilibrium (cge) models have often been expanded to include a financial sector, primarily to answer questions relating to stabilization and structural adjustment. We argue that by the inclusion of microstructuralist effects traditional (real) cge models can already capture most of the insights provided by these models. It is also not clear whether cge models have an advantage over more standard macroeconomic models with regards to the analysis of short-run stabilization problems. The future of financial cge models will probably depend on how well money demand - at present there is no strong reason to hold money in most financial cge models -, expectations, and the related problem of the velocity of money can be modeled.
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1. Introduction

The purpose of this paper is to discuss whether the inclusion of money and other financial assets in computable general equilibrium (CGE) models adds to the insights provided by the latter on the functioning of a developing economy. In particular, we are interested in whether or not the inclusion of these variables makes CGE models suitable for the analysis of stabilization problems. The paper begins with an analysis of some of the recent developments in this area. Given the existence of a recent excellent survey of the development of "financial CGE models" by Robinson (1991), however, we will limit ourselves to a few specific examples. (Throughout the paper financial CGE models indicates CGE models with both a financial and real side. Traditional CGE models or, more simply, CGE models indicates a model with only a real side.) In the third section, we will critically analyze the attempt to marry micro and macro models. The fourth section compares CGE and (traditional) macroeconomic analysis of short-run stabilization problems. The final section contains our conclusions and recommendations.

II. Loanable Funds and the Savings-Investment Balance

Most of the research which has tried to include money and other financial assets within the framework of a CGE model has
concentrated on the inclusion of a procedure for determining the real interest rate. A good example of this type of work is Lewis (1992). In his model there exists money, interest-bearing deposits, and capital goods. Firms demand loans in order to finance their working capital and investment. Households demand money for transaction purposes through a simple demand for money equation. Once this demand is satisfied, the rest of their wealth is put into time deposits. Note that money is not in their utility function; they have to have it but get no utility from it. Although it depends on income and interest rates, in a sense it is exogenous, (as given the structure of the model no one would want it). While the model can generate inflation, it only matters if there are certain rigidities in the model. Of these the two most important are an exchange rate which is not perfectly flexible and interest rate ceilings.

In the model the interest rate clears the banking sector. In effect, this is equivalent to the savings-investment balance in a traditional CSE model; when the supply of funds to the banking sector equals the demand, savings must equal investment. Still, the modification to the usual model serves at least two useful purposes. First, by including working capital in the cost structure of the firms, changes in interest rates can affect relative prices. This assumes the availability of some type of data on the relative weight of working capital costs in different industries. Second, it allows for simulations of different government credit policies, such as interest rate ceilings or
preferential access for targeted sectors. For example, a
government development bank could provide subsidized credit to
export-oriented industries. Note, as Lora (1992) has pointed out,
the model does not deal with the problem of access to credit in the
sense of a dual financial system. In many developing countries,
most borrowers (especially smallholding farmers) have to use curb
markets (moneylenders) which may have very little relation to the
organized financial markets, or indeed may be largely caused by the
policies followed in the latter.

The models by Bourquinon, Branson, and de Malo (1989) goes
somewhat further than the Lewis model described above. In their
model households first choose between money and other assets, next
between physical assets and bonds, and finally between domestic and
foreign bonds. (This tree-branch procedure greatly reduces the
number of parameters.) The other aspects of the financial markets
are similar to Lewis's model. As different income groups have
different asset portfolios, inflation can result in distributional
effects and, via the domestic-foreign bond substitution
possibility, capital flight. For example, a rise in inflation
causes a general shift away from money, thus reducing the real
return to other assets (assuming that without this shift their
nominal return would have kept pace with inflation). Income groups
with different portfolios will thus be affected differently, and,
given different consumption patterns, there will be real effects.
However, once again money is an "exogenous-endogenous" variable in
the sense described above. Aggregate effects of higher inflation,
with one exception, are trivial compared to distributional effects as long as there are no rigidities. The exception is that higher inflation results in higher expected inflation which can lead to larger capital outflows (as agents switch to foreign bonds). This presumably results in a (greater) depreciation of the exchange rate which could have significant real effects.

Lora (1989 and 1991) has a financial structure very similar to Bourguignon et al.'s, although with much more institutional detail and therefore a great number of rigidities. Due to the importance of credit availability for investment (versus the level of interest rates) in his model, an increase in the money supply can have large real effects. (Note that in the long-run Lora assumes that capital controls will be eroded. Therefore, an increase in the money supply which leads to an increase in expected inflation would just lead to an increased capital outflow.) In this model, as in the previous ones, there are no significant aggregate effects of large increases in inflation.

The model by Fargeix and Sadoulet (1992) starts with the same basic framework as Bourguignon et al. (1989) and then goes one step further. As in the earlier model, it is assumed that higher expected inflation leads to greater capital flight. The modelling of investment is somewhat different, however. Investment is affected both indirectly - by the decrease in credit availability - and directly by increasing uncertainty about the future. The latter is modeled by assuming that the demand for investment goods decreases with inflation according to a given elasticity. Despite
the simplicity of this approach, it at least captures some of the instability that accompanies higher rates of inflation. The velocity of money is constant in the model, however, and it does not increase with the uncertainty caused by inflation (which would lead to higher inflation). Especially in the Latin American context – this model is of Ecuador – where velocities change rapidly, this is a definite shortcoming. For example, both the Austral Plan in Argentina and the Cruzado Plan in Brazil resulted in large decreases in the velocity in their initial, more successful stages.

The last papers to be discussed are the group of papers either written or co-authored by Feltenstein. Perhaps the most notable feature of Feltenstein's work is that decisions are made within an intertemporal framework with perfect foresight. However, the money demand functions are very similar to the other models, exhibiting the same exogenous-endogenous characteristics. In Feltenstein (1986) and Feltenstein, Lebow, and Gilbert (1988) inflation does have some negative implications in that is assumed that when it is above a threshold level, the government is unable to meet its public goods target. Nevertheless, perhaps the most interesting result of the simulations is that consumer welfare is higher if the government finances a deficit with money and bonds versus bonds. (He does not investigate the case when only money is used.) This result suggests that stabilization is not very important in the paper.

In the framework of a model of Mexico, Feltenstein and Morris
(1988) investigate the problem of the consistency of macrovariable stability with restrictions on foreign exchange reserves and the level of consumer welfare. (Feltenstein (1989) uses a similar model to analyze the Dutch disease.) They point out in this paper that in order to keep the model homogeneous in prices, it is necessary that the expenditure elasticity of the demand for money be one. This, of course, implies that the velocity does not change when inflation rises. It is therefore not surprising that there are no substantial effects of inflation in their model. In their main simulation, a cut in government expenditure results in higher inflation, but they do not explain why this happens. Nor does it seem to matter very much, as consumer welfare is higher than in the base case.

III. Opposites Attract or an Ungainly Marriage?

In the brief commentaries on the models considered in the last section, we pointed out some of our perceived benefits and costs of including financial assets in a cge model. In this section we would like to deepen our analysis, keeping in mind the following questions: (i) In what situations does it make sense to add a financial sector to a cge model? and (ii) What does a financial cge model do that a traditional cge model cannot do? In the next section we will go one step further and question whether a financial (or traditional) cge model has something more to offer to the analysis of stabilization questions than a more traditional macroeconomic model.
The answer to our first question is that the addition of a financial sector only is justified when stabilization is a major issue. This would be the case in economies subject to high inflation and/or frequent external shocks. We did see above that if working capital is an important part of intermediate costs, interest rate changes can significantly change relative prices. However, as large real interest rate changes - often magnified by government intervention - usually only occur in economies subject to high inflation and/or external shocks, it seems likely to be the case, ceterus paribus, that working capital costs do not justify the extension of cge models to financial markets, especially given the data limitations on this item. However, as highlighted in the paper by Bourguignon, de Mello, and Suwa (1991), large real interest rate changes can have significant income distribution effects which can then work their way through the real side of the economy. Such effects seem to have been particularly important in countries of the Argentina, Chile, and Brazil, in the late 1970s and early to mid-1980s.

Our second question concerns the potential increase in insights of a financial over a traditional cge model. Robinson (1991) explains that if there are no rigidities (or microstructuralist features) in the real side of a cge model, financial assets have little to add to the discussion. These rigidities cause non-homogeneities which give significance to the price level changes. However, it should be noted that you do not need a financial sector for the functioning of this type of
transmission mechanism. In any real CGE model with rigidities, external shocks will have real effects, both at the aggregate and sectoral levels, via relative price shifts. As long as some prices can shift (relative to the numeraire) and others cannot, you will get real effects. Inflation is not necessary to capture, for example, the effect of a wage rigidity. (See Blomqvist and McMahon (1986) for one of many examples of this microstructuralist feature.) In fact, it seems likely that the only additional important rigidity which a financial CGE model could include is the interest rate. However, if the interest rate is controlled by the government - as is likely the case if it is an important rigidity - it can be easily included as an exogenous variable, obviating the need to carry along a financial model. Nevertheless, in cases where portfolio reallocations have large income distribution effects, as noted above for the Southern Cone in the last decade, the detail brought to bear by modelling the asset side may be important. In particular, this will be the case if distribution issues play a central role in the stabilization process (or "negotiations").

With this caveat, the above suggest that the main contribution of a financial CGE model will come via its effects on the price level. Unfortunately, as we saw in the last section, inflation rarely matters in financial CGE models. As there is no reason to hold money, higher levels of inflation do not impinge directly on welfare via individual or group utility functions. Moreover, given the rudimentary formation of expectations in most models, there are
no aggregate supply repercussions associated with inflation. There is also a problem in the interpretation of the results generated by simulations using financial cge models. Given that money holdings are not in the utility function of the individual, it is not consistent to use the traditional tools of equivalent or constant variations. Therefore, simulation runs have to rely on comparisons of income, which face the usual index problems as well as underestimating the gains to the consumer of substituting goods in the face of relative price changes.

In the present form, therefore, most financial cge models do not seem to add much to an analysis of external shocks that cannot be captured in a traditional cge model. In our view, the most important contributions come from the modelling of the tradeoff between domestic and foreign bonds, enabling the simulations to capture capital flight quite explicitly, and the income distribution consequences of different stabilization plans. The latter contribution would be enhanced somewhat if the effects on curb markets were also included.

IV. CGE Models and Stabilization Issues

We have argued above that in their present form financial cge models do not have a great deal more to say with regards to external shocks or inflation than real cge models. Does either model have something more to say about these topics in the short-run than a macroeconomic model? Let us assume that there has been
an external shock in the form of a drop in the price of the major export(s) of the country in question. In addition, the tax revenue of the government is very dependent on this export; therefore, the fiscal deficit increases substantially. In a pure (neoclassical) world, the government would adjust expenditure, resources would move to profitable sectors, and imports would fall. The initial shock would, in effect, be greatly diminished by all of the above.

A CGE model can capture this move to a new static equilibrium quite easily as in effect there is no short-run; the economy moves immediately to the long-run.

Of course, in many developing countries such effects are magnified rather than reduced by the working of the economy, especially in the short-run, due to the inability of the economy to adjust quickly to the shock. There are many possible reasons for this result. Generally, it is due to a lack of flexibility of wages, the exchange rate, government expenditure, interest rates, and some key prices. Moreover, capital usually cannot be reallocated very quickly. In addition, the government often cannot find new sources of tax revenue, a problem compounded by the multiplier effects of the shock on the output (and tax returns) of other sectors. These effects may be particularly strong in the short-run if the economy is dependent on imported inputs. If inflation rises quickly, the Olivera-Tanzi effect will also kick in, reducing the real amount of tax revenue collected with a delay. The end result of the process is that the fiscal deficit is usually at the heart of solution to the stabilization problem, whatever the
original cause may have been. In their summary of 10 developing country case studies, Easterly and Schmidt-Hebbel (1992) show that inflation can be avoided by funding the deficit by selling domestic bonds and/or interest rate repression. Ultimately, however, the tradeoff becomes worse and worse— as the premium on domestic bonds makes them very expensive or interest rate repression leads to capital flight and low investment—and fiscal adjustment is the only solution. Moreover, they found that in 8 of the 10 case studies fiscal adjustment was a major determinant of external adjustment.5

In effect, an adjustment problem becomes a stabilization problem because the government cannot reduce the fiscal deficit. For example, it may try to raise public sector prices (of electricity, for example) but this increase in input prices makes domestic goods less competitive against imports, so production and tax revenues fall further.6 A cge model, with a number of judiciously selected rigidities, can capture many of the effects on the fiscal deficit. If interest rate subsidization of failing companies (the quasi-fiscal deficit) is an important component of the budget deficit, a financial cge model can add substantially to the estimate. Traditional and financial cge models can help demonstrate how the external shock goes through the economy on the first round.

However, they probably have little to add on the successive rounds or dynamics of the "destabilization" process. A macromodel which can capture the effects on key macro variables—the exchange
rate, relative price of tradables and non-tradables, interest rate, inflation, income, and unemployment - probably gains little by carrying a cge model along with it. The latter is generally too cumbersome to capture the crucial expectation mechanisms which often lie at the heart of the short-run stabilization problem. For example, most financial cge models allow for substitution between domestic and foreign bonds. However, other than in some ad hoc fashion, they are not capable of capturing the massive capital flight that can occur when expectations "turn the corner" in a period of instability. Similarly, as noted above, they do not capture the enormous increase in the income velocity of money that usually occurs in such situations and often leads to a de facto dollarization of the economy. Moreover, as we also saw above, inflation does not matter very much (if at all) in financial cge models, there is generally no good reason why the government would want to stabilize if they are accurate depictions of reality.

Finally, we should note that an analysis of the political economy of the stabilization process is often more important than either a standard macroeconomic or general equilibrium interpretation. For example, an analysis of the current Brazilian situation which did not take account of the class "conflict" between large business, the government, trade unions, and informal sector workers would not have much credibility. The study of Chomian instability and structural adjustment by Leith and Lotchie (1991) is an excellent example of how macroeconomic disequilibrium and economic decline can persist for over two decades for reasons which have very little
to do with "pure" economics and almost everything to do with political economy.'

V. Conclusions and Recommendations

In his recent survey paper Robinson (1991) stresses the importance of microstructuralist effects as a justification for the use of financial cge models. We have argued above that a real cge model can capture these effects quite adequately, with the possible exception of a case where the quasi-fiscal deficit plays an important role. (Even in this case it is possible to have a real model with the interest rate being exogenous - perhaps given by international rates with a domestic premium - and government subsidies to business.)

We have also argued above that while a cge model can aid in the conceptualization of the stabilization problem, it does not add much to the analysis once you go past the original transmission of the shock to the economy. Shocks generally turn into severe stabilization problems because the fiscal deficit cannot be rectified. Therefore, the government has to turn to money or bond financing of its deficit which can play havoc with the price and/or interest rate levels. A key variable in the destabilization process is the velocity of money. In fact, perhaps the best indicator that a stabilization problem has become a stabilization crisis is when the velocity of money begins to increase quickly. We have seen that in their present form (with some minor, rather ad hoc exceptions) inflation does not matter in financial cge models.
As money is not in the utility function of the agents they do not suffer welfare losses due to inflation. Moreover, when spiralling inflation results in large output losses, as is often the case, a financial CGE model cannot capture this effect. The microstructuralist effects that it does capture are almost as adequately captured in a real CGE model. More importantly, neither is able to capture adequately the large losses caused by the effects of high inflation on uncertainty and expectations.

A macroeconomic model which concentrates on the key macro variables, expectations, indexation mechanisms, and the short-run dynamic path seems much more suitable for the task of short-run stabilization problems. As noted above, this analysis can be helped enormously by a political economy analysis of the situation.

We would like to finish this paper with a brief discussion of what can or could a CGE model do with respect to stabilization and adjustment problems. First, in the long-run a traditional CGE model can demonstrate possible restructurings of the economy which are consistent with the short-run goals. If one argues that in the long-run (defined as when stabilization is complete), money does not matter, then a financial sector would add little to this analysis. Second, in the short-run a financial or traditional CGE model can make policymakers aware of the source of the many of the problematic transmission mechanisms and tradeoffs. However, they have little to say with respect to expectations and the dynamic path. Third, if the quasi-fiscal deficit and income distribution considerations (through portfolio reallocation) are important parts
of the stabilization problem, the instructional function of a financial cgs model would be significantly enhanced. Fourth, the power of financial cgs models would be increased considerably if inflation could be made to matter more. The problem of the velocity of money is crucial in this regard. Related to this is our fifth point. Cgs models will be more useful for stabilization purposes if they can include expectations in a more realistic fashion. (Generally, this implies that the models must be kept very small in size in order to be manageable.) Sixth, the inclusion of political economy factors in cgs models will also make them more useful for stabilization purposes.

Endnotes

1. The institutional structure of this model is similar in many respects to the Indonesian model of Taylor and Rosensweig (1984).

2. Note that this model is an adaptation of the one already mentioned by Bourquinon, Branson, and de Melo (1989).

3. The main exceptions that we have encountered are when higher inflation leads directly to drops in investment as it causes poor expectations or indirectly via capital flight and lack of availability of credit. As noted in the previous section, the modelling of such features to this point has been rather ad hoc.

4. In his comments on early work on financial cgs models, Feltenstein (1984) and Robinson and Tyson (1984) - McKinnon (1984: 273) stresses the point that the importance of including a financial sector will be very much linked to "believable financial specifications that adequately reflect the way capital markets work in a typical less developed country." This statement is further discussed with regards to both financial institutions - informal and formal - and the manner in which budget deficits are typically financed.

5. We do not intend to exaggerate the importance of closing the fiscal deficit. While it will generally lead to stabilization, it may be a very stagnant stability, especially if it is done by cutting public investment and crowding-in is an important feature
of the economy. See Panelli, Frenkel, and Taylor (1992: 32-41) for a fuller discussion of this issue.

6. Remember that the problem began due to some price rigidities, one of which may be the real exchange rate. Even in cases where a real devaluation is possible, if imported inputs do not have domestic substitutes, this may only heighten the short-run crisis. Buffie (1992) develops a dynamic, dual economy macroeconomic model in which attempts to meet the fiscal deficit via increases in public sector inputs (such as electricity) have strong contractionary effects upon the economy. In the end he points out the urgency of tax reform which brings the argument back full circle.

7. While some exploratory work has been done on the inclusion of political economy factors in cge models - see Harrison and Rutstrom (1990) or Rutherford and Winex (1990), for example - it is beyond the scope of this paper to go into this issue.
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