**UNIVERSITA' CATTOLICA DEL SACRO CUORE**
**MILANO**

**Dottorato di ricerca in**
**Modelli Quantitativi per la Politica Economica**

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**S.S.D: SECS-P/01, SECS-P/02**

# THE MOZAMBICAN PARTICIPATION IN SADC. *A LIBERALIZATION PROCESS THROUGH DIFFERENT MODELS AND DIFFERENT CLOSURES*

**Tesi di Dottorato di: Elisa Delpiazzo**
**Matricola: 3580124**

**Anno Accademico 2009/2010**

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*Elisa Delpiazzo*

# Abstract

To define what a CGE is, scholars usually refer to closure rules to make the system square. This should affect the model's results and consequently the policies to be undertaken. In this thesis, the main goal is to detect and assess this issue, firstly as a theoretical problem and secondly in an empirical application.

Starting from the famous 1963 paper of Amartya Sen, literature presents many papers on this topic, both theoretical and empirical. However, currently, the closure rule problem is not central in the CGE debate, but more a secondary problem because of their codification under well - defined labels. Here, after a brief introduction on CGEs in their development and their structure, a series of simple *maquette* is presented. They have the exemplary role of introducing the concept of closure in order to explain how it affects the results of a simulation and how this modeller's choice is strictly connected to the macroeconomic foundation of the economic system. In other words, this choice reflects the modeller's beliefs on "how the system works."

After having demonstrated that these choices on macro - aggregates (savings, investments, government deficit ad current account) matter, we move into the real World analyzing through different models (Neoclassical, "Bastard Keynesian", and Structuralist/ Post- Keynesian), and through different closure rules: those on macro - variables and the impact of the Regional Trade Agreement of SADC with respect to the Mozambican economy.

In fact, theoretically the *maquette* were largely simplified in their structure to simply capture the interconnections between the demand - and the supply - side for instance. In this step, the economic structure is more complex. There are many productive sectors, (defined as agriculture, including forestry, fisheries, and breeding, mining, industry and manufacturing, trade services, and services in general) each one linked to the others; heterogeneous households (disaggregated according to location into rural and urban), enterprises and the central government in the Mozambican system. Moreover, this is a multi- country model where three specific trading partners are recognized: the Republic of South Africa, the rest of the SADC Free Trade Area members, and the rest of the World.

In this way, the analysis may capture different aspects of the trade liberalization process: changes in demand patterns and domestic production, which ultimately all reflect on changes in poverty and public policies to be pursued.

The analysis does not only assess the effects of trade liberalization as a reduction in import prices but also as a useful policy to attract investments and to better allocate resources.

Quantitatively, the framework consists of a 2003 Social Accounting Matrix, which collects data from National Accounts and surveys on households and enterprises, fiscal data and other data from different sources.

The simulation will be implemented using MPSGE/ GAMS.

# Riassunto

Nel definire cosa sia un CGE, gli studiosi di solito riferiscono di un cosiddetto "problema di chiusura" come se si trattasse solamente di un problema pratico per rendere il modello solvibile e il sistema quadrato. Questa scelta, però, influenza i risultati della simulazione di un modello e di conseguenza le indicazioni di policy da perseguire. In questa tesi lo scopo principale è l'analisi e la definizione di questa questione tanto dal punto di vista teorico quanto da quello empirico.

Ad incominciare dall'articolo di Amartya Sen apparso nel 1963, la letteratura presenta molti articoli sia con un focus teorico sia pratico sul problema. Ciò nonostante, in questo periodo il problema delle regole di chiusura del modello non appare centrale nel dibattito come se fosse una questione secondaria dopo la loro codificazione in ben precise definizioni.

Qui, dopo una breve introduzione sui CGEs, il loro sviluppo, e la loro struttura, viene presentata una serie di *maquette* (esempi). Essi hanno uno scopo puramente illustrativo per introdurre il concetto di chiusura, per spiegare come influenzano i risultati ottenuti durante la simulazione e come la scelta del *modeller* è strettamente connessa con i fondamenti macroeconomici che egli ritiene siano alla base del sistema economico. In altre parole, questa scelta riflette le sue convinzioni su "come funziona il sistema".

Dopo avere dimostrato che queste scelte sugli aggregati macroeconomici (risparmio, investimenti, deficit di governo, e conto corrente) sono cruciali, l'attenzione si sposta sul mondo reale con un'analisi attraverso diversi modelli (neoclassico, "bastardo Keynesiano" e strutturalista/ post- Keynesiano) e diverse chiusure dell'impatto dell' area di libero scambio del SADC rispetto all'economia mozambicana.

Infatti, dal punto di vista teorico, le *maquette* sono ampiamente semplificate nella loro struttura per catturare solamente alcuni elementi, come le connessioni tra il lato della domanda e quello dell'offerta. In questa fase, invece, la struttura economica appare più complessa. Ci sono diversi settori produttivi (definiti come agricoltura, che include anche pesca, allevamento e sfruttamento delle risorse boschive, industria estrattiva, industria manifatturiera, servizi al commercio, e servizi in genere), ciascuno dei quali è strettamente interconnesso con gli altri, consumatori eterogenei (disaggregati sulla base dell'area di residenza e quindi catalogati come rurali o urbani), imprese e governo centrale nel sistema

economico mozambicano. Inoltre questo è un modello *multi- country* e quindi sono specificati tre partner commerciali: la Repubblica del Sud Africa, i restanti membri dell'area di libero scambio del SADC e il resto del mondo.

In questo modo l'analisi permette di analizzare diversi aspetti della liberalizzazione commerciale: cambiamenti nella composizione della domanda e nella produzione domestica, che si riflettono in ultima istanza sul livello di povertà dei diversi consumatori e sulle politiche da attuare.

L'analisi non soltanto valuta gli effetti della liberalizzazione commerciale come una riduzione nel prezzo delle importazioni ma anche come una politica utile per attrarre nuovi investimenti e per meglio allocare le risorse.

Quantitativamente il contesto è rappresentato da una matrice di contabilità sociale del 2003, che raccoglie i dati della contabilità nazionale, censimenti della popolazione e delle imprese, dati fiscali, e infine dati derivanti da altre fonti.

La simulazione è svolta con l'utilizzo di MPSGE/ GAMS.

# Introduction

Computable General Equilibrium models are multi- sectoral models based on the concept of Walrasian equilibrium theory. This tool is suited for analysis of policy shocks on the whole economic structure. For this reason they may be applied both for national context and for a global system. As applied models, CGEs trace their origins from linear programming (1960s) and input - output analysis (1950s). Both constructions reflect a "pure command economy" (Dervis, De Melo, Robinson, 1982). Namely, input - output analysis answers specifically to the material balancing issue in the productive sector of a centrally planned economy. The scholar who was the first to link the concept of centralized planning and the scarcity price problem was the Soviet Kantorovich, whose theory was developed and extended by Dantzig.

However, these first attempts were not applicable to real policy analysis since they needed a number of compromises and *ad hoc* assumptions which limited their applicability.

Historically, scholars recognize three generations of models from the groundbreaking work of Adelman and Robinson in 1979. In the late 1970s CGEs were mainly implemented to solve income allocation issues. This application was due to the explicit introduction of prices and income, two distinctive features of the CGE framework. Examples of this class of models are Adelman and Robinson (1978) for Korea and Taylor and Lysy (1980) for Brazil.

At the end of that decade the World experienced the second oil crisis (1977-78), so attention was turned to the question of structural adjustment. Policy- makers were concerned about issues of foreign debt for developing countries. In this context, CGEs became the main instrument used to evaluate a "structural adjustment program" because they were able to detect both compositional effects on the production side and changes in macroeconomic aggregates. Under the aegis of OECD, a number of models were built. Modelling examples from this second generation are Thorbecke (1991) for Indonesia, de Janvry, Sadoulet and Fargeix (1991) for Ecuador, Morrison (1991) for Morocco, and Chia, Wahba and Whalley (1992) for the Ivory Coast.

In that period CGEs were also applied in different fields. For instance they became valuable tools for taxation, such as the work of Ballard *et al.* (1985) on optimal taxation, or in international trade analysis both as single- country and multi- country models[1].

Nowadays CGEs are applied to environmental issues to identify multi- sectoral and intergenerational effects of policies such as cuts in toxic emissions or raising green taxes, as in Rutherford et al. (2007a,b), Böhringer and Rutherford (2002), and Carbone, Helm and Rutherford (2006).

However, this is not the only criterion used to distinguish different classes of models. They may be classified according to their theoretical background. Literature usually distinguishes them according to macroeconomic properties of CGE models, mainly the two broadest classes, Walrasian and non- Walrasian models. This distinction is based on the so- called "closure rule" issue. Since the first applied models for Korea and Brazil, this topic has been widely discussed, developing a debate on macro closure in economy- wide models. The first works mostly focus on how equilibrium might be achieved between savings and investments, largely ignoring other macro- aggregates such as government and foreign accounts[2].

As already cited, CGEs are based on the Walrasian theory of general equilibrium. In this context, agents are utility maximizing consumers and profit maximizing producers, and the model specifies equilibrium wages and prices as any market clears. Supply and demand equations are homogeneous of degree zero so that the absolute price level does not matter. Moreover the model displays neutrality of money. All the markets clear so that the model always achieves full employment of all factors and the economy is always at its possibility frontier. In this case, inefficiency has to be interpreted as starting from a wrong point on the frontier itself and not from an interior point.

In the closure rule debate, scholars were widely concerned with analysing the relationships between macro- aggregates in order to classify each model under a specific label. Sen's work focuses on the relationship between saving and investment as the fundamental criterion to distinguish "Neoclassical" and "Keynesian" systems[3]. According to this classification, the main

[1] Typical examples of trade- focused single- country models are the IFPRI models while multi- country model examples are the GTAP model (Purdue University) or the LINKAGE model (World Bank).

[2] Fundamental contributions to the early debate on "closure rules" were the works of Sen (1963), Taylor and Lysy (1980), Rattsø (1982), and Lysy (1983), which survey the different closures analysing the macroeconomics behind. Then Decaluwe, Martens, and Monette (1987) and Dewatripont and Michel (1983) present different approaches to closure rules. Finally an interesting paper focused on the dichotomy between Neoclassical and Keynesian model is provided by Robinson (2003).

[3] These two labels are quite general. They represent a wide range of models. To be more accurate they may be defined as "supply- driven" and "demand- driven" models.

thing to be detected is if the amount of savings determines the total investments or if it is the other way around. Typically Neoclassical macroeconomics assumes a fixed exogenous level of investments which is balanced by savings. So, it is the households' decision as to how much to consume and save which ultimately affects the macro- aggregates. However, there is no a clear mechanism which leads households to increase or not to increase their savings. There may be an interest rate mechanism which makes savings more remunerative or another unspecified mechanism[4]. In contrast, Keynesian models assume a reverse causality between the two macro aggregates. Actors have a fixed propensity to save and investments move to reach equilibrium.

However, the seminal work of Sen had didactical purposes therefore not fitting into the real World. In his model there was a productive sector, two households – one owning labour and the other capital – who consume and save. There is no reference to government or foreigners. In the real World these two actors are fundamental and subsequent works deal with these additional elements.

Government treatment does not clearly contribute to the distinction between Neoclassical and Keynesian models because both models may assume different closures. When "Government closures" are investigated, it means that the modeller has to decide on the causality between tax receipts and recurrent expenditures, in other words if the government deficit is endogenous or not. This choice should rely on a strong assumption about how the political decisions are made. Supposing that government deficit is fixed, a change in real public expenditure makes tax receipts to modify and close the gap. However, assuming an endogenous tax is a strong presumption. Are the political decisions made rapidly in response to a shock? Are the policy makers able to answer opportunely? Is the bureaucratic course particularly complex and time consuming? Everyday life shows that to enact a bill, a governing body requires a long time period so it is less likely to assume endogenous tax. The other possibility is an endogenous government deficit with fixed recurrent expenditures. Here, a change in tax receipts means a change in deficit and it could be defined as a responsibility rule for government behaviour. The logic is to assume a minimum level of expenditures, which cannot be reduced, and then when taxes increase, it saves more to compensate for periods of tax decline.

The introduction of this new agent modifies the saving- investment balance as well. Now, available savings are both private and public, so that the sum of these two sources has to

[4] This is the case of the Johansen model (1960) where consumption becomes endogenous because of a government whose expenditures and taxes are designed to maintain a target level of investment. This mechanism is not explicit because the model does not include the government as an actor.

balance total investments. It is a straightforward conclusion that the closure choice affects the savings performance.

Applying the same logic as before on saving- investment balance, "Neoclassical" models assume endogenous tax rates (in other words exogenous government deficit)[5] while "Keynesian" models assume exogenous expenditures (or endogenous deficit). However, it is correct not to strictly follow this classification. In this work both the government closures are assumed in each model to evaluate whether or not they affect final simulation results or not.

The third relation to analyse is the foreign sector. A notably broad consensus has been reached on the general outlines of a trade- focused model. It usually takes the Armington approach[6], which incorporates imperfect substitutability between foreign commodities and domestic marketed commodities. More precisely, import demand is based on sectoral CES (Constant Elasticity of Substitution) "aggregation" function and export supply is based on CET (Constant Elasticity of Transformation) "transformation" functions[7]. In this way price advantages may be considered and different substitutability assumed instead of a rigid dichotomy between tradable and non- tradable goods.

But, with the introduction of foreigners arises a new crucial issue: the trade balance. Trade theory usually assumes this balance is zero. However, looking at data, it is quite impossible to assume this. So, the modeller has to make another decision on this aggregate: he could presume it exogenous, a decision made abroad, or endogenous. To overcome this problem it is usually assumed exogenous and a fully autonomous entity makes this decision. In other words, the modeller supposes that it is the foreigners who decide how much to save independently of what happens in the world. This interpretation brings to light a number of questions as Robinson (2003) suggests. From a macroeconomic point of view, treating this flow as exogenous imposes questions about why foreigners assume to save more today if there is not any explicit reference to assets or time inside the CGE model. Saving today means, coherently deciding to consume more in the future (i.e. higher future exports). Other scholars assume that trade balance is endogenous. This is the position of Taylor (2004), who recognizes a different behaviour of trade balance if it is referring to a developing or a developed country. In fact, he states that foreign savings (or trade balance) represent the "net foreign position" of a State. In this accounting definition there are not solely the financial assets held by

[5] Nowadays, the most widely used Neoclassical models assume endogenous tax rates (i.e. IFPRI models, LINKAGE model).

[6] This approach is based on the 1969 paper of Paul Armington.

[7] Examples of trade focused CGEs based on the Armington assumption are Robinson et al. (1999), Devarajan, Go, Lewis, Robinson, and Sinko (1994), Devarajan, Lewis, and Robinson (1990), Dervis, de Melo, and Robinson (1982).

foreigners but also the assets in foreign currencies held by wealthy domestic agents. If the analysis regards a developed economy, foreign savings may be considered endogenous if we consider that when actors change their tastes, for example, and ask for a lower amount of foreign assets, foreigners have enough power to reduce their savings supply. Otherwise, in a developing country endogenous foreign savings are justified according to the existence of rich agents, perhaps fewer, which may decide to reduce their foreign assets and use them domestically as their own choice.

This position, however, raises a question as well: is it possible to interpret foreign savings as a financial bowl even if the framework includes only real variables?

As in the other cases, "Neoclassical" models usually assume exogenous foreign savings while "Keynesian" models make them endogenous. However, as in the case of government closure, this choice does not strictly define the nature of the model itself.

Moreover, a micro- constraint should be added: the market closure factor. Modellers mainly presume that capital market clears and all the capital is full employed when the crucial issue is the behaviour of the labour market. Walrasian in spirit models, such as the "Neoclassical" models, suppose full employment of labour as well, and that the market clears at the equilibrium wage rate. "Keynesian" systems, instead, are characterized by under- employment of labour, or wage rigidities, so that the market is not always cleared and the wage rate may be different from its equilibrium value.

Many scholars, such as Llunch (1979), reduce the closure rule debate to this issue: only the labour market closure strictly defines the nature of the model. Later contributions recognize the role of the labour market closure but do not forget to highlight the crucial role of the macro- closures. In fact, nowadays, the labour market specifications allow for interpretation of the relationship between demand and supply. Typically, supply- driven systems, such as the "Neoclassical" one, assume full employment of resources, and only changes in their total endowments may affect total production. Demand- driven systems, such as the "Keynesian" ones, infer under- employment level for labour, so that demand injections cause changes in the employment level and eventually total production changes.

In this thesis two more models are presented as special cases of these two broad categories: the Johansen closure, a particular case of "Neoclassical" model, and the "Structuralist/ Post-Keynesian", a special case of demand- driven system.

The choice of applying these different closure rules to analyse the empirical case of the Mozambican participation in the SADC Free Trade Area is mainly due to the author's participation in a research project sponsored by the CICOPS – Interfaculty Centre for

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The work is organised as follows. There are two parts.

Part1 is a literature survey on the main concepts at the basis of CGE modelling and a simple numerical representation useful for didactical purposes.

The first chapter deals with Computable General Equilibrium theory as a development of linear programming and input - output analysis based on the Walrasian context of general equilibrium. Then, the mathematical interpretation of this class of model is presented both in the standard format and in an MCP format.

The second chapter focuses on a specific issue: the closure rule problem, already identified in the previous chapter. Here the topic is investigated more deeply, analysing the different closures for macro aggregates in a step- by- step procedure. Moreover, next to a purely theoretical discussion, (based on literature evidence) a series of examples is presented to describe the rationale behind the models applied in the next part of the work.

Then, part 2 is composed of five chapters and is an empirical application of the theoretical issues discussed earlier. Chapter 3 is an introductory chapter whose goal is to present Mozambique, the Southern African Development Community (SADC) and the main provisions for the Free Trade Area.

Chapter 4 presents how the 2003 Social Accounting Matrix was built, from National accounts to the final SAM.

Then, chapters 5 to 7 discuss the three models presented in chapter 2. Each chapter deals with a different model and the different closures inside the model itself. In this way the objective is to evaluate a trade liberalization shock inside the Mozambican economy.

Finally, chapter 8 shows the principal results of this analysis.