Two decades of CGE modelling
Lessons from models for Egypt

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Abstract

Egypt's exceptional experience of two decades of CGE modelling is used to derive lessons for comparable analysis for other countries, give important issues for CGE modelling in general and give future modellers a guide to build on the older modelling experience. It can be derived from the CGE studies of the Egyptian economy that the model closure and the parameters to a large extent determine the results. However, there is no agreement on the closure rule one should use to describe the Egyptian economy while the parameters are generally not very reliable if compared to parameters used in econometric models. The small contribution of these models to actual policy making in Egypt may be explained by the unreliability of the parameters, the absence of financial markets and the short-term focus of most models. It is therefore concluded that improvement of the reliability of the parameters, the adaptation of the model to changes in the economic structure and the introduction of financial markets are important issues for future research.

1

1. Introduction

Since the beginning of the 1980s Computable General Equilibrium (CGE) models have become increasingly popular to analyse the consequences of macroeconomic policy choices and the allocation of resources in developing as well as in developed countries. Until now, only a few survey articles on CGE modelling have been published. These surveys consider different subgroups of CGE models, such as those on CGE models used for policy analysis in developing countries (Decaluwé and Martens, 1988; Bandara, 1991). There exists no *overall* survey article because there are too many different CGE models to cover the complete field of CGE analysis. Unfortunately, the already substantial amount of CGE models for developing countries has rapidly expanded in recent years. This makes it virtually impossible to give a concise survey of this subgroup of CGE models.

Therefore, in this survey a different approach is followed. The different models constructed for one specific country, Egypt, are used to give an overview of the different analyses in CGE modelling. Additionally this approach has the advantage that the development of CGE analysis over time, where ideally new CGE models are improvements of older models, may be analysed.

Egypt has a long-standing tradition in CGE modelling which started with a Cairo University - MIT research project in 1977 (Taylor, 1979a; McCarthy, 1983a) and a joint research project of Cairo University, USAID and the World Bank (1985). An essential part of both projects was the construction of a SAM, containing most of the data needed for a CGE model for Egypt. After the first model by Taylor (1979b) and the associated Social Accounting Matrices (SAMs) for 1975 by Taylor (1979c) and for 1976 by Eckaus and Mohie-Eldin (1979), the building of SAMs became more or less institutionalised and a constant flow of SAMs was made available by the Egyptian statistical office CAPMAS (1989; 1991; 1995). This availability of data for CGE modelling led to several different models, mostly from authors that were associated with one of the above mentioned projects.

The first models are strongly influenced by the work of Dervis, de Melo and Robinson (1982) and Taylor (1979a; 1983) and the structural approach to CGE modelling. As mentioned by Löfgren (1994b) the more recent models are only partly build on the older models, although many of these models are related. An explanation may be found in their difference in focus, extending only a small part of the model such that the model may answer the specific policy questions the model builder intends to address. This has resulted in various models that are sophisticated with respect to small subsections, while staying highly stylized in other parts of the model.

Egypt's CGE research experience, treating a large variety of subjects and covering

the different types of models as presented in the next section, may give lessons for comparable analysis for other countries. The existing CGE models for Egypt are presented in sections 3 and 4. These sections give future modellers a guide to build on the older modelling experience. Comparing these different models in section 5 leads to several important issues for future research on CGE modelling which are summarized in the concluding section.

2. CGE modelling

A CGE model may be defined[1] as the fundamental macroeconomic general equilibrium links among incomes of various groups, the pattern of demand, the balance of payments and a multisector production structure. Moreover, the model incorporates a set of behavioural equations describing the economic behaviour of the agents identified in the model and the technological and institutional constraints facing them.[2] The model is in general equilibrium, because a set of prices and quantities exists, such that all excess demands for commodities and services, in nominal as well as in real quantities, are zero. It should be noted that, as was also mentioned by Bergman (1990, p. 4), CGE models are *not* true general equilibrium models if the latter is reserved for models devoted to the interaction of utility maximizing micro units in the economy.

Along the lines of Robinson (1989) and Willenbockel (1994) we may make a distinction within CGE analyses based on their origins, objectives and theoretical background. The main division in CGE models made in the literature is between Walrasian CGE models and macro CGE models.[3]

2.1 Walrasian CGE models

One group of CGE modellers tries to make the general equilibrium framework of Walras operational and has its roots in applied welfare economics. As such these models are the numerical counterparts of Walrasian general equilibrium models.

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1 See for definitions of CGE models also Dixon, Parmenter, Powell and Wilcoxen (1992, p. 70) and Dervis, de Melo and Robinson (1982, p. 132-133).

2 The agents identified by the model may be representative agents like a typical household with a given socio-economic background, or a typical producer in a particular industrial sector operating on a specific market. It is also possible that the behaviourial equations describe the behaviour of larger entities like social groups.

3 Robinson's (1989) distinction is between micro- and macrostructuralist models, while Willenbockel (1994) makes a distinction between orthodox and less orthodox models

Walrasian CGE models, being based on the optimizing behaviour of representative agents, are extensions of the basic competitive equilibrium as defined by Ginsburgh and Keyzer (1997) with utility maximizing consumers and profit maximizing producers. This type of modelling started with the work of Harberger (1962) on the incidence of taxation within the framework of a numerical two sector model. The work of Scarf (1973) made the determination of the equilibrium of a Walrasian system possible. Especially the pioneering work of Shoven and Whalley (Scarf and Shoven, 1984; Shoven and Whalley, 1992) and recently the work in the context of the Global Trade Analysis Project (GTAP) of Hertel (1997) as well as the work of Ginsburgh and Keyzer (1997) has further elaborated this category of CGE models. The objective of Walrasian CGE analysis is to analyse the quantitative effects of exogenous changes on the optimal allocation of resources, on efficiency and on welfare. Especially the effects of national tax and international trade policies have received much attention and are still popular.[4]

2.2   Macro CGE models

The second line of thought, macro CGE modelling, is a logical extension of Leontief's input-output analysis and linear programming models often applied in development economics (see Blitzer, Clark and Taylor (1975) for a first attempt at integrating both input-output and macro modelling for developing countries). The input-output analysis is extended with endogenous quantities and prices while consumption is related to income, thereby closing the flow of money within the economy. Johansen's (1960) model with simultaneous determination of quantities and prices on sectoral aspects of growth with sectoral reallocation of labour and capital in the Norwegian economy, is generally seen as the first model in this category of CGE models. These type of models are further extended with the ORANI/MONASH models of Australia (Powell and Lawson, 1990; Vincent, 1990) and numerous models of developing countries (Decaluwé and Martens, 1988). Leading authors in this field of CGE models for developing countries are Taylor (1990) and Robinson (1989).

The objective within this field of research is rather to quantify short run income distribution, sectoral growth and trade balance effects of exogenous shocks or policy alternatives, than to elucidate resource allocation effects. To describe the economy at hand, the macro CGE models, opposite to Walrasian CGE models, may include ad-hoc elements and the behaviour of economic agents may not be derived from optimizing behaviour. Thus, it may be argued that these models trade off internal rigour

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4   See for some recent work Harrison, Rutherford and Tarr (1997), Markusen, Rutherford and Hunter (1995) and Lopez-de Silanes, Markusen and Rutherford (1996)). Recently the field is extended with environmental policy issues (see for instance Böhringer and Rutherford (1997)).

for increases in empirical relevance resulting in models that are often impossible to solve analytically and, on the aggregate level, these models are comparable to the short run macro models of the previous decades with an extensive multisector input-output submodel.

2.3   A classification of macro CGE models

The discussion about macro-closures, initiated by Sen (1963), was revived by Taylor and Lysy (1979) who found that the choice of macro-closure to a large extent affected the policy simulation results obtained with a CGE model. Macro CGE models are therefore generally classified by their respective closure. In the tradition of Sen's original paper are the closure rules commonly associated with specific economic theories and 'schools'.

There are two ways to interpret and define the closure rule problem. In mathematical terms, the problem boils down to the simple notion that the model should consist of an equal number of equations and endogenous variables. Thus, the closure rule problem is the decision the model builder has to make on which variables are endogenous and which variables are exogenous. Alternatively, if the model is build in the Walrasian tradition and all decisions are based on optimizing behaviour, the closure rule problem is the introduction of macroeconomic constraints that inflict upon the microeconomic behaviour of individual agents and which introduce the need for an additional endogenous variable that balances this constraint (see, for instance, Ginsburgh and Keyzer (1997, pp. 111-112)). In general a closure rule is determined by the personal theoretical preferences of the model builder and the, in his view, empirically most plausible adjustment processes.[5] The different closure rules are not discussed here for reasons of space and because they are well discussed in the referred literature.[6]

3.   Walrasian CGE models for Egypt

There are relatively few Walrasian CGE models developed for Egypt. The CGE models built in the 1980s and the beginning of the 1990s were strongly influenced by the

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[5]   For instance Taylor (1991, p. 41) formulates this as follows: '...the closure question ... transforms itself to one of empirically plausible signs of 'effects' and -more important- a perception of what are the driving macroeconomic forces in the system', while Decaluwé and Monette (1988) add that 'there is no rigorous criterion for choosing the 'right' macroclosure, besides the modeller's intimate conviction of how the economy functions'.

[6]   See, for instance, Taylor (1991), Decaluwé and Monette (1988), Dervis, de Melo and Robinson (1982), Ekinci (1993) and Storm (1992) for a discussion of closure rules.

above mentioned first two CGE modelling projects. Most of the earlier CGE models are therefore macro CGE models. Only recently some models have been published which are Walrasian in character. These models are all based on the optimizing behaviour of representative agents, have no quantity clearing markets, and have the objective to analyse the quantitative effects of exogenous changes on the optimal allocation of resources, on efficiency and on welfare.

A distinction between these models can be made with respect to the following research subjects:

- Fiscal policy models
- Environmental models
- Trade liberalization models

The oldest model by Pleskovic (1989) stays relatively close to the original work of Harberger (1962) on fiscal policy. The second model by Blitzer, Eckaus, Lahiri and Meeraus (1994) is derived from linear programming models, and discusses environmental effects of economic policy. The last two reviewed Walrasian CGE models by Dessus and Suwa-Eisenmann (1998) and Maskus and Konan (1997) belong to the large group of models that discuss the welfare effects of trade liberalization.

3.1   Fiscal policy model

The model of Pleskovic (1989), based on the 1979 SAM (Ahmed, Bhattacharya, Grais and Pleskovic, 1985), is build within the Walrasian tradition and is basically an extension of the Harberger (1962) model with inter-industry transactions and preexisting taxes. In the tradition of these models, it addresses the effects of fiscal policy, i.e. changes in taxes and subsidies on the income distribution. This closed economy model is highly stylized with, for instance, no capital accumulation and fixed expenditure shares of the two distinguished income groups which each have a choice between two consumer goods.

3.2   Environmental model

The model of Blitzer, Eckaus, Lahiri and Meeraus (1994) is different from the other models as it is an environmental model focussing on carbon emissions and, although it is presented as a CGE model, it is in essence an extension of a linear programming model. It is comparable to their earlier energy model for Mexico (Blitzer and Eckaus, 1986). This model may be classified, if at all possible, as Walrasian because the outcomes of the model are determined by the maximisation of the utility of *one* representative agent over several periods. This analysis is an interesting first approach

explaining how one may attempt to build an empirical CGE model in an intertemporal setting. It is implicitly assumed that agents have perfect foresight because the model is solved by maximizing total welfare, defined as the discounted aggregation of the utility of the representative agents over the number of periods taken into account. The model is based on the 1983/84 SAM, from which most parameters are taken by use of calibration. If not for the specification of the objective function maximizing total welfare, the model would have been linear. Only the parameters in the utility function of the representative agent have been econometrically estimated.

3.3 Trade liberalization models

Many Walrasian CGE models have been built to analyze the consequences of trade liberalization for a country's welfare. Two such models have recently been constructed to analyze the welfare consequences of the bilateral trade agreement between the European Union and Egypt in the context of the Euro-Mediterranean Initiative initiated in 1995 (see Hoekman and Djankov (1997) for an overview of the agreement). Both models are highly stylized with a disaggregated multisector structure of about 40 distinguished industries to be able to analyze the sectoral impact of trade policy. Both models use nested CES production functions and use the Armington approach to model trade. In a second step trade is divided among different regions. The models perform government budget neutral policy analysis, thus analysing the effect of trade liberalization on welfare independent of fiscal policy effects.

The model by Dessus and Suwa-Eisenmann (1998) uses the extended linear expenditure system (see, for instance, Lluch, Powel and Williams (1979)) to model household consumption demand and savings. Furthermore, to model a technology transfer from trade, total factor productivity growth is assumed to depend on an export-led Marshallian externality (based on De Melo and Robinson (1992)). In the tradition of Walrasian models the neoclassical closure is used in this model. The parameters of the model are based on the calibration of a SAM for 1992 updated to match the national accounts of 1995. The model is solved using recursive dynamics.

The second model by Maskus and Konan (1997) and a comparable model by Konan and Maskus (1997) discusses the same policy issue. Additionally, this model is used to analyse the consequences of an hypothetical Egyptian free trade agreement with the U.S. (Hoekman, Konan and Maskus, 1998). The model is well embedded in the Walrasian literature and it is claimed to be a neoclassical model (Maskus and Konan, 1997, p. 277). However, this model uses a variant of the neoKeynesian closure. Total consumption, and thereby implicitly total savings, are determined by deducting exogenous investment from total income. Thus, it is assumed that a mechanism exists such that savings are brought into equilibrium with intended (exogenous) investment.

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This mechanism is not made explicit. The use of this neoKeynesian closure may be an argument to classify this model as a macro CGE model. However, the intentions of the authors, focussing on welfare analysis and the optimizing behaviour of one representative agent, makes this clearly a model in the Walrasian tradition.

This model does not use recursive dynamics and therefore discusses only the impact effect of trade liberalisation. The model parameters are based on the calibration of a SAM for the year 1990. The policy experiments are performed with a fixed current account and an endogenous exchange rate.[7]

4.   Macro CGE models for Egypt

Most of the earlier CGE models for Egypt are macro CGE models. These models primarily focus on the impact effect of different policies on the distribution of income, the trade balance and sectoral growth. The models are characterized by many rigidities to describe the highly regulated Egyptian economy in the 1980s and most of them use closures that deviate from the neoclassical closure. Analogous to Walrasian models, are financial markets not explicitly modelled in macro CGE models for Egypt, and are most of the parameters determined by calibration.

The macro CGE models for Egypt may be divided into the following three main groups:

- General purpose models
- Agricultural models
    - Water allocation models
- Energy models

The first group are the *general purpose models*. These models attempt to give the best possible 'general' description of the Egyptian economy, thereby being able to analyse several different types of policy questions. The other two groups focus on two important sectors for the Egyptian economy in the 1980s, i.e. the energy sector and the agricultural sector.

The agricultural sector was characterized by high food subsidies associated with high agricultural imports. These high food subsidies were generally seen as one of the main causes for Egypt's declining economic growth. The Egyptian government was consequently urged by both the World Bank and the IMF to reduce these subsidies.

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7   Why the current account is kept exogenous is not explained.

The earlier *agricultural models* focused therefore predominately on the consequences of such a reduction in food subsidies.

More recently the attention of agricultural models shifted to the allocation of water. These *water allocation models* may be used to analyse, for instance, the recent large scale land reclamation projects in the south around the Toshka canal, a spillover canal of lake Nasser, the 'New Valley' project in the Western Desert, and the recent land reclamation projects in the northern Sinai. They may also be useful in analysing the optimal allocation of water which is a scarce resource in both Egypt as well as in the region. It is even argued by some political scientist[8] that the scarcity of water is one of the largest future threats to stability in the Middle East.

Egypt has a considerable energy sector. The oil sector produced Egypt's main export product of the 1980s (in the 1990s the receipts from oil exports were surpassed by the receipts from tourism) while the domestic energy sector was, similar to the agricultural sector, characterized by high subsidies. The different stabilization and adjustment programs for Egypt all urged for a removal of these subsidies. Additionally, it was expected that Egypt's oil resources would run out in a few years, causing severe balance of trade shortages. The *energy models* were consequently used to analyse the effect of a reduction in energy subsidies and an expected decline in oil production.[9]

4.1   General purpose models

There are three different general purpose models. The model of McCarthy (1983b) is to a large extend based on the model of McCarthy and Taylor (1980) and the model of Taylor (1979b). It is a major result of the Cairo University - M.I.T. research project and is based on the project's SAM for 1976 (Eckaus and Mohie-Eldin, 1979). Much time is invested in linking the six distinguished income groups (based on percentiles) to the earnings from value added and remittances. The linear expenditure system is estimated based on a household budget survey while the other parameters are based on calibration of the model. The overall macro closure is, just like the models of McCarthy and Taylor (1980) and Taylor (1979b), structuralist with markup pricing and exogenous investment.

The model of Ahmed, Bhattacharya, Grais and Pleskovic (1985) is a very detailed and sophisticated model, and the main result of the Cairo University, USAID and World Bank project. For instance, this model distinguishes between producers and traders, giving the possibility to ration official traders vis-a-vis unregulated traders

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8   See for instance Bulloch and Darwish (1993), Kliot (1994) and Shapland (1997).

9   Recent finds of natural gas compensate however for this expected reduction in oil resources.

on the regulated Egyptian markets with fixed prices. Another example of the detail of this model is the modelling of the disaggregated foreign exchange market of the 1980s. Furthermore, does the model consist of an updating model that changes parameters in between periods. The model uses the neoclassical macro closure as investment is assumed to be rationed by available savings (Ahmed, Bhattacharya, Grais and Pleskovic, 1985, pp. 114-115).[10]

The third general purpose model by Nugent (1988) is somewhat different from the other two approaches. In this paper a sensitivity analysis is applied to the used parameters, closure rule and the specific modelling of investment and savings. The most important result derived from this model is, not surprisingly, that the model results are sensitive to both the model specification and the parameters.

4.2   Agricultural models

Like most developing countries is the Egyptian economy characterized by a relative large agricultural sector.[11] Furthermore, large scale government intervention on Egypt's agricultural markets, after the escalation of food prices in the beginning of the 1970s, caused large deficits on the balance of payments. Several models have been built to analyse policy questions related to reform of the agricultural sector.

The first CGE model for Egypt (Taylor, 1979b) is especially developed to address the consequences of changes in Egyptian food subsidies. This structuralist model was, as mentioned above, an example for many of the subsequent models.

For instance, the model by Thissen (1994) is strongly influenced by this model, although mainly because it is based on the model of McCarthy (1983b) and the model of Taylor (1983) for India. Both these models were, in turn, based on Taylor's original work. Although Thissen (1994) is much like a multi-purpose model it is especially focused on the effect of the interaction between the vegetative and livestock agricultural sectors. This structuralist model, based on the 1986 SAM extended with five socio-economic classes, uses estimated parameters for the linear expenditure system, the import and the export functions. The other parameters, mostly input-output coefficients and scale parameters have been derived from calibration.

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10   The parameters are probably derived from calibration, being the 'normal' procedure, though this is not obvious from the publication.

11   Agriculture accounts for about 20 percent of total value added.

4.2.1 The allocation of water

The model of Robinson and Gelhar (1996) assumes perfect working markets (no rigidities) and uses the Johansen closure to achieve macro equilibrium. This model, which is highly disaggregated with respect to the agricultural sector, focuses on the importance of a land constraint and a water constraint (fixed land and water supply) on the Egyptian agricultural sector and Egypt's economic development in general. This is a first approach towards a model that is able to address this, for Egypt and the region, very important agricultural issue.

A more recent model by Löfgren, Robinson and Nygaard (1997) is an extension of Robinson and Gelhar's (1996) model with more elements from earlier CGE models to improve its resemblance of the Egyptian economy with, for instance, rigidities in the energy sector as in Löfgren (1995) and the specific link between the vegetative and livestock sectors as in Thissen (1994). This model is used to simulate three growth scenarios with respect to investment and factor productivity growth over a period of 30 years. These scenarios are a pessimistic scenario with low investment and factor productivity growth, an optimistic scenario with high investment and productivity growth, and an urban focused scenario with low investments in agriculture and high investments in other sectors. Like in Ahmed, Bhattacharya, Grais and Pleskovic (1985) are the parameters in between periods updated by an updating model.

4.3 Energy models

The models of Choucri and Lahiri (1984; 1990), a major spin off of the Cairo University - M.I.T research project, and Khorshid and Löfgren (1992) are primarily constructed to anlyse the macroeconomic effects of changes in domestic and world energy prices. The model of Choucri and Lahiri is formulated along the lines of the models by Taylor (1979a; 1983), and uses a Kaleckian or structuralist closure with a distinction between quantity clearing excess capacity markets with a fixed mark-up price and quantity constraint price clearing markets. The model of Khorshid (1992) is more closely modelled along the lines of Dervis, de Melo and Robinson (1982) with a CES based production function and the Armington approach to modelling international trade. This model uses the neoclassical closure as investment is set equal to savings minus government borrowing (Khorshid and Löfgren, 1992, p. 21).

The model by Löfgren (1995) compares the results of raising domestic oil prices and subsidy cuts for different closures. Although several closures are compared, the model stays structuralist in character with markup pricing and rigidities on, for instance, the labour market. It is found by Löfgren (1995) that the results are significantly different for the different closure rules, but not opposite in sign. That is, for

both policy experiments and all used closures the model predicts a short run contraction. However, not surprisingly, there are large differences in implemented investment and, therefore, in long run effects of both policies.

5. CGE models for Egypt: Lessons

Several of the many models that have been constructed for Egypt build on older models, although some models have started from scratch, either because of their ignorance of the older work, or because of the difference in focus of the model. A few general purpose models exist, but most of the models concentrate on either the energy sector, the agricultural sector or trade liberalisation. It is concluded from the studies by Löfgren (1995) and Nugent (1988) that the model *closure* and the *parameters* are important for the obtained results. However, there is no agreement among modelers about which closure adequately describes the Egyptian economy. This may be a consequence of the focus of the model and the time period under investigation.

The focus of the model also affects the type of country specific elements that are introduced. To address the highly regulated Egyptian economy many of these models incorporate *structuralist* features such as markup pricing rules and excess capacity. The reforms implemented in recent years, and those to be expected in the near future, will probably lead to less rigidities in the Egyptian economy and a more *neoclassical* modelling seems, therefore, appropriate.

According to Löfgren (1994b) have CGE models for Egypt only little contributed to policy making. Probably this is due to the period covered by the CGE analysis (usually short run), the *unreliability of parameter estimates* of the model and the analysed policy questions. Most of the discussed CGE models for Egypt consider only *short-term* effects. A model that is capable of addressing medium to long run analysis will certainly add to the policy relevance of these models. For instance, structural reforms such as those within the context of the recently implemented Economic Reform and Structural Adjustment Program (ERSAP) for Egypt, are expected only to materialize after a time period of, at the least, five years.

With respect to the determination of *parameters* it may be concluded that there is much room for improvement (see also Löfgren (1994a)). The parameters of CGE models are in general, and also in the presented models for Egypt, derived from a calibration technique using only a Social Accounting Matrix (SAM). The reliability of the resulting parameters is questionable because of possible exceptional circumstances in the base-year of the SAM and the large consequences of errors in the data set, in terms of deviations of the calibrated parameters. The precise effect of devi-

ations in the parameters from their 'actual' value due to the use of the calibration technique on the results of CGE analysis is difficult to asses. It is not clear which variations in simulation outcomes are reasonable and which are not. Furthermore, the exact formulation of the model at hand, the value of other parameters not derived from the SAM and the size as well as the sort of policy measures will lead to different changes in the non-linear model outcomes. The tremendous amount of work involved in systematically performing conditional or unconditional sensitivity analyses on large scale CGE models for errors in base-year SAMs as proposed by Harrison, Jones, Kimbell and Wigle (1993) has prevented people from actually performing them. A few studies which do a less comprehensive sensitivity analysis show that at the very least initial conditions significantly matter for CGE analysis (Wiese (1995); Roberts (1994)). Furthermore, it seems likely that results obtained with CGE analysis will be more seriously affected by parameter errors if the period under investigation increases. Improvement of the reliability of parameter estimates, such that the dynamic behaviour of the model better describes the actual economic developments, is therefore crucial for long term CGE analysis.

From the perspective of *policy relevance* are the water and land allocation models very promising. They may be used to analyse, for instance, the recent large scale land reclamation projects such as the 'New Valley' project in the Western Desert, the projects in the northern Sinai and in the South around the Toshka canal, a spillover canal of lake Nasser. It may also be useful in improving water use as water is a scarce resource in Egypt as well as in the region. It is even argued by some political scientist[12] that the scarcity of water is one of the largest future threats to stability in the Middle East. The Euro-Mediterranean Initiative is presently also an important policy issue for Egypt as well as the region. The policy questions related to these agreements may be adequately addressed by the trade analysis models.

The main economic policy issues in the last decade were related to the Economic Reform and Structural Adjustment Program implemented in the beginning of the 1990s. However, with respect to analyzing recent structural reform policy in Egypt is the *absence of financial markets* the main shortcoming of the discussed models.[13] The Egyptian financial sector was subject to a large scale restructuring. Furthermore, many of the implemented reforms, as well as the reforms to be implemented in the near future, are expected to operate via financial markets. The lack of an explicit modelling of the financial sector inhibits policy analysis of these reforms. For instance, as admitted by Maskus and Konan (1997, p. 276), is the liberalisation of trade and the

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12   See for instance Bulloch and Darwish (1993), Kliot (1994) and Shapland (1997).

13   See Robinson (1991) and McMahon (1992) for an overview of the few CGE models that incorporate financial markets explicitly.

associated nominal exchange rate and balance of payments policy an important issue in nowadays Egypt that cannot be adequately analyzed by CGE models which focus strictly on the real economy.

6.   Conclusion

It was found that the CGE models for Egypt only moderately made use of the earlier models. It would be more efficient if the more recent models would use the experience of the previous decades of CGE modelling, though this is partly dependent on the focus of the model. However, the large scale restructuring of many of the developing economies causes future research, next to improving parameter estimates, also to focus on adapting the earlier models for the changes in the economic structure.

To increase the policy relevance of the model it is of great importance that the models are also capable of addressing medium to long run policy simulations. Therefore, it is crucial that the reliability of parameter estimates increases. Next to the time period considered, is also the modelling of financial markets important because a large part of structural adjustment and stabilization programs focus on reforms on specifically these financial markets.

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