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The Use General Equilibrium Models In Medium Term Planning

Theoretical Background

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Introduction :

Currently developed countries required a century to industrialize. This transformation involves large and systematic shifts in the structure of production, demand, employment, investement, and trade. Developing countries aim at achieving a similar transformation in a shorter period in an adverse world cirumstances.

The heart of the development problem is the relation among resource allocation decisions in different sectors of the economy. Early formulation of this problem were based on simple extensions of the leontief input-output system. These led to the accumulation of data on the relation among economic sectors, which has made possible the formulation of more complex analytical systems. Input-output and linear programming planning models pioneered in the 1950's and 1960's by Leontief, Chenery and others describe the problem from the point of view of a planner able to determine economic quantities as part of a centrally determined optimal plan. Recently a great deal of efforts are devoted to building applied general equilibrium models to support the formulation and conduct of economic policy in developing countries. This work focuses explicitly on the mixed market nature of most developing economies. The emphasis has thus shifted to modelling the market mechanism, including special institutional features and distortions, as it operates in actual, always partially decentralized economies.

In this paper we discuss the use of general equilibrium models in macro economic analysis that is now becoming an important part of meduim term planning efforts in mixed economies. We present a multisector, general equilibrium, policy model that can be used in the preparation of a five year plan, in exploring the direct and indirect effects of different economic policies. It can also be used to explore the effects of external events.

In a later stage we aim at applying this model to the Egyptian economy .

The Use of Models in Policy Analysis :

The analysis of development policy has evolved through the interaction between development theories and their application to varied countries and problems. In policy analysis, there is a gap between the erea of activity of pure theory, trade and growth theory in particular, and the real world that faces the policy maker and planner. Policy formulations needs more than the qualitative insights that pure theory can yield. Theoretical reasoning always provides the starting point, but models are always needed to provide quantitative significance of the various mechanisms analysed by theory. Further more, indirect effects of policies may escape intuition and thus the attention of theorists, whereas emperical modeling can reveal their presence and importance. Also senstivity tests are needed to clarify the role of key behavioural assumptions or important parameter values .

Emperical general equilibrium models that can be solved numerically are useful to provide a bridge between the theorist, the planner, and the policy maker. Theorists will be able to relate the functioning of the applied models to known theorems and analytical results. Policy makers,on the other hand, will be able to recognize in the questions adressed by the model some of the real-world policy difficult choices they face. Constructive debate can facus on particular behavioral assumption, a particular sector, or a particular set of parameter values. Disagreements and differences in policy recomendations can be traced back

to specific behavioral assumptions, emperical estimates, or fundamental differences in normative goals. Models should be flexible and detailed enough to accomodate various aspects of the reality of developing countries but should also remain close to pure economic theory. Important aspects of reality still defy formal economic analysis, however, and development problems in particular do not always fit into the established neoclassical frame work. A multisector, general equilibrium model need not always conform to walrasian theory.(1) It can accept rationing of foreign exchange and persistent excess demands in some important markets. Although the equilibrium described may not be Walrasian , neoclassical resource allocation theory remains the fundamental framework of the analysis. Different general equilibrium models may focus on different kinds of economy-wide consistency. They are designed for policy analysis and cannot be used to make unconditional projections or forcasts. In contrast to the large, temporally disagregated, macro economic forcasting models whose econometric specification relies heavily on lagged endogenous variables. The mechanisms driving general equilibrium models should be clear and easy to grasp, the model has to be as transparent and simple as possible.

If a country facing a foreign exchange shortage is thinking in a devaluation of its currency, and if export demand elasticities and substitution elasticities between domestic and imported goods are low,

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(1) Dervis, K. and Others (1982), [3]

then the country will gain nothing by devaluation, instead it will suffer from an adverse terms-of-trade effect. Extensive studies are needed befor taking such a step. Are supply elasticities thought to be very low ? If so, in which sectors and for what reasons? Is it a macro economic problem,with the price level seen tied to the exchange rate by strong cost-push factors that make a real devaluation impossible ? Or, is the whole problem is based on income distribution considerations ? If so, who stands to gain or lose from a devaluation? A general equilibrium model can provide an economy wide framework that permits an explicit specification and evaluation of each of these operations .(1)

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(1) Dervis K., and Others , [3]

Multisector Models and Development Policy:

Today, some fast-growing developing countries are achieving a large and systematic transformation in a relatively short time. Both the speed and systematic nature of this transformation implies that sectors cannot be considered in isolation from one another. Bottlenecks arise and it is necessary to view the economy at a sufficiently disaggregated level to reflect important differences in production and trade structures.

Furthermore, this complex transformation process depends jointly on both domestic policies and external events, including changes in international prices and access to markets in developed countries. Structural adjustements to external events is an important feature of development policy.

Multisector models provide a very sueful framework to understand and manage structural changes. Such models in corporate production at a level of aggregation that permits the analysis of structural change and also captures the essential interdependent nature of production, demand, and trade within a general equilibrium system. Whereas input-output models can capture only simple general equilibrium relationships, more recent models are able to incorporate market mechanisms and policy instruments that work through price incentives. Application of multisector

general equilibrium models contributes to a better understanding of how different policies affect economic performance. Different general equilibrium models may focus on different kinds of economy-wide consistency.

In development strategy i.e. medium to long term policies, focus is on real variables such as the growth and structure of production, employment and investement. Factors as capital accumulation, laborforce growth, productivity change, trade structure, investement allocation, real resource transfers through the foreign sector, and broad changes in the structure of demands as a result of income growth reflect the important forces at work. These factors largely determine the nature of the development process in a country and must provide the central focus of an analysis of different development strategies. Historically planners in socialist as well as in some developing countries worked within environment of a command economy. They were thus able to ignore the market system and to rely largely on command instruments. Production targets, investment allocation, intermediate inputs, and even labor were allocated directly in physical terms without much concern with the underlying value flows and market incentives. Most countries today, however, including eastern European countries, work within the environment of a mixed economy in which the market plays a central role. The exchange rate, taxes, tariffs, subsidies, and other policy variables that affect relative prices and incentives through the

market mechanism have become more important than command policies in modern mixed economies, developed and underdeveloped. Given the prevalence of the market mechanism, a major focus of policy analysis is to study carefully the relation between different policies and policy packages on the one hand and, on the other, the market responses to them. It is important to understand how incentive policies affect the allocation of resources and the structure of growth.

The analytic framework on which policy analysis is based, is explicitly or implicitly, that of an economy wide, multisector model. The core around which all such applied models are built is the input-output model. The essence of input-output analysis is that it captures the important element of the inter relatedness of production arising through the flow of intermediate goods among sectors. Even with its assumptions of linearity and cost-determined prices independent of demand, the simplest input-output model nonetheless represents a powerful tool for applied general equilibrium analysis . Multisector planning models are now extanded to include in a realistic manner the feadbacks through the price mechanism that achieve equilibrium between the independent optimising behaviours of suppliers and demanders of products, the essence of multisector policy analysis is to capture this interdependence .

The accounting framework that underlies multisector analysis is that of the input-output accounts. Through the more complete "System

of National Accounts" the input-output and national income and product accounts have been integrated into a single general framework. The more recent interest in income distribution and the flow of funds among "institutions" defined more broadly than in the system of national accounts has led to the development of a more general social accounting framework. All these systems provide a complete and consistant picture of the "circular flow" in an economy. Even without the apparatus of a fully specified formal model, such accounting systems provide a powerful tool of analysis because they focus on the interrelationships among the different "actors" in the economy and impose the requirement that all real and nominal flows must be consistant. Such a "consistency check" can often reveal problems both with the data and with the economic assumptions underlying policy analysis . As a matter of fact the major usefulness of applied general equiblibrium models is not in their particular emperical results, which may quickly becomes outdated, but in the fact that they force policy makers to analyze the implications of policy choices within a consistent analytic and information framework.

Prices play a crucial role in computable general equilibrium models and are solved so as to "clear markets" in the economy model. They are thus determined endogenously so as to equilibrate the results of individual optimizing behaviour of a number of actors, for example, producers, owners of factors of production, households, and governement.

Given their theoretical structure, input-output and linear programming models seem best suited to a situation in which a central authority fully in control of the various quantity variables in the system, but subject to various technological and physical constraints has to make consistant or optimal decisions. Input-output analysis has often been used to solve the famous problems of material balancing in the productive sphere of a centrally planned economy. Kantrovich observed in a programming approach a clear link between centralized planning and the scarcity price concept of neoclassical economic theory, while Dantrig developed linear programming as a tool for optimal central decision making. Formulation of these models does not appear well suited to situations where many agents independently maximize their own welfare functions and jointly but unintentionaly determine an outcome that can be affected only indirectly by the planner or policy maker. In mixed economic systems a great deal of economic activity is not under the direct control of policy makers. Autonomous decision making by various economic "actors" and market mechanisms have an important impact on resource allocation. Linear programming and input-output models usually do not contain variables that can be considered to be instruments controlled by policy makers. They can benefit from the consistent economy wide picture provided by the models, but they cannot easily relate the computed variables to any actual policy decisions .

In practice, applications of linear models (Input-output & linear programming) to developing countries have always involved a number of compromises and extensions to the basic model in order to make the models more realistic and useful in an applied setting.(1) Some modifications were made to capture indirectly the supposed effects that policy changes would have on endogenous variables. For example, the impact of import coefficients of the rise in the relative price of imports due to a tariff can be specified exogenously and so be fed back into the model. Other modifications represent attempts to capture non-linearities by imposing various constraints and/ or piecewise linear functions. None of these modifications, however, addresses the essential problem that the models do not directly include the sorts of price-incentive variables that represent the essential tools of planners and policy makers in mixed economies.

In order to achieve greater policy relevance, the model should not try to represent a central command economy, it should, instead, try to present a framework in which endogenous price and quantity variables are allowed to interact so as to simulate the working of at least partely decentralized markets and autonomous economic decesion makers. Such price endogeneity and general equilibrium interaction cannot be achieved using the standard linear programming formulation. Since economic behaviour and relations such as budget constraints, consumption functions and saving functions must

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(1) For example see Chenery (1971), [2]

be expressed in current endogenous factor and commodity prices. But the standard primal constraint equations of a linear program cannot include the "shadow" prices that result as a by-product of the maximization or, to put it differently, one cannot in general expect that the resource allocation and production structure determined by the solution of a linear program is consistent with the incomes and budgets that result from its dual solution. Indeed, if factor prices have any impact on the structure of demand, the quantities supplied that are the outcome of the primal solution will in general not equal the quantities demanded that are implied by the dual solution. On the contrary, computable general equilibrium models include the fundamental general equilibrium links among production structure, incomes of various groups and the pattern of demand .