A MACROECONOMETRIC MODEL OF A SUBSISTENCE ECONOMY: THE CASE OF ETHIOPIA

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by

HAILE KEBRET TAYE

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UNIVERSITÉ D'OTTAWA
UNIVERSITY OF OTTAWA

To my parents who may have not understood why I do what I do but have always supported my efforts and sacrificed a lot more than they should and can afford;

and

to my friend Abraham Hagos whose courage and determination has always been an inspiration.

ABSTRACT

The objective of this study is to analyze the structural and behavioral attributes of a small and open subsistence economy. Using a medium-sized macroeconometric policy model, the study analyses specific structural factors and internal rigidities facing the Ethiopian economy and examines the impacts of various past and recent policies implemented by successive governments. For instance, the study examines the impacts of devaluation, the effects of the "socialist" policies implemented in the mid-1970s, and the effects of reductions in military expenditures on the performance of the economy.

Consistent with the dominance of supply constraints and the subsistence level of the economy, the model emphasizes the crucial role of the availability of foreign exchange. Consequently, the workings of the model are structured as follows - export earnings are the main sources of foreign exchange (capacity to import) - which determines the level of imported inputs. The level of imported production inputs determines the level of capacity utilization, which in turn determines actual output directly and via its impact on the utilization of domestic inputs indirectly. The level of output determines aggregate demand. The role of aggregate demand is to determine the allocation of available output between its various components. This allocation will determine the external balance via patterns of expenditures (domestic goods vs imports), and will indirectly influence the growth of output via inter-temporal income allocation (consumption vs investment).

Within this broad structure, it is hoped, the study will contribute to the following areas of macroeconomic research.

The study addresses the question of the applicability of macroeconometric models for developing countries and uses such a model to examine the structural and institutional peculiarities of a subsistence economy.

This study also presents the first macroeconometric policy model of Ethiopia. This model is used to examine the supply constraints and the importance of the exchange rate on the economy.

Further, the study will attempt to examine the impact of alternative macro policies on

the performance of the economy and provide a quantitative framework for further policy analysis. The specific policy issues examined include: One, how was the performance of the Ethiopian economy affected by the policy shift of the mid-seventies? Two, what is the likely impact of the recently implemented devaluation of the domestic currency (birr) on the balance of payments and other economic aggregates? And, three, is there a trade-off between military expenditures and social programs? The key findings are summarized below.

Devaluing the currency would: One, have an adverse impact on output growth and, hence, on components of aggregate demand - on private consumption expenditures and on private investment, for instance; two, be inflationary, as would be expected for a small (price taking) open economy; but, three, it would have a positive impact on the current account balance.

A reduction in military expenditures: One, would increase total output, and would have a positive net impact on private consumption and investment expenditures; two, suggests the existence of a significant trade-off between military expenditures and expenditures on education and health; and, three, would improve the current account balance since most of the military equipment is imported.

No change in policy in the mid-1970s would have: One, increased total output and sectoral outputs, and would have had a positive net impact on private consumption and investment expenditures; two, increased expenditures on education and health; but, three, would have decreased most imports and exports and would have had a net positive impact on the current account balance.

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1. INTRODUCTION

1.1. OBJECTIVE

Most less developed countries (LDCs) have experienced weak, and in some cases, negative economic growth over the last three decades. Especially in the least developed African countries, low output growth resulted in, or was accompanied by, persistent unemployment, high inflation, endemic budget and trade deficits, and huge debt burdens. The factors responsible for the weak performance of these countries are usually grouped into two broad categories: external economic shocks and inappropriate domestic macroeconomic policies. Khan and Knight (1983, p. 823). External economic shocks include: unfavorable changes in terms of trade, a decline in economic activity in the industrialized countries, and an increase in the international interest rates and prices. And inappropriate domestic macroeconomic policies include: Price distortions (twisted price incentives and misalignment of the exchange rate), huge budget deficits, and the neglect of the agricultural sector in favor of import-substituting policies in the industrial sector.

Recognition of these problems highlighted the need and led to the search for macroeconomic models that could provide a quantitative framework for policy analysis in LDCs, as has been the practice in the industrialized countries. Partly due to the absence of relevant national income accounts data and partly due to the preoccupation of policy makers with long-term growth, however, the attention paid to short-term macroeconomic policies in LDCs has been limited. Improvements in the availability of data and disappointing results in the anticipated economic performance seem to have increased the interest and the level of

effort in building macroeconomic policy models for LDCs.

In the last three decades, macroeconomic modelling has come a long way, both in terms of theoretical refinements and in terms of devising appropriate econometric techniques. Many of these models are mainly built in line with the market and institutional structures of industrialized countries. There is, however, as Klein (1965) noted, a recognition that the theoretical postulates and the institutional structures that underlie advanced country macroeconomic models ought to be modified to take into account the specific economic relationships that prevail in a less developed economy. Owing to institutional peculiarities and the level and type of market interactions (in the financial sector for instance) in LDCs, Porter and Ranney (1982, p. 751) observed: "standard advanced country macro policy prescriptions often yield non-standard results". This study, therefore, attempts to contribute to this line of enquiry, with special emphasis on a subsistence economy. More specifically, the objective of the study is to build a policy-oriented macroeconometric model of Ethiopia, a country with one of the lowest income per capita and a traditional economic structure. It is hoped, the study will contribute to the following areas of macroeconomic research.

First, given the contention that the macroeconometric models of advanced countries have only a limited applicability to the economies of LDCs, this study will attempt to shed some light in that regard by focusing on the structural and institutional peculiarities of a subsistence economy. Both analytical formulations (Porter and Ranney (1982), Cook and Kirkpatrick (1990), for instance) and empirical results (Behrman (1977), Behrman and Hanson (1979), Atta (1981), Khayum (1991), to name a few) suggest that the structural attributes of

LDCs economies differ from that of industrialized countries. This is particularly true in the case of African countries whose economies are not even at the semi-industrialized stage. As Tarp (1993, p. 10) put it, "[T]he African economies are seriously fragmented as well as inflexible and dualistic in nature. The production base is narrow both in terms of size and range of goods produced. A modernized sector of monetized enclaves has been super-imposed over a large low-productivity subsistence sector, which has seen little technological development, and which continues to use traditional tools and techniques of production. Linkages with the modern sector are few and may have weakened during the 1980s." Macroeconomic models of such economies, therefore, must incorporate the above characteristics.

These characteristics are even more pronounced in countries like Ethiopia which have a subsistence economy. By a subsistence economy it is meant here that the ability and the focus of production is mainly limited to basic consumption goods, and the dynamic or modern sectors (manufacturing, finance and other industries) are weak or non-existent. That is, due to the low standard of living and the traditional nature of the production techniques, the range and the volume of goods produced are mainly for own consumption purposes. And even the weak modern sector, the impact of macroeconomic policy tools (monetary, fiscal and other policy tools) may not be the same as those of standard developed country macro models. It is hoped, this study will shed some light in that regard.

Second, in the absence of any macroeconometric policy model of Ethiopia, this study presents the first macroeconometric policy model of Ethiopia. This model is used to examine

the supply constraints and the importance of the exchange rate on the economy. As will be discussed later in the literature review, the number of macroeconomic models built for African economies are relatively small even by developing country standards. This is particularly true in the case of Ethiopia. An economy wide framework is necessary to examine the behavior of macroeconomic aggregates, design alternative policy scenarios, and analyze their likely impacts - this study will contribute to that effort.

And third, the study will examine specific macroeconomic policy issues on the performance of the economy and provide a quantitative framework for further policy analysis. The policy issues include:

(i) How was the performance of the Ethiopian economy affected by the policy shift of the mid-seventies? To implement its "socialist" policies, the then new military government introduced many fundamental economic policy changes after overthrowing the imperial regime in 1974. These changes included a redistribution of rural land and nationalization of manufacturing industries. These policy changes were a significant departure from the land ownership system and the prevalence of private manufacturing industries that had existed until that time. In essence, the land reform changed both land ownership and the administration of its distribution. The objective of this study is, therefore, to examine the effect of these policy changes on the performance of the economy. That is, what would have the performance of the economy been if these policy changes were not undertaken?

(ii) In contrast to the predictions of "conventional" open economy macro models, disagreements regarding the effects of devaluation on output growth have persisted in the

literature. For instance, Krugman and Taylor (1978), Edwards (1989), Agénor (1991), Kamas (1992) and Ghura and Grennes (1993) have suggested various arguments why a devaluation might be contractionary. In light of this controversy, one of the objectives of this study is to examine the likely impact of a devaluation on the macroeconomic performance of a subsistence economy. Specifically, the study will examine the likely impact of the recently implemented devaluation of the domestic currency (birr) on output growth, the balance of payments and inflation.

(iii) Due to internal and external conflicts, military expenditures in some LDCs has been increasing since the early 1970s. Ethiopia is among such countries in which a significant proportion of the country's resources were allocated for military purposes. An unsettled issue in the literature is whether an increase in military expenditures negatively affects output growth. In particular, the empirical evidence provides mixed results depending on the methodologies used and the country or countries under study. Many of these studies also only focus on the impact of military expenditures on output growth, and ignore its effects on other expenditures. The objective of this study is to examine both the impact of military expenditures on output growth and the possible trade-offs between military expenditures and social programs.

1.2. OUTLINE OF THE STUDY

To examine the above policy issues the approach that would be used is what is usually

referred to as counter-factual (or causal) analysis. This has been one of the widely used methods in macroeconometric policy exercise (see Challen and Hagger, 1983, p. 194). One of the essential feature of this approach is to determine how different the performance of the economy would have been (from what is actually observed) if certain policy changes were or not made in some past period. Given that the control simulation values reasonably mimic the historical values of the target macro variables, then, the deviations of policy induced simulation values (from the control simulation values) represent the effect of the changes in policy.

In order to examine the effects of the structural shifts that were undertaken in the mid-1970s, therefore, the basic control simulation values will be compared with the shocked run simulation results obtained using the coefficients of the behavioral equations for total output, agricultural output and manufacturing output prior to the change in policy. That is, while the control run simulation values represent the actual behavior of the economy, the shocked run simulation values that are based on the coefficients prior to the policy change represent the effects of the policy change. The difference between the two is the deviation attributed to the policy changes. A similar approach will be followed in examining the effect of a devaluation. The basic model will be simulated using the new values of the birr (5 birr/$US dollar instead of the 2.07 birr /$US dollar) and the difference between the two simulations suggests the effect of the devaluation. And finally, the effect of military expenditures will be evaluated by re-simulating the basic model with the following changes: The level of military expenditures, the size of armed forces, and other defence related expenditures will be kept at their pre-1974

levels. The difference between these shocked values and the values of the basic simulation levels will then represent the impact of military expenditures on the macro variables of interest.

The thesis is organized as follows. The second chapter will review the theoretical and empirical literature relevant to the study. The review will briefly examine the evolution of macroeconomic modelling in LDCs. The main focus of the review will be on the main features of the models built in the context of LDCs. Further, the review will examine both the theoretical rationale (section 2.1) and the empirical construction of these models (section 2.2) without dwelling on country specific attributes.

The third chapter will briefly outline the essential features and the structural characteristics of the Ethiopian economy. Basic socio-economic indicators relative to similar economies and relative to previous years are briefly discussed in section 3.1. Section 3.2 outlines the relevant economic sectors and their relative shares in the economy. The main sectors that are examined include: The agricultural sector (section 3.2.1), the industrial sector (section 3.2.2), the foreign sector (section (3.2.3), and the government sector (section 3.2.4). In addition to the structural attributes of the economy, the macroeconomic policies that had been pursued over the years are also outlined in this chapter. The discussion regarding both the vital statistics and the structure of the economy in this chapter will hopefully make it clear why the economy is at a subsistence level, as defined above.

Model specification and estimation will be undertaken in the fourth chapter. The chapter begins with the rationale and the structure of the model in section 4.1. After a brief

description of the specified model. section 4.2 presents the data and data sources used to estimate the model. And section 4.3 documents the estimation method and the respective estimation results of the equation specified in section 4.1. Section 4.4 evaluates the model regarding its performance using various validation criteria. Additional and alterative equation estimates and a single equation estimation results for the whole model are also presented in the appendix to chapter 4.

Policy issues are addressed in the fifth chapter using simulation exercises. After reviewing the policies undertaken in the mid-1970s as a background, section 5.1 will specify the design of the policies that will be used to examine the impact of changes in policy. Section 5.2 then examines the impact of the policies on the performance of the economy. Section 5.3 outlines the design of the policy exercise and the impact of a devaluation on the economy, while section 5.4 reports both the design of the policy experiment and the impact of a change in military expenditures on the performance of selected macro aggregates. Section 5.5 presents the net impact of the above polices if all of them were implemented simultaneously. Finally, a summary and conclusions of the study will be presented in the sixth chapter.

2. LITERATURE REVIEW

2.1. THEORETICAL BASES OF MACROECONOMIC MODELLING IN LDCs

In the 1950s and 1960s, the dominant economic policy issue in LDCs was how to mobilize available resources to achieve social and economic transformations similar to that of the developed countries. Consequently, short-term macroeconomic policy issues were given low priority, if any at all (Vernon, 1966). Instead, economic research in the area of economic development was preoccupied with the search for theories that focus on long-run growth strategies. Subsequently in the 1970s the research agenda broadened to include the notion of equity and basic needs.

Despite variations in approach and emphasis, most of the theories stressed the critical role of capital accumulation for economic growth. To use Khayum's (1991, p. 39) summary: "models of development suggested by Rosenstein-Rodan (1943), Nurkse (1957), Lewis (1954), Mahalanobis (1953), Rostow (1960), Hirschman (1958), and Myint (1958) share the generalizable result that higher rates of investment will lead over time to higher levels of output". In the absence of other established theoretical bases that took into account the institutional, structural and behavioral features of LDCs, most of these strategies employed Harrod-Domar or Solow (1956) type aggregate growth models as the main analytical framework, with capital formation considered as the 'engine of growth'.

Refinements of the above theories[1] led to the recognition that, among other things, economies of LDCs are characterized by, first, a dual economy with a disproportionately large agricultural sector. This recognition led to the view that economic growth is critically affected by how this sector is linked to the modern sector and by how fast the modern sector is able to absorb the surplus labor in agriculture. This proposition of surplus labor was originally presented by Lewis (1954), and then formally articulated by Ranis and Fei (1961) with its specific sectoral linkages. Second, LDCs rely heavily on the foreign sector for investment, either by directly attracting foreign investors or by increasing foreign exchange earnings. Recognition of the first highlighted the importance of the agricultural sector and the sectoral linkages between the modern and the traditional sectors. The second observation was the basis for the structuralist two-gap approach expounded by Chenery and Bruno (1962), McKinnon (1964), and Chenery and Strout (1966). According to the two-gap model, the two most important growth constraints facing LDCs are inadequate domestic saving and limited capacity to import investment goods.

Emphasis on the above growth strategies and structural features implied a neglect of short-run stabilization policies. In fact, most models constructed according to the above theories (e.g., Behrman (1977)), assumed that: (1) The extent of capacity utilization, the rate of inflation, and the level of aggregate demand are not important considerations; (2) the impact of financial constraints on the government and on the central bank's behavior could be safely ignored; and (3) due to the small price response in the short-run, the elasticity of

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[1]For a summary of the main theoretical contributions and their developments over the years, see Meier (1989).

substitution (between inputs) is almost zero. Most of the models built in the 1960s and 1970s, therefore, emphasized the real sector with the above mentioned constraints as critical determinants of output expansion.

An exception to the emphasis on the critical role of the real sector was a model developed by Polak (1957/1958), Polak and Boissonneault (1959), and later Marwah (1969, 1972), which highlighted the importance of the monetary sector on the behavior of macroeconomic aggregates in LDCs. These authors also addressed the implications of excess demand (relative to resource availability) on the balance of payments position and the price level and, ultimately, on overall economic performance.

The focus on long-run economic growth strategies, though important for such economies, was not integrated with short-term policy options to deal with economic fluctuations. The need to deal with these fluctuations, therefore, highlighted the need for elaborate macroeconomic models. Among these fluctuations was the high inflation rate in many LDCs after the oil price increases of the early seventies. Further, structural adjustment and stabilization policies, recommended by international agencies (the IMF and the World Bank, especially), required a macroeconomic framework to assess the impact and the growth potential of the borrowing LDCs. In fact, some of the first macroeconometric models covering a number of LDCs were constructed by UNCTAD (1973). Since then a number of models have evolved in many countries with different sizes and focus.

Having sketched the background of the evolution of macro models in LDCs, or the reasons for their neglect, the purpose of the rest of this section is to identify the main

characteristics of macroeconomic models describing a less developed economy. No attempt will be made to survey the theoretical rationale of specific models built on the basis of country-specific characteristics. Instead, the basic features incorporated in most of the models will be outlined as a summary of the main distinguishing features. Accordingly, the main structural, institutional and behavioral features that are assumed important in building a macroeconomic model in less developed economies, in contrast to that of developed countries, are summarized below.

(1) Most LDCs, in addition to the dominant traditional (agricultural) sector, are characterized by a small industrial sector, a big tertiary sector and nonexistent or very weak capital markets; such sectoral disaggregations in model building are important (Taylor, 1979), not only from the standpoint of technological requirements in production, but also due to the widely different patterns of consumer demand (say, between urban and rural).

(2) In the absence of well-developed capital markets, access to credit is rationed, not auctioned; therefore, the interest rate does not represent the "true" cost of borrowing funds (Vernardakis, 1978).

(3) According to UNCTAD (1973), macroeconomic models of developing economies should:

(i) Take into account the dual nature of these economies and their internal rigidities;

(ii) address both long-run growth objectives and cyclical fluctuations;

(iii) incorporate fiscal and monetary sectors with explicit recognition of country-

specific institutional factors: and

(iv) the size of these models should be determined on the basis of two considerations: First, they should be compatible with the degree of interdependence in model specifications and available data bases: and second, they must be large enough to allow the evaluation of relevant trade-offs, such as price stability and growth, current borrowing requirements and future levels of debt burdens, for instance.

(4) Unlike developed countries, there are no substitutes for money (like bonds or other assets) in LDCs and thus in most cases government budget deficits are financed by money creation; therefore, the roles of fiscal and monetary policies are not clear in the case of less developed economies because increases in government deficits result in increases in the money supply (Taylor, 1979).

(5) Economic policies that alter the income distribution (inflationary financing and devaluation, for instance) have a stronger impact in LDCs due to the subsistence level of income and the relatively high dependence on imports for necessities.

(6) Finally, in terms of specific structural attributes, the behavior of standard macro aggregates in an LDC model may differ from that of a developed country; for instance, Porter and Ranney (1982) noted that the usual assumptions of: (i) Rigid nominal wages, (ii) excess supply of labor, and (iii) the existence of excess idle capacity in LDCs suggest a flatter aggregate supply curve than is the case for a developed country; and due to its effect on the cost of imported inputs, changes in the exchange rate shift the aggregate supply curve; similarly, aggregate demand is much

steeper than in the case of a typical developed country due to high propensities to import and low interest elasticities of investment in LDCs.

In the African context, the number of macroeconometric models that have been constructed until recently is relatively small. This is particularly true, according to Harris (1985), if one excludes a few countries like Ghana, Kenya, Nigeria and South Africa. This is, however, likely to change when the macroeconometric models of many African countries that are being built under United Nations supervision (Project LINK) become fully operational.

In general, the models that have been built for African economies share the characteristics and limitations faced by all models of less developed economies, as outlined above. Among the main limitations in model building for a less developed economy are, as Atta (1981, p. 11) noted: "(a) short sample period, (b) low reliability of the data, and (c) constant revisions of data". What is particular to the case of African economies is that the limitations are even more serious. In addition to poor data quality, the relevant data for some sectors of the economy are not available at all. Data on financial markets and the labor market are prime examples of such limitations. The absence of data on financial markets limit the ability of model builders to integrate the financial sector with the real sector while a lack of labor data prevents modelling the supply side of the economy.

Another salient feature of most African economies is their vulnerability to natural disturbances. A significant proportion of the economy of all African countries is based on traditional agriculture. Hence, as correctly pointed out in the prototype model of the United

Nations, crop failures in some years and bumper crops in others are common occurrences. Consequently, agricultural production functions need to be adjusted to correct for such qualitative changes. One might add to the above observation that even the industrial sector may not be free from such erratic production relations due to the frequent change of governments with very different economic philosophies and policies. Hence, the standard neo-classical production function also has to be amended in such a way as to take such frequent qualitative changes into account.

Further, in terms of their relationship with the rest of the world, African economies again typically share the problems faced by most less developed countries, except that some of the problems are more acute in the case of African countries. For instance, the dependence of the domestic economy on agricultural exports (and in many cases, on a single export crop) for foreign exchange indicates the vulnerability of these economies to external shocks including a simple adverse terms of trade effect on the few cash crops they export. Therefore, given the erratic nature of the economy (either due to natural factors or to external shocks), modelling African economies has to take into account such limiting problems.

Before moving to a review of empirical macroeconometric models, it is worth digressing to sketch briefly alternative approaches that have been used to analyze economy-wide issues. As Robinson and Roldand-Holst (1988, p. 353) noted, economy-wide issues may be analyzed using one of the following levels of aggregation: (1) Macroeconomic aggregates based on the national income and products data, (2) sectoral composition of production and demand and intermediate flows based on an input-output table, and (3) a combination of the

above frameworks (national accounts and input-output information) as represented by the social accounting matrix (SAM). For instance, in addition to macroeconometric models, the use of computable general equilibrium (CGE) models which incorporate the information in the social accounting matrix (SAM) has also increased in recent years. No attempt will be made to review the structural details of such models;[2] the purpose here is to highlight their essential features and their limitations as related to this study.

The historical origin of CGE models is the Walrasian competitive economy where only relative prices matter. Producers and consumers are assumed to be profit and utility maximizers, respectively. And the economy is in equilibrium consistent with the competitive economic world view of the neo-classical paradigm. In applied CGE models, these assumptions are modified to incorporate price distortions, rationing, and structural rigidities that prevail in LDCs, Decaluwé and Martens (1988, p. 530).

Despite significant advances in the attempt to incorporate the specific economic attributes of LDC economies, the main features of most CGE models retains the basic tenets of a competitive market economy. After surveying the literature, Banadra (1991, p.10) identifies the following common features of CGE models built for LDCs: First, the emphasis is on the real side of the economy; second, demand and supply functions are specified according to the utility and profit maximization hypotheses; and third, the determination of

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[2]For a detailed discussion of the structural attributes, historical evolution and a survey of the literature of CGE models as applied to LDCs, interested readers could consult Bandara (1991), Decaluwé and Martens (1988); for a collection of structuralist CGE models see Taylor (1990); and for a comparison of macroeconometric and CGE models, see Robinson and Roland-Holst (1988) and Capros, Karadeloglou and Mentzas (1990).

resource allocation via endogenous price and quantity interactions has a "strong flavour of Walrasian general equilibrium".

There has been a significant increase in the construction of CGE models in recent years. By the end of 1988, Bandara (1991, p. 11) cites, at least 70 CGE models (found in the economic literature) that were applied to about 30 developing countries. And Decaluwé and Martens (1988, p.530) cite 73 applications of CGE models to 26 countries. Most of these models were built in the 1980s. Bandara (1991, p. 11) attributes such an increase in the use of CGE models to the following factors. First, in addition to its appropriateness to examine economy-wide issues, the development of social accounting matrix (SAM) for developing countries has facilitated a construction of CGE models. Second, the development in computational facilities eased the constraint of solving such models. And, one might add, the recent moves in favor of a market economy ("to get the prices right") in many LDCs probably has also made such a framework more attractive. In terms of coverage of policy issues, the purpose of model design varies, but most of these models have focused on the impact of trade barriers (protection), stabilization policies, and the impact of external shocks.

CGE modelling is not without its critics. Critics argue, Bandara (1991, pp. 29-31), that, first, the neo-classical assumptions (perfect competition, constant returns to scale, among others) incorporated in such model are unrealistic. Second, the role of the monetary sector is not adequately specified in such models. The response to these criticisms is that recent CGE models are making an effort to include structural rigidities and other distortions, and that some models have started to incorporate monetary sector aggregates. And third, the most

important criticism, in general and as relates to this study, is what Bandara (1991, p.17) calls "the enormous data requirements" of CGE models. As Bandara (p.31) put it, "[a] complete set of base-period input-output data for an economy is necessary for the use of CGE analysis. Since the initial costs and income shares are derived from the base-period input-output data set, the quality of it is critical in CGE modelling".

Whatever the merits of such a framework for analyzing economy-wide policy issues are, therefore, the approach is unlikely to be a feasible option for some countries. That is, for countries without a disaggregated sectoral data set (input-output accounts), and reliable parameter values, the data limitations are not easy to overcome. Ethiopia is unfortunately a country which lacks such data. There are serious data limitations at the national accounts level which are exacerbated at the sectoral level. In the absence of reasonably complete data, at least for the production side of the economy, and reasonable parameter estimates for key variables, a CGE model building is an option that has to be postponed for some time in such economies.

2.2. EMPIRICAL MACROECONOMETRIC MODELS OF LDCs

Following the established practice in developed countries, and partly as required by international agencies to get access to financial credit, a great number of macroeconometric models have been constructed in LDCs. Khayum (1991) identifies three phases in the development of LDC macroeconometric models. The first category of models was mainly scaled-down versions of those used in the developed countries. That is, they were demand-

determined models, built in the Keynesian tradition, with little if any attention to the structural and institutional characteristics of LDCs. The main contributions of these models were to highlight the data limitations facing such efforts and to point to the additional research needed to incorporate the LDCs' distinguishing features.

The challenges of incorporating these distinguishing features were taken up in models categorized in the second phase. Among the notable contributions in this area was one made by Klein (1965). He suggested that macroeconomic models of LDCs should emphasize: (1) Not the lack of effective demand but instead the limited capacity to expand output; (2) the impact of direct investment and foreign capital inflows; (3) the significance of government policies; and (4) the role of the trade sector, because of the importance of the capacity to import intermediate inputs and the level of export supply to increase the capacity to import intermediate inputs.

The third phase consisted of macro models that, by and large, focus on contemporary macroeconomic issues facing LDCs, such as adjustment and structural changes. Given the increase in the available data series and improvements in data quality, these models are relatively large, incorporating a wide range of policy instruments. Such instruments include: Government expenditures, taxation, monetary policy, and exchange rate policy, to name a few. According to Behrman (1977), the early models that were mirror images of the developed countries failed to reflect the structure of the less developed economies. For instance, the following shortcomings were common in most models: (1) Output was determined by effective demand without testing for capacity limitations due to capital

constraints: (2) due to the high level of aggregation, the impact of specific policies was difficult to capture: (3) no attempt was made to reflect dualism and underemployment of labor despite the long-held view favoring its existence: (4) the impact of widely used quantity restrictions was not examined.

A more recent survey of macroeconometric models of LDCs by Khayum (1991) and the account of their historical evolution by Bodkin, Klein, Marwah (1991) find a great diversity among models in terms of size, purpose, sectoral linkages and emphasis, and estimation techniques, to mention but a few attributes. For instance, among a sample of sixteen models selected for comparison by Khayum (1991), model size ranged from a four-equation system for Argentina to a sixty-seven equation system for Indonesia. Such a huge difference in model size indicates a significant difference in data availability, in the level of importance attached to sectoral coverage, or in the level of disaggregation adopted.

Output determination also varied in the sample of models surveyed (Khayum, 1991). For instance, in models for Hong Kong and Nicaragua, output is determined by changes in aggregate demand, while in models for Thailand, the Philippines, India, Nigeria, and Malaysia, output is supply-determined. Other models (that of Indonesia, Guyana, Taiwan, Korea, and Singapore, for instance) are specified with the interplay of demand and supply determining output. The common thread among all the models is that, as Khayum (1991, p. 60) observed: "...regardless of the analytical framework adopted, the central feature of the models is their focus on the behavior of aggregate output. For most of the models this concern is reflected in attention being placed on stabilization policies and short-term

forecasting in relation to output behavior".

In the models surveyed above, the linkage between the real and financial sectors is not through the interest rate, as is usually the case in a developed economy macro model. Instead, various mechanisms such as credit, output or the price level have been used. Furthermore, most of these models emphasize less the problems of inflation and unemployment, but instead focus on the importance of the external sector in the functioning of these economies. In fact, while some of the models omitted the financial sector, they all included the external sector, thus highlighting its importance in these economies. Another notable feature in terms of emphasis is the focus on fiscal policy more than on any other policy instrument, including monetary policy. This emphasis is probably due to the significant roles of government, in terms of policy and its share in the economy, as well as the non-exogeneity of money supply in a fixed exchange rate system which most LDCs have implemented.

The dominant estimation technique employed in these models was ordinary least squares (OLS). In only a few (three of the sixteen) of the models surveyed in Khayum (1991) was an alternative method (two-stage least squares) used. This is, of course, mainly due to the obvious data constraints, as some of the models in the sample were built some decades ago. The relatively recent models (that of Korea and Hong Kong - Ichimura and Ezaki, 1985 - for instance) used the two-stage least squares estimation method. Due to the diversity of the models in size, structure and other attributes, it is difficult to compare important parameter

estimates and generalize about the overall performance of the estimated models.[3] Nonetheless, relevant model performance measures will be reviewed later, when assessing the empirical estimates of this study.

This chapter has highlighted the essential features of most macroeconomic models of developing countries without focusing on country specific attributes. Despite similarities in overall economic structures, however, developing countries differ, to some degree, both in terms of institutional arrangements and in terms of the composition of production and consumption aggregates. For instance, the structure of government institutions, the composition of exports and imports aggregates, and other aggregates are not necessarily the same across countries. Consequently, specific country models should and do incorporate such features. This is evident from the variations in sectoral emphasis, and sectoral linkages of various models. As a background to the model in this study, therefore, the next chapter will review the economic structure, and some overall socio-economic indicators of the Ethiopian economy.

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[3]For a summary of specific model attributes and a summary of results in a sample of macroeconometric models, see Khayum (1991, p. 54, especially Tables 3.1-3.4); Behrman (1977, pp. 7-14); and for a historical perspective of model type and coverage for India and Latin American countries see Bodkin, Klein, Marwah (1991, especially pp. 356-447).

3. THE ETHIOPIAN ECONOMY

3.1 AN OVERVIEW OF SOCIO-ECONOMIC INDICATORS

Ethiopia has a total land area of 1.222 million square kilometres (124.8 million hectares). With a population of 53 million in 1992, and growing at 3 per cent per annum, Ethiopia is the second most populous country in sub-Saharan Africa. Some 46 per cent of the population is less than 14 years old, and women of child bearing age are 44 per cent of the total female population. According to World Bank estimates, the population will increase to 67 million by the year 2000, and will reach 130 million by the year 2025. That is, if this projection holds, the size of the population will more than double in about 30 years.

According to the United Nations' 1995 World Development report, Ethiopia ranked 171 out of 174 countries in terms of the overall development index. Income per capita, calorie in-take and social services are among the lowest in the world. For instance, as indicated in Table 3.1, Real GDP per capita on purchasing power parity (PPP) basis was $330 US in 1992, compared to an average of $1,346 for Sub-Saharan Africa and $2,591 for all developing countries. Similarly, the infant mortality rate in Ethiopia was 119 per 1000, compared to 97 for Sub-Saharan Africa and 70 for all developing countries. The decline in the infant mortality rate is also low compared to regional and all LDCs averages. The infant mortality rate declined by about 53 per cent and 41 per cent in all LDCs and in Sub-Saharan Africa, respectively between 1960 and 1992, but the decline in Ethiopia was about 32 per

cent. These numbers are consistent with the overall figures for availability of health care services as measured by the percentage of the population that has access to health care services, safe water and sanitation. Consequently, life expectancy at birth is only 48 years in Ethiopia, compared to 51 and 63 years for Sub-Saharan Africa and all developing countries, respectively. Related basic indicators such as maternal mortality rate, daily calorie supply per capita, population per doctor and nurse, and total expenditures on health as a ratio of GDP also indicate that health care services in Ethiopia are very low even by developing country standards. Health expenditures in Ethiopia increased to 2.3 per cent of GDP in 1992 compared to only 0.7 per cent of GDP in 1960.

The picture in the education sector is not different from that of the health care sector when compared to similar economies, even though the progress made over the last 20 years is encouraging. As indicated in Table 3.1, Ethiopia lags behind similar economies in the adult literacy rate, total school enrollment, and expenditures on education. For instance in 1992, the adult literacy rate and the enrollment ratio in Ethiopia were about half of the average for Sub-Saharan Africa. The only exception is in the availability of teachers at the primary school level, which fared better than the averages for Sub-Saharan Africa and all LDCs. It is worth noting that the modern education system in Ethiopia is a post WWII phenomenon, unlike in some colonized countries of Africa. But despite its recent introduction, enrollment increased by tenfold (Abraham, 1994, P. 220), between 1950 and 1970. And as could be seen in Table 3.2, enrollment in all levels significantly grew between 1974 and 1989. In addition to the total increase in enrollment, female participation also increased. By 1989, the proportion of female

Table 3.1 Basic Socio-Economic Indicators

Indicator*	Ethiopia	Sub-Saharan Africa	All LDCs
Human development index	0.227	0.389	0.570
Population (millions): 1960	22.8	210	2,070
1992	53	510	4,220
Annual growth rate(%): 1960	2.5	2.8	2.3
1992	3.0	2.9	1.8
Crude birth rate	48.5	44.9	28.3
Crude death rate	18.0	15.1	9.1
Total fertility rate	7.0	6.3	3.5
Life expectancy at birth: 1960	36.0	40.1	46.3
1992	47.5	50.8	63.2
Infant mortality rate (per 1000 live births): 1960	175	165	149
1992	119	97	70
Maternal mortality rate (per 100,000 live births: 1992	560	606	351
Expenditures on health:			
1960 (% of GNP)	0.7	0.7	0.9
1990 (% of GDP)	2.3	2.5	2.1
Population with access to: (%)			
health services	46	56	79
Safe water	25	43	69
Sanitation	19	36	36
Daily caloric supply per capita	1610	2096	2546
Rural population (% of Total)	87	70	64
Population per: doctor	33,333	18,480	N/A
nurse	14,286	6,532	N/A
Expenditures on education (% of GNP): 1960	0.8	2.4	N/A
1990	4.8	N/A	N/A
Adult literacy rate (%)	32.7	54.4	68.4
Enrollement ratio for all levels (% age 6-23)	17	36	50
Pupil-teacher ratio (1990): primary	30	40	34

Source: *Human Development Report 1995*, United Nations Development Programme (UNDP). New York: Oxford University Press, 1995.

* All figures are for 1992, unless otherwise indicated.

Table 3.2 Performance of the Education sector: Growth rates of Selected Indicators, 1974 - 1989, %

Level	Enrolment	Proportion of female	Number of teachers
Pre school	19.1	N/A	17.9
primary education	9.0	22.3	8.5
Junior secondary education	11.2	36.5	7.8
Senior secondary education	12.6	62.5	8.5
Special education	8.0	12.5	9.9
Technical education	-2.1	N/A	-1.0
Primary teacher education	2.1	N/A	3.6
University/College	9.4	N/A	N/A

Source: Abraham (1994), *Ethiopia: From Bullets to the Ballot Box*, The Red Sea Press Inc., p. 220.

in primary and secondary education reached about 40 per cent of the total student population. Compared to 1974, this represented a growth rate of 22.5 per cent for primary, 36.5 per cent for junior and 62.5 per cent for senior secondary education. During the same period, the number of teachers for all educational levels, except for the technical schools, also increased. These increases correspond to the increase in enrollment in the pre- and primary schools, but are lower at the secondary level. The low indices of health care facilities, education and other social measures clearly indicate that Ethiopia has massive structural poverty, both in absolute and relative terms. The weak performance of the economy is not limited to such vital statistics. At a macroeconomic level, the performance of most aggregates has also been

unsatisfactory.

3.2. STRUCTURAL OVERVIEW OF THE ECONOMY

Agriculture is the mainstay of the Ethiopian economy, contributing 48 per cent in 1992 to GDP. During the same period, as indicated in Table 3.3, the share of the industrial and the service (includes all other sectors) sectors was 13 per cent and 39 per cent, respectively. In comparison, the share of agriculture in GDP in Sub-Saharan Africa and in all less developed countries averaged about 23 per cent and 19 per cent, respectively, while the respective share of the industrial sector averaged about 33 per cent and 34 per cent.

The composition of aggregate demand also reveals the subsistence nature of the Ethiopian economy. Private consumption is very high while gross domestic investment is very low by the standards of similar economies. Private consumption was 86 per cent of GDP, while gross domestic investment was only 9 per cent of GDP in 1992. As indicated in Table 3.3, investment was only about half of the Sub-Saharan Africa and about one-third of all LDCs averages in 1992. The share of government consumption in Ethiopia was comparable to similar economies, but the share of the external sector in GDP was significantly lower in 1992, as was the case for gross investment. In addition to its low absolute level compared to similar economies, the structure of consumption also reveals the subsistence nature of the economy. As indicated in Table 3.3, more than 50 per cent of household expenditure is spent on consumption goods and clothing. The high share of consumption expenditure resulted in

Table 3.3 Selected Basic Indicators

Indicator*	Ethiopia	Sub-Saharan Africa	All LDCs
Real GDP per capita (PPP$): 1992	$330	$1,346	$2,591
Sectoral shares (% of GDP): 1992			
Agriculture	48	23	19
Industry	13	33	34
Services	39	44	47
private consumption	86	69	66
Government consumption	15	16	12
Gross domestic investment	9	16	24
External sector (exports+imports)	15.5	28.9	43.6
Food production per capita (1979-1981=100): 1992	86	95	121
Food imports - % of total imports: 1970	9	N/A	N/A
1992	15	11	9
Consumption expenditures (% of total household consumption):			
Food	49	N/A	N/A
Clothing & foot wear	6	N/A	N/A
Fuel & power	14	N/A	N/A
Medical care	3	N/A	N/A
Education	4	N/A	N/A
Total transport & communication	8	N/A	N/A
Labour force participation rate -%	41	N/a	N/A
Women's share of adult labour force	36	37	35
Total unemployment - %	32	N/A	N/A
Percentage of labour force in:			
Agriculture: 1965	86	78	71
1990-92	88	67	58
Industry: 1965	5	9	12
1990-92	2	8	15
Services: 1965	9	14	17
1990-92	10	25	27
Resource balance:			
Land area (million square kilometers)	1.222	20.6	76.3
Density: pop. per sq. km	41.2	22.4	77.6**
Forest and woodland (% of land area)	24.4	29.7	21.9
Arable land (% of land area)	12.7	6.9	10.3
Irrigated land (% of arable land)	1.2	3.4	23.8
External debt (% of GNP)	79	114	43

Source: United Nations Development Programme (UNDP), *Human Development Report 1995*. New York: Oxford University Press.

* All figures are for 1992, unless otherwise indicated.

** Only for low income countries.

low savings. Gross domestic saving as a share of GDP declined from 9.9 per cent in 1970 to 3 per cent in 1992. The decline in saving worsened the resource gap (saving and investment), which reached 10 per cent of GDP by 1992.

About 85 per cent of the population lives in rural areas, predominantly engaged in agricultural activity. No disaggregated historical data is available on the Ethiopian labor force. This is particularly true about the rate of unemployment. In 1992, labor force participation rate was 41 per cent, women constituting about 36 per cent of the adult labor force, as indicated in Table 3.3. The ratio of women in the labor force was similar to both the Sub-saharan Africa and all LDCs averages. During the same period, the estimated economy-wide unemployment rate was 32 per cent. This is an increase compared to the estimates of the Central Statistical Office of Ethiopia, which was about 20% in 1978. It should be noted that these figures are rough estimates, with a potentially huge margin of error.

An essential feature of the Ethiopian economy over the years is the uneven growth of demand and production aggregates. That is, the composition and, in many cases, the level of production has not changed very much over the last thirty years, while the demand side witnessed significant changes during the same period. As can be seen from Tables 3.4 and 3.5, the share of agriculture in GDP only declined from a high of 60 per cent in 1961-1965 to an average of 45 per cent in 1981-1988, while that of manufacturing increased from about 6 per cent to 10 per cent over the same period. Over the sample period, the share of investment was stable relative to other aggregates while saving significantly decreased during the 1980s. Investment increased to 14 per cent of GDP in 1981-1988, compared to 12 per

cent in 1961-1965 while saving decreased from 10 per cent to 3 per cent during the same period. Both the shares of investment and saving in GDP are low compared to other LDCs. For instance, the average shares of investment and saving in GDP for low-income countries in 1965 were 19 per cent and 15 per cent, respectively. By 1990, the respective shares increased to 28 per cent and 16 per cent. And for Sub-Saharan African countries, the average shares of investment and saving to GDP were 15 per cent and 13 per cent in 1965 and both increased to 16 per cent by 1990. In addition to low saving and saving rates in Ethiopia relative to similar economies, the gap between investment and saving also widened in the 1980s.

The changes in the behavior of the aggregates between 1961-1974 and 1975-1988 are worth noting. These sub-periods correspond to the relatively mixed and "socialist" economic structures, respectively. Compared to 1961-1974, in the second period real income per capita, real GDP, and real GDP per capita relative to US=100 declined by 35.8, 14.4 and 11.6 per cent, respectively. This indicates not only the low standard of living (averaging $2.4 for every $100 a US citizen earns), but that there was also a relative decline over the years, regardless of the measure of income used. During the same period, public expenditures, the budget deficit, military expenditures, and the money supply, on the other hand, grew by 115, 589, 129 and 121 per cent, respectively. This is a significant change because, despite the decline in GDP, the main components of government expenditures noticeably increased following the expansive policies of the military government.

TABLE 3.4 SELECTED MACROECONOMIC AGGREGATES (AVERAGE)

VARIABLE NAME	1961-65	1966-70	1971-75	1976-80	1981-88	1961-74	1975-88	1961-88
REAL INCOME PER CAPITA[a]	432	534	542	362	277	503	323	413
REAL GDP PER CAPITA RELATIV TO US=100[b]	2.6	2.4	2.4	2.3	2.1	2.5	2.2	2.4
AGRICULTURE /GDP (%)	60	53	47	47	44	54	45	50
MANUFACT /GDP (%)	6.3	7.9	9.4	9.4	10	7.7	9.8	8.7
INVESTMENT /GDP (%)	12	13	11	9	14	12	12	12
DOMEST SAVING / GDP (%)	10	12	9	5	3	10	4	8
PUBL EXP /GDP (%)	13	13	14	22	34	13	28	21
BUDGET DEFICIT / GDP (%)	0.6	1.0	1.7	4.5	7.5	0.9	6.2	3.5
MILTARY EXP/GDP- %	2	2	3	6	9	3	6	5
EXPORT/GDP (%)	9	8	7	10	8	8	9	8
IMPORT/GDP (%)	10	10	10	14	19	10	17	13
MONEY SUPP /GDP (%)	12	14	18	25	37	14	32	33
REAL EXCHANGE RATE[c]	3.2	3.2	3.6	2.9	2.8	3.3	2.9	3.1

SOURCES: IMF Financial Statistics, various years, with 1985 as a base year, and Central Statistical Office of Ethiopia.

[a]In local currency (birr).

[b]Based on current international prices (PPP);

[c]Based on US whole sale price index.

TABLE 3.5. AVERAGE GROWTH RATES - %

VARIABLE NAME	1961-65 to 1966-70	1966-70 to 1971-75	1971-75 to 1976-80	1976-80 to 1981-88	1961-74 to 1975-88
REAL INCOME PER CAPITA	23.6	1.5	-33.2	-23.5	-35.8
REAL GDP	22.1	14.9	-25.0	-7.8	-14.4
REAL GDP PER CAPITA RELATIVE TO US=100	-7.7	0.0	-4.2	-8.7	-11.6
AGRICULTURE / GDP	-11.7	-11.3	0.0	-6.4	-16.7
MANUFACTUR. /GDP	25.4	19.0	0.0	6.4	27.3
INVESTMENT /GDP	8.3	-15.4	-18.2	55.6	0.0
SAVING /GDP	20.0	-25.0	-44.4	-40.0	-60.0
PUBLIC EXP. / GDP	0.0	7.7	57.1	54.5	115.4
BUDGET DEFICIT /GDP	66.7	70.0	205.9	66.7	588.9
MILITARY EXP /GDP	0.0	50.0	100.0	50.0	100.0
MONEY SUPPLY /GDP	16.7	28.6	38.9	48.0	128.6
EXPORT/GDP	-11.1	12.5	42.9	-20.0	12.5
IMPORT/GDP	0.0	0.0	40.0	35.7	70.0
REAL EXCH. RATE	0.0	12.5	-19.5	-3.4	-12.1

SOURCE: based on Table 1.1. and calculated as follows:

average growth rate (%) = $\frac{\text{average}_t - \text{average}_{t-1}}{\text{average}_{t-1}} * 100$,

where average is the respective years' simple average.

3.2.1 THE AGRICULTURAL SECTOR

Due to its dominant share in GDP, the performance of the agriculture sector significantly influences the performance of other sectors of the economy. For instance, agriculture accounts for more than 80 percent of employment and 90 per cent of exports. Ethiopia exports exclusively primary products such as coffee, hides and skins, oil seeds and oil nuts. These exports are the main sources of foreign exchange, and hence capacity to import. Manufacturing output, which depends on imported intermediate inputs is, therefore, indirectly influenced by the performance of the agricultural sector. Similarly, other macro aggregates, level of employment, rate of inflation, for instance, are also directly influenced by the performance of the agricultural sector. Its contribution to employment, the availability of foreign exchange is, therefore, crucial.

The performance of the agricultural sector, and hence GDP[4], has been unsatisfactory, at least in meeting food requirements. Low agricultural productivity and the population explosion led to a decrease in food availability. In 1992, the food production index decreased to 86 per cent compared to 1979-1981. This index is lower than both the averages for Sub-Saharan Africa and all LDCs. Further, Ethiopian food imports increased to 15 per cent of total imports in 1992, compared to only 9 per cent in 1970. The respective 1992 figures for Sub-Saharan Africa and all LDCs were 11 per cent and 9 per cent. Food consumption per

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[4]Recent available data also indicate that the growth rate of real GDP continued to worsen until 1992, and then started to recover after the new government implemented significant economic and political changes. According to IMF Survey (January 23, 1995), real GDP grew by 12.3 per cent in 1992/93 from a negative growth rate of 2.3 per cent in 1991/92.

capita decreased from 178.8 kilograms in the early 1980s to 163.9 kilograms in 1990, which is only 75 per cent of the recommended calorie-intake. By the end of 1991, food availability got even worse and declined to 124.5 kilograms. Consequently, according to Mulat (1990, p. 58), food aid increased from 2 kg per capita in 1975 to 5.1 kg per capita in 1979. The sector was, therefore, unable to close Ethiopia's "food-gap" since food production and food demand grew by 1.7 per cent and 2.4 per cent per annum, respectively, from 1971 to 1980. That is, food demand was growing by 0.7 per cent per annum faster than food production.

The existing food-insecurity does not seem to be due to land scarcity. Population density in Ethiopia is about twice that of the Sub-Saharan Africa average, but only about half of the average for all LDCs, as indicated in Table 3.3. Further, since arable land (as percentage of land area) in Ethiopia is twice that of the Sub-Saharan Africa average, a shortage of arable land cannot explain the poor agricultural performance in Ethiopia. The explanation probably lies in inappropriate agrarian policy, and low rates of resource utilization, rather than land scarcity. According to some estimates,[5] about 65 per cent (or 78.9 million hectares) of Ethiopian territory is considered either fertile, or sufficiently fertile and therefore suitable for agriculture. And with an average population density of 41.2 persons per square kilometre, land scarcity is not a problem in Ethiopia, as is the case, say, in South and South-East Asian countries. In fact, the size of potential agricultural land that is actually utilized is very small. According to Galperin (1981, pp. 169-170), "[i]n the early 1970s, the area of cultivated land constituted about 10.5 million hectares or 9.3 per cent of the country's

[5]For a detailed discussion of the size of arable land, and rate of utilization by region and at the national level, see Galperin (1981, Chapter 10); and Griffin (1992, Chapter 2).

territory: ...and in the late 1970s, this area had decreased to approximately 8.7 million hectares, 3.2 million hectares constituting long fallows". Similarly, Griffin (1992, p. 52), on the basis of a relatively recent survey, concluded that, without even introducing any irrigation system or any other technological change, the stock of cultivated land in Ethiopia could be increased by an additional 18 to 22 per cent.

Another low resource utilization example is the absence of developed irrigation systems in Ethiopia. Only 1.2 per cent of the total arable land is irrigated in Ethiopia, compared to 3.4 per cent in Sub-Saharan Africa and about 23.8 per cent in all LDCs. Being rainfed, therefore, agricultural output in Ethiopia is vulnerable to rainfall fluctuations, as witnessed by the repeated occurrence of drought over the years. In addition to low resource utilization, backward farming techniques, and inappropriate agrarian policy, the land tenure system is also believed to have contributed to the poor performance of the agricultural sector. To highlight this point, a brief review of the land ownership structure before and after the 1975 major land reform is in order.

Due to regional variations and intricate land ownership and land use relationships within a region, the Ethiopian land ownership system that had existed prior to the 1974 revolution defies any clear classification[6]. Ignoring the intricacies within each tenure system, Rahmato (1984, p. 23) identifies two major land ownership patterns: usufructuary tenures and private tenures. Usufructuary tenure system includes all the land under communal (kinship based), church and state ownership. And the private tenure refers to all the land owned by

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[6]For a detailed discussion of the land tenure system that had existed in Ethiopia prior to the land reform of 1975, see Mengisteab (1990) and Rahmato (1984).

(originally taken away from peasants and then given to) powerful officials and loyal servants of the imperial government. The term "private" here is misleading because in essence what is termed private land is distributed by the state to individual owners.

No accurate data is available on the proportion of cropland under the respective tenure systems. And what is more, the extent of tenancy which was the main argument for abolishing the land tenure system that had existed prior to 1975 is not well documented at a national level. The sketchy evidence available, based on official survey carried out just before the 1975 land reform, is reported in Table 3.6. According to this survey, about 33 per cent of the crop land and 36 of total landholdings were in the hands of tenant cultivators. Rahmato

Table 3.6 Pre-1975 Distribution of Holdings by Tenure and Area of Control- %

Tenure type	% of Total Holding	% of Total Cropland Area
Communal	11	6
Owned and rented	15	24
Tenant Operated	36	33
Owner Operated	38	37

Source: Rahmato (1984, p. 23), Table 2.

(1984, p. 22) cites other estimates that put tenant holdings ranging from 42 per cent to well above 50 per cent of total rural landholdings. Whatever the share of tenant holdings was under the pre-1975 land tenure system, it was not conducive for improving agricultural output. Rahmato (1984, p. 25) noted, "[f]or all tenants, the major factor for their dependency,

and the chief obstacle to improved production was the lack of security of tenure. Each share-cropper was never certain how long he would cultivate his holding, or when he would be told to give it up."

The 1974 revolution fundamentally changed both the landholding system and the land/tenant relationship. After overthrowing the monarchy in 1974, the then military government nationalized rural land in 1975. The No. 31/1975 land reform provision, known as the "Public Ownership of Rural Land Proclamation", declared, among other things, that rural land a property of the state (Article 3) and prohibited both private ownership of rural land and the transfer of its ownership in any form (sale, exchange, lease, etc) and for any reason (Article 4). The declaration also prohibited hiring of agricultural labor by private individuals (Article 5), thus ending not only tenancy but also whatever insignificant "wage" labor that might had existed.

The government also established Peasant Associations to administer land distribution among local farmers who were given access to use, but not to own, the land. Each Peasant Association was organized as part of the central government bureaucracy whose function extended to implementing government policies related to land over an area of 800 hectares and about 2400 families. According to Mulat (1990, p. 57): "[b]y the end of 1985 there were a total of 20,157 Peasant Associations with a membership of about 6 million households covering about two-thirds of the country's rural population". The nationalization of rural land and the transfer of its administration to local Peasant Associations contrasted with the private ownership of land (mainly landlord/tenant relationships in the south and family ownership in

the northern half of the country) that had existed prior to 1974. When the land reform was implemented, about 94 per cent of agricultural output was produced using primitive techniques while the mechanized sector produced the remaining 6 per cent. The few mechanized large agricultural estates producing cash crops were not distributed to individual farmers, but instead put under direct state control when land was nationalised.

In essence, the above measures gave each farmer access right (short of ownership) to a piece of land (up to a maximum of 10 hectares for each self-cultivating rural household). Hence, this freed many rural farmers from being a tenant of absentee landlords (who had been entitled to extract from one-third to one-half of tenant output), at least in the southern part of the country. But the reform also meant frequent redistribution of land among respective inhabitants as the size of the population increased. Consequently, lack of security in land holdings due to the periodic redistributions and the decrease in the size of allocated land as population increased led to overutilization of the cultivable land, with less concern for its appropriate development. That is, there was no incentive for farmers to pay attention to crop-rotation, planting or protecting available trees to safe-guard against soil erosion, and other related efforts that affect the future productivity of the land. It is clear therefore, despite their contrasting structures, both land tenure systems have failed to address the insecurity in landholding.

In addition to nationalization of rural lands, the government also established the Agricultural Marketing Corporation (AMC) with a mandate to supervise the production and sale of agricultural output. Through this corporation, as Griffin (1992, p. 66) observed: "[t]he

government has attempted to control the prices of major agricultural products, particularly food grains, through direct intervention. In addition, it has a monopoly of the distribution of fertilizer and thus is able to control its price directly."

As is clear from Table 3.7, the price differential between AMC farm-gate and selling prices is substantial. For instance, the AMC average selling price for Teff, Wheat, and Barley was higher by about 50, 64.4 and 66.6 per cent, respectively, than the AMC farm-gate prices. Even if one attempts to justify government intervention on equity grounds and/or price stabilization, therefore, such a huge gap between what farmers earned and what government charged for their produce represents a substantial "hidden" tax. This is particulary true compared to what farmers could earn selling in free market prices. The gaps between free market and farm-gate prices averaged 162 per cent, 155 per cent, and 256 per cent for Teff, wheat and barley, respectively.

It should be noted that, despite some arguments about the government's political motives in undertaking the land reform and its implementation, the nationalization of rural lands was well received especially by the majority of peasants and intellectuals who had been demanding for such a change for a long time. As the government started to strengthen its control over the production and the marketing of agricultural output, however, even the peasants who were supposed to be the main beneficiaries of the reform, started to lose their enthusiasm. As Rahmato (1984, pp. 66-67) noted: "[t]he price system for agriculture has not been favorably received by a large number of peasants. Peasants felt particularly resentful of the unfavorable price structure, and for comparison they pointed to a long list of goods

Table 3.7 Wholesale Prices of Grain (Birr per Quintal), 1989

Grain Type	AMC Farm-gate price	AMC Selling Price	Free Market average price
Teff			
white	48.0	69.55	124.83
mixed	41.0	61.90	112.00
red	37.0	57.55	93.67
Wheat			
white	36.0	57.55	110.6
mixed	32.0	53.15	74.00
black	31.0	52.10	67.83
Barley			
white	30.0	49.90	115.00
mixed	28.0	47.70	63.50
Maize	22.0	44.45	52.00
Chicken peas	30.0	49.90	135.67
Lentils	45.0	66.30	186.50

Source: Abraham (1994), Table 3, p. 209.

whose prices had gone up sharply within the last five years... [W]hether or not peasants were accurate in their view that prices of many manufactures and other items at the village market have risen sharply is not the main point: the main point is the growing conviction among peasants that they are not offered commensurate prices for their products." The initial enthusiasm generated by the land reform seems, therefore, to have lost its momentum since it was accompanied by inefficiencies in the distribution of inputs and unfavorable pricing structures for both agricultural inputs and outputs.

Other possible factors that might have contributed to poor agricultural performance include: Outdated farming techniques, lack of imported agricultural inputs, ecological degradation of potential arable land, and high underemployment due to relative increase in population. Land cultivation techniques have not significantly changed for decades (maybe centuries) in Ethiopia. Traditional farming methods which use rudimentary implements (a wooden plough, sickle, etc.) are still the dominant farming methods. Usage of fertilizers, soil conservation methods and other modern agricultural techniques are at their embryonic stage. For instance, according to Mengisteab (1990, p. 106), in 1983-1984 the proportion of farmers using fertilisers, improved seeds and pesticides were 14 per cent, 2 per cent and 0.5 per cent, respectively. Similarly, during the same period, the proportion of fertilized area and new seed area were 12.3 per cent and 1.3 per cent of the total cultivated area, respectively. The situation improved in recent years, but is still low even by African standards. In 1993, for instance, fertilizer consumption per hectare in Ethiopia averaged about 2.3 kilograms compared to 4.6 kilograms for all-Africa.

How much of the decline in per capita food consumption is due to an increase in population, shortage in rainfall or decline in output due to the above policies is hard to discern. What ever the contribution of each of these factors, Table 3.8 indicates a declining trend of agricultural output especially beginning the early 1980s. Crop yield (measured as quintals per hectare), was about the same (except for maize) in 1973/74 and in 1979/80, in peasant farming. Beginning the early 1980s, however, yield for most crops declined for all ownership types. For instance, Teff (the staple cereal), probably the most labor intensive among the crop types, declined over the indicated period. And the decline was more significant in state operated farms than the other two ownership types. Peasant farming consistently outperformed both the

cooperative and state operated farming in terms of the productivity of Teff. Given the

Table 3.8 CROP YIELD BY TYPE OF FARMING

Ownership & Crop Type	1973/74*	1979/80	1981/82	1983/84	1984/85	1985/86
PEASANT:						
Teff	8.0	9.5	8.2	8.3	6.8	7.5
Barley	10.6	11.7	12.0	10.9	10.7	10.0
Wheat	10.1	11.1	10.1	10.5	10.3	9.8
Maize	43.8	17.3	18.2	18.7	11.4	11.4
Sorghum	19.0	16.2	14.7	13.3	6.1	11.0
Pulse	--	12.1	10.6	9.5	6.9	7.1
COOPERATIVE:						
Teff	N/A	7.2	5.0	7.2	5.4	5.8
Barley	N/A	8.3	9.1	1.9	7.7	7.8
Wheat	N/A	7.4	8.2	8.5	6.4	9.3
Maize	N/A	20.2	7.7	13.4	9.6	8.9
Sorghum	N/A	3.8	8.5	11.4	8.3	11.0
Pulse	N/A	5.6	4.6	6.1	3.4	5.2
STATE:						
Teff	N/A	5.8	5.6	4.2	2.8	5.6
Barley	N/A	13.5	18.7	12.1	12.8	16.4
Wheat	N/A	11.9	13.1	13.3	14.8	16.3
Maize	N/A	23.3	27.8	21.3	24.2	24.2
Sorghum	N/A	11.8	14.1	9.1	9.9	5.1
Pulse	N/A	4.6	3.4	3.5	3.6	3.0

Source: Abraham (1994), Table 4, P.200; and Mengisteab (1990), Table 4.4, P. 78.

* Mean yield of unfertilized hectare;

N/A = not applicable.

government's monopoly over the distribution of fertilizers and pesticides, the low productivity in state operated cultivated land suggests bureaucratic inefficiencies in managing the state farms. The overall decline in agricultural output beginning in the early 1980s also coincided with

implementation of farm cooperatives. In summary, it seems, the traditional farming techniques, combined with unfavorable land tenure system prior to 1975, inappropriate agrarian policies (pricing, farm input supply, etc) since 1975, and sporadic drought occurrences have kept the performance of the agricultural sector below its potential.

3.2.2. THE INDUSTRIAL SECTOR

It was noted earlier that the contribution of the manufacturing sector to both GDP and employment has been relatively small. Indeed, the entire industrial sector (manufacturing, mining, construction, handicrafts and related activities) only accounted for about 13 per cent of GDP in 1992. The entire industrial sector's contribution to total employment is estimated to be about 5 per cent. In the 1960s and 1970s, the manufacturing sector exhibited modest growth, partly due to the relatively stable political environment in the country compared to the then newly independent African states, and partly due to more liberal foreign investment policies followed by the Haile Selassie government. As Wubneh (1990, p. 312) noted, foreign investment was a significant component of the manufacturing sector prior to 1974. For instance, in a sample of 273 firms, foreign investment accounted for about 41 per cent of the total paid-up capital in 1971/72. In terms of ownership, foreigners had complete ownership over 101 firms (37 per cent of the sample) and more than 50 per cent ownership over additional 42 firms (15 per cent of the sample) during the same period.

The manufacturing sector is dominated by few labor intensive industries. For instance, in

1975, food products, beverages and tobacco accounted for 41 per cent of total value added in manufacturing. This share increased to 48 per cent by 1990. The share of textile & clothing was 36 per cent in 1975 and declined to 20 per cent of total value added in manufacturing by 1990. The shares of the relatively more technology-intensive industries in value added and in employment are very minimal. For instance in 1990, the share of machinery and transport equipment, and the share of chemicals in total manufacturing value added were 2 per cent and 4 per cent, respectively. In terms of employment, food products, beverages, tobacco, and textiles accounted for 64 per cent of total employment in 1990. Transport equipment and machinery, and chemicals, on the other hand, accounted for only about 3.2 per cent of total manufacturing employment during the same period.

In addition to its small share in GDP (Table 3.9), the performance of the manufacturing sector has also been weak, despite initial success. Manufacturing output grew by about 15 per cent per annum between 1960 and 1974, but its performance has been modest since then. As is clear from Table 3.9, the sector's overall progress deteriorated after 1975 both in terms of creating total value added and in terms of the number of establishments. The decrease in the number of establishments may be partly due to the consolidation of similar establishments after they were nationalized, as will be discussed below. In either case, a decrease in value added while employment was increasing suggests that the changes introduced after 1975 did not improve the performance of the manufacturing sector. Employment increased by at least 3 per cent every year, on average, between 1975 and 1990. But value added averaged either negative or less than one per cent during the same period, except between 1985 and 1990, in which it averaged about 7.5 per cent. In terms of overall performance, therefore, the manufacturing sector fared better

between 1960 to 1974 than the latter years. The main reasons for the relatively poor performance of the manufacturing sector are related to the policy changes that took place during the 1970s.

Table 3.9. Growth of Manufacturing Activity, annual average (%)

Indicator	1960-1974	1975-1979	1980-1984	1985-1990
Total output	14.7	1.9	6.5	0.4
Value added	8.3	-3.1	0.2	7.5
Employment	3.7	6.2	3.2	3.6
Number of establishments	12.7	-1.2	-0.2	0.4

Source: Calculated from Wubneh (1990), Table 1 for 1960-1984; and *African Development Report, 1994-1995*, for the remaining years (1985-1990).

In the mid-1970s, when political change was sweeping the country, the industrial sector in general and the manufacturing sector in particular also went through many structural changes. In 1975, the government nationalized most manufacturing industries, which were then reorganized as state corporations under the supervision of the Ministry of Industry.[7] Following the nationalization of most manufacturing industries, most foreign investors left the country. The mismanagement problems that accompanied the transition period (from private to public), the shortage of foreign exchange and intermediate inputs, and the unstable political environment of that period created serious constraints both on the expansion and on the optimal utilization of the sector's capacity (Mulat, 1990, p. 62).

[7]Proclamation 26/1975, Declaration on Economic Policy of Socialist Ethiopia.

3.2.3. THE EXTERNAL SECTOR

Ethiopia has a small open economy. It mainly exports coffee and hides. Coffee exports accounted for more than 60 per cent of total exports over the years. Main imports range from basic food items to fuel energy and capital goods. But between 1975 and 1992 the share of military imports in total imports was substantial. As indicated in Tables 3.4 and 3.5, the growth of imports was faster than that of exports. Consequently, the trade account balance was mainly in deficit over the last 30 years. Recent figures also indicate that this trend still continues. For instance, between 1971 to 1975 the current account deficit averaged about 7 per cent of total exports. By 1985 it reached 97 per cent of exports. And by 1993 it increased to 149 per cent of exports. In 1994, it slightly declined to 133.5 per cent of total exports, but still remained high compared to the early 1970s.

The increase in the trade deficit led to external indebtedness. Between 1975 to 1979, net long-term borrowing averaged 64 million (current) US dollars. This average increased to US$ 211 in the early 1980s and further increased to US$ 304 in the late 1980s. Total external debt service payments (long-term loans and IMF credit) averaged US$ 26 million between 1975 and 1979, and increased to a yearly average of US$ 88 million between 1980 and 1985. In the late 1980s total external debt service payment averaged US$ 199 million - which is a substantial increase (more than 600 per cent) compared to its level in the late 1970s.

Corresponding to the misalignment of the trade sector in particular and aggregate demand

and supply in general, the real exchange rate[8] also exhibited a significant appreciation (12 per cent) between 1975 and 1988 compared to 1961-1974. This is due to the trade imbalance, and the government's deficit financing and inflationary tax policies. As noted above, the external sector was consistently in deficit, mainly due to an increase in imports, despite the relative increase in the price of imports. Due to the increase in imports, exports and imports averaged about 26 per cent of GDP during the military regime, compared to 18 per cent over the previous sample period (1961-1974). The increase in imports occurred despite the government's imposition of import restrictions and foreign exchange rationing. Thus, the increase in imports could be attributed mainly to increases in government consumption, which explains why public expenditures and particularly military expenditures and the money supply significantly increased. Such an increase resulted in both trade and budget deficits during the military regime. Such deficits led to high inflation rates over that period, and hence an appreciation of the real exchange rate.

Further, the slow growth in exports, the increase in government consumption, including demand for imports, led to a shortage of foreign currency. Such a shortage, in turn, resulted in the emergence and expansion of the parallel (black market) for foreign exchange, which was as high as three to four times the official rate. The prevalence of such a market and the balance of payment position were the two main reasons for devaluing the currency in 1992. The gap between the official and the parallel market values of the currency (birr) also encouraged black

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[8]The real exchange rate is defined as, RER = EP*/P, where E is the nominal value of domestic currency (birr per US dollar), P* is the world wholesale price index, and P is the domestic price index. During the sample period, the Ethiopian currency (birr) was pegged to the US dollar at 2.07 birr per $US (E = 2.07 birr /dollar) until it was devalued to five (birr) per US dollar in September 1992.

market trade (in cash crops like coffee and live animals) with neighbouring countries, which further denied the government its traditional sources of foreign currency. The shortage in foreign currency led to even tighter controls and rationing.

3.2.4. THE GOVERNMENT SECTOR

Government has played a significant role in the Ethiopian economy, both in terms of its share in GDP and degree of intervention. This is particularly true beginning in the mid-1970s, after the then new government adopted a "socialist" economic development path. As indicated in Tables 3.4 and 3.5, public expenditures as a percentage of GDP increased from 13 per cent in the 1960s to 34 per cent in the 1980s. Consequently, the central government budget deficit as a percentage of GDP increased from a low of about 1 per cent in the 1960s to about 8 per cent of GDP in the 1980s. By 1990 it reached 17 per cent of GDP.

Such an expansion of government expenditures was taking place in the absence of an increases in government revenue. On average, government revenue only covered about 67 per cent of total current government expenditures between 1975 to 1988. To finance its deficits the government relied partly on external sources and partly on domestic bank borrowing. During the period, external assistance accounted for 27 per cent of total deficits while external loans and bank borrowing financed the remaining 31 percent and 42 percent of the total deficit, respectively. The reliance on bank borrowing (including money printing) to finance the deficit resulted in high inflation rates, which more than doubled between 1975-1988 compared to 1961-1974.

Due to political instability and due to the then military government's "socialist" policies, no significant direct foreign investment was coming into Ethiopia between 1975 and 1988. The only sources of foreign exchange, in addition to exports, during that period were economic assistance and loans. Consequently, the size of the central government debt increased significantly between the two sub-periods. The central government's total debt increased from a mere 12.7 per cent of GDP in 1974 to 73 per cent of GDP in 1988.

The increase in imports, in public expenditures, and in total government debt are partly the result of the increased severity of the internal armed political conflict. The internal war that had been going on between the central government and national movements in northern areas intensified in the mid-1970s. This was particularly true after the new military government took power in 1974. Due to its preoccupation with winning the war, the government shifted substantial amounts of resources, both material and human, to the war effort. Given the meagre available resources of the country, such a shift in resource allocation could only be accomplished at the expense of other economic programs.

As can be seen in Figures 3.1 to 3.2, both the level of military expenditures and the size of the armed forces significantly increased after 1974. Ethiopia's military expenditures as a percentage of GNP (see Fig. 3.1) were lower than the all-Africa average until 1974. But by 1980, domestic military outlays (excluding foreign military aid) as a percentage of GNP reached 9.7 per cent while the all-Africa average was only 2.9 per cent. That is, over the decade (1971-1980), domestic military outlays in Ethiopia increased by 262.5 per cent compared to only 3.6 per cent for the all-Africa average. On the other hand, the respective growth rates in per capita GNP, during the same period, were 1.7 per cent and 6.6 per cent.

This pattern of military expenditures continued during the 1980s. Ethiopian domestic military expenditures as a percentage of GNP averaged roughly twice that of the all-Africa average between 1981-1987, while the average standard of living deteriorated (negative growth rate of per capita GNP) in both Ethiopia and in all of Africa on average.

Figures 3.2 and 3.3 also indicate a similar picture regarding the level and changes in military expenditures in Ethiopia relative to the all-Africa average. Military expenditures as a percentage of the central government budget (Fig. 3.2) and arms imports as a percentage of total exports (Fig. 3.3) have been higher in Ethiopia than the all-Africa average. This is probably because Ethiopia had a well established domestic army while most of the rest of African countries were under colonial rule. Consequently, Ethiopian domestic military expenditures as a percentage of the central government budget were almost twice the all-Africa average between 1971 and 1974. After 1974, military expenditures as percentage of the central government budget dramatically increased in Ethiopia relative to the all-Africa average. By 1987, it increased to 24 per cent while for all-Africa it was only 13.1 per cent. Compared to 1974, this represents 72.6 per cent and 18 per cent increases, respectively.

Similarly, until 1974 Ethiopian expenditures on arms imports as a percentage of total exports was about three times that of the all-Africa average. Between 1974 and 1987, however, arms imports as a percentage of total exports averaged 13.2 per cent per annum for all-Africa, while arms imports in Ethiopia reached 158 per cent of its total exports. Given that the main source of foreign exchange is export earnings and the scarcity of foreign exchange, such an allocation of resources must result in a high opportunity cost in terms of, say, forgone

imports of intermediate inputs.

In addition to the material resources allocated for military purposes, the size of the Ethiopian armed forces also grew between 1971 and 1987. As shown in Figure 3.4, between 1976 and 1987, the size of the armed forces per 1000 inhabitants in Ethiopia was twice the size of the all-Africa average.

The extent to which military expenditures in Ethiopia were much higher than for the all-Africa average is more apparent from Table 3.10. The level of Ethiopian GNP per capita averaged about 17 per cent of the all-Africa average, per annum, between 1971 and 1987. But during the same period, domestic military outlays as a percentage of GNP and as a percentage of central government budget, arms imports as a percentage of total exports, and armed forces per 1000 inhabitants averaged 164, 202, 1643, and 154 per cent of the all-Africa average, respectively. When military outlays as a percentage of GNP and as a percentage of central government budget are weighted by relative GNP per capita (Ethiopian values relative to the all-Africa average), the respective Ethiopian outlays were 947 and 1172 per cent of the all-Africa average. That is, for equivalent GNP per capita, on average Ethiopia was allocating 9.5 dollars for military purposes for every dollar allocated by the all-Africa average. Both in terms of human and material resources, therefore, Ethiopia allocated more resources for military purposes than the average for all of Africa. This significantly contributed to both the overall public expenditures and hence the total government debt directly, and probably affected the growth of output indirectly, by competing for scarce foreign exchange resources and hence imports of intermediate inputs, since most of the military equipment was imported.

MILITARY EXPENDITURES AS A PERCENTAGE OF GNP: ETHIOPIA AND ALL AFRICA

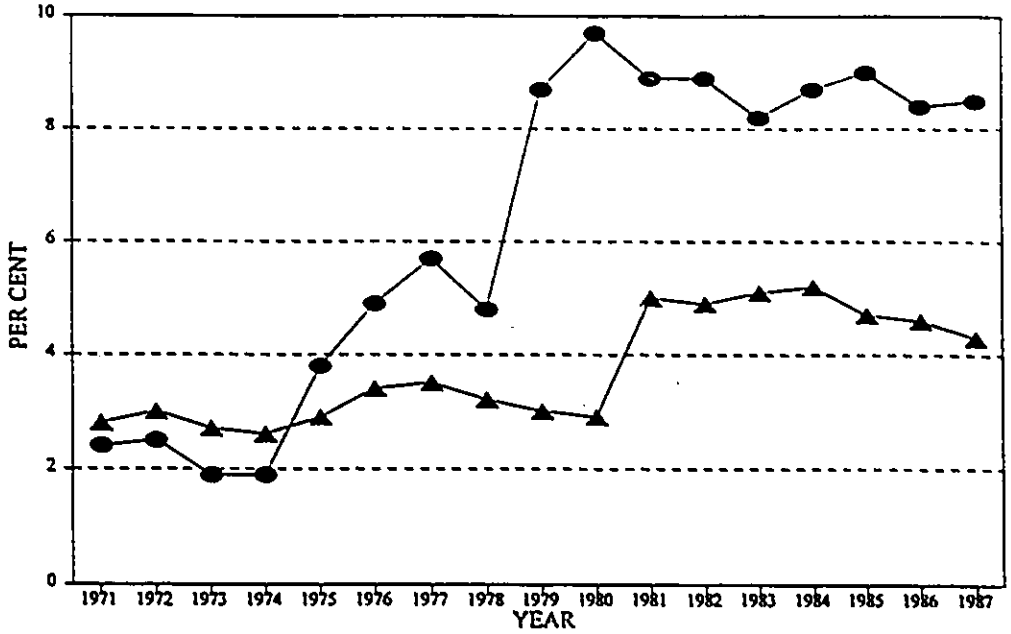

Fig. 3.1

MILITARY EXPENDITURE AS PERCENTAGE OF CENTRAL GOVERNMENT OUTLAYS

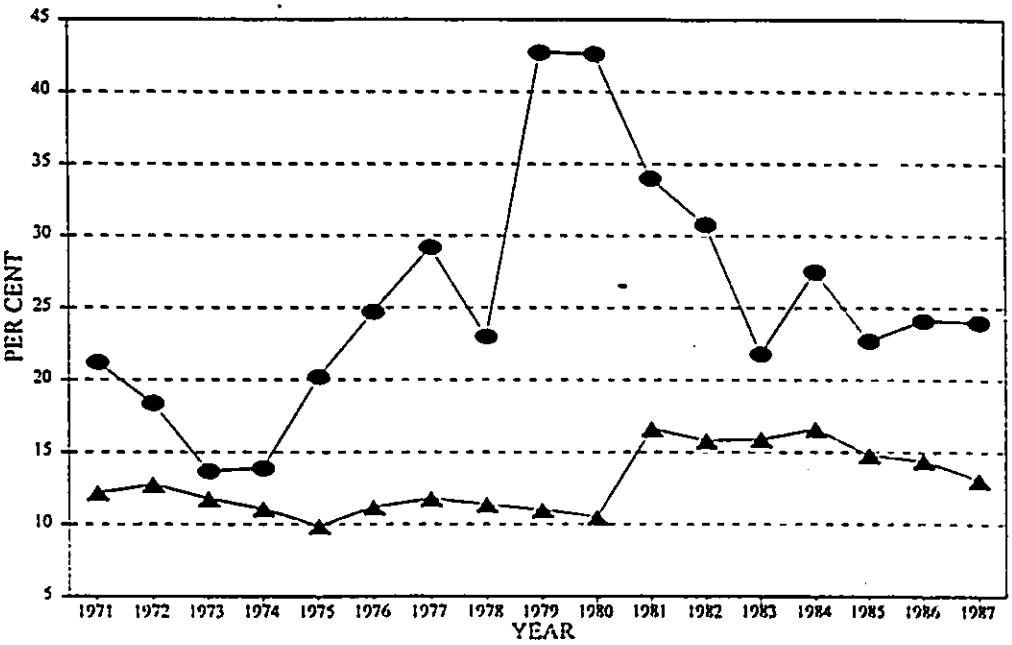

Fig. 3.2

ARMS IMPORTS AS PERCENTAGE OF
TOTAL EXPORTS

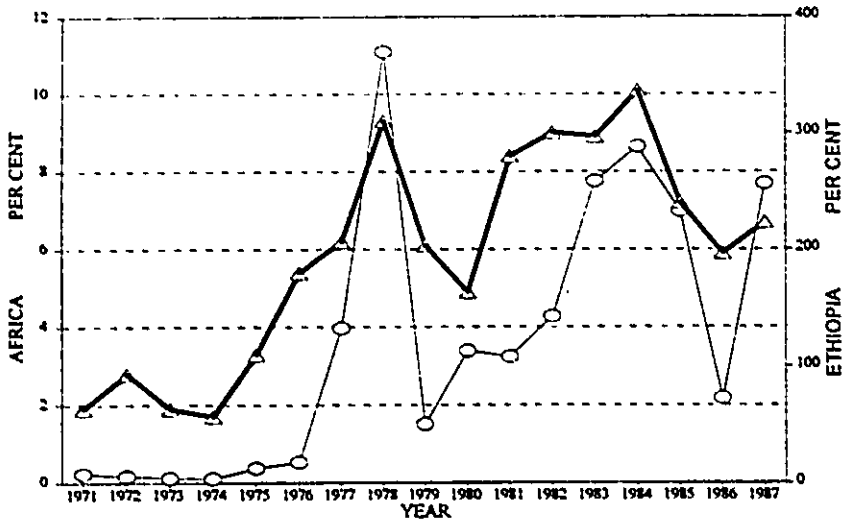

Fig. 3.3

ARMED FORCES PER 1000 INHABITANTS:
AFRICA AND ETHIOPIA

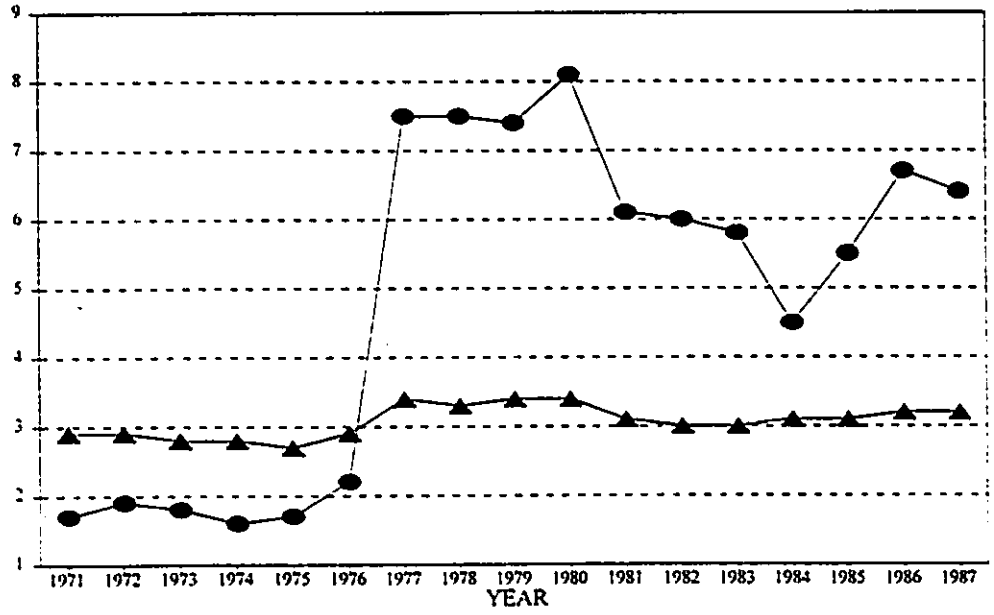

Fig. 3.4

Table 3.10 MILITARY OUTLAYS RELATIVE TO THE ALL-AFRICA AVERAGE

ETHIOPIAN GNP PER CAPITA, MILITARY EXPENDITURES, CENTRAL GOVERNMENT EXPENDITURE, ARMS IMPORTS AS A % OF TOTAL EXPORTS AND ARMED FORCES PER 1000 INHABITANTS RELATIVE TO TOTAL AFRICAN AVERAGE (%)							
YEAR	1	2	3	4	5	6	7
1971	18	86	471	955	174	59	416
1972	18	83	451	778	144	66	207
1973	18	70	383	631	116	64	211
1974	17	73	433	742	125	57	218
1975	17	131	774	1205	204	63	385
1976	16	144	887	1357	221	76	328
1977	16	163	999	1518	247	221	2135
1978	16	150	949	1277	202	227	3978
1979	16	290	1793	2400	388	218	823
1980	17	334	1912	2319	406	238	2306
1981	18	178	1014	1167	205	197	1286
1982	18	182	1001	1075	195	200	1583
1983	19	161	843	719	137	193	2907
1984	18	167	908	899	166	145	2852
1985	17	191	1149	920	153	177	3235
1986	17	183	1053	965	167	209	1231
1987	18	198	1078	999	183	200	3827
AVERAGE	17	164	947	1172	202	154	1643

formula:

(i) relative measure - $(value^E / value^A)*100$;

(ii) GNP per capita weighted measures - $(value^E/value^A)*(GNP^A/GNP^E)*100$,

where superscripts A and E represent total Africa and Ethiopia, respectively and GNP is GNP per capita.

1. Relative GNP per capita.
2. Relative domestic military outlays to output ratio.
3. Relative domestic military outlays to output ratio weighted by GNP per capita.
4. Relative domestic military outlays to total central government budget.
5. Relative domestic military outlays to total central government budget weighted by GNP per capita.
6. relative armed forces per 1000 inhabitants.
7. Relative arms imports as a ratio of total exports.

In summary, the Ethiopian economy is a rural subsistence economy. The modern sectors (manufacturing and services) are small both in terms of their contribution to GDP and in terms of their ability to create employment. Growth in the manufacturing sector is influenced by the availability of foreign exchange, which in turn depends on the exports of primary (agricultural) products like coffee. Both due to the relative size of the agricultural sector and due to its impact on the other sectors, therefore, the performance of the whole economy depends (and will continue to depend for some time) on the performance of the agricultural sector.

Owing to government policies and partly due to an increase in population, components of aggregate demand expanded during the last three decades. This was especially the case since the mid-1970s. Such an increase in demand while growth of output was either weak or stagnant created an excess demand pressure. The gap between aggregate demand and supply, therefore, resulted in an increase in government and current account deficits. The deficits generated an inflationary pressure, which in turn led to an overvalued local currency (in real terms).

Many government policies were implemented during the period in question. These policies include: Radical land reform, nationalisation of most manufacturing industries, strict price controls - especially for agricultural goods, and expansive monetary and fiscal policies. Whatever the contribution of these polices is, the performance of the economy has been unsatisfactory. The objective of the following chapters is to specify a model that reflects the essential features of the economy as outlined in this chapter.

4. MODEL SPECIFICATION AND ESTIMATION

4.1. THE MODEL

In addition to the relevant identities and definitions, the model contains twenty-two behavioral equations pertaining to four sectors. These sectors include: Output supply, labor demand, aggregate demand, and external sectors. The level of disaggregation adopted is, to some extent, influenced by data availability.

In specifying the model, an attempt is made to capture the specific features of the economy and to incorporate the main features outlined in the literature review. Consequently, the model is eclectic in the sense that it includes both Keynesian and Neo-Classical assumptions and formulations, as is deemed appropriate for the economy at hand. For instance, nominal wages are assumed to be fixed following the Keynesian tradition, while output is, in line with Neo-Classical assumptions, not demand- but supply-determined. This is not, however, because "supply creates its own demand", but is instead due to the assumed bottlenecks of capital and intermediate input. Given such specific features, therefore, some of the explanations for macroeconomic problems differ from the standard developed country models. For example, unemployment cannot be explained by a Keynesian lack of aggregate demand.

Further, due to the importance of resource constraints on the supply side, an effort is

made to take the role of capital and intermediate inputs on output supply into account. The importance of capital and intermediate inputs is based on the observation that almost all capital and intermediate inputs used in the manufacturing sector are imported because no domestic substitutes are available. Given the scarcity of foreign exchange, manufacturing output is expected to be significantly affected by the behavior of the real exchange rate, export earnings and foreign aid. Therefore, an attempt is made, directly or indirectly, to have these influences captured by the model.

The interactions of the variables is summarized in the following flow chart. Unlike conventional Keynesian assumptions, aggregate demand plays no direct influence in stimulating output since output has consistently fallen short of aggregate demand over the sample period. This gap is assumed to be filled by foreign borrowing and economic aid. Aggregate output is determined by the availability of intermediate inputs, which in turn are determined by the availability of foreign exchange and by the work force, which is influenced by the real wage.

Aggregate demand influences the external sector via the demand for imports and the latter influences aggregate demand through export earnings and the price of imports. Aggregate demand is also influenced by the exchange rate through its impact on price of imports. The influence of the exchange rate (and the main source of foreign exchange, export earnings) is crucial, not only because of its direct impact on imported inputs, and hence on the level of output, but also because of its effect on imported medicine and other health-related necessities.

GENERALIZED FLOW CHART OF THE MODEL:

SELECTED SECTORAL LINKAGES

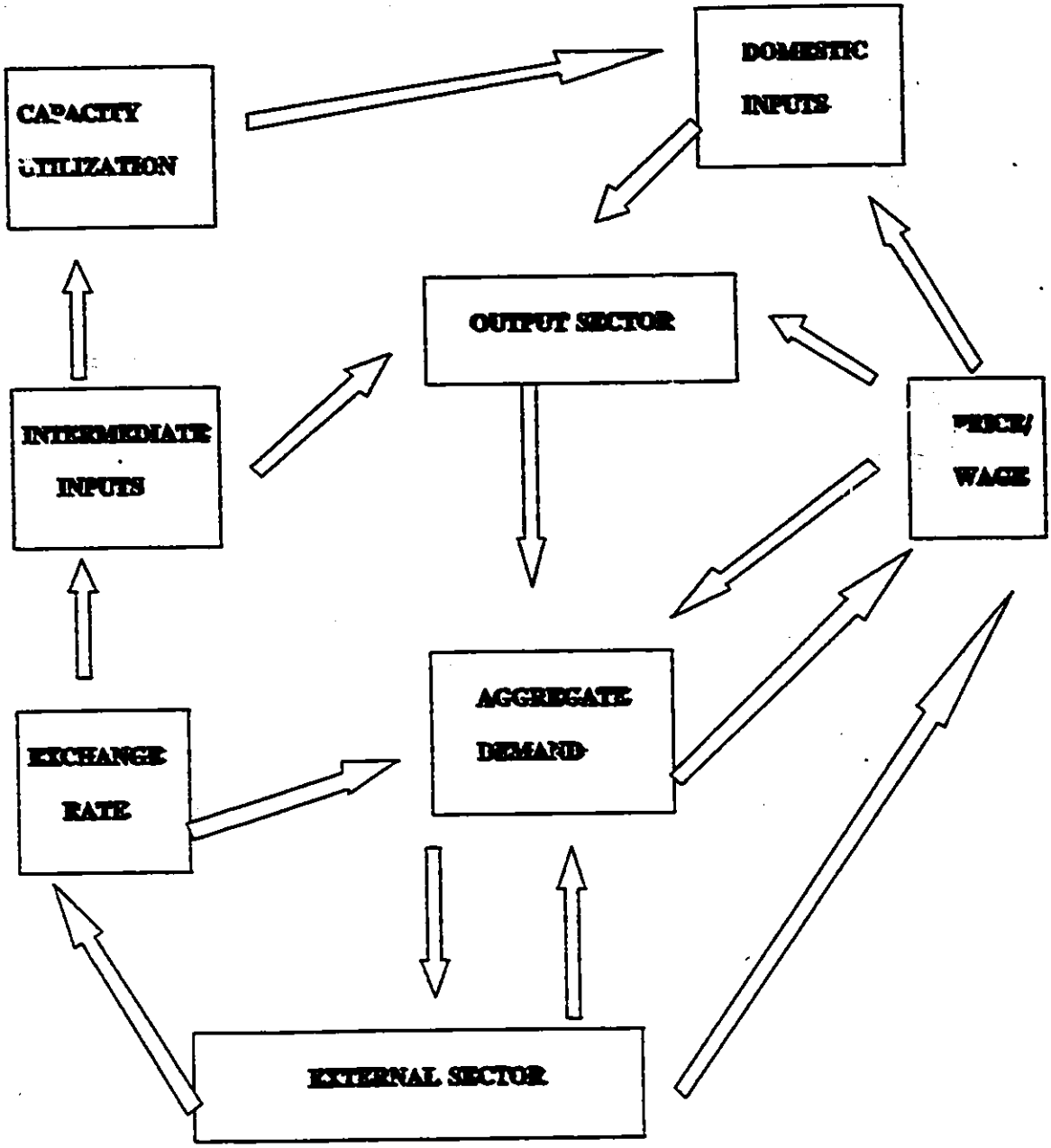

Fig. 4.1

Direct and indirect linkages omitted from the flow chart (to simplify the presentation) include: The effects of aggregate domestic demand on export earnings (via consumption), foreign aid on aggregate demand, and world income and world prices on the trade balance.

What is worth noting is that, due to the weak financial sector and partly due to data limitations, financial sector variables are assumed exogenous. Further, consistent with the dominance of supply constraints and the subsistence level of the economy, the workings of the model are structured as follows: Export earnings are the main source of foreign exchange (and hence of the capacity to import), which determines the level of imported inputs. The level of imported production inputs determines the level of capacity utilization, which in turn determines actual output directly and indirectly via its impact on the utilization of domestic inputs. The level of output determines aggregate demand. The role of aggregate demand is to determine the allocation of available output between its various components. This allocation will determine the external balance via patterns of expenditures (domestic goods vs imports), growth (consumption vs investment) and will thus indirectly influence output.

In line with the above briefly sketched linkages, the proposed model is presented below. The list of variables and units of measurement are presented in appendix A, at the end of this chapter.

4.1.1. OUTPUT SUPPLY (PRODUCTION)

In a country where intermediate inputs are almost all imported, domestic production

consists of the domestic consumption of goods and services (private and public) and exports. To the extent that a country experiences a chronic trade deficit, it indicates that domestic supply falls short of aggregate demand. Such is the case in Ethiopia. Aggregate demand (private and government consumptions plus the trade surplus) was consistently greater than total output between 1962 - 1988, except in 1975/76 when imports were almost totally curtailed by the new military government. This disequilibrium phenomenon in terms of the domestic economy suggests a significant role for the exchange rate in determining the level of imports and hence output supply - via imported capital and intermediate inputs. To reflect the scarcity of imported inputs, the utilization rates of the fixed capital stock (RFCA1) and of the total labor force (STR1) are adjusted[9] by the capacity utilization rate (CUR).

The output sector consists of total output, manufactured output, agricultural output, and residual output (mainly services). The ratio of real output to the real fixed capital stock (RY/RFCA) depends on the ratio of labor force employed to the real fixed capital stock (STR/RFCA). No data on the rate of unemployment are available. Therefore, both the labor force and the real fixed capital stock are adjusted by rate of capacity utilization (CUR) to determine what is actually employed and used, respectively. The production process follows the usual assumptions of positive but diminishing marginal products.[10] To capture the

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[9]Adjusted fixed capital stock, RFCA = RFCA1*CUR; and adjusted labour force, STR = STR1*CUR, where RFCA1 and STR1 are the unadjusted stock of fixed capital stock and total labour force, respectively, and CUR is the capacity utilization rate.

[10]This assumption may seem unreasonable in the face of idle capacity and surplus labour, but given the assumption of non-substitutability between domestic and imported inputs, and, as long as imported inputs are not available due to shortages in foreign exchange, there will be diminishing returns.

structural shift in the mid-seventies, a dummy variable is also included in the production function:

$$\left(\frac{RY}{RFCA}\right) = \alpha_i \left(\frac{STR}{RFCA}, D1\right), \qquad (1)$$

where the dummy variable takes the value 1 in the years from 1975 to 1987, and zero otherwise.

Following Marwah (1972), capacity utilization (CUR) depends on the ratio of lagged money supply to output $(RMS/RY)_{-1}$, the ratio of intermediate inputs to lagged manufacturing output $(RMNT/RMO_{-1})$, lagged CUR and a dummy variable. CUR is defined as the ratio of actual real manufacturing output to potential manufacturing output (RMO/CMO). Potential manufacturing output is calculated as a linear approximation of the peak periods of manufacturing output. That is, manufacturing output is at its maximum capacity if it follows a linear trend between the peak periods over the sample period. Both the ratio of money supply to output and the ratio of intermediate inputs to manufacturing output are expected to positively influence capacity utilization:

$$CUR = \varpi_i \left(\left(\frac{RMS}{RY}\right)_{-1}, \frac{RMNT}{RMO_{-1}}, CUR_{-1}, D1\right), \qquad (2)$$

where D1 takes the value 1 in the years from 1975 to 1987, and zero otherwise. In the mid-seventies the new government nationalized most manufacturing industries and there was a labor union strike during the transition period. Further, the flow of intermediate inputs was adversely affected due to the political instability that emerged during the transition period. The dummy variable is, therefore, included to account for changes that took place following the government's new policies.

Real agricultural output (RAO) depends on the labor force in agriculture (LAFI), lagged rainfall (RF_{-1}) and a time trend (T):

$$RAO = \beta_i(LAFI,\ RF_{-1},\ T) \qquad (3).$$

Manufacturing output depends on the labor force employed (LM), imported manufacturing inputs (RMNT) and the real fixed capital stock (RFCA):

$$RMO = \gamma_i(LM,\ RMNT,\ RFCA) \qquad (4).$$

4.1.2. LABOR DEMAND

The labor market, as in most LDCs, is imperfect in the sense that the existing wage

structure fails to clear the market. The modern sector provides a relatively high wage level, but cannot absorb the available labor force. Due to the wage gap between the modern and the agricultural sector, rural-urban migration continues, as suggested by Harris and Todaro (1970), until the probability of being employed in the modern sector is so small that it is not worth making the move. Therefore, the supply of labor in both sectors is taken as given since the price of labor ceases to be an incentive in a surplus labor economy, where an unlimited supply is available at the existing wage rate. Consequently, the level of employment is determined by the demand for labor.

In this model, the demand for labor only consists of activities in the two important sectors: Demand for labor in the agricultural and manufacturing sectors. In the agricultural sector, where no money wage exists, the demand for labor (LAFI) depends on the level of agricultural output (RAO), and a dummy variable (D1):[11]

$$LAFI = \varepsilon_i(RAO,\ D1), \qquad (5)$$

where D1 takes the value 1 in the years from 1975 to 1987, and zero otherwise. The rationale for including a dummy variable in the above equation is that after 1975 the land ownership system was completely changed. Private land ownership was abolished, ending the tenant-landlord relationship that had existed until then. Instead the government owns all land while

[11] Due to the assumed surplus labor in agriculture, the absence of wage structure in the sector, and lack of data for other potential additional explanatory variables (other agricultural inputs, prices of inputs and output) this equation is not adequately specified as it stands.

local farm-cooperatives administer its use (see section 3.2.1 for details). The dummy variable is expected to capture this shift in policy, which altered the demand for labor in the agricultural sector.

In the manufacturing sector, labor demand (LM) depends on the real wage rate (RWR), the level of manufacturing output (RMO), intermediate imports (RMNT), and a dummy variable (D1):

$$LM = \epsilon_1(RMO,\ RWR,\ RMNT,\ D1), \qquad (6)$$

where D1 takes the value 1 in the years from 1975 to 1987, and zero otherwise. The reasons for including a dummy variable in this equation are, again, similar to the case of the agricultural sector. That is, since most manufacturing industries were also nationalized during the same period, a dummy variable is included to capture the effect of these changes on the demand for labor in the manufacturing sector.

4.1.3. AGGREGATE DEMAND

Aggregate demand consists of eight behavioral equations and a definition of the capital stock. These include: Components of private consumption, indirect taxes, government expenditures, and investment. Private consumption is disaggregated into total domestic consumption (RC), imported consumer durables (RMCD), and imported consumer non-

durables (RMCND). A price equation is also included with the above components of aggregate demand.

Real private total consumption (RC) depends on real disposable income (RDY), and lagged real consumption (RC_{-1}). The lagged value of consumption is included to capture the influence of habit persistence, as suggested by Brown (1952). It is therefore assumed that a household will attempt to maintain the previous year's level of consumption via borrowing or other available sources:

$$RC = \theta_1(RDY,\ RC_{-1}) \qquad (7).$$

Imports of consumer durables (RMCD) and non-durables (RMCND) both depend on real disposable income (RDY), relative prices (the import price index (MPI) to the domestic price index (P)) and a time trend (T). Further, Warner and Kreinin (1983) argue that, in the absence of equal influences of these two price ratios, using the relative price (MPI/P) may not be appropriate. The observation is probably more true in the case of imported consumer goods, which do not have close domestic substitutes either due to price or quality differences (for estimates of alternative equations, consistent with this observation, see appendix B).

$$RMCD = \mu_1(RDY,\ \frac{MPI}{P},\ T) \qquad (8)$$

$$RMCND = \nu_1(RDY,\ \frac{MPI}{P},\ T) \qquad (9).$$

Indirect taxes (IT) depend on the level of output (Y) and a weighted index of import and export prices (ETI). In Ethiopia, both imports and exports are taxed as a ratio of their prices (*ad valorem* tariffs); therefore, the level of tax revenue will depend on the price level of traded goods:

$$IT = \vartheta_i(Y, ETI) \qquad (10).$$

Total real government consumption depends on the growth of output (ΔRY), real indirect taxes (RIT), and a time trend (T):

$$RG = \kappa_i\ (\Delta RY, RIT, T) \qquad (11).$$

In anticipation of later policy analysis, separate equations for government expenditures on education and health are specified to see to what extent social programs are affected by military expenditures. The issue of trade-offs between social programs and defence expenditures has been controversial in the development literature in recent years. See Hess (1989) and Russet (1982), for instance. Therefore, real education expenditures as a ratio of real total output (RGEE) depends on military expenditures as a ratio of total output (RMILEX), and the growth of real output (ΔRY). RMILEX is expected to be negatively related to RGEE, postulating that there has been a trade-off between military and education expenditures:

$$RGEE = \chi_i(RMILEX, \Delta RY, D1), \qquad (12)$$

where D1 takes the value 1 in the years 1975 to 1987, and zero otherwise. As was discussed in the third chapter, military expenditures significantly increased between 1975 and 1987 following the intensified internal armed conflict. The dummy variable is, therefore, included to capture the change in policy in allocation of resources between social programs and military expenditures.

Similarly, expenditures on health as a ratio of total output (RGEH) is expected to be negatively affected by the ratio of military expenditures to total output (RMILEX) and positively affected by the growth of output:

$$RGEH = \tau_1(RMILEX,\ \Delta RY,\ D1), \qquad (13)$$

where D1 takes the value 1 in the years 1975 to 1987, and zero otherwise, for reasons discussed above.

In Ethiopia and in similar economies, a very significant part of investment is public and not private. Therefore, the level of investment on machinery and equipment cannot be explained by cash flow, the level of profit or other similar investment models which assume that investment decisions are made at a firm level (Berndt, 1991, Chapter 6). The investment model formulated here is constructed in line with the accelerator model, though crude even by the standards of the naive version. Further, to capture the significance of imported intermediate inputs, the real exchange rate is included in the investment equation.

Accordingly, real investment expenditures depends on the growth of output (ΔRY), the real exchange rate (RER), the inflation rate (ΔP) and the lagged unadjusted real capital stock ($RFCA1_{-1}$):

$$RI = I_1(RER,\ \Delta RY,\ \Delta P,\ RFCA1_{-1}) \qquad (14).$$

Where the unadjusted (by the rate of capacity utilization, see footnote 9) capital stock is determined as follows:

$$RFCA1_t = (1-\delta)RFCA1_{t-1} + RI_t \qquad (15).$$

A range of values for the depreciation rate (δ) were tried, but a 10 per cent rate of annual depreciation was used because it is much closer to the available data on the capital stock.

The price level incorporates the interaction of excess aggregate supply over aggregate demand (RGAP/RY). In essence, the excess supply variable is used as an equilibrating device by exerting pressure on producer and consumer behavior via the price level. Hence, no monetary variable is included in the price equation since the effect(s) of monetary policy (money creation - deficit financing, or inflationary tax), for instance, will be captured by the aggregate demand and supply gap (RGAP/RY). Further, to capture the influence of foreign prices, the price of imports (MPI) is included as a determinant of the general price level:

$$P = \Pi_1\left(\frac{RGAP_{-1}}{RY},\ MPI,\ P_{-1}\right) \qquad (16).$$

4.1.4. EXTERNAL SECTOR

Exports are disaggregated into four main items (coffee - RXCOF, hides and skins - RXHK, oil seeds and nuts - RXOSN and other exports - OX). Other exports include mainly petroleum products, cotton, sugar, pulse and vegetables, and other primary products. Total real exports (RX) depend on the world GDP index (WY), the export price index (XPI), and the real exchange rate (RER):

$$RX = X_i(WY, XPI, RER) \qquad (17).$$

Real coffee exports (RXCOF) also depend on world income (WY), the coffee price index (COFPI), the unit price index of Kenyan coffee exports (XPK) and the real exchange rate (RER):

$$RXCOF = \omega_i(WY, COFPI, XPK, RER) \qquad (18).$$

Finally, real exports of hides and skins (RXHK) and of oil seeds and oil nuts (RXOSN) both depend on the world GDP index (WY), the export price index (XPI) and the real exchange rate (RER):

$$RXHK = \theta_i(WY, XPI, RER) \qquad (19)$$

$$RXOSN = E_i(WY, XPI, RER) \qquad (20).$$

In addition to imports of durable and non-durable consumer goods discussed earlier, imports are further disaggregated into imports of intermediate goods (RMNT), imports of fuel and lubricants (RMFL), and arms imports (RGUN).

Real imports of intermediate inputs depend on the relative price of imports (MPI/P), real manufacturing output (RMO), the lagged capital stock ($RFCA_{-1}$) and lagged export earnings (RX_{-1}). The real exchange rate (RER) is not included since the relative price captures its effect. Lagged export earnings are used as a proxy for exchange rate availability (capacity to import):

$$RMNT = B_i\left(\frac{MPI}{P},\ RMO,\ RFCA_{-1},\ RX_{-1}\right) \qquad (21).$$

Real imports of fuel and lubricants (RMFL) depend on real disposable income (RDY), the relative price of imports (MPI/P) and real military expenditures (RMILEX1). The demand for fuel is expected to increase as the degree of conflict, and hence military expenditures, increase. Therefore, RMFL is expected to be positively related to RMILEX1:

$$RMFL = \varphi_i\left(RDY,\ \frac{MPI}{P},\ RMILEX1\right) \qquad (22).$$

Real arms imports (RGUN) depend on the size of the armed forces (MP), and a dummy variable (D1), representing the periods of heavy internal conflict (1975 to 1987):

$$RGUN = \xi_i(MP,\ D1) \qquad (23).$$

4.1.5. IDENTITIES AND DEFINITIONS

RY	= RRY*RFCA	(24)
Y	= (RY*P)/100	(25)
OY	= Y - AO - MO	(26)
AO	= (RAO*P)/100	(27)
MO	= (RMO*P)/100	(28)
STR	= STR1*CUR	(29)
RFCA	= (RFCA1/CUR)	(30)
FCA	= (RFCA*P)/100	(31)
RDY	= RY - RIT	(32)
RIT	= (IT*100)/P	(33)
DY	= Y - IT	(34)
DC	= PC - MCD - MCND	(35)
PC	= (RC*P)/100	(36)
MCD	= (RMCD*P)/100	(37)
MCND	= (RMCND*P)/P	(38)
I	= (RI*P)/100	(39)
ROG	= RG - RGEE1 - RGEH1 - RMILEX1	(40)
RGEE1	= RGEE*RY	(41)
RGEH1	= RGEH*RY	(42)
GEE	= (RGEE1*P)/100	(43)
GEH	= (RGEH1*P)/100	(44)
OG	= (ROG*P)/100	(45)
G	= GEE + GEH + MILEX + OG	(46)
X	= (RX*XPI)/100	(47)
OX	= X - XCOF - XHK - XOSN	(48)
XCOF	= (RXCOF*COFPI)/100	(49)
XHK	= (RXHK*XPI)/100	(50)
XOSN	= (RXOSN*XPI)/100	(51)

TX	= XCOF + XHK + XOSN + OX + GR	(52)
TM	= MCD + MCND + MNT + MFL + GUN + OM	(53)
MNT	= (RMNT*MPI)/100	(54)
MFL	= (RMFL*MPI)/100	(55)
GUN	= (RGUN*MPI)/100	(56)
MT	= TM - GUN	(57)
AP	= MPI/P	(58)
RER	= (EXR*WWPI)/P	(59)
Y1	= PC + G + I + TX - TM	(60)
GAP	= Y - Y1	(61)
RGAP	= (GAP/P)*100	(62)
CA	= TX - TM	(63)

Equations (24) to (63) summarize the remaining relationships that serve to determine residuals in respective sectors and to ensure the internal consistency of the model. It is implicitly assumed that the conventional identity of total output from the supply side is not necessarily identical to total expenditures on the demand side unless inflows from the rest of the world are also included. That is, there usually is a gap between aggregate demand and supply which is usually filled, in the case of Ethiopia, by either foreign aid or loans. Thus, once the supply of total output (including the respective sectoral outputs) and total expenditures from the various components of aggregate demand are determined, any discrepancy between these measures is captured by the supply gap. This supply gap is then included in the price equation to capture demand pressures or excess supply when aggregate demand exceeds or falls short of aggregate supply, respectively.

Accordingly, equations (24) to (31) determine total output including residual output.

And equations (35) to (59) detail the relevant identities and definitions of aggregate demand which ultimately determine total aggregate demand, equation (60). Total aggregate demand, equation (60), and aggregate supply, equation (25), determine equation (61), which is the supply gap. Equation (63) simply determines the current account balance.

4.2. DATA AND DATA SOURCES

Availability of data for certain sectors in particular and the length of the available data series for the whole economy in general were limiting factors in two important respects. First, the lack of data for some key variables (the interest rate, for instance) made it difficult to compare important economic interactions vis-à-vis standard macroeconomic models. Second, for most sectors no data were available prior to 1960. This limited the size of the model due to the obvious problem of small sample size (limited degrees of freedom). Therefore, the selection of model specification and model size must be viewed in light of these limitations.

The main data sources are various official publications of international agencies and published and unpublished government reports. Where choice is available, however, data from international agencies are used to maintain consistency in updating and facilitate comparisons over time. The primary data sources include: International Financial Statistics, Government Financial Statistics, and Balance of Payments Yearbook published by the International Monetary Fund; Yearbook of National Income Statistics and World Tables published by the United Nations. Additional data from the National Bank of Ethiopia, the

Ethiopian Statistical Office and other Ethiopian government agencies were also collected to supplement the international data sources. The sample size used for estimating the model is 27 (from 1961 to 1987).

4.3. MODEL ESTIMATION

In principle, the econometrics literature provides ample estimation methods ranging from single equation estimators (SIEs) to full information system estimators (FISEs). In practice, however, data and other constraints limit the choice of estimation techniques, as discussed earlier. The simultaneity of the relationships outlined in the above model suggest that an estimator that would use all the information available in the system (say, three stage least squares) is appropriate. This leads, however, to what is usually referred to as "The Undersized Sample Problem" or the degrees of freedom problem, since there are only 27 observations available. The choice is, therefore, limited to either SIEs (OLS, for instance) or any of the limited information estimators (2SLS, instrumental variables, etc).

Accordingly, an attempt was made to estimate the model using the Cochrane-Orcutt procedure (C-O), instrumental variables and some variations of 2SLS in order to test the stability of the parameters. The analysis will depend, however, mainly on the results obtained from the 2SLS and OLS estimates. The results obtained using the 2SLS estimators are presented below, while alternative estimates (OLS) are presented in appendix B.

Before proceeding to examine the estimated results, it is worth highlighting that the

question of data stationarity (invariance with respect to time) and therefore model estimation has gained much attention in recent years. According to Kennedy (1992 p. 247), econometricians for the most part ignored the issue of stationarity until recently. Kennedy (1992, p.252) suggests two reasons for this neglect: "First, it was generally believed that although economic time series data looked nonstationary, this was only because of an underlying trend, and if the trend were removed, the data would be stationary. And second, it was thought that the validity of traditional econometric analyses was not adversely affected by nonstationarity of the variables being analyzed". Some recent studies, however, suggest that most macroeconomic data series are not stationary[12]. In response to such findings, more sophisticated methods have been and are being developed, to test whether a given economic data series is stationary or not. Such tests include unit root tests. And corresponding estimating procedures have also been and are being developed. Among such models is the error-correction model.[13] No attempt is made here to apply these tests and estimating techniques. This is partly due to the limitation of the data to lend itself to any appreciable potential lag structure that might be required to establish the degree of integration (the number of times a data series has to be differenced to achieve stationarity). The model is, therefor, estimated using "traditional" methods.

In reading the results, the following points are worth noting: the reported R square is

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[12]For a detailed discussion of the procedures of stationarity tests, see Kennedy (1992), Charemza and Deadman (1992), and Oxley, George, Roberts and Sayer (1995).

[13]For a detailed survey of such models' evolution and their application, see Charemza and Deadman (1992) and Oxley, George, Roberts and Sayer (1995).

adjusted for degrees of freedom. numbers in parenthesis are t-statistics. and 'Ln' is the natural logarithm: D.W. and D.h. are Durbin-Watson 'd' and 'h' statistics. respectively. and ρ is the serial correlation coefficient.

4.3.1. SYSTEMS ESTIMATION (2SLS)

EXOGENOUS VARIABLES: COFPI. D1. MP. MPI. POP. RF. RFR. RGR. RMILEX1. RMS. RTGB. RWR. T. WWPI. WY. XPI. XPK.

4.3.1.1. OUTPUT SUPPLY

(1) Ln (RY/RFCA) = 6.0133 + 0.78508 Ln (STR/RFCA) - 0.19196 D1
(24.013) (15.15) (3.388)

$\bar{R}^2$ = 0.94 D.W. = 0.5671 ρ = 0.882 SSE = 0.081775 $\bar{Y}$ = 1.7799

(2) Ln CUR = 0.3105 + 0.26168 Ln $(RMNT/RMO_{-1})$ +
(0.147) (2.506)

0.11844 Ln $(RMS/RY)_{-1}$ + 0.47893 Ln CUR_{-1} - 0.754 D1
(2.659) (3.076) (4.723)

$\bar{R}^2$ = 0.82 D.h. = 0.49 SSE = 0.085453 $\bar{Y}$ = 0.097215

(3) Ln RAO = 6.0991 + 1.2593 Ln LAFI + 0.0654 Ln RF_{-1} - 0.036162 T
(8.163) (8.382) (4.678) (5.731)

$\bar{R}^2$ = 0.75 D.W. = 1.6 ρ = 0.130 SSE = 0.20832 $\bar{Y}$ = 8.7907

(4) Ln RMO = 1.8437 + 0.45529 Ln LM + 0.2647 Ln RMNT + 0.43753 Ln RFCA
(2.185) (2.688) (2.173) (4.450)

$\bar{R}^2$ = 0.51 D.W. = 0.85 ρ = 0.705 SSE = 0.20925 $\bar{Y}$ = 7.1508

4.3.1.2. AGGREGATE DEMAND

(5) Ln RC = 0.51882 + 0.92285 Ln RDY + 0.0057899 Ln RC_{-1}
(1.545) (25.93) (1.418)

$\bar{R}^2$ = 0.97 D.h. = 2.1 SSE = 0.017446 $\bar{Y}$ = 9.2923

(6) Ln RMCD = 3.0183 + 0.2603 Ln ((RDY_{-1} + RDY_{-2})/2)
(6.347) (4.713)
-0.69971 Log (MPI/P) -0.017108 T
(1.718) (1.225)

$\bar{R}^2$ = 0.31 D.W. = 2.7 SSE = 2.6469 $\bar{Y}$ = 4.9988

(7) Ln RMCND = 5.0789 + 0.01753 Ln RDY_{-1} - 1.493 Ln (MPI/P) + 0.042895 T
(20.65) (0.614) (7.088) (5.439)

$\bar{R}^2$ = 0.70 D.W. = 1.6 ρ = 0.148 SSE = 0.70816 $\bar{Y}$ = 5.7295

(8) IT = -173.76 + 0.085208 Y + 3.1064 ETI
(4.958) (6.401) (3.132)

$\bar{R}^2$ = 0.98 D.W. = 1.5 ρ = 0.251 SSE = 35690 $\bar{Y}$ = 589.05

(9) Ln RG = 4.9698 + 0.001963 Δ Ln RY + 0.32892 Ln RIT + 0.01645 T
(4.348) (0.141) (2.004) (4.751)

$\bar{R}^2$ = 0.70 D.W. = 1.8 SSE = 0.11136 $\bar{Y}$ = 7.5473

(10) Ln RGEE = 3.4705 - 0.43905 Ln RMILEX + 0.0411 Δ Ln RY
(21.15) (10.23) (4.331)
+ 0.58286 D1
(1.045)

$\bar{R}^2$ = 0.82 D.W. = 2.2 SSE = 0.34993 $\bar{Y}$ = 1.751

(11) Ln RGEH = 2.1312 - 0.38339 Ln RMILEX + 0.034941 Δ Ln RY + 0.47503 D1
(19.38) (13.98) (2.528) (7.047)

$\bar{R}^2$ = 0.91 D.W. = 2.3 SSE = 0.1606 $\bar{Y}$ = 0.62266

(12) Ln RI = 4.3925 - 0.28544 Ln RER + 0.51385 Ln $RFCA1_{-1}$
(10.55) (3.195) (7.379)

+ 0.63895 Δ Ln RY + 0.07878 ΔLn P
(8.224) (2.289)

$\bar{R}^2$ = 0.77 D.W. = 1.6 ρ = 0.204 SEE = 0.21849 $\bar{Y}$ = 7.3855

(13) Ln P = 0.7114 - 0.04868 $RGAP_{-1}$ + 0.70174 Ln MPI + 0.08853 Ln P_{-1}
(3.556) (3.843) (7.575) (1.914)

$\bar{R}^2$ = 0.95 D.h. = 2.2 SSE = 0.08602 $\bar{Y}$ = 3.8032

4.3.1.3. EXTERNAL SECTOR

(14) Ln RX = 3.1989 + 1.3675 Ln WY - 0.62934 Ln XPI + 0.17317 Ln RER
(3.878) (5.547) (7.634) (2.560)

$\bar{R}^2$ = 0.76 D.W. = 1.5 ρ = 0.232 SSE = 0.1221 $\bar{Y}$ = 6.8025

(15) Ln RXCOF = 3.5252 + 0.64504 Ln WY + 0.98322 Ln XPK
(1.920) (1.470) (2.411)

+ 0.27834 Ln RER - 0.1197 Ln COFPI
(1.984) (1.578)

$\bar{R}^2$ = 0.37 D.W. = 2.1 SSE = 0.5616 $\bar{Y}$ = 6.2795

(16) Ln RXHK = -8.6746 + 4.0447 Ln WY - 1.3774 Ln XPI + 1.0074 Ln RER
(2.662) (4.153) (4.229) (3.769)

$\bar{R}^2$ = 0.46 D.W. = 1.18 ρ = 0.320 SSE = 1.906 $\bar{Y}$ = 4.6841

(17) Ln RXOSN = -5.675 + 2.2902 Ln WY - 0.035292 Ln XPI
(1.792) (3.050) (8.265)

+ 1.2758 Ln RER
(4.971)

$\bar{R}^2$ = 0.90 D.W. = 1.6 ρ = 0.214 SSE = 1.9627 $\bar{Y}$ = 3.7056

(18) Ln RMNT = 6.1283 + 0.19488 Ln RMO - 0.55073 Ln (MPI/P)
(4.399) (0.941) (4.761)

- 0.27473 Ln $RFCA_{-1}$ + 0.31921 Ln RX_{-1}
(2.937) (3.724)

$\bar{R}^2$ = 0.50 D.W. = 1.7 SSE = 0.14053 $\bar{Y}$ = 7.7573

(19) Ln RMFL = 1.2583 + 0.059264 Ln RDY_{-1} -
(2.912) (1.275)

0.87962 Ln (MPI/P) + 0.59951 Ln RMILEX1
(3.115) (6.642)

$\bar{R}^2$ = 0.87 D.W. = 2.2 SSE = 2.4978 $\bar{Y}$ = 6.1123

(20) Ln RGUN = 12.023 + 2.3214 Ln MP - 1.231 D1
(11.64) (7.142) (2.271)

$\bar{R}^2$ = 0.74 D.W. = 1.5 ρ = 0.203 SSE = 12.09 $\bar{Y}$ = 5.1399

The above model is used for dynamic and deterministic simulation after adding the relevant identities and definitions. All equations are used in the simulation. The equations for labor demand (reported in the appendix for this chapter) are not included in the simulation. The reason for dropping these two equations is due to their poor performance in tracking their corresponding historical data series (both within-sample and outside-sample periods). This is not surprising in light of the poor quality of data in the labor market, as discussed earlier. One solution to the problem, assuming the source of the simulation error is what is usually referred to as "estimation residual", would have been to re-specify the equations using additional and /or alternative explanatory variables. Data constraints discussed earlier, however, limited the possibility of such an effort. Further, some adjustments are also made to the intercepts of some equations (capacity utilization, investment, and imported intermediate inputs) at the simulation stage in line with what is called tuning (in most cases a 10 per cent increase or decrease).

4.4. MODEL VALIDATION AND MULTIPLIER ANALYSIS

Challen and Hagger (1983) suggest that, among the most commonly used tests to evaluate the appropriateness of single equations, are tests for the existence of disturbance autocorrelation, for goodness of fit and for the significance of the explanatory variables. The respective evaluation procedures are usually examined by looking at the Durbin-Watson statistics (for some estimators), the adjusted R square, and the t-statistics. Using the above

criteria[14] and focusing on the last two tests, more than 60 per cent of the estimated individual equations in this study have an adjusted R square which is above 80 per cent. And more than 80 per cent of the explanatory variables are significant at the 5 percent level.

Comparing the goodness of fit results in this study with similar studies cited earlier (Khayum, 1991) indicates that the explanatory power of this model is comparable to those models. A review of these studies show that thirteen of the sixteen models have more than seventy percent of their equations with R square (unadjusted) of 80 per cent or more. Comparison of the number of explanatory variables that are significant is difficult, however, due to missing information in the sample size of some of the studies.

Most of the coefficients in this study are also plausible in terms of their consistency with theoretical expectations. For instance, to cite few examples, a short-run marginal propensity to consume of 0.92 (and a long-run MPC of 0.94) seems reasonable, given the subsistence nature of the economy with a limited ability to save out of disposable income. Similarly, the price (relative) elasticity of demand for imported intermediate inputs is less than one (in absolute value) indicating a limited availability of domestic substitutes. On the other hand, while the price elasticities seem on the whole reasonable - mainly less than one (in absolute value) as would be expected, the income elasticities of demand for exports of hides and skins and that of oil seeds and oil nuts seem too high.

With regard to the whole-system evaluation procedure, tests range from within-sample

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[14]For a critical discussion of the relevance and limitations of the R^2 and student-t statistic criteria for model selection and other model attributes, see Charemza and Deadman (1992, especially Chapter 2).

and outside-sample tracking performance of the model to dynamic properties (multiplier analysis to examine the stability and plausibility of results). To test the tracking performance of this model, various measures, both within-sample and outside-sample, are examined.

Some of the commonly used indicators to measures tracking performance include:

MAE = MEAN ABSOLUTE ERROR

MAE % = MEAN ABSOLUTE PERCENTAGE ERROR

RMSE = ROOT-MEAN-SQUARE ERROR

RMSE %= ROOT-MEAN-SQUARE PERCENTAGE ERROR

THEIL'S INEQUALITY COEFFICIENT

ERROR DECOMPOSITION:

FRACTION OF ERROR DUE TO BIAS

" " " " " DIFFERENT VARIANCE

" " " " " IMPERFECT CO-VARIATION

Before evaluating the tracking performance of the model, according to the above measures, graphs of selected variables (actual and simulated values) are presented below, in Figures 4.2 to 4.11 to examine how the model tracks the actual data series. The predicted values track the trend of the actual data reasonably well. Considering the volatility of the actual data, the deviations of the predicted values from measured counterparts seem acceptable. Despite the overall acceptable level of tracking performance of the model, however, the model is inadequate in tracking some turning-points. This weakness is more obvious in 1985. That is, due to the drought and political problems that resulted in acute

economic crises in that year, all economic aggregates were very low.

As can also be seen from the following tables, both the within-sample and outside-sample errors are comparable to that of models of other countries. Most of the endogenous variables have a root-mean squared percentage error [RMSE%] that is less than 10 per cent. This is particularly true for the more relevant endogenous variables. It is worth noting that, as Challen and Hagger (1983, p. 166) noted: "...if the observed values of the endogenous variable are typically very small, as in the case of a rate of change such as the inflation rate, or if the observed values switch frequently between positive and negative values, as in the case of variables obtained as residuals such as the balance of trade, ...a modest error can be associated with a very large value of RMSPE (RMSE%), simply because the observed value on which the percentage error is calculated is very close to zero". Consequently, variables that are estimated as a ratio seem to have bigger percentage errors even though, as could be seen from the respective graphs, the predicted values reasonably track the actual historical data series. Examples of such variables include: The capacity utilization rate, and education and health expenditures as a ratio of output.

The few variables that have a root-mean squared percentage error (RMSE%) which is greater than 10 per cent are: Exports of hides and skins (RXHK), exports of oil seeds and oil nuts (RXOSN), arms imports (RGUN) and the current account balance (CA). Clearly, all the variables (including the residual CA) are subject to volatility. The two export variables are directly affected by weather conditions. The supply of hides and skins increases with unfavorable weather conditions (a decrease in survival of animals). And the supply of oil

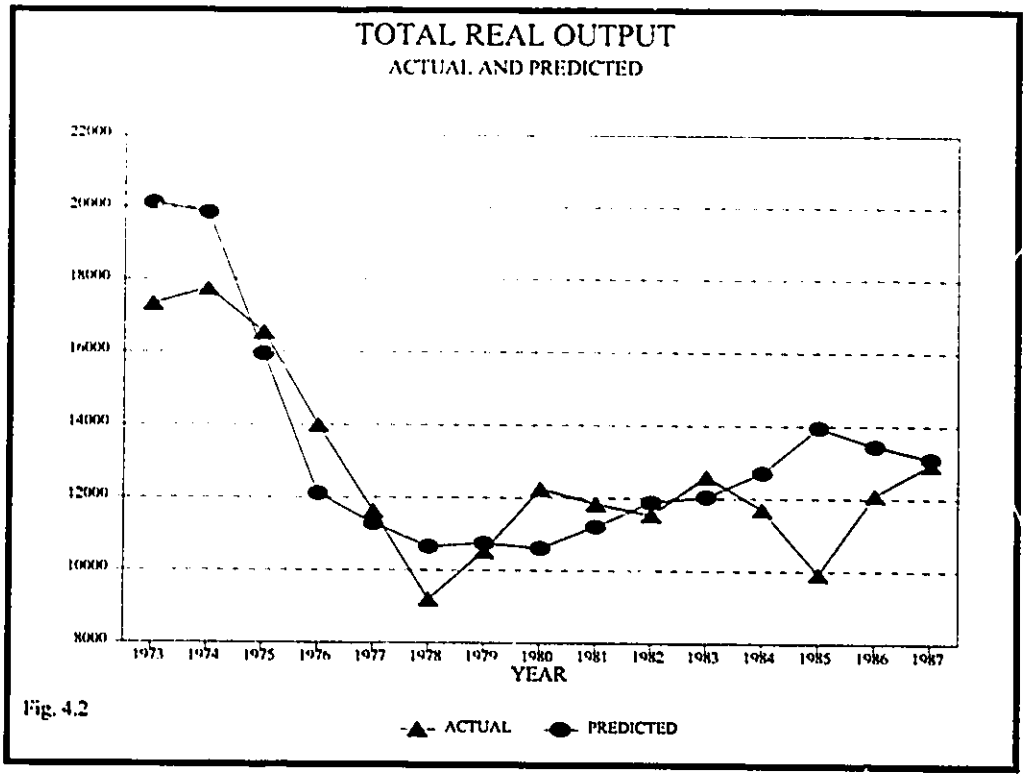
TOTAL REAL OUTPUT
ACTUAL AND PREDICTED
22000
20000
18000
16000
14000
12000
10000
8000
1973 1974 1975 1976 1977 1978 1979 1980 1981 1982 1983 1984 1985 1986 1987
YEAR
ACTUAL
PREDICTED

Fig. 4.2

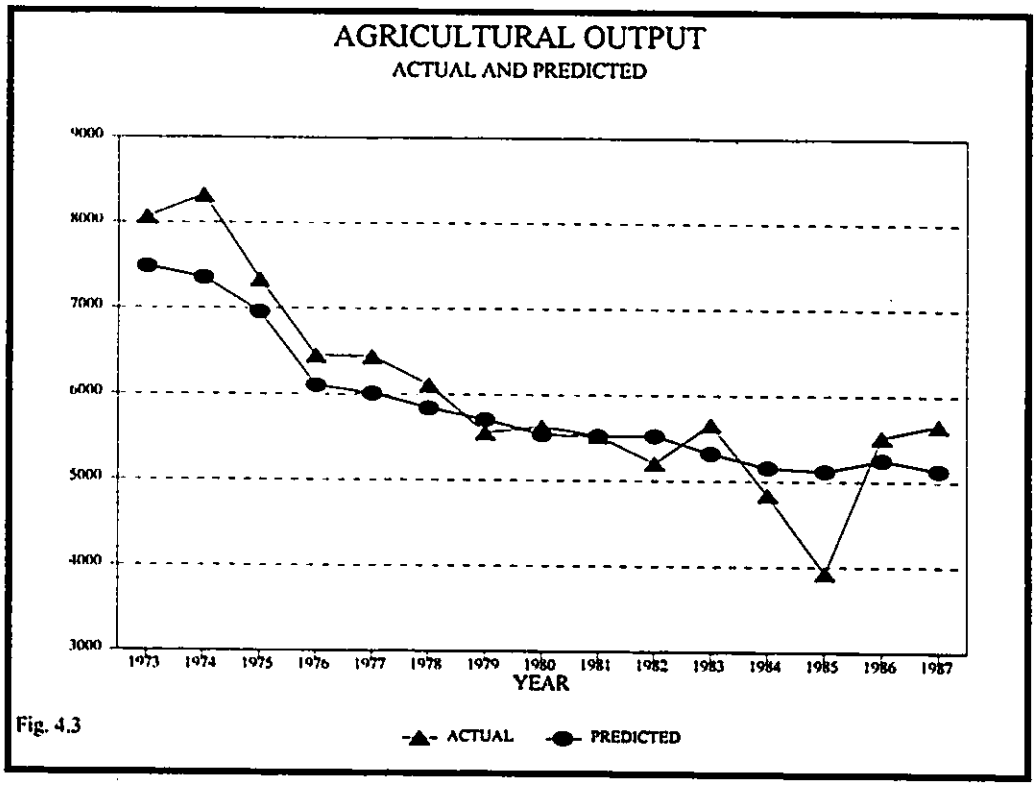
AGRICULTURAL OUTPUT
ACTUAL AND PREDICTED
9000
8000
7000
6000
5000
4000
3000
1973 1974 1975 1976 1977 1978 1979 1980 1981 1982 1983 1984 1985 1986 1987
YEAR
ACTUAL
PREDICTED

Fig. 4.3

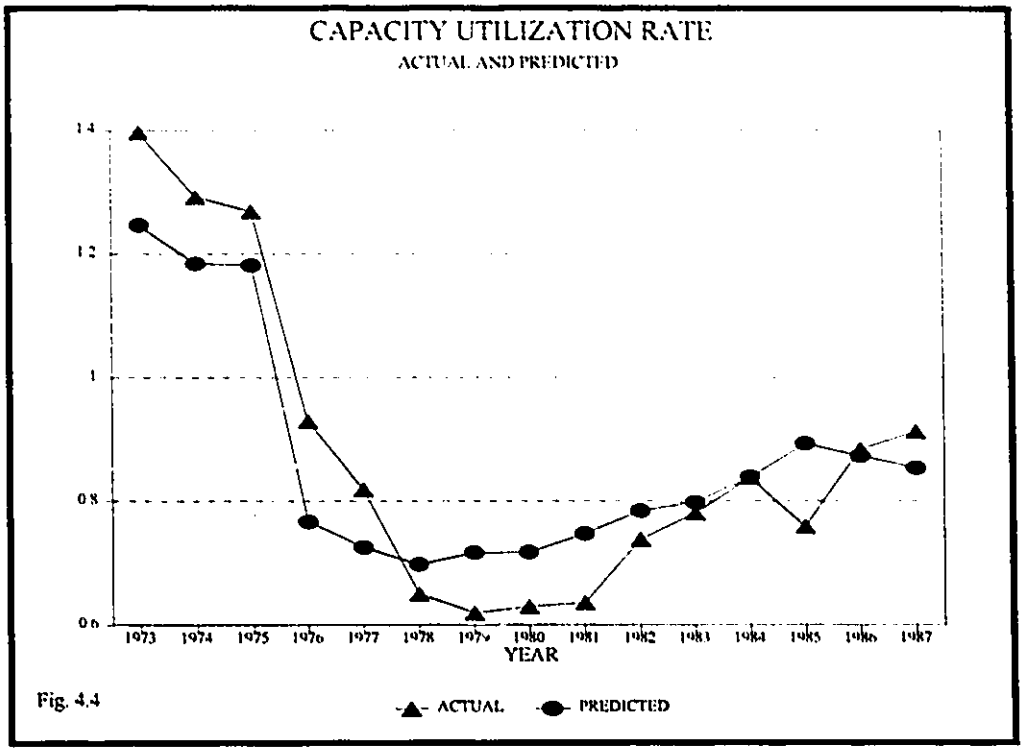
CAPACITY UTILIZATION RATE
ACTUAL AND PREDICTED
1.4
1.2
1
0.8
0.6
1973 1974 1975 1976 1977 1978 1979 1980 1981 1982 1983 1984 1985 1986 1987
YEAR
ACTUAL
PREDICTED

Fig. 4.4

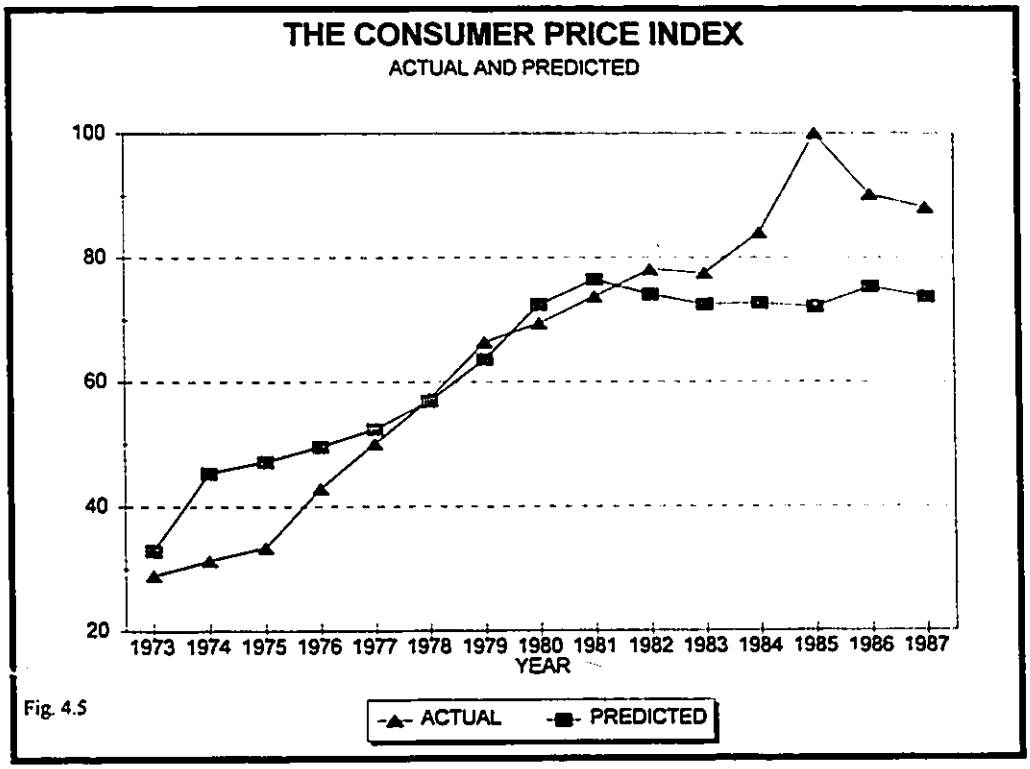
THE CONSUMER PRICE INDEX
ACTUAL AND PREDICTED
100
80
60
40
20
1973 1974 1975 1976 1977 1978 1979 1980 1981 1982 1983 1984 1985 1986 1987
YEAR
ACTUAL
PREDICTED

Fig. 4.5

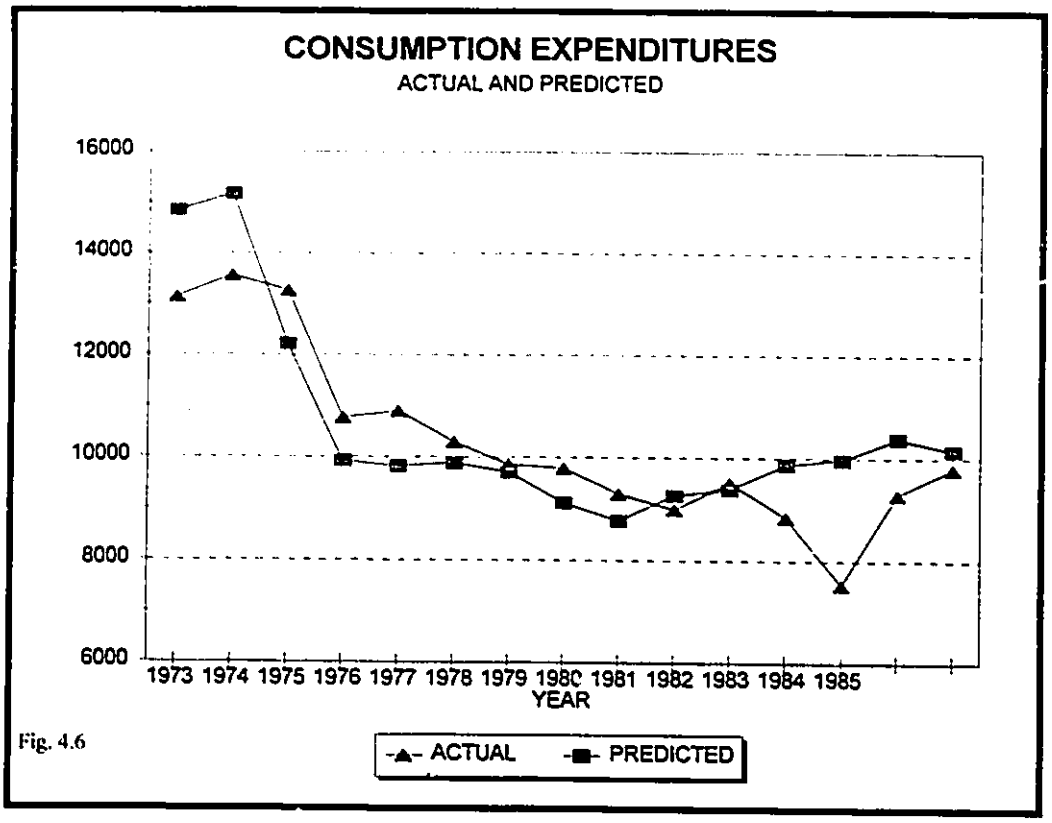
CONSUMPTION EXPENDITURES
ACTUAL AND PREDICTED
16000
14000
12000
10000
8000
6000
1973 1974 1975 1976 1977 1978 1979 1980 1981 1982 1983 1984 1985
YEAR
ACTUAL
PREDICTED

Fig. 4.6

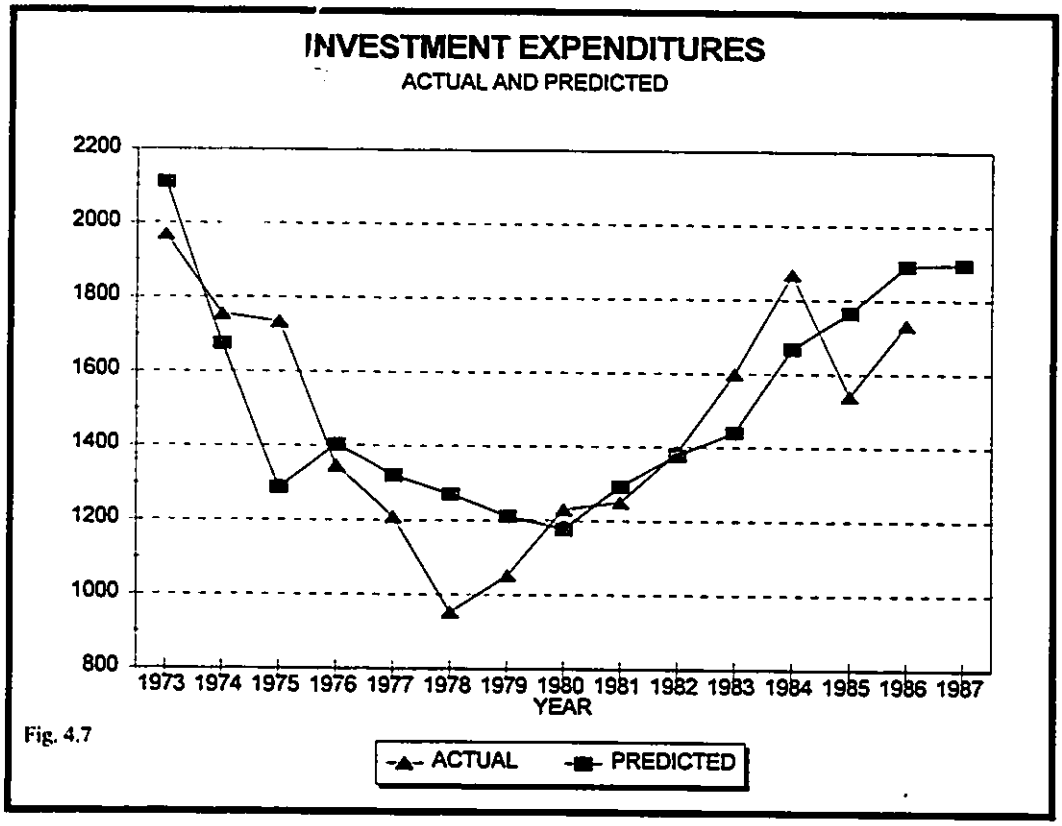
INVESTMENT EXPENDITURES
ACTUAL AND PREDICTED
2200
2000
1800
1600
1400
1200
1000
800
1973 1974 1975 1976 1977 1978 1979 1980 1981 1982 1983 1984 1985 1986 1987
YEAR
ACTUAL
PREDICTED

Fig. 4.7

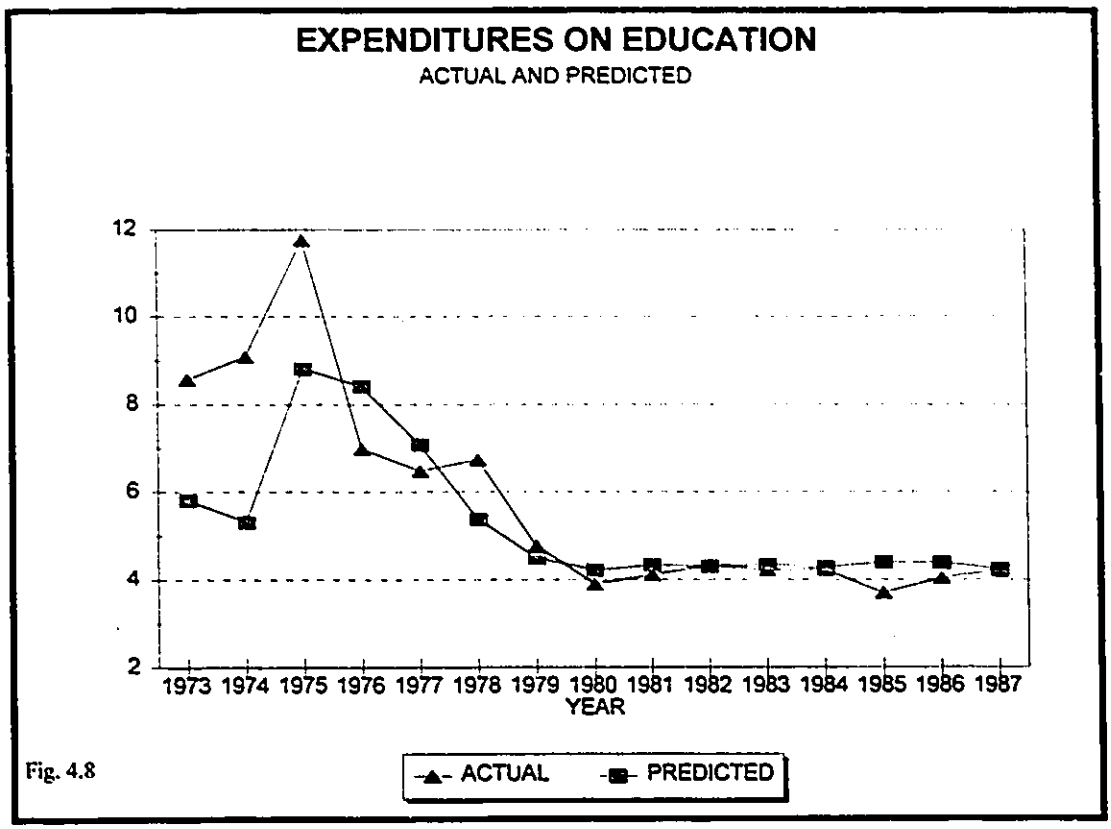
EXPENDITURES ON EDUCATION
ACTUAL AND PREDICTED
12
10
8
6
4
2
1973 1974 1975 1976 1977 1978 1979 1980 1981 1982 1983 1984 1985 1986 1987
YEAR
ACTUAL
PREDICTED

Fig. 4.8

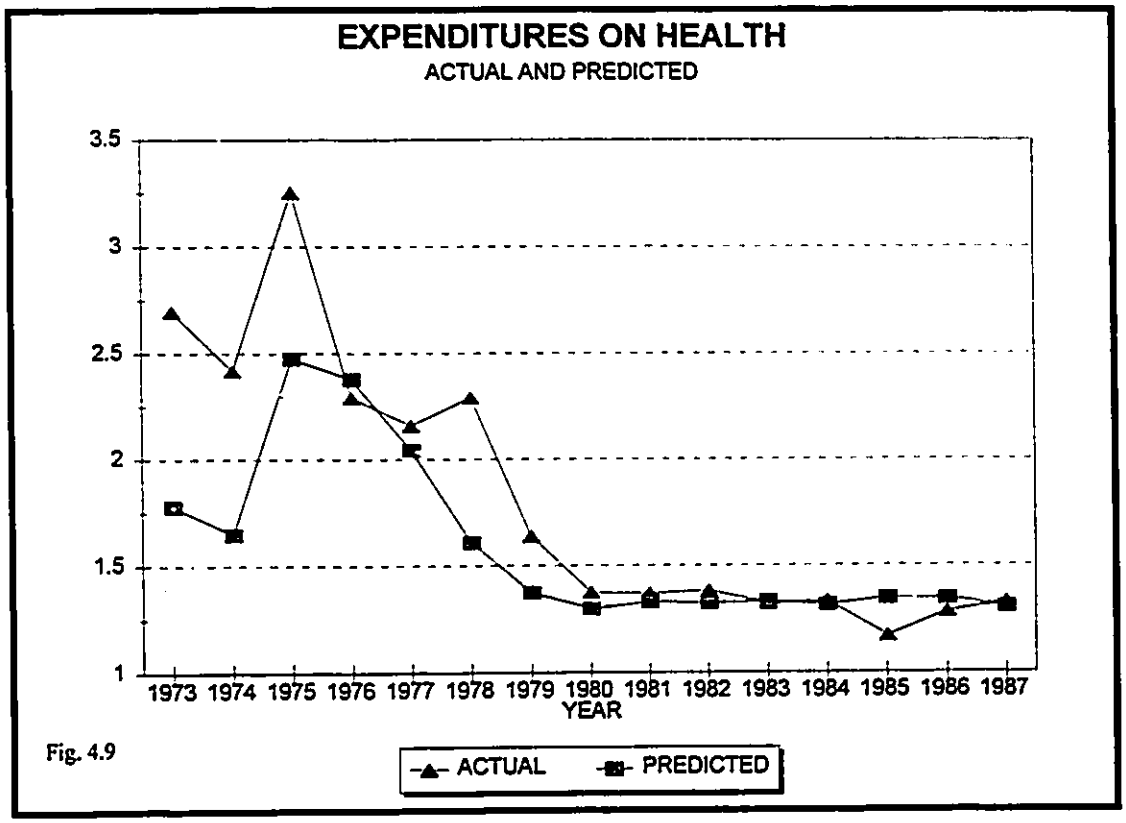
EXPENDITURES ON HEALTH
ACTUAL AND PREDICTED
3.5
3
2.5
2
1.5
1
1973 1974 1975 1976 1977 1978 1979 1980 1981 1982 1983 1984 1985 1986 1987
YEAR
ACTUAL
PREDICTED

Fig. 4.9

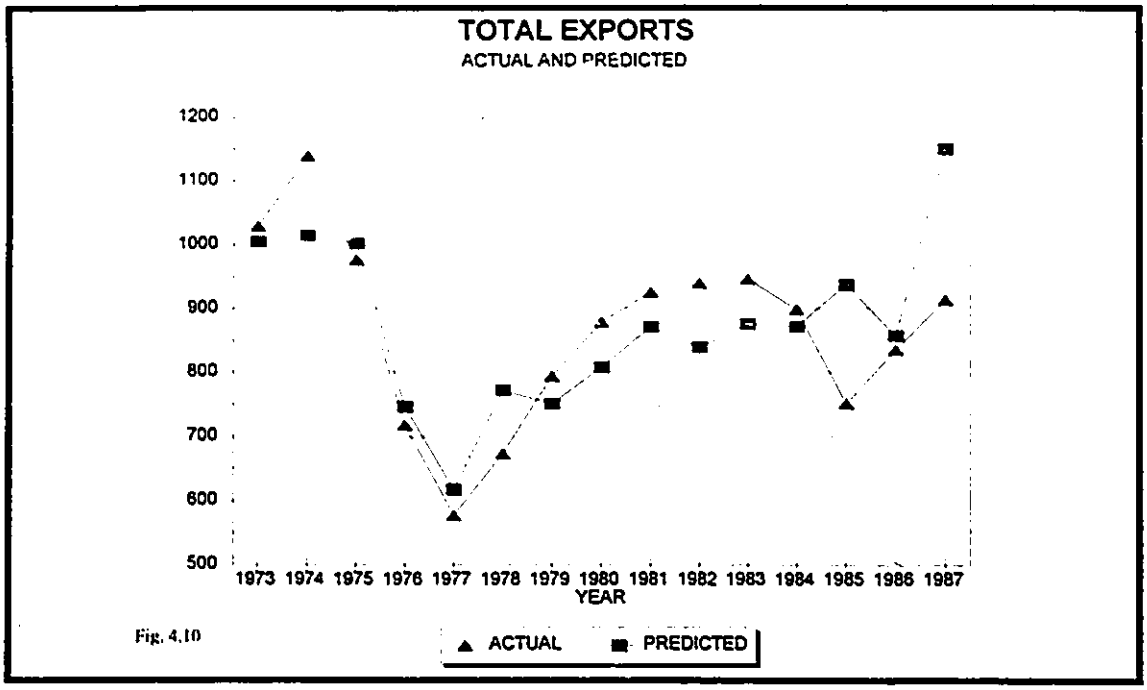

Fig. 4.10

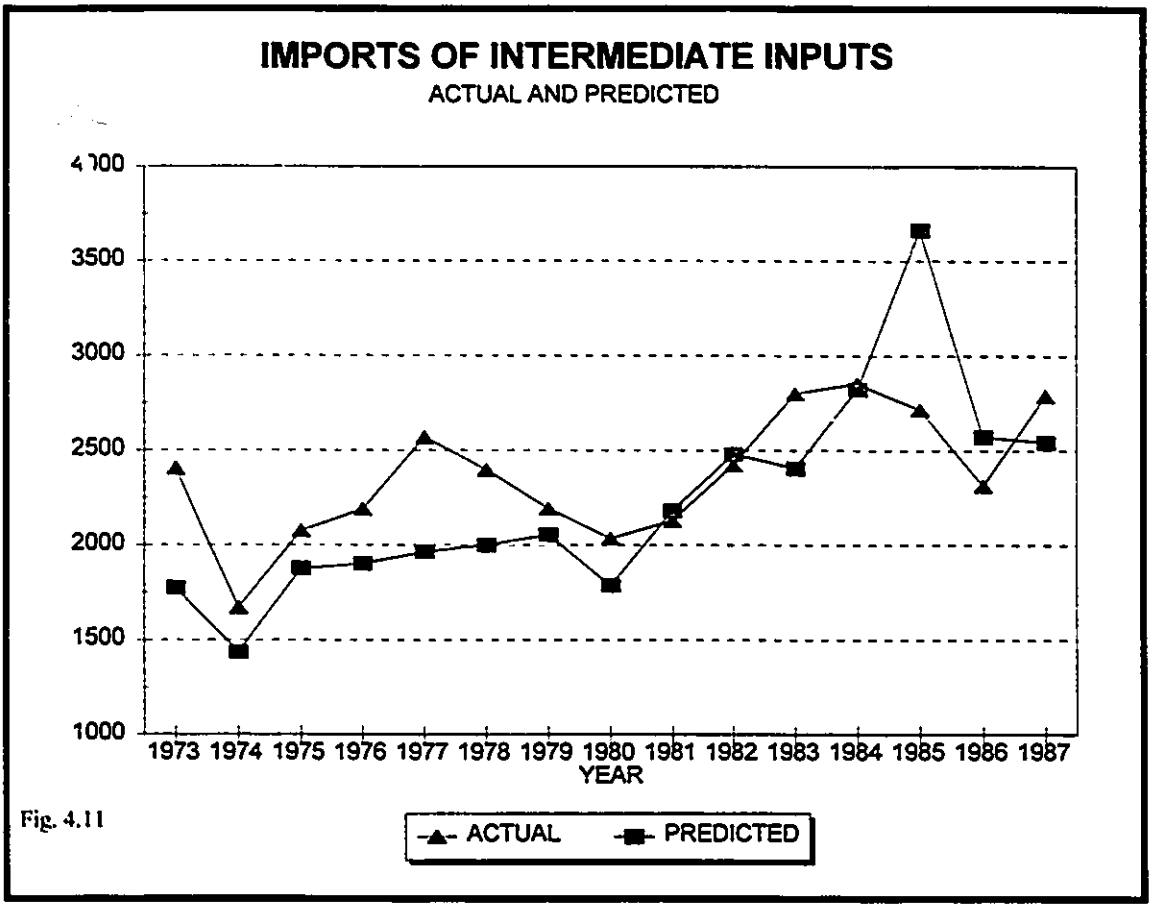

Fig. 4.11

seeds and nuts increases with favorable weather conditions such that farmers are able to export in excess of their needs, unlike, say coffee, for which the government determines the level of exports regardless of the level of output produced and of domestic consumption needs. Therefore, such volatility was probably the cause of the model's failure to track the historical series of these variables as weather changes have become more frequent since the mid-1970s. Arms imports were much higher in some years such that the equation's ability to track the historical data series is relatively poor. The reason for the high simulation error of the current account balance is therefore obvious, given the fluctuations in some of the export variables and arms imports.

Table 4.1 also indicates that Theil's inequality coefficients, a measure of simulation error related to root-mean squared error (RMSE), are low (about 0.2 or less) for all variables except the ones discussed above. The simulation error (as measured by Theil's inequality coefficient) is further decomposed into the proportions due to bias, variance and covariance. In all the variables, the dominant source of error is the covariance component representing the unsystematic portion of the simulation error. Even for the variables that have root-mean squared errors greater than 10 per cent, discussed above, this component is much larger except for the current account balance.

Table 4.2 reports the outside-sample (1988 to 1991) simulation for few selected variables. Historical data series for some of the exogenous variables were unavailable. Consequently, the number of endogenous variables used for simulating the model is limited. Compared to the within-sample forecast errors discussed above, the outside sample simulation

Table 4.1 WITHIN-SAMPLE SIMULATION

VARIABLE NAME	MAE %	RMSE %	THEIL'S INEQ. COEF.	FRACTION OF ERROR DUE TO:		
				BIAS	VAR.	CO VAR.
CUR	0.80	4.21	.084	.05	.33	.62
RAO	0.66	3.45	.069	.16	.14	.69
RMO	1.15	6.08	.119	.01	.02	.98
RY	0.84	4.24	.080	.04	.12	.84
IT	0.96	4.43	.087	.01	.28	.71
RMCD	0.68	3.39	.064	.14	.04	.82
RMCND	2.44	9.73	.201	.31	.07	.62
RC	1.00	4.62	.089	.00	.14	.86
RI	1.10	5.75	.117	.16	.08	.76
RGEE	1.14	6.37	.131	.10	.29	.61
RGEH	1.00	5.64	.118	.29	.31	.40
RG	0.66	3.28	.066	.34	.08	.58
P	0.87	4.20	.084	.04	.34	.62
RXCOF	1.31	6.29	.114	.01	.34	.65
RX	0.59	2.90	.056	.01	.01	.98
RXHK	2.01	12.20	.27	.13	.31	.56
RXOSN	6.51	19.24	.375	.14	.36	.50
RMNT	1.24	6.02	.121	.23	.38	.39
RGUN	9.20	36.36	.439	.26	.14	.60
RMFL	1.85	7.92	.164	.34	.19	.47

Table 4.2. OUTSIDE-SAMPLE SIMULATION

VARIABLE NAME	MAE %	RMSE%	THEIL'S INEQUAL. COEFF.	FRACTION OF ERROR DUE TO: BIAS	VAR.	CO.VAR
CUR	2.88	6.49	.129	.10	.83	.07
RAO	3.14	7.07	.141	.23	.29	.48
RMO	2.37	5.29	.106	.33	.62	.05
RY	1.98	5.12	.102	.09	.11	.79
RC	4.58	9.39	.187	.48	.47	.04
RI	3.47	6.98	.139	.57	.01	.42
RGEE	3.24	6.35	.123	.71	.08	.21
P	2.63	5.91	.118	.11	.02	.87
RXCOF	7.34	15.4	.307	.09	.01	.90
RX	2.91	5.90	.119	.19	.01	.80
RMNT	3.03	7.26	.145	.89	.06	.05

Table 4.3. SUMMARY MEASURES OF SAMPLE LDC MACRO MODELS - RMSE%

COUNTRY	VARIABLE NAME**					
	REAL OUTPUT	PRICE LEVEL	INVEST-MENT	FINAN-CIAL	TRADE	SIMUL. PERIOD
HONG KONG	4.74	3.36	9.35	11.22	1.78	1963-81
NICARAGUA	7.72	----	13.85	5.74	5.02	1965-80
MALAYSIA	3.72	10.3	8.09	---	12.7	1969-82
SINGAPORE	1.40	2.70	3.30	4.3	---	1973-80
INDONESIA	2.80	7.00	7.20	15.5	---	1972-80
PHILLIPP.	3.42	41.8	12.7	---	21.8	1960-80
TANZANIA	3.53	10.9	11.33	12.1	5.14	1970-84
KENYA	5.76	4.8	---	---	4.79	1976-80
KENYA1*	3.0	2.8	8.4	7.6	7.8	1971-80
GHANA*	7.8	21.7	18.8	16.1	18.7	1970-81
SUDAN*	8.9	11.8	11.0	15.0	20.0	1968-80
MOROCCO*	5.9	4.2	13.0	8.6	5.7	1966-80
SENEGAL*	5.9	9.8	3.9	6.8	13.9	1973-80
ETHIOPIA1*	4.9	6.8	11.0	8.9	22.0	1969-79
ETHIOPIA	4.24	4.20	5.75	----	2.90	1973-87

SOURCES: Khayum (1991, Table 3.4, pp. 67-68); for Tanzania, see Lipumba, Ndulu, Horton, and Plourde (1988, P. 361); for Kenya, Elliot, Kwack, and Tavlas (1986, pp. 2-30); and for Ethiopia, own calculations.

* Development Prospects in Africa (forthcoming). Department of International Economic and Social Affairs, The United Nations, Chapter 7 & 8.

** The variables used to account for these measures vary from one model to another; therefore, they must be compared with some caution. In most cases, the financial variable imply money demand or money supply equations, and the trade variables are represented by either an import or export equations.

errors (RMSE%) are, on the whole, relatively larger as would be expected. Similarly, Theil's inequality coefficients are larger than the corresponding within-sample coefficients.

Finally, Table 4.3 summarizes some root-mean squared percentage errors (RMSE%) for a sample of LDC macro models. The size of error significantly varies from one model to another and among variables within a given model. For instance, the size of the root-mean squared errors associated with investment and the trade variables (as would be expected due to their relative volatility) are significantly higher for most models than the errors associated with real output, and in many cases the price level. Comparing the last row of the table with the corresponding root-mean squared errors, the predictive ability of this model is comparable to similar LDC macro models reported in Table 4.3. That is, the forecast errors of most of the variables in this model are in many cases at the lower-end relative to the errors of other models. More specifically, the reported errors in this model are lower than the corresponding errors of the Ethiopian macro model built by the United Nations.

In addition to the performance of the model in tracking the historical data, additional tests regarding its stability and the plausibility of the multipliers were also performed. The stability of the model is tested using a one-time increase in capital inflow of $100 million and a one percent increase in world GDP. As can be seen in Figures 4.12 to 4.17, this increase in capital inflow has a positive impact, for instance, on total output, consumption and investment. After the maximum impact in the first year (or second), it takes about ten years for its total effect to disappear and thus for the initial shock to work its way through the system. Even though the impacts differ from one variable to another, as could be seen from

the impact multipliers (Table 4.4), in all cases the effects were as expected and they decline over time, indicating that the system is stable. The increase in capital inflow is assumed to come from an external source of financing. It is targeted to increase capital formation, which increases output via increases in the capital stock. An increase in output then increases disposable income and hence consumption. The assumed accelerator mechanism also translates the increase in total output to increased investment.

Table 4.4 IMPACT MULTIPLIERS

IMPACT MULTIPLIERS: A 1% INCREASE IN WORLD GDP AND A CAPITAL INFLOW OF 100 MILLION Birr		
VARIABLE	WORLD GDP	CAPITAL INFLOW
RY	0.31	3.62
RMO	0.58	0.52
RC	0.28	2.55
RI	0.2	0.19
P	0.02	0
RXCOF	2.87	0
RX	1.93	0
RMNT	1.62	-0.43
CA	12.98	-0.23

*NOTES: impact multipliers refer to the effect of either the first or the second year; and it is calculated as the difference between the control run and the shocked run divided by the size of the shock.

THE IMPACT OF A CAPITAL INFLOW
ON REAL TOTAL OUTPUT

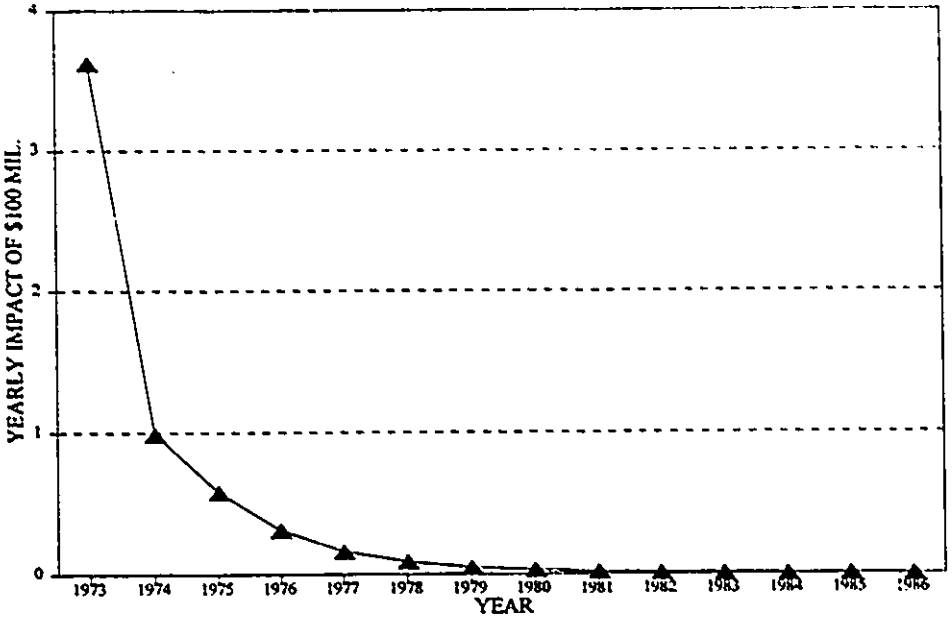

Fig. 4.12

THE IMPACT OF A CAPITAL INFLOW
ON CONSUMPTION EXPENDITURES

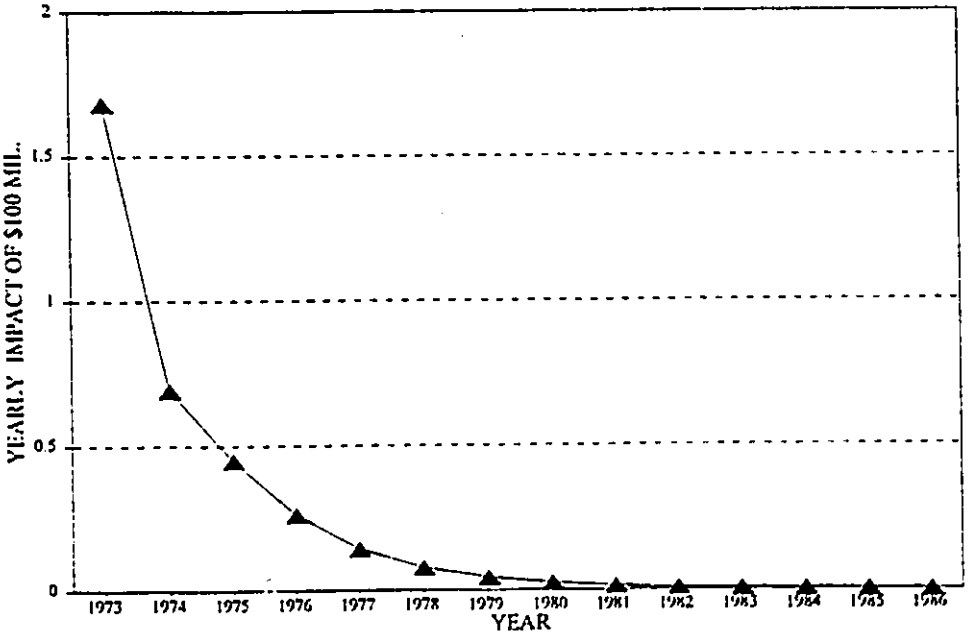

Fig. 4.13

THE IMPACT OF A CAPITAL INFLOW
ON INVESTMENT EXPENDITURES

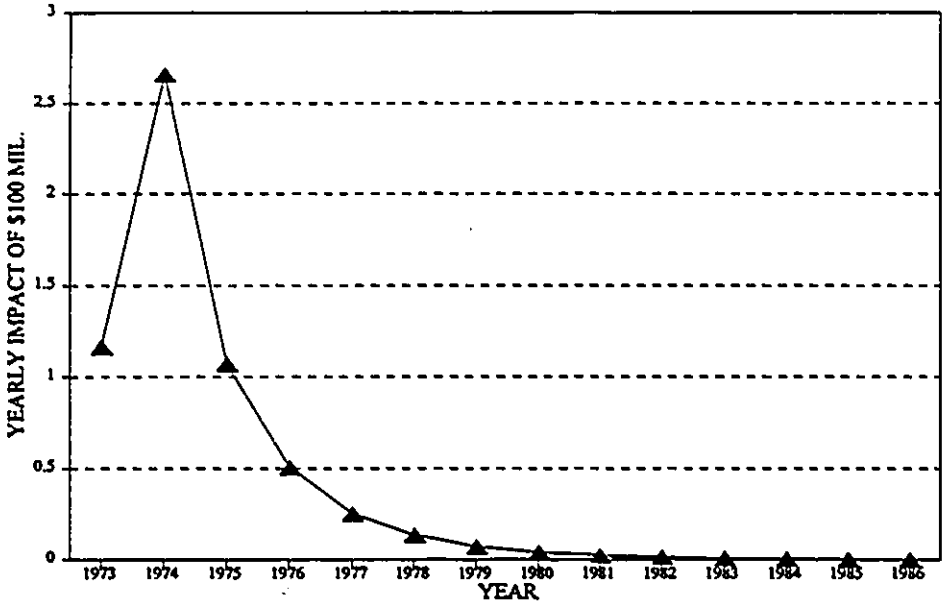

Fig. 4.14

THE IMPACT OF AN INCREASE IN
WORLD GDP ON REAL TOTAL OUTPUT

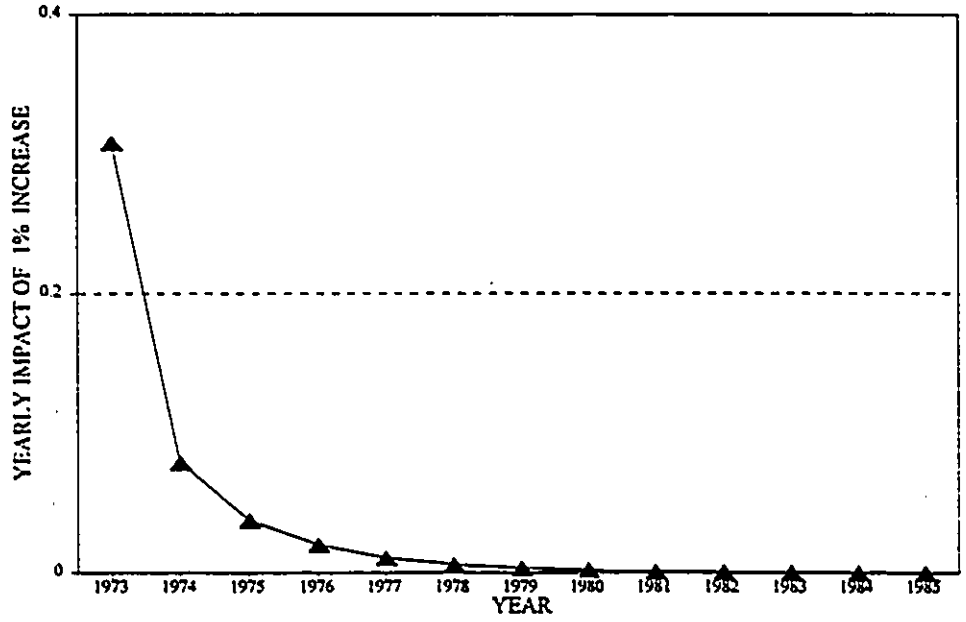

Fig. 4.15

THE IMPACT OF AN INCREASE IN WORLD GDP
ON TOTAL EXPORTS

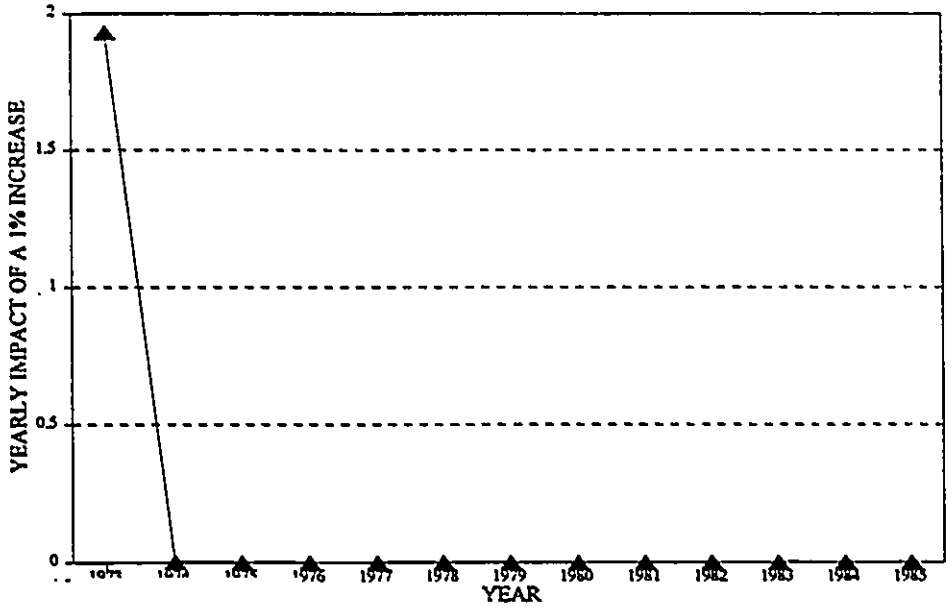

Fig. 4.16

THE IMPACT OF AN INCREASE IN WORLD
GDP ON IMPORTS OF INTERMEDIATE INPUTS

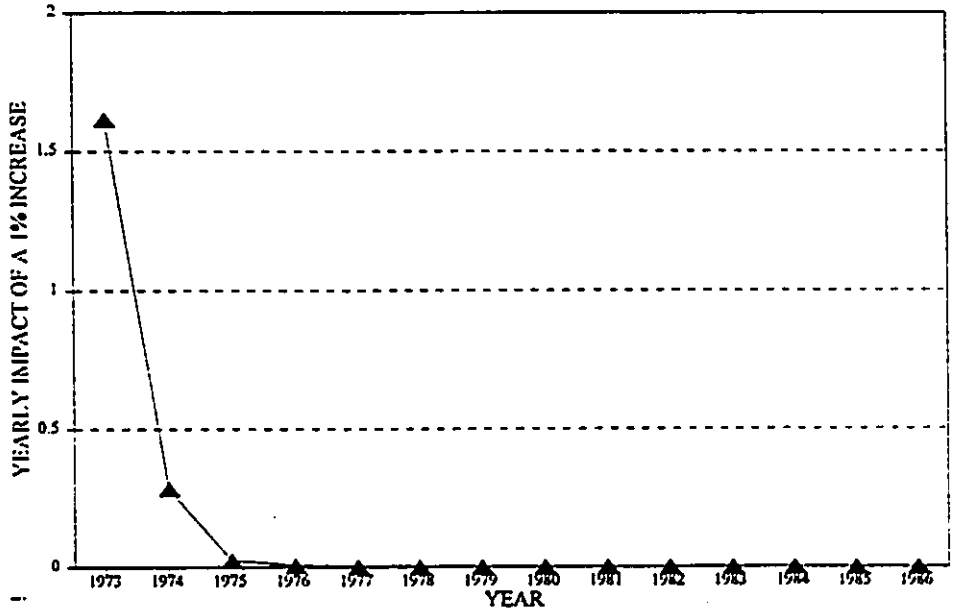

Fig. 4.17

Similarly, a one per cent increase in world GDP increases total output, total exports, imports of intermediate inputs and improves the current account balance. The world GDP index is used as a proxy for an increase in world demand, and hence increases exports and the demand for intermediate inputs. The improvement in the current account balance, while imports are also increasing, is due to the relatively larger increase in exports. Total output is affected via increases in intermediate inputs; an increase in intermediate inputs increases capacity utilization, which in turn increases total output. As indicated in Figures 4.15 to 4.17, the impact on all variables declines over time, taking roughly from two to ten years for the total effect to disappear.

APPENDIX A: LIST AND DEFINITIONS OF VARIABLES

N.B: all real variables are in 1985 prices.

A. ENDOGENOUS VARIABLES

AO	= agricultural output (nominal) - million birr
AP	= ratio of import to domestic prices (MPI/P)
CA	= current account balance - million bir
CUR	= capacity utilization rate (RMO/CMO)
DC	= private consumption expenditures on domestic goods - million birr
DY	= nominal disposal income - million birr
FCA	= nominal fixed capital stock - million birr
G	= total government expenditures - million birr
GAP	= gap between aggregate expenditures and total output (nominal) as a ratio of nominal output
GEE	= government expenditures on education (nominal)- million birr
GEH	= government expenditures on health (nominal)- million birr
GUN	= nominal arms imports - million birr
I	= nominal investment expenditures - Million birr
IT	= indirect taxes - million birr
LAFI	= agricultural labor force index (1980=100)
LM	= labor force in manufacturing-thousands of individuals
MCD	= imports of consumer durables (nominal) - million birr
MCND	= imports of consumer non-durables (nominal)- million birr
MFL	= imports of fuel and lubricants (nominal) - million birr
MNT	= imports of intermediate inputs (nominal) - million birr
MO	= manufacturing output (nominal) - million birr
MT	= total non-military imports (nominal)- million birr
OG	= other government expenditures - million birr
OY	= output of other sectors - million birr (nominal)
OX	= other exports - million birr
P	= domestic consumer price index - 1985=100
PC	= total private consumption (nominal) - million birr
RAO	= real agricultural output - million birr
RC	= real private consumption - million birr
RDY	= real disposable income - million birr
RER	= real exchange rate (based on world whole sale price index - WWPI)
RFCA	= real capital stock, adjusted for capacity utilization - million birr
RFCA1	= real capital stock, unadjusted for capacity utilization - million birr

RG = real government expenditures - million birr
RGAP = gap between aggregate expenditures and total output (real)
RGEE = real government expenditures on education to output ratio
RGEE1 = real government expenditures on education - million birr
RGEH = real government expenditures on health to output ratio
RGEH1 = real government expenditures on health - million birr
RGUN = real arms imports - million birr
RI = real investment expenditures - million birr
RIT = real indirect taxes - million birr
RMCD = real imports of consumer durables - million birr
RMCND = real imports of consumer non-durables - million birr
RMILEX = the ratio of military expenditures to output
RMNT = real imports of intermediate inputs - million birr
RMO = real manufacturing output - million birr
RMFL = real imports of fuel and lubricants - million birr
ROG = real other government expenditures - million birr
RRY = ratio of real output to capital stock - RY/RFCA
RX = total real exports - million birr
RXCOF = real exports of coffee - million birr
RXHK = real exports of hides and skins - million birr
RXOSN = real exports of oil seeds & nuts - million birr
RY = real total output at factor cost - million birr
STR = total employed labor force - millions of individuals
TM = total imports (nominal) - million birr
TX = export earnings and net transfers - million birr
XCOF = nominal value of coffee exports - million birr
XHK = exports of hides and skins (nominal) - million birr
XOSN = exports of oil seeds & nuts (nominal)- million birr
Y = nominal total output - million birr
Y1 = aggregate demand - million birr (nominal)

B. EXOGENOUS VARIABLES

CAPI = capital inflow (net changes in reserves plus current account balance as a ratio of output)
COFPI = export price index of coffee - 1985=100
CMO = capacity manufacturing output - million birr
BD = central government budget deficit - million birr
D1 = dummy variable (1975 - 1987 = 1)
ERR = statistical error in national account
ETI = weighted import and export price index, 1985=100

EXDC	= excess domestic credit (difference between growth in domestic credit and real GDP growth
EXR	= nominal exchange rate (birr/$US)
GR	= net transfers (grants+aid) - million birr
MP	= size of armed forces - thousands of individuals
MPI	= import price index - 1985=100
MS	= total money supply (currency + demand deposit) - million birr
MILEX	= military expenditures - million birr (nominal)
OM	= other imports - million birr
POP	= population - millions of individuals
RF	= rainfall - millimetres
RFR	= real international reserves - millions of SDRs
RGR	= real net transfers (grants+aid) - million birr
RMD	= real money demand - million birr
RMILEX1	= real military expenditures - million birr
RMS	= real money supply (currency + demand deposits) - million birr
ROP	= relative openness (the ratio of imports & exports to GDP)
RTGB	= total government borrowing - million birr
RWR	= real wage rate in manufacturing
STR1	= total labor force - millions of individuals
T	= time trend
TLF	= ratio of total labor force to capital stock
TOT	= terms of trade (export/import)
V	= income velocity (ratio of total output to money supply)
W	= wage bill in manufacturing - thousands of birr
WWPI	= world wholesale price index (1985=100)
WY	= world GDP index - 1985=100
XPI	= export price index - 1985=100
XPK	= unit price index of Kenyan exports (1985=100)

APPENDIX B: ALTERNATIVE AND ADDITIONAL EQUATIONS

1. IMPORTS OF NON-DURABLE CONSUMER GOODS (RMCND)

$$\text{Ln RMCND} = \underset{}{6.202} + \underset{(0.842)}{0.022782}\ \text{Ln RDY}_{-1} + \underset{(2.495)}{1.1556}\ \text{Ln P} - \underset{(6.131)}{1.6167}\ \text{Ln MPI} + \underset{(1.86)}{0.0807}\ \text{T}$$

(4.738)

$\bar{R}^2 = 0.72$ D.W. = 1.9 SSE = .61201 $\bar{Y} = 5.7295$

2. IMPORTS OF DURABLES CONSUMER GOODS (RMCD)

$$\text{Ln RMCD} = \underset{}{4.2568} + \underset{(16.49)}{0.22589}\ \text{Ln RDY}_{-1} + \underset{(3.328)}{0.65823}\ \text{Ln P} - \underset{(9.151)}{0.97174}\ \text{Ln MPI} + \underset{(0.223)}{0.0041613}\ \text{T}$$

(7.545)

$\bar{R}^2 = 0.93$ D.W. = 1.8 SSE = 0.25894 $\bar{Y} = 4.9988$

3. REAL MONEY DEMAND

$$\text{Ln RMD} = \underset{}{-2.9732} + \underset{(2.458)}{0.77879}\ \text{Ln RY} + \underset{(3.996)}{1.1655}\ \Delta\ \text{Ln P} - \underset{(3.907)}{0.63426}\ \text{Ln RER} + \underset{(4.760)}{0.54402}\ \text{Ln RMD}_{-1}$$

(0.887)

$\bar{R}^2 = 0.62$ D.W. = 1.9 SSE = 0.42719 $\bar{Y} = 7.8079$

4. THE REAL EXCHANGE RATE

$$\text{Ln RER} = 2.2925 + \underset{(6.744)}{0.50745}\ \text{Ln ROP} + \underset{(4.234)}{7.4187}\ \text{CAPI} - \underset{(7.672)}{0.04117}\ \text{EXDC} - \underset{(2.194)}{0.087414}\ \text{Ln TOT} + \underset{(1.018)}{0.21887}\ \text{Ln RER}_{-1}$$
$$\underset{(2.027)}{}$$

$\bar{R}^2 = 0.94$ D.W. = 2.2 SSE = 0.098168 $\bar{Y} = 1.4724$

5. THE CURRENT ACCOUNT BALANCE

$$\text{Ln (CA/RY)} = -0.32044 + \underset{(9.518)}{0.080436}\ \text{Ln RER} + \underset{(8.684)}{0.04625}\ \text{(BD/MS)} + \underset{(1.287)}{0.048356}\ \text{Ln TOT} - \underset{(4.544)}{0.069488}\ \text{Ln (RG/RY)} - \underset{(4.148)}{0.0000927}\ \text{KY}$$
$$\underset{(1.244)}{}$$

$\bar{R}^2 = 0.94$ D.W. = 1.99 SSE = 0.0015013 $\bar{Y} = -0.049968$

6. LABOR DEMAND IN AGRICULTURE

$$\text{Ln LAFI} = \underset{(24.09)}{3.9143} + \underset{(3.013)}{0.05916}\ \text{log RAO} - \underset{(3.585)}{0.030573}\ \text{D1}$$

$\bar{R}^2 = 0.78$ D.W. = 1.6 SSE = 0.003 $\bar{Y} = 4.4121$

7. LABOR DEMAND IN MANUFACTURING

$$\text{Ln LM} = \underset{(3.901)}{3.7648} - \underset{(7.933)}{0.72835}\ \text{Ln RWR} + \underset{(1.372)}{0.16316}\ \text{Ln RMNT} + \underset{(6.066)}{0.24892}\ \text{D1}$$

$\bar{R}^2 = 0.93$ D.W = 1.5 SSE = 0.06996 $\bar{Y} = 4.18$

APPENDIX C: SINGLE EQUATION ESTIMATION

(method: Cochrane-Orcutt estimator)

4.3.1.1. OUTPUT SUPPLY

(1) $\text{Ln}(RY/RFCA) = 6.3093 + 0.87413\ \text{Ln}(STR/RFCA) - 0.10475\ D1$
$(18.11)\quad (10.75)\qquad\qquad (1.771)$

$\bar{R}^2 = 0.97 \quad D.W = 1.6 \quad SSE = 0.06299 \qquad \bar{Y} = 1.799$

(2) $\text{Ln CUR} = 0.6979 + 0.29574\ \text{Ln}(RMNT/RMO_{-1}) - 0.699\ D1$
$(1.125)\quad (3.533)\qquad\qquad (1.94)$

$+ 0.17457\ \text{Ln}((RMS/RY)_{-1}) + 0.3382\ \text{Ln CUR}_{-1}$
$(2.505)\qquad\qquad (2.553)$

$\bar{R}^2 = 0.83 \quad D.W. = 2.0 \quad SSE = 0.09367 \quad \bar{Y} = 0.097215$

(3) $\text{Ln RAO} = 1.0567 + 1.80876\ \text{Ln LAFI} + 0.037813\ \text{Ln RF}_{-1}$
$(0.141)\quad (1.080)\qquad\qquad (1.858)$

$- 0.025441\ T$
(3.222)

$\bar{R}^2 = 0.80 \quad D.W. = 1.8 \quad SSE = 0.16883 \qquad \bar{Y} = 8.7907$

(4) $\text{Ln RMO} = 1.2274 + 0.11802\ \text{Ln LM} + 0.42876\ \text{Ln RMNT}$
$(1.423)\quad (0.808)\qquad\qquad (4.351)$

$+ 0.29645\ \text{Ln RFCA}$
(5.184)

$\bar{R}^2 = 0.91 \quad D.W = 1.6 \quad SSE = 0.03793 \quad \bar{Y} = 7.1508$

4.3.1.2. AGGREGATE DEMAND

(5) $\text{Ln RC} = 0.3565 + \underset{(0.642)}{0.761}\ \text{Ln RDY} + \underset{(1.864)}{0.1875}\ \text{Ln RC}_{-1}$
(8.112)

$\bar{R}^2 = 0.96$ D.W. = 1.8 SSE = 0.00091 $\bar{Y} = 9.3136$

(6) $\text{Ln RMCD} = 2.4109 + \underset{(32.44)}{0.23655}\ ((\text{Ln RDY}_{-1} + \text{Ln RDY}_{-2})/2)$
(19.48)

$- \underset{(8.520)}{0.91791}\ \text{Ln (MPI/P)} - \underset{(6.057)}{0.02384}\ T$

$\bar{R}^2 = 0.92$ D.W. = 1.7 SSE = 0.30127 $\bar{Y} = 4.9988$

(7) $\text{Ln RMCND} = 4.9594 + \underset{(23.65)}{0.036897}\ \text{Ln RDY}_{-1} - \underset{(1.551)}{1.5098}\ \text{Ln (MPI/P)}$
(5.780)

$+ \underset{(3.957)}{0.0404}\ T$

$\bar{R}^2 = 0.72$ D.W. = 1.82 SSE = 0.64388 $\bar{Y} = 6.77002$

(8) $\text{IT} = -172 + \underset{(3.807)}{0.085671}\ Y + \underset{(5.064)}{3.0432}\ \text{ETI}$
(2.394)

$\bar{R}^2 = 0.98$ D.W. = 1.8 SSE = 34246 $\bar{Y} = 589.05$

(9) $\text{Ln RG} = 5.0435 + \underset{(4.611)}{0.3182}\ \text{Ln RIT} + \underset{(2.013)}{0.0017011}\ \Delta\ \text{Ln RY}$
(0.1765)

$+ \underset{(4.529)}{0.016573}\ T$

$\bar{R}^2 = 0.70$ D.W. = 1.95 SSE = 0.1023 $\bar{Y} = 7.5473$

(10) Ln RGEE = 3.3715 - 0.4146 Ln RMILEX + 0.01566 ΔLn RY
(20.72) (10.11) (1.002)

- 0.54271 D1
(5.605)

$\bar{R}^2$ = 0.84 D.W. = 2.0 SSE = 0.30996 $\bar{Y}$ = 1.751

(11) Ln RGEH = 2.1085 - 0.37798 Ln RMILEX + 0.039965 Δ Ln RY - 0.46754 D1
(22.55) (15.91) (3.673) (8.170)

$\bar{R}^2$ = 0.91 D.W. = 2.1 SSE = 0.14871 $\bar{Y}$ = 0.62266

(12) Ln RI = 5.4332 + 0.24127 Δ Ln RY + 0.011466 Δ Ln P
(5.717) (2.088) (0.252)

- 0.18126 Ln RER + 0.32436 Ln $RFCA1_{-1}$
(0.998) (2.116)

$\bar{R}^2$ = 0.67 D.W. = 1.9 SSE = 0.32434 $\bar{Y}$ = 7.3855

(13) Ln P = 0.13645 - 0.03542 $RGAP_{-1}$ + 0.2087 Ln MPI + 0.69369 Ln P_{-1}
(0.974) (3.357) (2.084) (9.808)

$\bar{R}^2$ = 0.98 D.W. = 1.9 SSE = 0.07645 $\bar{Y}$ = 3.8032

4.3.1.3. EXTERNAL SECTOR

(14) Ln RX = 3.2954 + 1.3087 Ln WY - 0.60195 Ln XPI
(3.176) (4.295) (5.921)

+ 0.20587 Ln RER
(2.253)

$\bar{R}^2$ = 0.78 D.W. = 1.9 SSE = 0.11357 $\bar{Y}$ = 6.8025

(15) Ln RXCOF = 3.7966 + 0.6207 Ln WY - 0.78631 Ln COFPI
(2.238) (1.167) (3.159)

+ 0.63413 Ln XPK + 0.2673 Ln RER
(2.147) (2.032)

$\bar{R}^2$ = 0.33 D.W. = 2.1 SSE = 0.50083 $\bar{Y}$ = 6.2795

(16) Ln RXHK = -8.4241 + 4.0223 Ln WY - 1.4192 Ln XPI
(2.073) (3.384) (3.586)

+ 1.0292 Ln RER
(2.847)

$\bar{R}^2$ = 0.59 D.W. = 1.7 SSE = 1.6591 $\bar{Y}$ = 4.6841

(17) Ln RXOSN = - 0.53194 + 2.5914 Ln WY
(0.113) (1.906)

- 2.1835 Ln XPI + 1.3012 Ln RER
(4.992) (2.935)

$\bar{R}^2$ = 0.90 D.W. = 1.4 SSE = 1.7968 $\bar{Y}$ = 3.7056

(18) Ln RMNT = 7.8216 + 0.340 Ln RMO - 0.5621 Ln (MPI/P)
(3.018) (1.379) (3.474)

- 0.16461 Ln $RFCA_{-1}$ + 0.19241 Ln RX_{-1}
(1.768) (2.034)

$\bar{R}^2$ = 0.50 D.W. = 1.8 SSE = 0.14388 $\bar{Y}$ = 7.7573

(19) Ln RMFL = 3.7395 + 0.026657 Ln RDY - 0.4698 Ln (MPI/P)
(7.280) (1.728) (2.423)

+ 0.34452 Ln RMILEX1
(4.298)

$\bar{R}^2$ = 0.50 D.W = 2.0 SSE = 0.43054 $\bar{Y}$ = 6.1123

(20) Ln RGUN = 12.549 + 2.9886 Ln MP - 0.97015 D1
(9.746) (7.189) (1.470)

$\bar{R}^2$ = .87 D.W. = 1.79 SSE = 10.293 $\bar{Y}$ = 5.4676

5. POLICY ISSUES

Having briefly examined model validity and stability, the purpose of this chapter is to use the model for policy analysis. As stated in the introduction, the policy questions that the model will be used to address are: First, to what extent was the performance of the economy affected by the policies introduced in the mid-1970s by the then military government? Second, what is the impact of devaluation on the performance of the economy? And, third, is there a trade-off between military expenditures and social programs? These questions are in essence counter-factual policy issues that address what is commonly referred to as the "what if" question or causal analysis. That is, the policy analyses are concerned with what the performance of the economy would have been if government policies had been different from what was actually observed.

Before examining the policy design, it is worth digressing to briefly note what has become to be known in the literature as the *Lucas Critique*. Lucas (1976) argued that parameter estimates represent the optimal choice of economic agents in a given policy environment. These parameter estimates are susceptible to change if expectations of the policy regime changes. Causal analysis ignores such potential changes in economic agents' decision rules and, therefore, the change in the parameter estimates that would follow the changes in expectations. Lucas argued that the conclusions reached using causal analysis are misleading because they are based on assumed stable parameters. Despite the wide acceptance of the criticism at a theoretical level, however, its practical impact on macroeconomic modelling has been limited. Challen and Hagger (1983, p. 204) suggest two possible reasons for this. First, the quantitative significance of Lucas'

argument is not clearly known. That is, whether the effect is so strong as to make the predictions practically useless or only affects model results in an insignificant way is not yet known. Second, even if its practical significance is accepted, "it is by no means clear how causal-analysis procedures should be amended to meet it". It is true that developed country models that incorporate rational expectations have been built in recent years. But, one might add, whatever the practical significance of Lucas' argument is in a developed market economy, where the flow of information is relatively efficient and economic agents' ability to extract relevant economic signals is relatively well developed, its practical impact on an economy like of Ethiopia is likely to be less due to the rigid economic structure and backward nature of such economies. This study, therefore, assumes that the last observation holds for Ethiopia and similar economies. The study examines key economic policy issues that were or were not addressed in the mid-1970s. Specifically, the model is used to simulate the consequences of implementing different policies, and the consequences of not undertaking policies that did take place.

Since the purpose of the study is to evaluate the effects of the main components of each policy as a package, an attempt will be made to incorporate the policy changes simultaneously instead of one at a time. For instance, to evaluate the effects of land reform and nationalization of manufacturing industries, both policy changes will be incorporated at the same time. This will be clear in the next sub-sections of the chapter, when the policy design of each policy experiment is discussed. Before discussing the design of each policy experiment and the simulation results, however, a brief review of the main issues related to land reform will be presented.

5.1 STRUCTURAL CHANGE POLICY ISSUES

5.1.1. LAND REFORM POLICY ISSUES: AN OVERVIEW

It was discussed in chapter three that the military government carried out a land reform and nationalized most manufacturing industries after overthrowing the monarchy in 1974. The land reform was radical in the sense that it fundamentally changed both the ownership of rural land and the way it is administered. In short, private ownership of land and tenancy (rent payment to landlords and sharecropping) were abolished without any compensation to previous owners of the land. In essence the proclamation ended a feudal order and the corresponding land tenure system that had existed for decades, and in some regions of Ethiopia for centuries.

The justifications given for undertaking the land reform were both political and economic. In declaring the land reform (Proclamation No. 31/1975), the government stated that, "[i]n countries like Ethiopia where the economy is agricultural, a person's right, honour, status and standard of living is determined by his relation to the land". It is, therefore, essential, the declaration continued, " ...to fundamentally [sic] alter the existing agrarian relations so that the Ethiopian peasant masses ...be liberated from age-old feudal oppression." Whatever the conviction of the government in liberating the peasants from the feudal land tenure system, its political motive is unmistakable. Prior to 1974, the vocal left-wing movement (which included sporadic peasant uprisings, constant student protests, the labor movement and the teachers union, among others) had been demanding a land reform, "land to the tiller", and other political changes for years. In fact, according to Mengisteab (1990, p.13), "[i]n the 1970s, most of the literature on Ethiopia's agriculture emphatically claimed a causal relationship between the land tenure pattern

that existed prior to 1975 and the stagnation of the country's food production". The initiative to reform the land tenure system was, therefore, in tune with the demands of the political movements in urban areas and the landless peasants in the rural areas. Consequently, the land reform declaration was well received by opposition groups and especially by the peasants in the southern part of the country, where tenancy was relatively widespread. By championing the very issue that was at the centre of the political opposition, therefore, the government managed to put its political opponents on the defensive. Despite their scepticism on the motives of the government and its commitment to implement it effectively, they had no choice but to support the declaration of land reform in principle (Mengisteab, 1990, p. 87).

Whether the government shared the conviction that land reform was necessary to improve the economic performance of the agricultural sector (as its declaration states), or it was drawn into it to pacify its political critics and potential peasant uprising (as its critics claim) is hard to determine.[15] Whatever other political objectives it might have had, the government's officially stated objectives for undertaking the land reform were, Mengisteab (1990, p. 93), "[t]o free the tenants from exploitation by the landowners, to provide land to the landless in order to generate employment, to eliminate poverty and extreme inequality and also to modify the country's position in the international division of labor". These objectives are not particularly unique to the land reform in Ethiopia. In fact most land reform initiatives include most or all of the above objectives, although the degree of reform necessary to achieve these goals may vary (from simply reforming tenant/landlord relationships to abolishing private ownership of land). As El-Ghonemy

[15]This scepticism is due to the vague political philosophy of the government just prior to the land reform proclamation, and its lack of commitment in allocating investment funds to the agricultural sector while taxes on agricultural produce were constantly increasing.

(1990, p. 95) correctly put it, "[p]ublicly declared aims (of land reform) are usually in stock phrases such as the abolition of feudalism, exploitation, injustice, absentee landlordism, under-utilization of land, and of the arbitrary market power of landlords, water lords and money lenders". The main variations in land reform initiatives probably lie in the degree of their comprehensiveness, and the ideological tenet under which they are carried out. The Ethiopian land reform is among the most comprehensive and it was carried out, at least in later years, in the context of what the government claims was a socialist development path.

The debate whether land reform is an appropriate tool to achieve all or some of the proclaimed objectives, and, if so, under what conditions, has been an unsettled issue (Mengisteab, 1990, P. 27). Those in favor of land reform argue that land reform is essential for economic efficiency (Berry and Cline, 1979), employment generation, income redistribution, economic growth, and hence alleviation of poverty (Dorner, 1971, 1992, and Griffin, 1981, 1992). The efficiency argument in favor of land reform runs as follows (Berry and Cline, 1979): Given that there are no increasing returns to scale in LDC agriculture, large size farms under-utilize land, while small land holdings under-utilize labor. Therefore, land reform which remedies such imbalances will increase efficiency in the agricultural sector. Given the weak industrial sector in LDCs, the agricultural sector accounts for a substantial share of employment. Because large farms tend to be more capital-intensive than small farms, land distribution is likely to generate more employment. Similarly, land distribution in favor of the landless and tenant farmers will lead to more equitable distribution of rural land, and hence alleviate rural poverty.

Opponents of land reform concede that land reform might be a useful instrument to redistribute income in the short run, but it constrains economic growth. Therefore, they argue,

the best way to achieve income distribution is by fostering economic growth in the long run. This conclusion is predicated on two assumptions: First, large scale farming is more productive than small scale farming, and tenants are not necessarily less productive than owner-farmers; second, economic growth ultimately reduces poverty and redistributes income. Given these assumptions, therefore, land reform is not the most efficient way of achieving both economic growth and equitable distribution of income, at least in the long run.

Whether land reform increases efficiency, generates employment, fosters economic growth, and alleviates poverty or not is, of course, an empirical question. The empirical evidence over the last thirty years seems, however, inconclusive.[16] The lack of consensus is partly due to (1) differences in measurement across studies, (2) variations in country specific characteristics, and (3) type of reform implemented. For instance, due to type of reform and the degree of commitment to follow through in the implementation process, the economic effects of land reforms in Latin America and some Asian countries are different. Dorner (1992, pp. 29-30) noted, "[e]xperience shows that basic reforms can improve the income share of the poor as well as the growth of the economy. The widely heralded capitalist development and land reforms in Japan, South Korea and Taiwan cannot be ignored as mere coincidences. In all cases, economic growth followed major agrarian reforms." Summarising the experience of Latin American countries (based on various studies), on the other hand, Dorner (1992, p.56) states that, "[o]verview of Latin American land reforms over the past thirty years allows no clear and definitive judgement about these efforts. Compared to the East Asian reforms (Japan, Taiwan, South Korea), those of

[16]For a detailed discussion of the arguments both in favour and against land reform and the corresponding evidence, see Mengisteab (1990, pp. 21-38), and Dorner (1992, pp. 14-57).

Latin America were of a different order". Dorner attributes some of the differences in the impacts of land reform to differences in the degree of commitment of respective governments in providing farm input and lack of political will to carry through the initiated land reforms.

Despite differences in country characteristics and political ideology under which land reforms are implemented, Mengisteab (1990, p. 34) suggests that there are common attributes of a successful land reform. After evaluating the experiences of Japan, Taiwan, China and Cuba, which are considered to have carried out a successful land reform, he concludes that all four cases had the following common characteristics which contributed to the successful implementation of land reform. These attributes include: (1) in all countries, land was distributed in a comprehensive way and landlessness was either reduced or eliminated; (2) agricultural extension services (fertilizers, improved seeds, pesticides and marketing services) were made available to peasants; (3) multiple cropping and variety of seeds were made possible by significant advances in irrigation system; and (4) all four countries improved rural living conditions by providing health care, education and other related public infrastructures. In the case of Latin America, Mengisteab (1990, p.35), on the other hand, "[t]he reform sectors were largely neglected. The outcome has been that the expected result of land reform has not materialized."

In summary, the empirical evidence regarding the precise impact of land reform on the above stated objectives in particular and the performance of the agricultural sector in general is inconclusive. In addition to variations in country-specific attributes and evaluation criteria across studies, the difficulty of arriving at a consensus, it seems, is further complicated by two factors: The complex objectives that accompany a land reform package, and the vulnerability of the agricultural sector to external shocks. That is, given that the objectives of land reform range from

equitable distribution of income to growth of agricultural output, it is difficult to evaluate precisely the success of a given land reform in absence of a ranking scheme to evaluate the various objectives, unless all follow a similar pattern. Further, even if one focuses on a single criterion, say agricultural output, to evaluate the impact of land reform, all natural factors and government policies do not remain the same and therefore the comparison could only be suggestive rather than precise. Consequently, conclusions may vary depending how one views the relative importance of the unmeasurable natural factors or policy issues in influencing agricultural output. Even though these limitations are prevalent in most areas of economic enquiry, they are particularly important in agriculture where weather conditions play a significant role. In the policy experiments that follow, these caveats should be understood.

It has been almost twenty years since the land reform was implemented in Ethiopia. And few studies have been carried out to evaluate its impact on the performance of the agricultural sector. These studies will be discussed later in this chapter in relation to the results of this study. Two points should be highlighted. First, there is no consensus on the overall impact of the land reform. For instance, Griffin (1992, p. 3) states that, "[i]t is not possible to calculate the extent to which the reform improved the standard of living of the masses of the rural people, but it is evident that the improvement must have been considerable". Mengisteab (1990, p. 35), on the other hand, concludes that "[E]thiopia's land reform is another unsuccessful case... (and this is because) the distribution of land was not accompanied by favorable allocation of other resources to the peasantry ". Second, these studies are descriptive analyses of how the economy performed during the period, with no reference to what the path of the economy might have been had it continued its pre-1974 trend. As will be clear in the next sub-sections, the objective of this study

is, as Griffin (1992, p. 4), suggested to "[c]onsider whether the land reform simulated production above what it otherwise would have been". In addition to the impact of the land reform, the other nationalization measures undertaken in the mid-1970s will also be included in the simulation exercise. It is hoped an integrated approach of the main policy initiatives will shed some light on the performance the economy might have had in the absence of these policies. The next section will describe the specific designs of the policy experiments.

5.1.2. RE-ESTIMATES OF POLICY VARIABLES

To evaluate the effects of these policies, the basic model is re-simulated with the following changes. The equations for the total output, agricultural output, manufacturing output and arms imports are re-estimated for the pre-policy period (1961-1974). The respective estimated equations are reported below (with t-statistics in parentheses); the other attributes are as defined in section 4.3. Due to the small sample size, the equations are estimated using a single equation estimator (Cochrane-Orcutt). The reported Durbin-Watson (D.W.) statistics, therefore, incorporate the corrections made for serial correlation. As before, after dropping the dummy variable, the ratio of real output to the real fixed capital stock (RY/RFCA) depends on the ratio of labor force employed to the real fixed capital stock:

(32) $\text{Ln}\,(RY/RFCA) = 7.0830 + 0.99116\ \text{Ln}\,(STR/RFCA)$
$\qquad\qquad\qquad\qquad\qquad\quad (7.7083)\ \ (5.8642)$

$\bar{R}^2 = 0.87$ D.W. = 1.723 SSE = 0.01872 $\qquad\qquad \bar{Y} = 1.7255.$

As can be seen from the t-statistics, the coefficients are significant and the explanatory power of the equation is acceptable. Compared to the 2SLS estimates reported earlier (equation 1, in section 4.3.1.1), the autocorrelation problem is reduced and the coefficient of the labor-capital ratio is larger in this equation.[17] Further, the coefficient of the labor-capital ratio in this equation is not different from one, indicating constant returns to labor as a fixed factor, and zero marginal productivity of capital.[18] But the coefficient for the entire sample is less than one, indicating diminishing returns. This conclusion is also verified using a formal test (for test procedures, see footnote 15), which rejected the hypothesis that the coefficient is equal to one. The implied marginal products of labor-capital ratios[19] for the entire sample and the short sample also shed some insight on the performance of the economy. The respective marginal products are 0.27 and 0.32, indicate that it was higher for the pre-1974 period than it was for the entire sample period (1961-1987).

Agricultural output depends on the labor force (LAFI), lagged rainfall (RF_{-1}) and a time trend (T):

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[17]For a discussion of model choice (between single information (SIE) and limited information (LISE) or full information estimators (FISE)) in the face of simultaneity and autocorrelation problems, see Challen and Hagger (1983, p. 133).

[18]Even though this is clear from visual inspection, it could also be verified formally using the following t-statistics:

$$t_{N-k} = (\hat{\alpha} - \alpha)/s_{\hat{\alpha}},$$

where N-k is the number of degrees of freedom, $\hat{\alpha}$ and α are the estimated and the actual (hypothesised) coefficients, respectively, and $s_{\hat{\alpha}}$ is the standard deviation of $\hat{\alpha}$. Using this test, the hypothesis that the coefficient of the labour capital ratio is not different from one cannot be rejected at the 5 per cent level of significance.

[19]The marginal product of labour is calculated as the estimated coefficient of labour times the actual average product of labour.

(33) Ln RAO = 3.5898 + 0.59177 Ln LAFI + 0.53308 Ln RF_{-1}
(2.324) (1.792) (1.5264)

+ 0.011268 T
(2.0675)

$\bar{R}^2$ = 0.69 D.W. = 1.59 SSE = 0.04198 $\bar{Y}$ = 8.935.

The statistical significance of the above coefficients is inferior to the 2SLS estimates reported earlier (equation 3 in section 4.3.1.1). But the problem of serial correlation is significantly improved in this equation compared to the 2SLS estimate. And in terms of coefficient size, a unit increase in labor input had a greater impact on agricultural output over the entire sample period than pre-1974, as can be seen from the respective coefficients.

Manufacturing output depends on the labor force employed (LM), intermediate inputs (RMNT) and the existing real fixed capital stock (RFCA):

(34) Ln RMO = -2.5599 + 1.0762 Ln LM + 0.1191 Ln RMNT
(3.4368) (12.295) (2.890)

+ 0.26735 Ln RFCA
(1.8377)

$\bar{R}^2$ = 0.95 D.W. = 1.93 SSE = 0.008748 $\bar{Y}$ = 7.205.

The statistical significance of the coefficients is much better in the smaller sample than with the 2SLS estimates (equation 4 in section 4.3.1.1). The adjusted R square and the Durbin-Watson statistics are significantly improved compared to the previous estimates. The marginal

products of labor and capital in the smaller sample are 2.14 and 1.25, respectively. The respective marginal products for the entire sample are 1.35 and 0.68. The above cited study, Wubneh (1990, p. 321), also reports a decline in the marginal productivity of labor between 1975 to 1984 compared to 1960 to 1974. According to his estimates, the marginal product of labor between 1960 to 1974 averaged 1.95, while the respective figure for 1975 to 1984 averaged 1.44. Despite the differences in model specification and sample size, the values obtained in this study and that of Wubneh seem to be of the same order of magnitude.

Finally, arms imports (RGUN) depend on the size of armed forces. The rationale for re-estimating this equation is that, as discussed in Chapter Three, the military expenditures significantly increased after 1974. Consequently, it is likely that other sectors were affected as substantial resources are used for military purposes. To account for the potential changes between the two sub-periods, therefore, the equation is re-estimated for the smaller sample:

(35) Ln RGUN = 9.5305 + 1.6385 Ln MP
(5.5359) (2.6146)

$\bar{R}^2$ = 0.53 D.W. = 1.54 SSE = 5.8908 $\bar{Y}$ = 4.9705.

Compared to the estimates for the entire sample, both the intercept and the coefficient are smaller in this estimate. This reflects the fact that military imports were more sensitive to military needs after 1974 than in the pre-1974 period, as discussed in Chapter Three.

5.2. POLICY SIMULATION, 1973-1987

The basic model discussed in chapter four is re-simulated by substituting the respective coefficients of the smaller sample (1961-1974) for the entire sample. The difference between these simulation results and the basic simulation (control run) results predicts what would have been the performance of the economy if there had not been any change in policy in the mid-1970s.[20] Alternative results are also reported in Appendix D, at the end of this chapter.

As summarized in Tables 5.1 to 5.2, the shocked values of all the endogenous variables are different from the control run values, suggesting that the above discussed policy changes had a measurable impact on the macroeconomic aggregates concerned. The effects of the policies on each variable could be read from the tables and hence the following brief explanations will focus on selected aggregates.

Agricultural output (RAO in Table 5.1) would have been lower, on average, if agricultural reform had not been undertaken. As discussed above, the essence of the reform was to distribute land equally to those who use it (taking it away from absentee landlords). This measure, therefore, must have initially created positive incentives for farmers to increase their production. But agricultural output started to decline beginning in the early 1980s, which corresponds to the formation of farm cooperatives, which enabled the government to control the sale and the price of agricultural produce (see Table 3.3). Such policies probably created disincentives and bureaucratic obstacles in the production and distribution processes, such that efficiency was

[20]For a discussion of why shocked runs (policy experiments) ought to be compared with the control run (model based solution values) and not with the actual historical values of each endogenous variables, see Challen and Hagger (1983, p. 153).

compromised, causing output to decline, as the results beginning in the 1980s indicate. On the whole, agricultural output would have been about one per cent lower, on average per annum, if the government had not implemented the land reform and related policies. It should be noted that, even though the trend is informative, no significance could be attached to the net effect due to its low value.

Manufacturing output (RMO in Table 5.1), on the other hand, would have been higher if the government had continued with the pre-1974 policies. Both the level and the rate of manufacturing output would have increased over the simulation period. This might be explained by the unfavorable economic policies taken and the political environment that was created after 1974. That is, in addition to the possible uncertainties created by the nationalization of manufacturing enterprises, the shortage of foreign exchange and the mismanagement of the public enterprises, and political instability probably contributed to the decline in manufacturing output. Consequently, manufacturing output would have increased by about 7 per cent if the changes in policy had not taken place.

The main source of the difference in manufacturing output between the two sub-periods seems to be the change in the marginal productivity of the factors used. Specifically, the marginal productivity of both labor and capital prior to 1974 was significantly higher compared to the entire sample period. Compared to pre-1974, both the level of the labor force employed and the level of real fixed capital stock used in the manufacturing sector increased after 1975. The increase in the size of the labor force is partly due to the government's overstaffing policy (especially nonoperative employees - administrators, secretaries) to alleviate unemployment. For instance, according to Mulat (1990, p. 320), the number of nonoperative employees grew by 5.9

Table 5.1 THE IMPACT OF STRUCTURAL CHANGE

THE IMPACT OF THE MID-1970s POLICY SHIFT							
DEVIATIONS FROM CONTROL RUN - %							
YEAR	CUR	RAO	RMO	RY	IT	RMCD	RMCND
1973	-0.67	-12.85	-7.43	-22.29	-24.36	0.00	0.00
1974	-0.19	-6.10	-10.30	-15.62	-15.08	-6.30	-0.44
1975	7.66	-2.12	-10.54	-1.60	-0.51	-7.38	-0.52
1976	10.04	-1.03	-0.57	3.10	2.02	-2.59	-0.18
1977	11.82	-7.30	-6.05	8.56	6.36	0.59	0.04
1978	13.11	-6.34	26.21	14.44	12.62	2.60	0.17
1979	14.06	-11.22	18.19	20.46	17.12	4.75	0.31
1980	14.93	-14.27	17.28	25.74	21.88	6.94	0.45
1981	15.58	-16.43	9.73	27.14	23.24	8.91	0.58
1982	16.38	-16.75	0.01	29.51	25.78	9.83	0.64
1983	16.88	-25.71	7.38	33.71	29.71	10.51	0.68
1984	17.23	26.65	8.50	36.85	31.63	11.71	0.75
1985	17.74	21.05	16.91	35.61	31.63	12.86	0.82
1986	18.47	29.08	10.80	41.92	37.22	12.92	0.82
1987	18.74	25.24	17.67	46.41	42.52	14.18	0.90
AVERAGE	12.78	-1.21	6.52	18.93	16.12	5.30	0.34

Table 5.2. THE IMPACT OF STRUCTURAL CHANGE

THE IMPACT OF THE MID-1970s POLICY SHIFT							
DEVIATIONS FROM CONTROL RUN - %							
YEAR	RC	RI	RGEE	RGEH	RG	P	RXCOF
1973	-20.59	-14.88	-1.03	-0.88	-9.22	0.00	0.00
1974	-14.60	0.34	0.34	0.29	-5.37	0.94	-0.44
1975	-1.57	10.84	0.63	0.54	-0.23	1.12	-0.52
1976	2.86	5.94	0.19	0.16	1.06	-0.92	0.43
1977	8.01	5.16	0.21	0.18	2.49	-0.99	0.47
1978	13.48	5.43	0.22	0.19	4.09	0.01	0.00
1979	19.18	5.33	0.21	0.17	5.43	0.04	-0.02
1980	24.14	5.03	0.18	0.15	6.62	0.57	-0.26
1981	25.38	2.55	0.05	0.04	7.08	0.16	-0.07
1982	27.54	2.30	0.08	0.07	7.74	0.38	-0.18
1983	31.39	3.10	0.13	0.11	8.83	0.47	-0.22
1984	34.26	2.42	0.10	0.08	9.61	-0.28	0.13
1985	33.11	0.44	-0.04	-0.03	9.35	0.26	-0.12
1986	39.06	3.79	0.19	0.16	10.49	1.59	-0.74
1987	43.03	3.64	0.13	0.11	11.85	1.57	-0.73
AVERAGE	17.64	2.76	0.11	0.09	4.65	0.33	-0.15

Table 5.3. THE IMPACT OF STRUCTURAL CHANGE

THE IMPACT OF THE MID-1970s POLICY SHIFT							
DEVIATIONS FROM CONTROL RUN - %							
YEAR	RX	RXHK	RXOSN	RMNT	RGUN	RMFL	CA
1973	0.00	0.00	0.00	-7.25	33.71	0.00	645.83
1974	-0.16	-0.94	-1.15	16.94	-51.92	-1.47	96.89
1975	-0.19	-1.12	-1.37	10.18	-90.99	-1.00	75.09
1976	0.16	0.93	1.15	-7.84	-48.60	-0.10	-375.9
1977	0.17	1.01	1.23	-1.78	0.59	0.18	-0.22
1978	0.00	-0.01	-0.01	15.72	0.74	0.50	-7.67
1979	-0.01	-0.04	-0.05	7.79	-4.73	0.81	2.62
1980	-0.10	-0.57	-0.69	6.47	-1.87	1.13	-3.26
1981	-0.03	-0.16	-0.19	-0.52	-1.73	1.39	2.65
1982	-0.07	-0.38	-0.46	-8.58	-1.58	1.46	14.06
1983	-0.08	-0.47	-0.58	-2.26	15.71	1.57	297.17
1984	0.05	0.28	0.34	-16.85	-1.29	1.76	30.07
1985	-0.04	-0.26	-0.32	-24.23	-15.18	1.90	35.48
1986	-0.27	-1.58	-1.93	-18.32	-15.06	1.84	33.15
1987	-0.27	-1.56	-1.90	-25.44	-21.94	2.13	37.25
AVERAGE	-0.06	-0.32	-0.40	-3.73	-13.61	0.81	58.88

per cent, while that of operative employees grew by only 2.8 per cent between 1979 and 1982. The decline in productivity was probably worsened because the increase in employment was taking place while capacity utilization was declining. The decline in capacity utilization is the result of shortages in foreign exchange and hence intermediate inputs that were created after foreign firms left the country following the nationalization of most manufacturing industries.

Similarly, the solution values of real total output (RY in Table 5.1), and hence private consumption (RC in Table 5.2), would have been higher, except for the first three years of the simulation period, if there had been no policy changes in the mid-1970s. On average, total output and private consumption, would have increased by about 19 per cent and 18 per cent, respectively, if the economy had continued with no changes in policy. The decrease in real total output is mainly due to the fall in the marginal productivity of labor, which was higher between 1961 and 1974, than for the entire sample period. In addition to the decrease in factor productivity and the overall political instability in the mid-1970s, the related issue of foreign exchange shortage and its impact on productive capacity also contributed to the decline in total output, as was the case in manufacturing.

As noted in the flow chart, scarcity of foreign exchange limits the ability to import intermediate inputs, which affects total output directly and via utilization of domestic inputs indirectly. Therefore, the policies which essentially limited foreign investment by nationalizing most industries, and focused on shifting most of available foreign resources to import military equipment created a huge shortage of foreign exchange. This shortage, in turn, reduced the ability to import intermediate inputs, which reduced the rate of capacity utilization, leading to reduced real total output.

Similarly, because changes in output are one of the determinants of the investment function, the directional impact of the changes in policy on investment expenditures parallels that of output. That is, investment (RI in table 5.2) would have been higher if there had been no changes in policy in the mid-1970s. On average, investment would have increased by about 3 per cent, if the economy were to have continued with its pre-1974 policy regime.

As indicated in Table 5.2, total government expenditures and government expenditures on health and on education as a ratio of total output (RG, RGEH, and RGEE, respectively) would have also been higher under the pre-1974 policy regime than under the post-1974 policies. Among the explanatory variables of these endogenous variables is changes in total output. The increase in the solution values of total output in the pre-1974 sample period, therefore, resulted in a corresponding increase in total government expenditures, and in government expenditures on education and health. The increases in the ratios of health and education expenditures to total output are modest compared to the other variables. Furthermore, the fact that these social expenditures (education and health) would have been higher on a GDP per capita basis for the pre-policy period than after it suggests that the government was paying less attention to social expenditures despite the increase in population in those years.

Finally, the effect of the policies undertaken in the mid-1970s on the current account balance (CA in Table 5.3) is negative. The solution values of total output would have been higher in the absence of the policies introduced in the mid-1970s. Consequently, the solution values of imports, which depend on disposable income (consumer durables (RMCD) and consumer nondurbles (RMCND) in Table 5.1), would also have been higher. Arms imports (RGUN in Table 5.3) would have been lower under the pre-1974 policy regime. Therefore, despite the

relatively higher imports of consumer goods and slightly lower exports that would have occurred under the pre-1974 policy regime, compared to the post-1974 policy regime, the current account balance would have improved under the former policy regime. This is mainly due to the substantial increase in arms imports (see equation (35) above and RGUN in Table 5.3) after 1974.

The small increase in all export variables (coffee exports (RXCOF) in Table 5.2, total exports (RX), exports of hides and skins (RXHK), and exports of oil seeds and oil nuts (RXOSN), in Table 5.3) after 1974 is caused by the effect of the policy change on domestic prices, which in turn affected the real exchange rate. The domestic price level (P in Table 5.2) would have been slightly higher had the economy continued under the pre-1974 policy regime. This would have decreased the real exchange rate (an appreciation of the Ethiopian currency), which would have decreased exports. On the import side, the relatively higher domestic prices that would have prevailed in the absence of the policy changes would have decreased relative prices (import/domestic), which would have increased imports of consumer goods. The increase in income and the decrease in relative prices, therefore, would have increased imports of consumer goods.

It is worth noting that the model-based results discussed above reflect the policies adopted by the government after 1974. The then military government restricted the imports of all consumer goods that were considered as luxury items, and in some cases imposed import tariffs as much as 300 per cent to save foreign currency. At the same time, the government was directing most exportable goods, especially coffee, to the foreign market at the expense of domestic consumption. The immediate effect of these policies can be seen in the significant positive current account balance (CA in Table 5.3) in 1976. Beginning in 1977, however, the

government was significantly increasing its military expenditures. Consequently, despite the measures undertaken by the government in the mid-1970s to curtail imports of consumer goods and to increase exports, the current account balance would have been improved if the economy were to have continued under the pre-1974 policy regime.

In summary, therefore, except for their small net positive effect on agricultural output, the policies that were introduced by the military government in the mid-1970s seem to have a net adverse effect on the performance of the economy. It is worth noting that the net effect of the policy on agricultural output over the sample period is too small to suggest a clear effect. What is probably more important is how the pattern of positive impact of the reform in the first seven years reversed itself and consistently declined until the end of the sample period. To put the results in context, a brief review of similar studies is in order. As stated earlier, there is no consensus regarding the overall effect of the land reform on the performance of the agricultural sector. But since many authors use different criteria to evaluate the success of the land reform initiative, here the focus will be only on one criterion: Did agricultural output increase following land reform compared to its pre-1975 level?

In answering this question on the basis of his survey, Griffin 1992, p. 4) concludes that "[i]t is unlikely that the growth performance would have been any better had the reforms not occurred." He notes that output per capita was not growing fast enough to improve the living standard of the rural peasants significantly, but he argues that the situation would not have been any better without land reform. Similarly, Ghose (1985), examined the performance of the agricultural sector between 1975 to 1983. Ghose (1985, p. 133) notes that, even allowing for the increase in crop area, "[t]he growth of agricultural output as well as of food output was quite

impressive during the first four-year period 1977/78-1982/83". Further, although cautious on the conclusiveness of the data, Rahmato (1984, p 73) on the basis of regional surveys reaches a similar conclusion when he states that, "[i]f the figures for 1980 are not a result of changes in data collection, and instead indicate a trend, small-holder agriculture may be showing a promising sign of improvement."

Mengisteab (1992, pp. 115-118) is, however, sceptical that the land reform resulted in any significant improvement of agricultural output. After examining agricultural output between 1961 and 1988, he argues that the variation in agricultural output does not show a consistent pattern that is directly attributable to the redistribution of land. He attributes the stagnation of the agricultural output, however, not to the land reform but to lack of commitment of the government to provide "appropriate agrarian policies". It has to be noted that all these studies are a descriptive analysis of the agricultural sector over time, and do not address the issue of what would have been its performance in the absence of land reform. Hence, direct comparability is not possible.

To recapitulate: (1) the results of this study suggest agricultural output would not have been higher if land distribution were not undertaken; but the margin of improvement due to land distribution is minimal; (2) most of the studies undertaken suggest an improvement in agricultural performance, at least in the early years of the land reform; the qualitative conclusions of most of these studies are, therefore, consistent with this study; (3) since the studies are not directly comparable, and the data are subject to variations (due to weather and other exogenous factors), the results should be viewed as suggestive orders of magnitude; and (4) now that the new government adopted the previous land reform as is, while introducing more liberalized policies (free market pricing in agriculture, and a limited role for Peasant associations), to what extent the

effect of the land reform will be different remains to be seen.

5.3. EXCHANGE RATE POLICY SIMULATION

The second policy experiment to be undertaken is the impact of devaluation of the currency on the performance of the economy. Before discussing the policy design and simulation results, it is important to note the relevance of this policy issue in the context of the LDC economies. The macroeconomic performance (output growth, inflation, current account balance etc) of the less developed countries (LDCs) in general and that of African countries in particular has been unsatisfactory since the 1970s. Although both external and domestic factors are assumed to be responsible for the weak economic performance of these countries, in most cases, the exchange rate policy has been singled out as one of the most important factors influencing economic performance. For instance, Ghura and Grennes (1993, p. 157), state, " [i]t is now accepted that chronic misalignment in the real exchange rate (RER) has been a major source of slow growth in Africa and Latin America. The RER, the relative price of tradables to nontradables, is an important variable in determining economic performance." Consequently, the exchange rate policy has attracted significant attention and has been a controversial policy issue, as exemplified by the IMF-recommended adjustment programs.

One or a combination of the following four approaches are commonly used to evaluate the effects of stabilization programs, such as devaluation. The first approach, referred to as the "before-after" method, compares relative economic performance before and after the currency is devalued to capture the effects of the change on economic aggregates. The second approach,

known as the "with-without" or "control-group" approach, compares the economic performance of devaluing countries with that of non-devaluing countries. The third, "actual-versus-target" approach, focuses on evaluating actual performance of some macroeconomic aggregates compared to their pre-specified targets using econometric models. The fourth approach uses a simulation technique to examine the impact of changes in the exchange rate on economic activity.[21] This study falls within the last category.

Various studies have been carried out using the above approaches to evaluate the effects of devaluation in particular, and stabilization programs in general, mainly in relation to the less developed countries. In most cases, the analyses focused on the impact of changes in the exchange rate on output growth, inflation, on balance of payments, and the current account balance. Among such studies, Edwards (1989) examined 39 devaluation episodes using the "with-without" approach and regression analysis and found that in many cases devaluations have negatively affected the growth of output (at least, in the short run) and real wages, but improved the current account. And Khan (1990, p. 222), on the basis of his survey of the literature concluded that the impacts of stabilization programs on the current account balance is positive, but "[t]he picture for inflation and growth performance is unclear". In addition to these multi-country studies, various studies were also carried out in a country-specific context. After reviewing these studies, Agénor (1991, p. 26) concluded that his "[b]rief survey of empirical work suggests that, so far, evidence concerning the contractionary effect of devaluation on real output is, at best, mixed". In contrast to the predictions of "conventional" open economy macro

[21]For a detailed discussion of the various approaches and their limitations, and a survey of empirical results, see Khan (1990, pp. 199-210) and Agénor (1991, pp. 20-26).

models, therefore, disagreements regarding the effects of devaluation on output growth have persisted in the literature.

There are many hypotheses, why a devaluation might be contractionary in a less developed economy. For instance, Diaz-Alejandro (1963), Krugman and Taylor (1978), Bruno (1979), Gylfason and Schmid (1983), Hanson (1983), Gylfason and Raisager (1984), Islam (1984), Gylfason and Radetzki (1985), Branson (1986), Solimano (1986), Wijnbergen (1986), and Kamas (1992), to name a few, have suggested various arguments[22] why a devaluation might be contractionary. Among the factors that may contract the aggregate demand of a devaluing developing country include: Changes in income distribution that favor economic sectors with low marginal propensity to consume, a decline in investment, a decline in real wealth or real balances, an increase in debt and debt service payments (measured in local currency), and low government expenditure out of tax revenue (where *ad valorem* taxes on imports and exports are in effect). On the other hand, aggregate supply may contract following a devaluation due to an increase in the price of imported production inputs and due to wage indexation schemes.

The analytical and empirical models used to examine the impacts of devaluation on output growth, inflation and the current account balance vary both in scope (country-specific vs multi-country models, short run effects vs long run effects) and in their assumptions regarding the behavior of macro aggregates (treatment of nominal wages - exogenous vs endogenous, for instance). Such variations in model specification suggest, therefore, that results should only be compared with care. Further, because most studies examine stabilization policies as a package, the conclusions that emerge may not be necessarily attributable to the effects of a devaluation.

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[22]For a detailed discussion of the above arguments, see Lizondo and Montiel (1989).

This study attempts to focus on the effects of devaluation in the absence of other adjustment programs.

Within the above broad frame of enquiry regarding the effects of devaluation, this policy experiment is specifically motivated by the following observations. First, examining the various approaches, Agénor (1991, p. 26) noted, "[s]tudies using a macro-simulation approach have as a major advantage the fact that they usually provide considerable information on the transmission process of exchange-rate changes on output, contrary to factual approaches. However, most of the studies available so far use imputed parameter values; the reliability of results derived from a set of 'guess estimates' and coefficients that are not consistently estimated in an integrated framework can rightly be questioned". Second, Khan (1990, p. 226), stressing the importance of specific-country studies, observed that, "[c]ase studies permit one to delve deeply into the specifics of program design and implementation, and to identify special circumstances surrounding the program". Accordingly, this study attempts to address the above two observations. Such an approach captures the net effects of devaluation on aggregate macro variables (growth, inflation etc.) and sheds light on the effects of devaluation on various sectors of the economy. This is in contrast to models which consist only of aggregate variables of the economy constructed in a multi-country context, as are commonly formulated to examine the impacts of devaluations.

The transitional government devalued the currency from a 2.07 birr per US dollar to a 5 birr per US dollar (by 142 per cent) in the Fall of 1992. The rationale of this measure, as stated in the Transitional Government's document (The Prime Minister's Office, 1992, p. 1), was that "[t]he Transitional government had from the outset recognized that the birr is over-valued...[and]

Devaluation is expected to have a positive impact on the balance of payments. In fact that is the core reason for devaluing".

It should be noted that despite the substantial increase in the black market rate and the fluctuations in the domestic and foreign prices and the nominal values of its trading partners' currencies, previous Ethiopian governments kept the nominal value of the birr fixed over the sample period. Its trading partners include mainly the major industrialized countries. Because their currencies have been floating against each other since the early seventies, the effective and the bilateral real exchange rate (due to changes in relative prices) values of the Ethiopian birr has also been fluctuating. As the price level increased after 1974 (relative to world prices) and the shortage of foreign exchange became acute, therefore, the real exchange rate appreciated and an alternative unofficial foreign currency market became widespread. For instance, between the mid 1980s and the time it was devalued in 1992, the unofficial exchange rate averaged about 7 birr per US dollar, in contrast to the official rate of 2.07. Due to the gap between the official and the unofficial exchange rates and other indicators of misalignment, therefore, there seems to be a consensus that the birr had been over-valued.[23]

According to the government's rationale (The Prime Minister's Office, 1992, p. 28), a devaluation was expected to improve the current account balance mainly by increasing exports. First, due to the gap between the official and the unofficial exchange rates, illegal exports of coffee and live animals, to neighbouring countries, had been increasing over the years. The

[23]Other studies, Ghura and Grennes (1993, p. 166), and Edwards (1989, p. 112), for instance, concluded that in light of the unofficial market rate and other relevant measures of misalignment, the official value of the Ethiopian birr in the 1980s was roughly double or more the unofficial market rate.

government expected such trade to diminish as the gap between the official and unofficial value of the exchange rate disappeared. Second, most Ethiopian exportables can be used in domestic consumption (coffee, oil seeds and oil nuts, for instance). By making foreign markets more attractive than domestic markets via devaluation, the government expected to increase the volume of exports. Third, a devaluation was expected to encourage the production of exportables by shifting resources from non-tradables to tradables.

Given the government's objectives, what is the likely impact of devaluation on the performance of the economy in general and the current account balance in particular? Further, given the consensus that the Ethiopian birr had been over-valued, how would it have affected the performance of the economy if such devaluation had taken place in the mid-1970s? In the absence of relevant data for the exogenous variables, it is not possible to forecast its future impact and therefore answer the first question directly. But to address the second question directly and indirectly to shed some light on the first, the basic model is re-simulated with the following changes: First, the new value of the birr (5 birr / US dollar) is used instead of the previous value (2.07 birr/ US dollar) in calculating the real exchange rate; and second, the price of imports and exports are adjusted by the relative increase of the exchange rate to reflect the relative change in the domestic equivalent of these prices. The results obtained from this exercise are then compared with the basic simulation (control run) results. A positive deviation implies that the value of a target variable would have been higher if the birr was devalued in the mid-1970s. The results of the exercise are summarized in Tables 5.4 to 5.6.

As can be seen from Table 5.4, capacity utilization (CUR), manufacturing output (RMO) and total output (RY) would have decreased had the currency been devalued in the mid-1970s.

Consequently, as shown in Table 5.5, private consumption (RC) and investment expenditures (RI) would have also decreased had the currency been devalued in the mid-1970s. Among the relevant channels through which devaluation affects these variables is via imports of intermediate inputs. As indicated in Table 5.6, a devaluation would have decreased, in real terms, the values of imported intermediate inputs (RMNT) by about 25.5 per cent per annum, on average. And a decrease in intermediate inputs would have adversely affected manufacturing output directly and via capacity utilization indirectly. A decrease in capacity utilization would also have decreased total output by decreasing the actual capital stock used and the labor force employed. Consequently, as indicated in Table 4.5, private consumption (RC) and investment expenditures (RI) would also have decreased due to the decrease in total output. In addition to this indirect effect, investment expenditures are also affected directly since the real exchange rate is one of the explanatory variables. On average, the capacity utilization rate, manufacturing output, total output, private consumption and investment expenditures would have decreased by 11.9, 13.1, 7.9, 7.9 and 26.4 per cent per annum, respectively, over the simulation period.

In addition to its adverse effects on output and on some components of aggregate demand, a devaluation would have also been inflationary, as one might expect for a small price taking economy like that of Ethiopia. If the devaluation had taken place in the mid-1970s, the solution values of the price level (P in Table 5.5) would have increased by about 27.7 per cent per annum, on average, during the simulation period. This is mainly due to the impact of an increase in import prices, which is one of the explanatory variables.

As stated earlier, in the case of the Ethiopian government in particular and in many IMF adjustment programs in general, one of the main objectives of devaluation is to improve the

current account (balance of payments) position. If the government had devalued the currency in the mid-1970s, the current account balance (CA in Table 5.6) would have improved by about 60 per cent per annum. In fact, sales of all export goods would have increased while purchases of all import goods would have decreased, resulting in a positive current account balance - a rare event given that the current account has always been mainly in deficit. If the sole objective of the government is to improve the current account balance, regardless of its impact on output and employment, then, devaluation seems a feasible policy option.

Furthermore, due to the high *ad valorem tax* on imports and exports, devaluation would have resulted in a higher indirect tax revenue for the government. Other things being equal, this would have lowered the huge government budget deficit.

The qualitative impacts of devaluation does not change with changes in the time period it is implemented. To verify if changing the devaluation period would have a different impact, the model was re-simulated beginning in 1980 instead of 1973. Despite differences in magnitude, the qualitative impact of devaluation remains the same regardless of the time period chosen to devalue the currency. The results of the simulation for selected variables are reported in Appendix E, at the end of this chapter.

It is worth noting that the qualitative effects of devaluation in this study are consistent with results obtained by Gylfason and Radetzki (1991). On the basis of 1980s data and parameter estimates, the authors concluded that if the Ethiopian government were to devalue the currency by 10%, assuming constant real wages, GNP and employment would fall by 1.6 and 2.8 per cent, respectively, while the current account would improve by 1.1 per cent. This suggests that a 142 per cent devaluation (the actual figure and the one used in this study) would have led to a 23 per

Table 5.4. THE IMPACT OF DEVALUATION

THE IMPACT OF CHANGES IN THE EXCHANGE RATE							
DEVIATIONS FROM CONTROL RUN - %							
YEAR	CUR	RAO	RMO	RY	IT	RMCD	RMCND
1973	-5.34	0.00	-2.86	2.98	25.75	-37.83	-47.73
1974	-9.86	0.00	-15.37	-4.30	22.81	-39.04	-49.50
1975	-11.19	0.00	-15.17	-6.95	29.25	-40.38	-49.97
1976	-12.30	0.00	-13.74	-7.74	20.79	-41.66	-50.29
1977	-11.85	0.00	-12.51	-8.07	14.43	-40.23	-48.26
1978	-10.86	0.00	-10.58	-7.37	16.15	-37.22	-44.67
1979	-11.22	0.00	-11.10	-7.56	13.15	-36.65	-44.08
1980	-11.96	0.00	-11.80	-7.87	16.77	-38.05	-45.78
1981	-13.51	0.00	-13.89	-8.97	22.46	-41.97	-50.31
1982	-14.03	0.00	-13.66	-9.23	25.98	-44.36	-52.81
1983	-14.73	0.00	-15.40	-10.33	30.07	-46.51	-55.13
1984	-15.79	0.00	-16.99	-11.51	31.94	-49.09	-57.85
1985	-13.67	0.00	-16.57	-12.01	23.09	-45.17	-53.04
1986	-12.34	0.00	-13.42	-10.12	15.30	-41.05	-47.97
1987	-10.21	0.00	-12.91	-9.34	8.03	-34.21	-40.03
AVERAGE	-11.92	0.00	-13.09	-7.89	21.07	-40.89	-49.16

Table 5.5. THE IMPACT OF DEVALUATION

THE IMPACT OF CHANGES IN THE EXCHANGE RATE							
DEVIATIONS FROM CONTROL RUN - %							
YEAR	RC	RI	RGEE	RGEH	RG	P	RXCOF
1973	2.10	-18.71	0.12	0.10	3.63	29.67	25.40
1974	-4.59	-26.36	-0.30	-0.26	0.86	31.24	25.13
1975	-7.41	-26.61	-0.12	-0.10	1.37	32.70	24.50
1976	-7.80	-27.56	-0.04	-0.03	-0.47	29.86	26.07
1977	-7.61	-26.16	-0.02	-0.01	-2.41	27.08	23.68
1978	-7.26	-24.16	0.03	0.03	-1.10	22.83	19.94
1979	-7.33	-24.60	-0.01	-0.01	-1.61	19.90	19.78
1980	-7.81	-25.52	-0.01	-0.02	-1.12	20.89	21.06
1981	-9.06	-27.69	-0.05	-0.05	-0.73	26.43	25.75
1982	-9.30	-28.46	-0.01	-0.01	-0.82	31.46	27.54
1983	-10.38	-29.55	-0.05	-0.05	-0.97	36.11	29.75
1984	-11.48	-31.25	-0.05	-0.05	-1.40	40.52	33.54
1985	-11.79	-28.87	-0.02	-0.02	-2.06	31.49	27.98
1986	-9.79	-26.80	0.09	0.07	-2.24	22.80	22.56
1987	-9.11	-23.25	0.04	0.02	-1.76	11.99	16.72
AVERAGE	-7.91	-26.37	-0.03	-0.02	-0.72	27.66	24.63

Table 5.6. THE IMPACT OF DEVALUATION

THE IMPACT OF CHANGES IN THE EXCHANGE RATE							
DEVIATIONS FROM CONTROL RUN - %							
YEAR	RX	RXHK	RXOSN	RMNT	RGUN	RMFL	CA
1973	41.13	57.27	72.60	-31.76	-49.30	-44.14	55.72
1974	43.01	56.26	78.17	-34.07	-51.12	-45.79	78.44
1975	43.21	54.49	77.70	-27.96	-51.54	-46.43	3.12
1976	44.18	58.68	83.77	-27.62	-51.80	-46.78	127.44
1977	40.86	52.60	78.83	-21.81	-49.72	-44.83	61.63
1978	35.56	43.34	70.52	-17.31	-46.06	-41.39	52.86
1979	34.92	43.01	73.22	-21.70	-45.46	-40.82	46.66
1980	37.15	46.09	78.72	-25.37	-47.20	-42.45	47.95
1981	44.04	57.81	89.95	-32.07	-51.80	-46.79	52.11
1982	47.81	62.24	93.84	-31.04	-54.32	-49.23	48.69
1983	51.79	67.90	98.58	-32.87	-56.66	-51.48	162.73
1984	57.31	78.05	107.50	-35.78	-59.40	-54.15	44.85
1985	48.25	63.41	94.88	-19.47	-54.52	-49.51	38.19
1986	40.00	49.69	84.88	-16.68	-49.36	-44.65	41.00
1987	29.88	35.78	71.43	-6.38	-41.26	-37.05	40.86
AVERAGE	42.60	55.11	83.64	-25.46	-50.63	-45.70	60.15

cent decline in GNP, and a 16 per cent improvement in the current account balance.

In terms of the controversies regarding the impact of a devaluation on output growth and inflation, outlined earlier, the simulation results suggest that a devaluation is stagflationary. That is, the decrease in output and the increase in prices following a devaluation seem to lend support to the structuralist hypothesis that a devaluation is both contractionary and inflationary. More specifically, the increase in tax revenue and the low government marginal propensity to spend out of tax receipts[24] and the decrease in investment and consumption expenditures are all consistent with the hypothesis that a devaluation is likely to contract aggregate demand. Similarly, a devaluation affects imported inputs directly and domestic inputs indirectly via capacity utilization. Both effects lead to a contraction of the aggregate supply and hence a decrease in output, again suggesting a contractionary devaluation, at least in the short run.

In summary, 'orthodox' economic theory predicts that a devaluation is expected to have an expenditure-switching (from foreign to domestic goods) and expenditure-reducing (decrease in import demand) effects. Both effects work to improve the current account balance. For devaluation to be effective, of course, it must be accompanied by appropriate macroeconomic policies. These policies include restrictive monetary and fiscal policies such that the effect of devaluation is not neutralized or nullified by an increase in the price level. All the relevant indicators, but particularly the prevalence of a significant black market premium for foreign exchange, and the fact that the real exchange rate is consistently higher than the nominal exchange rate, suggest that the Ethiopian currency (birr) was misaligned, specifically overvalued.

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[24]The estimated equation for changes in government expenditure due to changes in tax revenue indicates: $\Delta RG / \Delta IT = 0.32892$.

Therefore, devaluing the currency or implementing any other corrective measures such as disinflationary policies, tax/subsidy mix, to correct the existing disequilibrium was long overdue. The results of this study suggest that such a measure would indeed improve the current account balance, but would decrease output growth, employment and hence consumption and investment, among other things.

An important implication of these results is that an improvement in the current account balance, while output and employment are decreasing, suggests that such improvement is due to the expenditure-reducing rather than the expenditure-switching effect of a devaluation, as argued by the structuralist school. Such a reduction mainly falls on imported intermediate inputs and consumption goods. Given the subsistence nature of the economy and the low elasticity of substitution between domestic and foreign inputs, the respective impacts on the supply of basic food items and on the supply of intermediate inputs (and hence future economic growth) are likely to be of some policy concern. This will indeed be the case, unless the liberalization policies that are underway and the inflow of foreign capital (from private investors and the international agencies) are able to neutralize the above negative effects by stimulating output.

5.4. THE IMPACT OF CHANGES IN MILITARY EXPENDITURES

As discussed in detail in Chapter Three, the military government which took power in 1974 was preoccupied with winning the internal war that had been going on for about 15 years. Consequently, military expenditures significantly increased between 1975-1987 both in absolute value and relative to the all-Africa average. The size of the armed forces, measured in terms of

per 1000 inhabitants, increased from 1.6 in 1974 to 6.4 in 1987 (or by 300 percent), while the respective increase for the all-Africa average was from 2.8 to 3.2 (a rise of 14 per cent).

Such significant increases in military expenditures in many LDCs have attracted the attention of economists in recent years. In particular, this interest gained momentum following Benoit's 1978 study regarding the relationship between defense spending and economic growth. In this study, Benoit (1978, P. 271) concluded that, "[c]ontrary to my expectations, countries with a heavy defense burden generally had the most rapid rate of growth, and those with the lowest defense burden tended to show the lowest growth rates". This conclusion, according to Grobar and Porter (19[illegible] p. 318), "[s]hocked development economists by presenting positive cross-country correlations between military expenditure rates and economic growth rates in less developed countries (LDCs)". Consequently, scrutiny of the methodology and the results of the study intensified. Specifically beginning the early 1980s, various studies have examined whether such an allocation of resources negatively affects the performance of the economies or not, and if so to what extent. Such studies include: Lim (1983), Frederiksen and Looney (1983), Nabe (1983), Faini, Annez and Taylor (1984), Deger (1986), Weede (1986) Gyimah-Brempong (1989a), Grobar and Porter (1989), Stewart (1991) and Grobar and Gnanaselvam (1993), to name a few. These and most other similar studies are carried out using cross-section data (multi-country studies), and focus on the impact of military expenditures on economic development. But as Chan (1985, p. 35) in his survey of the literature noted, "[t]here are definite limits in the extent to which cross-sectional analyses of aggregate data can inform us about the complex causal interactions that characterize the relationship between military spending and economic performance". That is, in addition to multi-country tests, country-specific interactions between

defense spending and other economic aggregates are required. In contrast to most studies, therefore, this study has two main objectives: To examine the effect of military expenditures on output growth and other macroeconomic aggregates using a specific country data set, and to asses a possible trade-off between military expenditures and social programs, especially expenditures on health and education.

To examine the above issues the basic model is re-simulated by incorporating the following changes: (1) real military expenditures are kept at its 1973 level and any deviation from this level is treated as additional injection to the supply of goods and services; and (2) the size of the armed forces is also kept at its 1973 level, and the additional members of the armed forces are included as part of the total labor force.[25] The main objective of the policy design is then to answer the question of how the economy would have performed had the government kept its military expenditures and the size of its armed forces at their 1973 level. It should be noted that the per capita GNP weighted military expenditures, as ratios of GNP and total central government budget, were much higher in Ethiopia relative to the all-Africa average even in 1973. An increase in military expenditures above the 1973 level, therefore, should suggest that military expenditures in Ethiopia was excessive, on a GNP per capita basis, even by African standards, which are considered relatively high.[26]

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[25]Including the excess military personnel into the labour force may seem to contradict the common assumption of excess supply of labour in such economies. But since most of the people called for military service were the most productive members of the work force and whatever underemployment that might have existed was adjusted by capacity utilization, any additional recruitment for military service should represent a decrease in the effective labour force - especially in the non-agricultural sector.

[26]For instance, according to Sivard (1985, p. 14), military expenditures as a percentage of GNP for Latin American countries was only 1.32 per cent of GNP, which is lower than the all-

A positive increase in any endogenous variable as a result of the incorporated changes would indicate that the increase in military expenditures after 1974 had a negative impact on the endogenous variables concerned. A comparison of the basic simulation (control run) and the results obtained after incorporating the above changes are summarized in Tables 5.7 to 5.9.

As can be seen from Table 5.7, a reduction in military expenditures and the size of the armed forces would have increased, on average, total output (RY) and sectoral outputs (agricultural output - RAO, and manufacturing output - RMO). Consequently, private consumption (RC) and investment expenditures (RI), in Table 5.8, would have also increased. For instance, manufacturing output, agricultural output and total output would have increased, over the sample period, by about 0.3, 0.1 and 0.75 per cent per annum, respectively, if the size of the armed forces and the ratio of military expenditures to total output had been maintained at their 1973 levels. Private consumption and investment would also have increased by 0.75 and 0.6 per cent, respectively. This is because reductions in military expenditures and the size of the armed forces affect the output sector by increasing the capital available for investment purposes and adding to the labor force engaged in production. It is worth noting that the increases in output due to an increase in the labor force, both expressed as per unit of capital, are modest. This indicates that labor shortage is not a serious problem for such economies.

With regard to the possible trade-off between military expenditures and social programs, both expenditures on education and health (as ratios of GDP) would have been higher if military expenditures had been kept at the 1973 level. As indicated by the negative relationship between military expenditures and expenditures on education and health (equations

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Africa average reported above.

Table 5.7. THE IMPACT OF DEFENCE EXPENDITURES

THE IMPACT OF REDUCTIONS IN MILITARY EXPENDITURES							
DEVIATIONS FROM CONTROL RUN - %							
YEAR	CUR	RAO	RMO	RY	IT	RMCD	RMCND
1973	-0.02	0.00	0.25	-0.03	-0.22	0.00	0.00
1974	-0.01	0.02	0.29	0.06	-0.05	-0.01	0.00
1975	0.21	0.02	0.39	0.34	1.93	0.01	0.00
1976	0.07	0.05	0.20	0.32	0.73	0.10	0.01
1977	0.25	0.11	0.49	0.90	2.25	0.13	0.01
1978	0.99	0.11	0.98	1.76	8.21	0.29	0.02
1979	0.75	0.12	0.32	1.50	6.82	0.61	0.04
1980	0.53	0.11	0.26	1.20	5.44	0.67	0.04
1981	0.23	0.11	0.11	0.81	3.31	0.55	0.04
1982	0.17	0.11	0.26	0.71	2.59	0.40	0.03
1983	0.19	0.08	0.26	0.56	2.37	0.31	0.02
1984	0.08	0.12	0.20	0.54	1.42	0.25	0.02
1985	0.21	0.15	0.25	0.73	2.24	0.22	0.02
1986	0.49	0.14	0.30	0.97	3.81	0.27	0.02
1987	0.50	0.17	-0.05	0.95	3.85	0.37	0.02
AVERAGE	0.31	0.09	0.30	0.75	2.98	0.28	0.02

Table 5.8. THE IMPACT OF DEFENCE EXPENDITURES

THE IMPACT OF REDUCTIONS IN MILITARY EXPENDITURES							
DEVIATIONS FROM CONTROL RUN - %							
YEAR	RC	RI	RGEE	RGEH	RG	P	RXCOF
1973	-0.02	-0.10	-0.56	4.52	-0.02	0.18	-0.08
1974	0.06	0.00	7.20	11.61	0.02	0.11	-0.05
1975	0.31	0.92	14.30	18.04	0.13	-1.54	0.71
1976	0.30	0.21	21.43	24.45	0.09	-0.46	0.21
1977	0.87	1.17	44.45	44.81	0.18	-1.74	0.80
1978	1.74	1.11	90.13	84.08	0.23	-7.51	3.33
1979	1.52	1.01	128.36	116.02	0.07	-6.58	2.94
1980	1.23	0.50	143.57	128.52	0.03	-5.32	2.40
1981	0.81	0.35	137.58	123.60	0.07	-3.07	1.40
1982	0.70	1.07	138.82	124.63	0.10	-2.28	1.05
1983	0.56	0.65	136.62	122.82	0.06	-2.17	1.00
1984	0.52	0.52	140.03	125.62	0.10	-1.09	0.51
1985	0.70	0.37	134.44	121.03	0.14	-1.81	0.83
1986	0.97	0.52	133.70	120.42	0.10	-3.52	1.61
1987	0.93	0.41	141.94	127.18	0.13	-3.43	1.57
AVERAGE	0.75	0.58	94.13	86.49	0.10	-2.68	1.22

Table 5.9. THE IMPACT OF DEFENCE EXPENDITURES

THE IMPACT OF REDUCTIONS IN MILITARY EXPENDITURES							
DEVIATIONS FROM CONTROL RUN - %							
YEAR	RX	RXHK	RXOSN	RMNT	RGUN	RMFL	CA
1973	-0.03	-0.18	-0.22	0.25	0.00	-9.76	6.88
1974	-0.02	-0.11	-0.14	0.32	-66.47	-18.55	136.63
1975	0.26	1.53	1.87	0.38	-74.50	-25.38	-58.30
1976	0.08	0.46	0.56	-0.08	-89.16	-31.30	824.03
1977	0.30	1.72	2.11	0.40	-97.12	-45.79	157.64
1978	1.25	7.03	8.55	0.53	-97.12	-62.74	158.17
1979	1.10	6.22	7.57	1.30	-97.63	-70.99	154.43
1980	0.89	5.09	6.20	1.02	-97.39	-73.44	186.47
1981	0.52	3.00	3.66	-0.86	-97.39	-72.53	197.42
1982	0.39	2.25	2.75	-0.23	-97.39	-72.73	202.45
1983	0.37	2.14	2.61	-0.15	-95.51	-72.39	-2416
1984	0.19	1.09	1.33	-0.14	-97.39	-72.92	212.41
1985	0.31	1.79	2.19	0.08	-98.45	-72.03	126.70
1986	0.60	3.43	4.18	0.08	-98.45	-71.91	150.82
1987	0.58	3.34	4.08	0.48	-98.84	-73.20	134.35
AVERAGE	0.45	2.59	3.15	0.22	-86.86	-56.38	11.58

12 and 13), military expenditures were increased at the expense of social programs (education and health, in this case). As indicated in Table 5.8, expenditures on education (RGEE) and on health (RGEH) would have increased, on average, by about 94.1 per cent and 86.5 per cent, respectively, over the simulation period. The significant portion of the increase in military expenditures could not be financed without sacrificing other government programs, especially programs with relatively large budget shares like education and health. Further, a reduction in arms imports (RGUN in Table 5.9) in the mid-1970s would have had a significant positive impact on the current account balance. The current account balance (CA in Table 5.9) would have improved by about 11.6 per cent, on average, if the government had kept its military expenditures at its 1973 level. This result probably is not surprising since most of the arms, vehicles and other related army requirements are imported. More specifically, a reduction in military expenditures would have decreased arms imports and imports of fuel (RMFL in Table 5.9) by 86.9 and 56.4 per cent per annum, respectively, while all exports would have slightly increased on average, over the simulation period. The increase in exports is due to an increase in excess supply, which reduces the supply and demand gap, which in turn decreases domestic prices leading to an increase in the real exchange rate (depreciation).

To put the above results in context, a brief review of similar studies is in order. Despite various efforts, the evidence regarding the net impact of military spending on economic growth to date is mixed, at best. For instance, among the above cited studies, Benoit (1978), Frederiksen and Looney (1983), Weed (1986), and Stewart (1991) concluded, using a single equation model and multi-country data, that there is a positive and, in many cases significant, relationship between defense spending and economic growth. The main arguments given to defend these

results are based on the familiar Keynesian explanations and technological spin-offs. That is, an increase in military expenditures leads to an increase in demand and hence to an employment of otherwise idle resources. Further, since the military sector is more modernized relative to other sectors in LDCs, this will lead to an increase in skill level and other positive externalities to the economy at large. Studies by Lim (1983), Faini, Annez and Taylor (1984), Deger (1986), Gyimah-Brempong (1989a), and Grobar and Porter (1989), on the other hand, indicate negative relationship between military expenditures and economic growth. According to the last set of studies, the main reason why economic growth and defense spending are negatively related is due to the opportunity cost of allocating scarce government resources for military purposes, instead of say for investment and other foreign exchange-starved sectors.

It should be noted that one cannot directly compare the results. One of the few exceptions to this approach is the study by Grobar and Gnanaselvam (1993), which examined the effects of defense spending on the Sri Lankan economy. Using Sir Lankan data from 1960 to 1988, they estimated the effect of military spending on investment. On the basis of their estimates, Grobar and Gnanaselvam (1993, p. 403) concluded that, given a fixed incremental capital-output ratio (ICOR) of 2.5, a 3.8 percentage point increase in military spending would lead to a 5.5 and 2.2 percentage points decline in investment to GDP ratio and in GDP, respectively. Clearly, the results obtained in this study are qualitatively similar to that of Sri Lanka, and the impact of military spending on the growth of output, in particular, is of the same order of magnitude.

Among the above cited studies, that of Nabe (1983) and Gyimah-Brempong(1989a) deserve special attention due to their focus on the African economies. Both studies used cross-sectional data of African countries. The methodologies used, sample period and country coverage,

however, differ. Nabe (1983) used co-variation and path analysis to test the relationship between military expenditures and economic development over the sample period between 1967 to 1976. On the basis of pooled data of 26 African countries, Nabe (1983, p. 584) concluded that, "[t]here is a repeated absence of co-variation between military expenditures and economic development...[therefore] the weight of our statistical evidence is contrary to the proposition that military expenditures have a positive effect on development". Gyimah-Brempong's study is extensive both in terms of country coverage (39 African countries) and the length of sample period (1973 to 1983) as compared to that of Nabe (1983). Gyimah-Brempong (1989a) estimated a four equation simultaneous model using the three stage least square method with defense burden (military expenditures to GDP ratio) as one of the explanatory variables. His results indicate that a unit increase in military expenditures would have a negative multiplier impact of 0.12 on GDP. Gyimah-Brempong (1989a, p. 79), therefore concluded that, "[t]he implication of this result is that African countries cannot use increased defence spending to simulate economic growth because there is a trade-off between high defense burden and economic growth".

Studies that have examined the trade-offs between military expenditures and social programs are relatively limited, particularly in the less developed countries. In the African context, Gyimah-Brempong (1989b) examined a possible trade-off between defense spending and social expenditures (expenditures on education, health, housing and other social services) using a utility maximization model and three stage least square estimation technique. His study covered 20 Tropical African countries over a 10 year period (1973-1983). The estimated results indicate that there is a significant budgetary trade-off between military and social expenditures. That is, an increase in military expenditures negatively affects spending on social expenditures.

In the context of the above reviewed studies the following points are worth highlighting. First, the results of this study are consistent with the studies that found a negative relationship between military expenditures and economic growth and with those that found a trade-off between defense spending and social programs. This is particularly true in the case of studies that used African data exclusively. Second, military expenditures in Ethiopia exceeded that of African average by a wide margin, particularly since the mid 1970s, while its GDP per capita and its growth were among the lowest in the continent. It is not surprising, therefore, that military expenditures in an economy with limited resources would have an adverse effect on economic growth and a significant trade-off in terms of other social programs. The policy implication of the above results is obvious. To the extent that military expenditures adversely affect economic performance, at least in the least developed countries, governments may have to rearrange resource allocation priorities away from defense expenditures. This is particularly essential in countries like Ethiopia where military expenditures increased at the expense of investment in human capital (education) and health facilities.

5.5. THE NET IMPACT OF COMBINED POLICY CHANGES

Finally, the three policies discussed above are combined to examine their likely net effect had they all been implemented in the mid-1970s. That is, given the impact of each policy experiment implemented separately, what would have been the net impact of the policy interactions had all the policies been introduced as a total package in the mid-1970s? To answer this question, the basic model is re-simulated by incorporating the changes discussed in sections

Table 5.10 NET COMBINED POLICY EFFECT

NET IMPACT OF COMBINED POLICES							
DEVIATIONS FROM CONTROL RUN - %							
YEAR	RY	RC	RI	P	RX	RMNT	CA
1973	-21.73	-22.58	-19.14	29.49	41.13	-29.06	724.03
1974	-20.77	-20.07	-14.33	32.00	42.84	-17.45	312.73
1975	-8.85	-9.27	-6.53	35.32	42.73	-16.36	20.60
1976	-5.09	-5.34	-11.22	29.35	44.19	-28.85	546.23
1977	0.97	0.91	-9.73	27.79	40.69	-20.38	221.55
1978	7.47	6.69	-7.66	30.34	34.24	-1.93	205.33
1979	12.78	11.86	-7.23	26.51	33.75	-12.58	205.99
1980	16.54	15.24	-7.71	26.77	36.03	-17.30	225.20
1981	15.59	14.10	-11.69	29.65	43.43	-28.41	266.01
1982	16.89	15.28	-12.45	34.11	47.24	-33.41	279.32
1983	19.28	17.43	-12.83	38.75	51.21	-30.57	-2192.30
1984	21.07	19.11	-15.05	41.34	57.04	-42.61	304.32
1985	23.39	21.38	-15.18	33.55	47.75	-38.39	209.71
1986	32.11	29.81	-12.19	27.91	38.97	-29.65	230.98
1987	40.12	36.96	-9.90	16.99	28.90	-30.79	215.66
AVERAGE	9.85	8.77	-11.52	30.66	42.01	-25.18	118.36

5.2., 5.3, and 5.4 all at the same time. The results of the exercise for selected variables are summarized in Table 5.10.

As can be seen from Table 5.10, the net effect of the policies on real total output (RY) and hence on consumption expenditures (RC) would have been positive. That is, the negative impact of the devaluation would have been dominated by the positive effects of the other sets of policies. Investment expenditures (RI), on the other hand, would have decreased if the three policies had been implemented in the mid-1970s. This is mainly due to the dominant negative impact of the devaluation. That is, the positive impacts of the structural change and reductions in military expenditures on investment expenditures would have been insignificant relative to the negative impact of the devaluation. On average, real total output (RY) and consumption expenditures (RC) would have increased by 9.9 and 8.8, percent per annum, respectively, while investment expenditures (RI) would have decreased by 11.5 percent during the simulation period.

Similarly, the price level (P) and total exports (RX) would have increased, while imports of intermediate inputs (RMNT) would have decreased, had the three policies been jointly implemented in the mid-1970s. In all these cases, the effect of the devaluation on these variables is the strongest. Consequently, both qualitatively and quantitatively, the net effect on these variables is dominated by effects of the devaluation. The net increase in exports and the decrease in most imports, therefore, would have improved the current account balance (CA in Table 5.10). The current account balance would have improved under each policy experiment implemented separately. It is not surprising, therefore, that implementing the combined policies would have also improved the current account balance. More specifically, as can be seen in Table 5.10, total exports (RX) would have increased, while imports of intermediate inputs (RMNT) would have

decreased, by 42 and 25 per cent per annum, respectively. And the current account balance (CA) would have been improved by about 118 per cent per annum over the simulation period, if the three policies had been implemented in the mid-1970s.

APPENDIX D: POLICY SIMULATION, 1973-1987

In section 5.2 the impact of changes in policy in the mid 1970s were reported in Tables 5.1 to 5.3. Those results were based on the comparison between the coefficients of the entire sample and those of the short sample (1961-1974). Due to the small number of observations, a small sample bias might have corrupted the simulation results. As an alternative to this approach, the model is simulated with following changes. First, the basic model covering the entire sample period is simulated with the dummy variable set to zero to account for the regime of no change in policy. Second, the same model is again simulated with the dummy variable set to one to account for the policy shifts. The difference between these set of results indicates the impact of the changes in policy. The results are reported in Tables 5.1a, 5.2a, and 5.3a, below.

As could be seen from the average impact of the policy change on each variable, the results in terms of magnitude and direction of change are, on the whole, comparable to Tables 5.1 to 5.3, reported in the main text. The main difference seems in the behavior of the variables over the simulation period. Since only dummy variables are changed in this specification, the simulation results are smoother (with less volatility both in terms of changes in sign and magnitude over successive years) than the alternative specification reported in Section 5.2. Some of the outliers, however, persisted in both cases: see CA in Table 5.2a in 1976 and 1983.

The impacts of the policy on each variables could be read from the respective tables, but it is worth summarizing the results reported in this appendix compared to those reported in Tables 5.1 to 5.3. First, as is clear from the averages, the impact of the policy in both cases fall within a reasonably close range for most variables. The variables that are significantly different from

the previous results are imports of intermediate inputs (RMNT), arms imports (RGUN), and the current account balance (CA), reported in Table 5.3a. It should be noted that CA is a residually determined variable. It is, therefore, reflecting the cumulative changes in all the import and export

Table 5.1a THE IMPACT OF STRUCTURAL CHANGE

THE IMPACT OF THE MID-1970s POLICY SHIFT							
DEVIATIONS FROM NO CHANGE IN POLICY - %							
YEAR	CUR	RAO	RMO	RY	IT	RMCD	RMCND
1973	0.88	-1.41	2.65	8.76	10.86	0.00	0.00
1974	1.28	-1.27	3.05	12.77	13.05	1.46	0.05
1975	1.48	-1.17	3.33	14.75	15.13	3.04	0.37
1976	1.59	-1.08	3.54	15.87	14.35	3.68	0.51
1977	1.66	-1.01	3.65	16.55	13.35	4.02	0.59
1978	1.71	-0.94	3.77	17.13	14.89	4.48	0.93
1979	1.76	-0.89	3.85	17.55	14.71	4.82	1.21
1980	1.79	-0.84	3.90	17.86	15.10	5.12	1.48
1981	1.80	-0.80	3.92	17.97	15.79	5.16	1.43
1982	1.80	-0.77	3.97	18.02	16.33	5.17	1.42
1983	1.80	-0.74	3.98	18.00	16.60	5.10	1.33
1984	1.79	-0.71	3.98	17.89	16.31	4.90	1.09
1985	1.79	-0.69	3.85	17.86	16.32	4.77	0.96
1986	1.79	-0.66	3.91	17.92	15.91	4.82	1.04
1987	1.80	-0.64	3.86	18.00	16.76	4.91	1.13
AVERAGE	1.65	-0.91	3.68	16.46	15.03	4.10	0.90

variables between the two specifications. A possible reason why the impact of the policy changes on arms imports is less in this case than the results based on the shorter sample might be the failure of the dummy variable to capture the whole effect of the policy change. The reason for the relatively larger effect of

policy change on imports of intermediate inputs is, however, due to the slightly higher impact of the policy change on capacity utilization rate - CUR in Table 5.1a, which affects RMNT via the fixed capital stock.

Table 5.2a THE IMPACT OF STRUCTURAL CHANGE

THE IMPACT OF THE MID-1970s POLICY SHIFT							
DEVIATIONS FROM NO CHANGE IN POLICY - %							
YEAR	RC	RI	RGEE	RGEH	RG	P	RXCOF
1973	5.44	1.64	0.16	2.55	2.65	0.00	0.00
1974	9.48	3.24	0.32	0.78	3.10	-0.12	0.03
1975	11.69	4.12	0.41	0.33	3.42	-0.04	0.01
1976	13.02	4.64	0.46	0.17	3.27	0.01	0.00
1977	13.88	4.97	0.50	0.11	3.08	0.03	-0.01
1978	14.38	5.21	0.52	0.09	3.27	0.23	-0.06
1979	14.84	5.40	0.54	0.06	3.17	0.40	-0.10
1980	15.16	5.55	0.55	0.05	3.18	0.55	-0.14
1981	15.23	5.62	0.56	0.02	3.30	0.52	-0.13
1982	15.24	5.66	0.57	0.01	3.39	0.51	-0.13
1983	15.20	5.71	0.57	0.00	3.46	0.46	-0.12
1984	15.10	5.71	0.57	-0.02	3.47	0.31	-0.08
1985	15.05	5.71	0.57	-0.01	3.51	0.23	-0.06
1986	15.12	5.59	0.56	0.01	3.42	0.28	-0.07
1987	15.14	5.63	0.56	0.01	3.54	0.34	-0.09
AVERAGE	13.60	4.96	0.50	0.28	3.28	0.25	-0.06

Second, despite different coefficients that are obtained from two different estimation techniques - 2SLS in this case and a combination of Cochrane-Orcutt and 2SLS methods in the first case, the qualitative impact of the policy remains the same, even for the variables that indicate different magnitudes.

Table 5.3a THE IMPACT OF STRUCTURAL CHANGE

THE IMPACT OF THE MID-1970s POLICY SHIFT							
DEVIATIONS FROM NO CHANGE IN POLICY - %							
YEAR	RX	RXHK	RXOSN	RMNT	RGUN	RMFL	CA
1973	0.00	0.00	0.00	8.30	-3.33	0.00	6.08
1974	0.02	0.12	0.15	-2.84	-3.45	2.23	3.95
1975	0.01	0.04	0.05	-6.49	-11.01	2.40	6.73
1976	0.00	-0.01	-0.01	-8.13	-1.40	2.40	75.32
1977	-0.01	-0.03	-0.04	-9.15	-1.55	2.42	-1.55
1978	-0.05	-0.23	-0.29	-9.58	-2.33	1.58	-1.56
1979	-0.08	-0.39	-0.49	-10.04	-0.37	0.86	-1.89
1980	-0.11	-0.54	-0.67	-10.42	-1.70	0.23	1.87
1981	-0.10	-0.50	-0.63	-10.72	-1.15	0.42	4.57
1982	-0.10	-0.50	-0.62	-10.76	0.34	0.46	5.17
1983	-0.09	-0.45	-0.57	-10.93	-0.11	0.68	38.65
1984	-0.06	-0.31	-0.39	-11.01	-2.45	1.35	6.98
1985	-0.05	-0.23	-0.29	-11.22	-7.31	1.71	2.60
1986	-0.06	-0.28	-0.35	-10.66	-3.11	1.47	2.86
1987	-0.07	-0.33	-0.42	-10.86	-2.56	1.22	2.75
AVERAGE	-0.05	-0.24	-0.31	-8.30	-2.77	1.30	10.22

APPENDIX E

Table 5.11 THE IMPACT OF DEVALUATION

THE IMPACT OF CHANGES IN THE EXCHANGE RATE							
DEVIATIONS FROM CONTROL RUN - %							
YEAR	CUR	RMO	RY	P	RX	RMNT	CA
1980	1.6	3.6	-5.5	35.4	37.3	-31.0	54.6
1981	2.6	-5.0	-7.3	25.2	47.6	-27.3	41.8
1982	4.6	-4.3	-8.4	17.8	55.0	-31.5	45.9
1983	-2.4	-0.8	-11.7	23.3	61.6	-38.3	40.3
1984	-6.4	1.7	-7.2	21.3	69.3	-35.9	39.0
1985	-5.9	-4.2	-6.7	26.4	61.5	-15.8	43.3
1986	-7.7	-1.7	-7.3	20.7	51.4	-21.4	55.3
1987	-7.6	0.4	-6.1	4.8	41.8	-13.4	60.0
AVERAGE	-2.6	-1.3	-7.5	21.9	53.2	-26.8	47.5

6. SUMMARY AND CONCLUSIONS

The objective of this study has been to build a macroeconometric model of Ethiopia which is a small, open, subsistence economy. The model is intended to reflect and summarize the essential features of the economy, and on that basis, to provide a quantitative framework to address various policy issues.

The Ethiopian economy, being small and open, is vulnerable to external shocks. Such shocks limit both the volume and the value (terms of trade) of its exports and its imports. Changes in such aggregates determine the economy's ability to secure needed foreign exchange to import required production inputs. Foreign demand for exports and the price of imports thus determine the capacity to import. Availability of imported intermediate inputs determine the rate of capacity utilization in the domestic economy. Further, due to the subsistence nature of the economy, aggregate demand exceeds aggregate supply, more often than not, creating a frequent resource gap. Such excess demand is met with imported goods and in some instances foreign loans and grants. The role of the external sector and its components is, therefore, very important in influencing the performance of the Ethiopian economy, as is the case with many similar economies. These salient features of the economy are incorporated in the model by emphasising the roles of the external sector in general, and the exchange rate and the rate of capacity utilization in particular.

Even though sectoral coverage is limited due to data constraints (in terms of both quality and quantity), an attempt has been made to incorporate the above features into the

model. The model consists of three sectors: Total output, aggregate demand and the external sector. The economic interactions among these sectors are captured by a total of twenty behavioral equations and forty-one identities and definitions.

Model performance, both at a single-equation level (statistical attributes) and whole-system estimation (forecasting performance), is reasonably satisfactory. In addition to acceptable statistical attributes, the number of equations with variables that have unexpected signs and/or unusually high or low coefficients is very small. Furthermore, the relative performance of the model as compared to similar models is also encouraging, given the data limitations and other resource constraints encountered in building the model. The simulation errors of the relevant variables are in most cases comparable or better in this model than in a number of models of similar economies.

The main purpose of examining the structural features, statistical attributes, and forecasting ability of a model is to ascertain its reliability in charting the behavior of the economy under different policy regimes. That is, a model will allow alternative policies to be considered and examine the impact of specific policy shocks on the performance of an economy. Accordingly, the impact of three alternative policies on the performance of the economy in general and on specific sectors in particular were examined in this study. These policies include: The impact of the policies undertaken in the mid-1970s (including nationalization of rural lands and most manufacturing industries), the impact of devaluing the local currency, and the impact of a change in military expenditures. The main results of the policy exercise can be summarized as follows.

1. The impact of policies undertaken in the mid-1970s led to:

   a. Decreases in both total output and manufacturing output but slightly increased agricultural output;
   b. decreased components of domestic aggregate demand;
   c. decreased exports and imports of consumer goods, but increased military imports; and, on balance,
   d. worsened the current account balance.

2. The likely impact of devaluing the local currency is to:

   a. Decrease total and manufacturing outputs;
   b. decrease components of domestic aggregate demand;
   c. increase the price level;
   d. increase exports and decrease imports; and therefore,
   e. improve the current account balance.

3. The impact of reductions in military expenditures is to:

   a. Increase total and sectoral outputs;
   b. increase components of aggregate domestic demand;
   c. increase expenditures on education and health significantly - indicating the existence of a trade-off;
   d. increase exports and decrease arms imports;
   e. improve the current account balance.

If the three policies had been simultaneously implemented in the mid-1970s, the net effect on real GDP, and hence on most components of aggregate demand, would have been positive. This is despite the negative impact of devaluation on real output and on most components of aggregate demand. Similarly, most imports would have decreased, while most exports would have increased as a result of the combined effects of the above policies. Therefore, due to the increase in exports and the decrease in most imports, the current account balance would have improved. Such an improvement would have come mainly from a reduction in military imports.

Despite the relatively satisfactory performance of the model, however, the study faces shortcomings, mainly related to level of sectoral coverage. The most obvious weaknesses of the study, at a sectoral level, are the inadequate treatment of the monetary sector, the labor market and the capital account. First, for reasons discussed earlier, the linkages between the monetary and the real sectors are weak. Consequently, no relevant monetary policy issues were addressed. For instance, the impacts of inflationary tax, and/or deficit financing on the price level and other sectors of the economy are not examined. Second, the treatment of the labor market is inadequate since it does not determine the demand and supply of labor at a sectoral level, except in the two sectors (agriculture and manufacturing). Consequently, the question of unemployment is completely ignored even at a national level. And third, the treatment of the capital account is inadequate since no account is made of the level of capital flow, the debt burden and its relationship to domestic monetary and fiscal policies.

In addition to the above limitations, some of the estimates are not at a disaggregated level enough to shed sufficient light on some important issues. Such aggregates include: Investment expenditures, government expenditures and the price level. For instance, no distinction was made between public and private investment even though the determinants of the two sub-categories may not be the same. Similarly, despite the significant role of the government in such economies, important sub-sectors such as public enterprises, and policy tools such as taxes are not sufficiently incorporated in the model. Finally, the treatment of the price level is inadequate since no sectoral prices are estimated. Using the consumer price index instead of sectoral prices probably distorts the output-price relationship of sectors that do not follow the general trend of price movements.

Despite the above limitations, the model provides some insight about the structure of the Ethiopian economy and the implications of some policy measures. It sheds some light on the production and demand structures of the economy and it provides some quantitative magnitudes of their relationships. For instance, the model highlights the disproportionate influence of the agricultural sector in determining the overall performance of the economy directly (because of its relative size), and the performance of the other sectors indirectly (as a source of foreign exchange). Exports being composed of agricultural produce, poor performance of the agricultural sector leads to scarcity of foreign exchange; and such a scarcity results in shortages of intermediate inputs, raw materials and even food supply. The policy implication of such relationships for development strategy in general and agrarian policy in particular are obvious: First, in such economies, self sufficiency in fulfilling basic needs is predicated on giving priority to the development of the agricultural sector; second, agriculture being the potential source of surplus to finance investment in other sectors, future prospect of economic growth will more likely depend on the success of the attendant agricultural policies. Such policies include: Incentive compatible land tenure system and pricing policies, and a commitment to facilitate the availability of agricultural inputs, such as fertilisers and pesticides. The contribution of this study in this regard is in highlighting the importance and the impact of such policies on the performance of the agricultural sector.

Another policy issues facing economies like that of Ethiopia is deciding on the appropriate value of their currencies. The results of this study suggest that while devaluation is likely to improve the current account balance, it is also likely it will be contractionary. Short of recommending any specific policy, the study provides a quantitative magnitude of

impacts of devaluing the currency on the economy as a whole and on specific sectors. This will help, it is hoped, in weighing against alternative policies and to design policies that would neutralize some of the adverse effects of devaluation if and when it is implemented.

Finally, the study highlights the trade-off between military expenditures and economic growth. Whatever the noneconomic arguments might be, the model highlights the high opportunity cost of military expenditures. The trade-off between military expenditures and social programs suggests that such expenditures cannot be justified on the grounds of stimulating aggregate demand. Such expenditures lead to direct budgetary trade-offs and create supply bottlenecks by competing for the scarce foreign exchange. Excessive military expenditures, therefore, have adverse effects on investment on human capital (education), well-being (health services), and manufacturing output (via intermediate inputs).

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