ADDIS ABABA UNIVERSITY
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MACROECONOMIC POLICY AND POVERTY REDUCTION IN ETHIOPIA:
A General Equilibrium Approach

By

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ABSTRACT

This study presents a case study assessing instructors' provision of written responses to students' business letter writing practices at Admas College, a privately run business college in Addis Ababa.

The goal is to examine, by means of detailed analysis of sample data gathered from 20 students, who are selected by availability sampling and instructors responses handling the course. Two instruments were used. A format with four micro- skills and conditions set for rating the instructors' formative responses against given rating scales was prepared. Then, the results were tabulated and analysed.

The results showed that most of the students' works were rated below adequate standard and only a few of the students works were able to meet required letter writing standards. Then, the instructors written comments were collected and categorised using a format with six categories for which features were specified for characterising the instructors' comments. Using the six categories, the comments were summarised showing categories of clarity, style, form, reorganisation, provision of more information, and provision of less information.

The results showed that a good number of the comments revolved around issues of clarity, style, and form, whereas lesser number of the comments

were to do with issues of reorganisation, provision of more and/or less information. Moreover, it was observed that quite a good number of the comments were either too general to follow, or too strong or harsh, and did not teach or help the students to overcome their writing difficulties. On the other hand, however, significant number of

the comments seems to have met the students' preferences to a certain extent. Based on the finding of the study, some possible recommendations are suggested.

Chapter I

Introduction

1.1 Background

Despite being one of the oldest countries in the world with long-enjoyed independence and diverse cultural heritage, including a potentially huge market ensured by its 67 million people[1], prolonged war, recurrent drought, and bad economic management, among others, have made Ethiopia one of the poorest countries on planet earth. Several studies show that large proportions of its populace still live under abject poverty both in urban and rural areas. According to the Household Income Consumption and Expenditure (HICE) survey conducted by the Central Statistical Authority (CSA) in 1999/00, 45% and 37% of the rural and urban population live under the absolute poverty line, respectively [MoFED (2002)].

After overthrowing the Dergue regime, which adopted a socialist economic policy in most of its 17-year rule[2], the present government has undertaken several economic reforms under the Structural Adjustment Program (SAP), sponsored mainly by the International Monetary Fund (IMF) and the World Bank (WB), which aimed at mitigating the prevailing macroeconomic imbalances and instability, and restoring growth. The key elements of the Program consisted of tight fiscal and monetary policies, devaluation, price deregulation, financial and trade liberalization, and privatization. Moreover, the government has adopted a rural-based long-term strategy of development, Agricultural Development Led Industrialization (ADLI), to achieve higher growth and reduce poverty both in urban and rural areas.

The international community as well has offered unprecedented attention to the fight against poverty by providing poor countries like Ethiopia to benefit from debt reduction facility embodied in what is known as the Enhanced Highly Indebted Poor Countries Initiative (HIPC). As part of the eligibility criteria for participation in the Initiative, the government of

[1] It is an estimate of July 2002 by the Central Statistical Authority (CSA).

(HIPC). As part of the eligibility criteria for participation in the Initiative, the government of Ethiopia has prepared and submitted its Sustainable Development and Poverty Reduction Program (SDPRP) in July 2002. This document shows that the government is planning to fight poverty, inter alia, thorough decentralization, reforming the civil service and the judiciary, and achieving rapid growth and macroeconomic stability mainly by further pursuing those economic reforms it has been undertaking.[3] [Ibid].

1.2 Problem Statement

Though poverty reduction has recently become a new global agenda, there is still an ongoing debate on the policies that should be pursued to attain that same objective [Cashin et al (2001, p.3)]. This is primarily because the impact of macroeconomic polices on poverty is diverse and complex [Lipton and Ravallion (1995)].

One possible channel identified in the literature is the growth effect of macroeconomic polices which in turn would affect poverty [Ames et al (2001, p.2)]. Those who believe the macroeconomic policy-poverty link can only be established through economic growth further advance to confine the role of government, hence public policy, only to promote the latter. Contrary to this view, Lipton and Ravallion (1995) argued that this conclusion does not necessarily follow as the government may intervene in choosing the patterns of growth that are more effective in poverty reduction. Moreover, it is widely believed that macroeconomic shocks can affect the welfare of the society via other mechanisms such as through changes in relative prices, changes in aggregate labor demand, changes in the rates of return on assets, and changes in public transfers. In this regard, there is recent evidence suggesting the possible existence of 'supra-poor' policies that do have direct impact on poverty after their growth effect is taken in to account [Ghura et al (2002)].[4] In fact, recently, the literature on the links between macroeconomic policies and poverty is steadily evolving away from a

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[2] The regime had declared it has changed its policy to a mixed economy one to the end its power.
[3] The macroeconomic strategies incorporated in the SDPRP to achieve the required growth for poverty reduction include reducing fiscal deficit to a 'sustainable level' while monetary policy is geared toward containing inflation and achieving international reserve target.
[4] These include policies that, among others, reduce inflation and promote financial development.

focus on the strong link between economic growth and poverty reduction to explore what policies, beyond growth itself, contribute to poverty reduction [Cashin et al (2001, p.4)].

The debate on the link between macroeconomic policy and poverty is not only centered around the transmission mechanisms through which economic polices affect the poverty status of individuals and households. Actually the controversy further extends to the likely impacts of specific macroeconomic policies on the poverty situation, especially that of the policy packages of the SAP which include devaluation, fiscal contraction, and trade liberalization that are primarily geared towards achieving macroeconomic stability.

Some believe that devaluation of the official exchange rate improves the external competitiveness of the economy which would promote exports, and, hence, bring about growth. This is based on the assumption that as the prices of tradables relative to the non-tradable goods increase, producers will respond by engaging themselves more and more in the export sector. The country's trade balance will also improve as the promotion of exports is accompanied by reduced imports, which will become more expensive after the devaluation. Therefore, it is argued, the resulting economic growth translates into poverty reduction. Nevertheless, there are strong criticisms against this proposition. Accordingly, devaluation will not lead to increased exports due to several structural rigidities that hamper the economies of many developing nations from responding to changes in relative prices. In addition, as a significant share of the imports of a typical developing economy consists of necessities and capital goods, demand for imports is price inelastic. Thus, not only is devaluation ineffective in improving the current account balance but it is also an important source of inflation in the domestic economy which erodes the income of the poor. Besides, it adversely affects the poor because the poor may not be net producers of tradables, the price of which devaluation increases [Lipton and Ravallion (1995); Sahn et al (1997)].

Proponents of orthodox stabilization policies also perceive the economic ills of many developing nations as arising from excess aggregate demand over supply. They regard huge fiscal deficit to be a root cause of high inflation, crowding out of private investment, macroeconomic instability, and, in general, lower economic growth. As a result, they call for

reduced government expenditure to redress such phenomena. However, some say that reducing government expenditure will hurt the poor as pro-poor expenditure, such as on the social sector, is likely to be curtailed in the process. The fact that the poor are usually politically powerless[5] will also mean that much of the expenditure cut will be in the areas which benefit the poor. It follows from this argument that the incidence of the poverty increases during fiscal adjustment [Sahn et al (1997)].

Regarding trade liberalization, the proponents argue that liberalizing the external sector helps positively in attacking poverty, principally through its growth impact brought about by larger volumes of exports, not to mention the lower prices of imported commodities consumers would be allowed to enjoy. In addition, they contend that trade liberalization increases the profits in the tradable sector and, as a result, benefits the poor from increased wages and employment. Nonetheless, some point out flaws in the argument. To begin with, lifting the protection of local industries may result in their collapse as they could not compete with lower prices of imported substitutes, thus adversely affecting people employed in those industries. Furthermore, lower government revenue because of lower foreign trade taxes may cause unemployment in the public sector along with a consequent reduction in public investment. On top of that, the poor may not take advantage of the opportunity created by trade liberalization because of lack of skill or capital. In a related manner, it is argued that if complementary policies and appropriate infrastructures are not in place, trade liberalization will not be effective in achieving its goals [McCulloch et al (2001); Rutherford and Tarr (1998); Kydd et al (2002)]

1.3 Objectives of the Study

The general objective of the study is to investigate the impact of trade, fiscal, and, exchange rate policies on the poverty situation in Ethiopia. More specifically, the study attempts to:

1 analyze the impact of reduction in import tariffs (trade liberalization) on the poverty status in both urban and rural areas of the country;

[5] In fact, as discussed in the following chapter, poverty has various dimensions among which powerlessness or

2 examine how devaluation affects urban and rural households;

3 investigate how aggregate reduction in government consumption expenditure may affect the welfare of individual households.

1.4 Methodology and Data Source

A simple non-dynamic Computable General Equilibrium (CGE) model is employed in this study to achieve the goals described above. The underlying Social Accounting Matrix (SAM), which provides initial values for variables and parameters in the model, is taken from Ayele (2000) with 1996 as its base year. Few other parameters are econometrically estimated. Before conducting simulations in the CGE, the Generalized Quadratic and Beta Lorenz functions are estimated from the Household Income Consumption and Expenditure survey conducted by the Central Statistical Authority (CSA) in 1995/96. The Foster-Greer-Thorbeck (FGT) decomposable classes of poverty indices and the mean income elasticities of these indices are as well derived from the Lorenz curves. Subsequently, simulation exercises of devaluation, import tariff reduction, and aggregate reduction in government consumption expenditure are undertaken, with particular focus on the impact of these macroeconomic policies on the incomes of the representative urban and rural households. By assuming intra-group income distribution to remain the same after each macroeconomic shock, the poverty-impact of the specific macroeconomic policies is analyzed.

1.5 Limitations of the Study

Explicitly mentioning the limitations of the study helps to cautiously judge the findings that come out from the analysis. With this view, two drawbacks of the study are worth looking at.

1 Only two households groups, namely urban and rural, are identified in the model. Needless to say, each group is comprised of various heterogeneous sub-groups and, hence, more meaningful poverty analysis can be made by further disaggregating each household group.[6] The fact that we do not have an official SAM at all and due to the

being voiceless is one.

[6] The idea is that the impact of a certain macroeconomic policy on different subgroups, say, in the rural household group, may vary greatly. However, when we regard the rural household group as homogeneous we

unavailability of any such matrix that has more than these two household groups leaves us with no option than getting along with what is currently existing.[7]

2 Though inter-group income inequality is addressed, within group income inequality is assumed to remain the same in estimating the mean income elasticities of the various poverty indices[8].

1.6 Significance of the Study

There are several poverty-related studies conducted in Ethiopia in recent times, mainly because of the accessibility of data from the various household surveys recently made available.[9] However, most of them are essentially done at micro level and did not attempt to integrate the macroeconomic policymaking and their impact on the poverty status at household level.[10] This study makes a humble attempt to fill this gap by investigating the link between public policies and household welfare.

Moreover, one of the unique features of this study from poverty-related studies conducted so far is the methodology employed. As stated earlier, in an attempt to analyze the link between macroeconomic policies and poverty within a general equilibrium framework, it makes use of a simple CGE model. The CGE models so far available for Ethiopia include the ones developed by the then ONNCP (now MoFED) in collaboration with the University of Oxford and a recently developed 1-2-3 model (one country, two sectors, and three commodities) by the World Bank in 1998. The first model was based on a SAM taking year 1987 as its base

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can only see the average impact of the policy on the group by ignoring what is going on within the various sub-groups.

[7] Constructing one is of course an option. Yet I found it infeasible to construct a SAM and implement a CGE within a period of less than a year.

[8] However, the assumption of distributionally neutral growth is justifiable to some extent.. As a matter of fact, much of the recent evidence on poverty-growth relationship rejects any systematic link between the two. Some studies also reveal the income of the poor to rise directly proportional to the mean income of the population [e.g. Dollar and Kraay (2001)]

[9] These include the household income, consumption and expenditure surveys conducted by Addis Ababa University (AAU) and the CSA.

[10] Among these Abbi Mamo (1996), Abebe Shimeles and Bereket Kebede (1995), Mekonen Taddesse (1996), and Bereket Kebede and Abebe Shimeles (1997) can be mentioned.

year (when the country was following a command economy), and only disaggregated the agricultural sector in a relative detail while treating the remaining sectors as a single one. The latter model is a highly aggregated one and does not allow any study aiming at establishing a macro-micro link. There is, however, a recent rural-urban CGE model developed for Ethiopia by Ayele (2000) which can be used for such purposes. Though the model employed in the present study is a simple one, it will hopefully serve as a starting point towards building a full-fledged CGE model for Ethiopia.

Furthermore, the study will contribute to the on-going debate regarding the impact of fiscal policy, devaluation, and trade liberalization on the poor. Besides, the fact that it plans to address a very topical issue will have a limited contribution in identifying those polices that are effective in reducing poverty.

In sum, apart from its attempt to identify the policies that help fight poverty by employing a general equilibrium framework, the study will be a step forward in developing a policy tool that links macroeconomic policies and the welfare of households, which is currently in its infancy in Ethiopia.[11]

1.7 Organization of the Study

The study is organized in five parts. The first chapter provides a summary of the macroeconomic policies pursued in the 1990's in Ethiopia and the performance of the economy along with the poverty situation in the same period. The relevant literature is surveyed in the following chapter. The third chapter is devoted to the presentation of the SAM and the CGE applied in the study. The results from the simulations are discussed in the fourth chapter. The last chapter concludes.

[11] Though the existing Social Accounting Matrices (particularly the one developed by Tadele (2000)) can be considered as such a tool, poverty analysis can only be done in a very limited way using SAMs [B.Declauwe et al: (1999)].

1.8 Macroeconomic Performance and Policy in Ethiopia in the 1990's

1.8.1 Economic Reforms in the 1990's

Following the overthrow of the military government in May 1991, the current government engaged itself in carrying out several structural and macroeconomic reforms beginning from fiscal year 1992/93 under the Structural Adjustment Program (SAP). Exchange rate adjustment, public expenditure reduction, trade liberalization, reduction of government intervention in the market, liberalization of the financial sector, and privatization were among the major reform measures that has been carried out.. [Fantahun (2002)].

The first phase of structural and economic reform program was undertaken during 1992/93-1994/95. In this period the Birr was devalued from Birr 2.07/USD to Birr 5.00/USD (58.6 percent in terms of the US dollar); new interest rate structure was introduced; attempts were made to rationalize public expenditure; direct price controls were eliminated; the maximum tariff rate was reduced to 80 percent from 230 percent; treasury bill auctions were introduced; entry of domestic privately owned financial institutions was allowed. [MoFED (1998)]

The second phase of economic policy reform was implemented during 1994/95-1996/97. The goals sketched out in this stage included creating a favorable environment for labor-intensive development, limiting the role of the government to selected economic services, and promotion private sector investment.[Ibid] Apart from implementing the long-term development strategy of ADLI, these objectives were planned to be achieved by mobilizing external resource for infrastructure development and pursuing liberal external trade and exchange rate policies to improve the competitiveness of the economy.

The country indulged into a three year Enhanced Structural Adjustment Facility (ESAF) arrangement with the IMF and began the third phase of the reform program (for 1996/97-1998/99) by October 1996. Under this program, the government made commitment to work for the reduction of poverty by achieving broad based economic growth in a stable macroeconomic environment. Accordingly, the government reduced the maximum import tariff rate from 60 percent to 50 percent in December 1996. It also pushed further on its

privatization program. Despite its failure to reach an agreement with the IMF on the policy package for 1997/98, the government liberalized interest rates by setting only a minimum deposit rate. In the external sector, the average import tariff rate was lowered from 24.5 percent to 21.5 while maximum tariff rate remained at 50 percent. [Ibid]

In 1998, however, war broke out with Eritrea which led to the suspension of the program after donors froze aid. When the war ended, the government and the IMF drew a Poverty Reduction and Growth Facility (PRGF) program for the period 2000/01-2002/03. In this agreement, they focused on GDP growth, industry, private sector development and export promotion, reduce food insecure rural households, strengthen macro economic stability, increase public expenditure on poverty reduction and strengthen expenditure management, reduce the prevalence of HIV/AIDS, improve tax administration and enhance revenue, financial sector development, improve foreign exchange market, justice system reform, civil service reform, capacity building, and decentralization. [Fantahun(2002); MoFED(2002)]

The government finalized its Sustainable Development and Poverty Reduction Paper (SDPRP) in July 2002, which was set as requirement set to benefit from the enhanced Highly Indebted Poor Countries (HIPC) Initiative. The major objective of the government's poverty reduction strategy is to reduce poverty though at the same time maintaining macroeconomic stability. Accordingly, poverty head count ratio is projected to decline by about 10% by the end of the poverty reduction strategy program period (2004/05) from its 1999/2000 level of 44 percent. To this end, real GDP is targeted to grow by at least 7 percent on average during the program period. Other macroeconomic targets include maintaining low inflation rate (not more than 5%) as well as preserving foreign exchange reserve to cover 4-5 months of import of goods and non-factor services [MoFED(2002)].

The fiscal policy is aimed at reducing the deficit to a 'sustainable' level while at the same time diverting investment and current spending towards the agricultural sector, natural resource, education and health and road construction. Regarding government revenue, the government plans to lay foundation for strong revenue performance during the program period; accordingly, tax revenue is forecast to increase from 14.3 percent of GDP in 2000/01

to 17.7 percent in 2004/05. In this context, the government has already introduced Value-Added Tax (VAT) in January 2003 [Ibid].

Monetary policy is designed to focus on keeping low inflation and achieving the international reserve target. Here the net domestic asset of the central bank is intended to be the monetary policy instrument [Ibid].

1.8.2 Performance of the Economy

As can be seen from Table 1.1, the growth rate of real GDP averaged 5.78% during 1992/93-2000/01, compared to a 2.35%, 2.37 %, and 4.0% growth rates in the preceding three decades, respectively. In this period, the share of agriculture has tended to decline while that of the service sector increased. The highest growth was also recorded for the service sector (8.8%) in the period. In addition, and despite the strategy of agricultural-led industrialization adopted by the government, much of the growth in GDP came from the same sector.

Fig 1.1 depicts trends in real growth rate of GDP. An interesting observation is that sustainable growth has not been achieved through out the period 1970/71-1998/99. Drought, which occurs almost on a regular basis (1984/85, 1994/95, 2002/03), war (both civil and with neighbors), and political instability (particularly the change of governments: 1974/75, 1991/92), among others, are the major factors behind this trend.

Table 1.1 Growth in Real GDP and Sectoral Growth Analysis

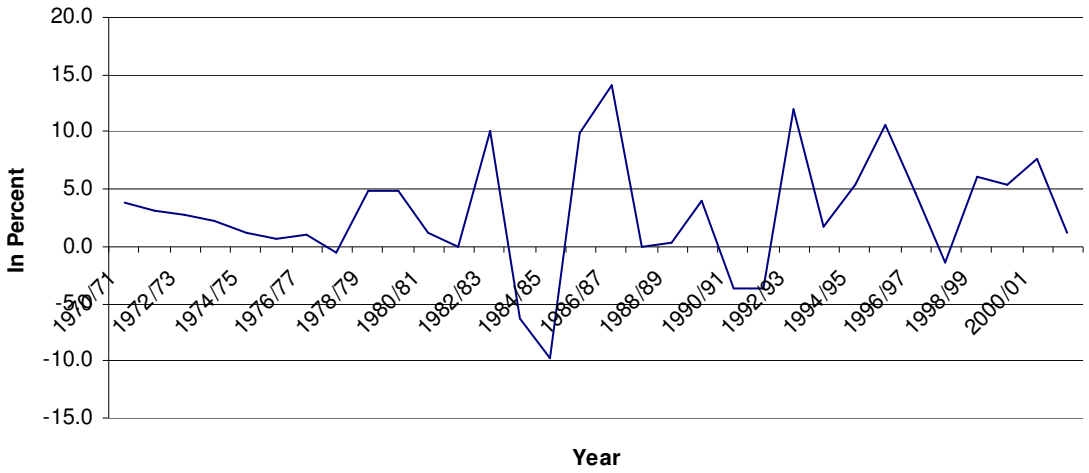
Period	Growth Rate of real GDP	Share of Agrciulture	Share of Industry	Share of Service	Growth Rate of Agri.	Growth Rate of Ind.	Growth Rate of Ser.	GCA	GCI	GCS
1960/61 -69/70	4.00	70.22	8.68	21.09	2.29	8.20	8.33	1.6	0.7	1.7
1970/71-1979/80	2.37	61.56	10.09	28.35	1.36	3.24	4.44	0.8	0.3	1.2
1980/81-1989/90	2.35	52.51	12.60	34.90	1.37	2.74	4.41	0.5	0.3	1.5
1990/91-1991/92[12]	-3.66	56.18	9.20	34.62	1.22	-13.09	-7.66	0.56	-1.40	-2.82
1992/93-2000/01	5.78	48.42	10.75	40.83	3.36	7.71	8.76	1.59	0.78	3.41
Average (1970/71-2000/01)	3.0	57.78	10.26	31.96	1.92	1.76	3.65	1.02	0.14	1.00

Source: Computed Based On National Accounts Data from MoFED

N.B.GCA= contribution of Agriculture to GDP growth (in absolute terms)
GCI= contribution of Industry to GDP growth (in absolute terms)
GCS= contribution of Service to GDP growth (in absolute terms)

[12] This was period of political instability. Including it with the reform period will give a wrong picture on the consequences of reform measures.

Fig 1.1 Trends in Real GDP Growth Rate(ggdp)



Despite a relatively commendable economic performance since 1992/93, there is little improvement in per capita income of the population. (See Figure 1.2) This is mainly due to high population growth rate. In fact, average growth of the population during 1970/71-2000/01 was around 2.8 percent, not very much different from the average growth rate of real GDP in the period i.e.3.0%. Yet there is still a slightly increasing trend of per capita income after the economic reforms were undertaken.

Fig 1.2 Trends in Per Capita Income

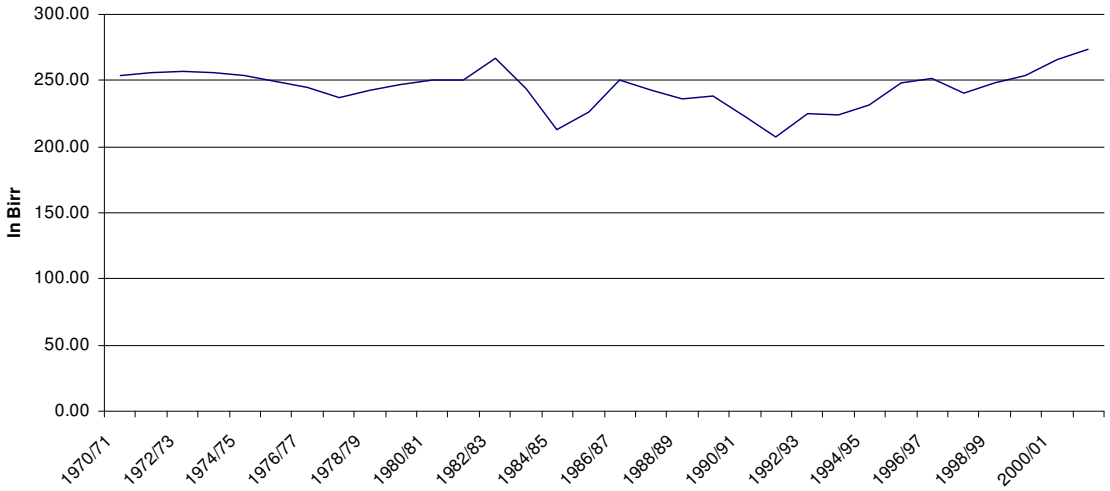
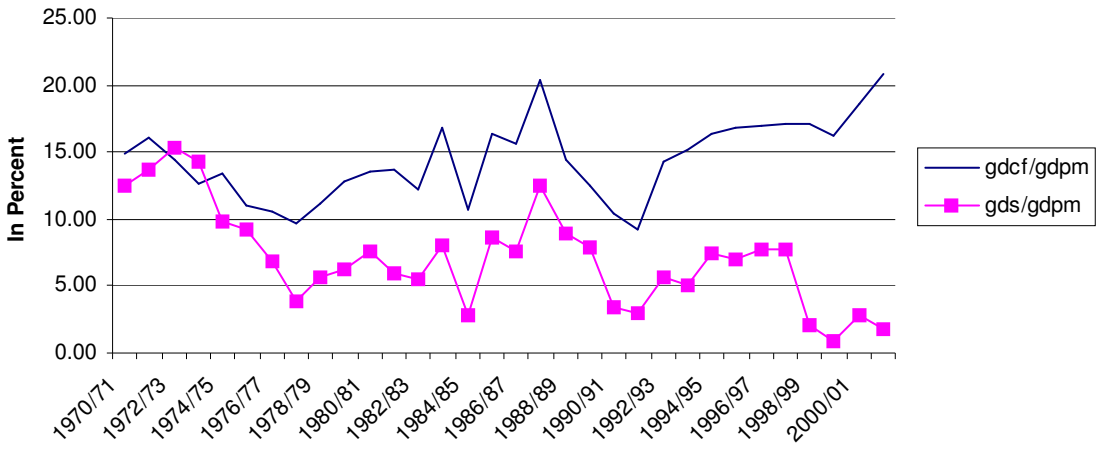


Table 1.2 provides a summary of important macroeconomic variables. Accordingly, in spite of various financial sector reform measures discussed above, no considerable improvement is made in domestic saving mobilization. Gross domestic savings averaged around 5% of GDP during 1992/93-2000/01, lower than the corresponding figures for 1970-71-1979/80 (9.7%) and 1980/81-1989/90 (7.5%). Gross domestic capital formation, however, has shown an increasing trend, with an average value of 16.5 % in the reform period. From first glance at Fig 1.3., one can observe that gross domestic investment follow the path of gross domestic savings or vice versa. Though traditional economic theory suggests the former, a formal test is required to see if investment is indeed determined by the available savings.[13]

Fig 1.3 Ratio of Gross Domestic Capital Formation(gdcf/gdpm) and Saving (gds/gdpm) to GDP

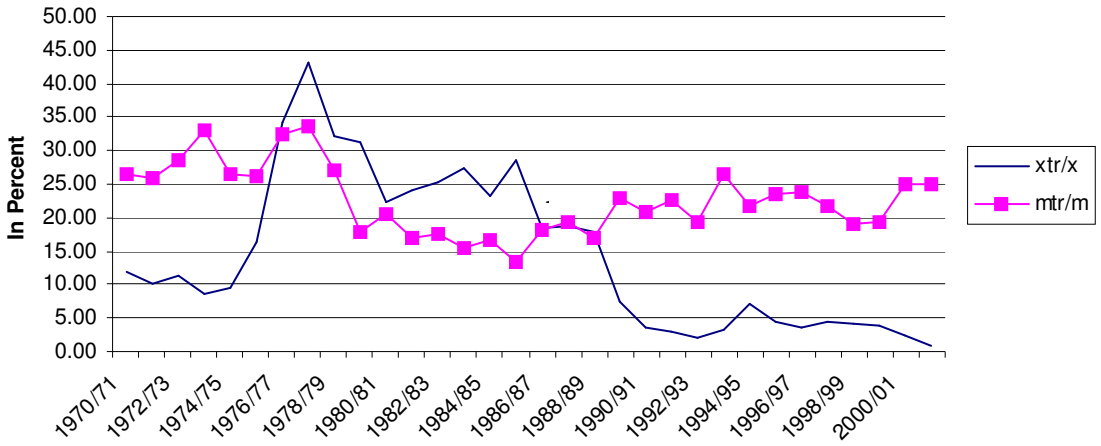


Regarding the external sector, average export tax rates significantly declined (to 3.9 %) from an average value of 21.3 % and 20.9% in the 1980's and 1990's.[14] It should be, however, noted that average export taxes already started to decline before economic reforms were launched. Nevertheless, no significant reduction in average import tariff rates is observed

[13] One of the macroeconomic closures in any CGE model is regarding the Saving-Investment balance. In our model investment adjusts to available savings, both domestic and foreign.
[14] In this study, average import tariffs and export taxes are measured by the ratio of import taxes to total imports and that of export taxes to total exports, respectively.

during economic reforms. In fact, the average tariff rate in the period 1992/93-2000/01 was higher than that of 1980/81—1989/90. (See Table 1.2 and Fig.1.4)

Fig 1.4 Average Export(xtr/x) and Import Taxes(mtr/m)



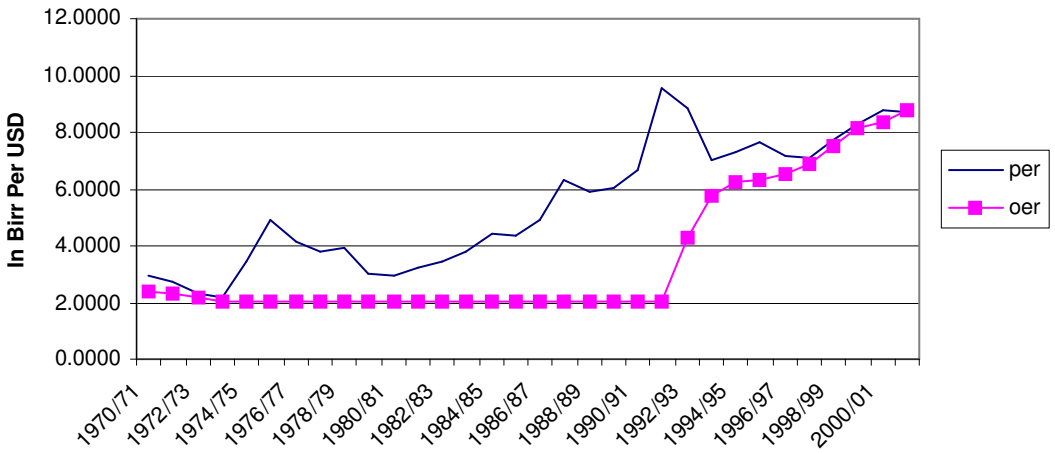
Devaluation was one of the reform measures undertaken by the government with a view to promote exports and improve the external trade balance. As noted earlier, the Birr was devalued to Birr5.00/USD from its pegged value of Birr2.07/USD during 1973/74 -1991/92. The exchange rate premium (i.e. the gap between the official and parallel exchange rate) has been closing afterwards. (See Fig 1.5)

Table 1.2 Key Macroeconomic Variables

Period	Gross Domestic Capital Formation	Gross Domestic Savings	Private Investment	Public Investment	Exports	Imports	Trade Balance	Average Export tax	Average Import Tariff	Government Budget Deficit	Government Expenditure	Social Sector Expenditure
1970/71-1979/80	12.7	9.7	9.3	3.4	7.6	9.6	-2.0	20.9	27.7	-2.5	15.8	2.7
1980/81-1989/90	14.6	7.5	6.1	8.5	6.5	14.8	-8.3	21.3	17.8	-6.7	29.6	3.8
1990/91-1992/93	9.8	3.2	4.6	5.2	2.3	2.3	-7.6	3.3	21.7	-7.9	22.7	3.4
1992/93-2000/01	16.5	5.1	8.0	8.4	7.2	20.5	-13.3	3.9	22.2	-5.2	26.9	4.6
Average (1970/71-2000/01)	13.4	6.4	7.0	6.4	5.9	11.8	-7.8	12.4	22.4	-5.6	23.8	3.6

Source: Computed Based on Data From MoFED and National Bank of Ethiopia
N.B. All but average export and import taxes are expressed as a percentage of GDP.
Also the figures are the average valued in the given period.

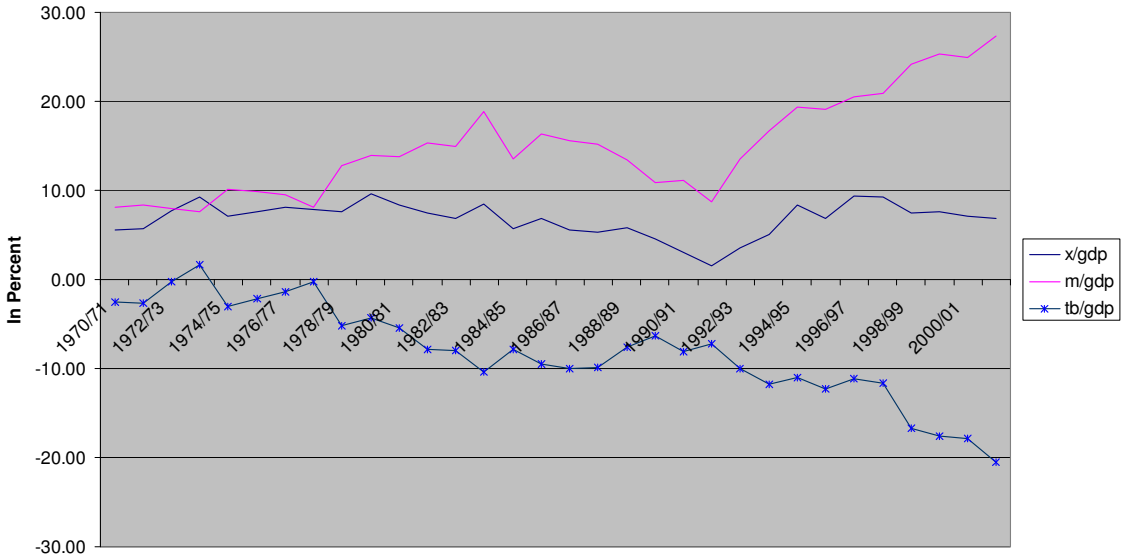
Fig 1.5 Offical(oer) and Parallel Exchange Rates (per)



The share of both exports and imports to GDP also increased during 1992/93-2000/01. The ratio of exports to GDP reached 7.2% in the period compared to 6.5% in the 1980's. The share of imports, which were 9.6 % and 14.8% of GDP in the 1970's and 1980's respectively, rose up to 20.5% of GDP. Concomitant with this fact, Ethiopia's trade deficit further deteriorated reaching 13.3 % of GDP in the 1990's from the mere value of 2.0% and 8.3% in the 1970's and 1980's, respectively. (See Fig. 1.6)

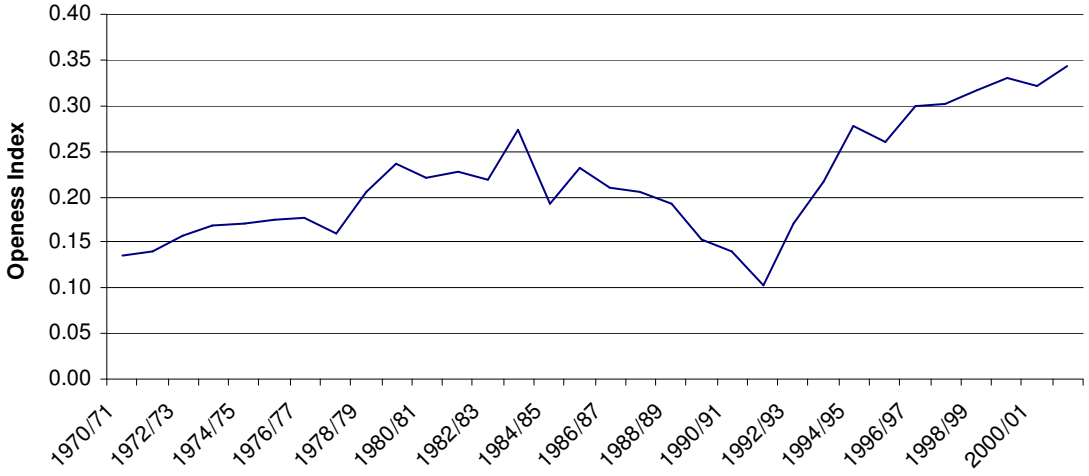
And, clearly, the openness of the economy, measured as the ratio of the sum of exports and imports to GDP, exhibited an increasing trend after the commencement of economic reforms. (Fig 1.7)

Fig 1.6 Ratio of Exports,Imports,and Trade Balance to GDP



On the fiscal side, the government maintained its deficit around 5.2 percent of GDP on average during 1992/93-2000/01. The corresponding figures were 2.5% and 7.9% in the 1970's and 1980's. With respect to government expenditure, it averaged 26.9% of GDP

Fig 1.7 Openess of the Economy



in the reform period. The lowest figure is recorded in the 1970's (15.8%) contrasted to the highest value in the following decade (29.6%). (See Fig 1.9) As can be learned form Fig 1.8,

the government budget deficit exhibited a continuously declining path which was interrupted in 1998/99 as result of the war with neighboring Eritrea. (See Table 1.2)

Though relatively lower fiscal deficit was maintained, the share of social sector expenditure to GDP (expenditure on education and health) was the highest in the reform period. It accounted for 4.6% of GDP during 1992/93-2000/01 compared to the corresponding figures in 1970's and 1980's i.e. 2.7% and 3.8%, respectively. (See Table 1.2).

Fig 1.8 Ratio of Fiscal Deficit to GDP

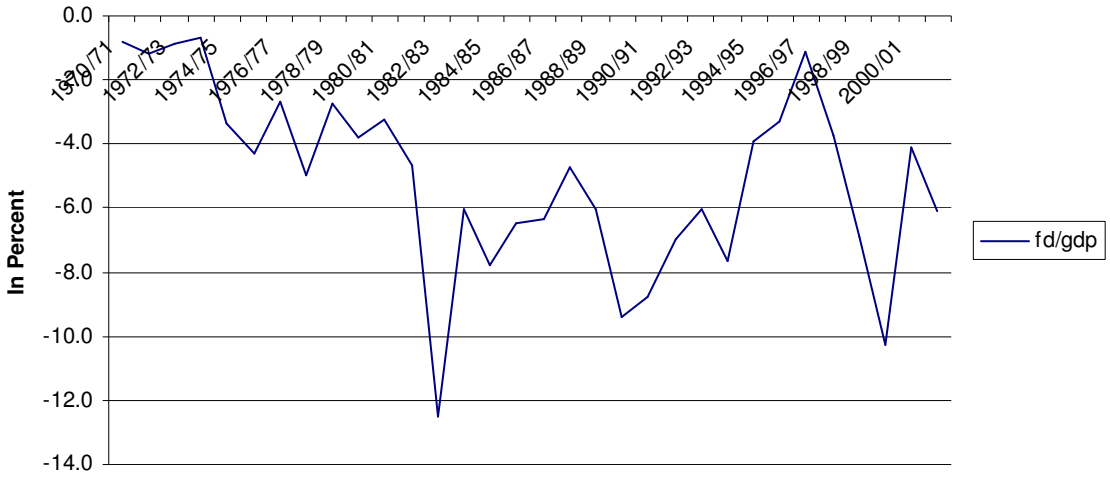
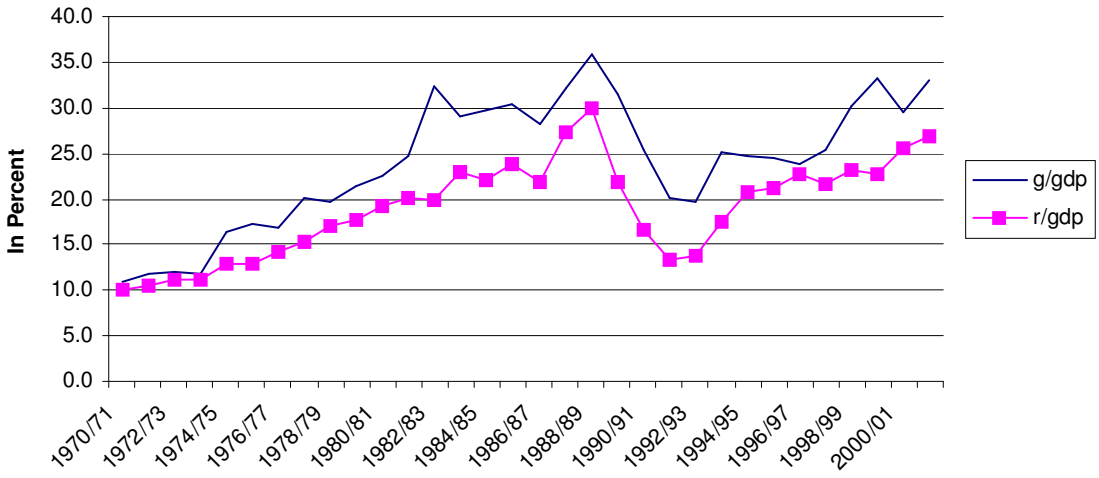
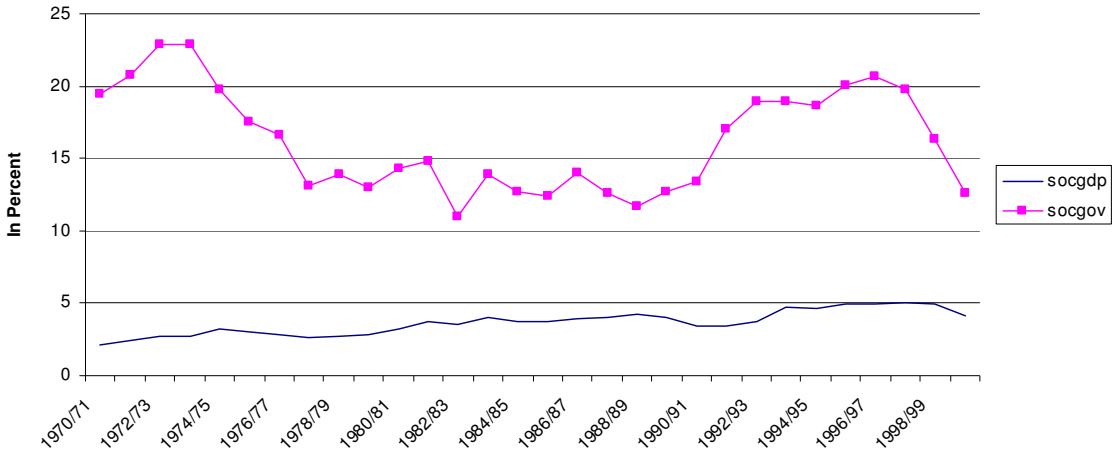


Fig 1.9 Ratio of Government Expenditure (g/gdp) and Revnue(r/gdp)to GDP



From the look of things, the fear that budget reduction may result in reduced government expenditure on the social sector during economic reforms did not materialize in Ethiopia. (Fig 1.10). Nevertheless, social expenditure decreased during the war with Eritrea.

Fig 1.10 Share of Social Sector Expenditure to GDP (socgdp) and total Government Expenditure (socgov)



1.9 Poverty Situation in Ethiopia

This section derives heavily from the SDPRP and a document released in 2002 from MoFED. Based on the Household Income, Consumption and Expenditure (HICE) survey conducted by CSA in 1995/96, 47 percent and 33.3 percent of the respective rural and urban population are identified as poor. This meant that 45.5 percent of the Ethiopia population lived below the poverty line at the time of the survey. In a similar survey conducted by the same body in 1999/00, 45 percent of the rural and 37 percent of the urban population were deemed to be poor, indicating that only 55.8 percent of the total populace was above the poverty line. Comparing the two periods, the incidence of poverty declined rural areas (by 4.2%) while it increased in urban sites (by 11.1 %) (See Table 1.3). As indicated in Table 1.3, the bulk of the poor are concentrated in rural areas. Nevertheless, the incidence of poverty is not inconsiderable in urban areas either.

Table 1.3 Trends in Poverty Head Count Ratio (P_0) by Rural and Urban Areas (%)

Location	1995/96	1999/2000	% Change Over 1995/96
Rural	47.0	45.0	-4.2
Urban	33.3	37.0	11.1
Total	45.5	44.2	-2.9

Source: MoFED 2002

Though knowing the characteristics of the poor and the poverty situation in general is desirable to gain insight in any poverty analysis, our main interest in the study is investigating the dynamics of poverty during macroeconomic reforms which, broadly speaking, began in 1989 when the socialist government adopted a mixed economy policy. As reported in Table1.4, the proportion of people below the poverty line, the depth of poverty (the poverty gap), and the severity of poverty (squared poverty gap) in rural Ethiopia depict a declining trend during the 1989-1997 period.[15]All these poverty indices increased in 1995 in urban areas compared to their levels in 1994, though they declined again in 1997. [Dercon (2002) ; Mekonnen (1997)].

Table 1.4 Trends in Poverty During 1989-1997

Rural Ethiopia		Urban Poverty	
Head Count (1989)	0.61	Head Count (1994)	0.467
Head Count (1994/95)	0.51	Head Count (1995)	0.516
Head Count (1997)	0.31	Head Count (1997)	0.463
Depth of Poverty (1989)	0.29	Depth of Poverty (1994)	0.183
Depth of Poverty (1994/95)	0.22	Depth of Poverty (1995)	0.229
Depth of Poverty (1997)	0.10	Depth of Poverty (1997)	0.189
Severity of Poverty (1989)	0.17	Severity of Poverty (1994)	0.098
Severity of Poverty (1994/95)	0.12	Severity of Poverty (1995)	0.129
Severity of Poverty (1997)	0.005	Severity of Poverty (1997)	0.102

Source: Dercon (2002) and Mekonnen (1997)

[15]. The data on rural poverty is obtained from Dercon (2002) while that of urban sites is taken from Mekonnen (1997). The definition and computation of the reported poverty indices are discussed in chapters two and three in a relative detail.

Official estimates indicate income distribution to be more or less low equitable in Ethiopia, both in rural and urban areas. Accordingly, in 1999/00, the overall income inequality, measured by the Gini coefficient, was 0.28. However, inequality was found to be higher in urban centers (0.38) compared to what was the case in rural areas (0.26). The Gini coefficient was 0.27 for rural areas and 0.34 for urban areas in1995/96. While there is a slight decline of inequality in the rural areas, urban inequality rose up. At national level income distribution improved a bit. [MoFED (2002)]. Studies by Mekonnen et al (2000), as cited in Alemayehu et al (2002), however, report higher figures of income inequality in Ethiopia. Furthermore, the figures reveal that income inequality has generally exhibited an increasing trend during 1994-1997.(Table 1.5).

Table 1.5 Inequality In Ethiopia (Gini Coefficient)

Region	1994	1995	1997
Rural	39	56	43
Urban	44	45	48
National	39	54	43

Source: Alemayehu, Abebe & Weeks (2002)

As hinted earlier, looking at the various characteristics of the poor facilitates the understanding of the different dimensions and severity of poverty in a given society. According to Table 1.6, in 1999/00, 70.4% of the total urban population was literate compared to a mere 21.8 percent in rural sites. Gender wise the vast majority of illiterates were women, though the situation was comparatively better in urban areas. In 1995/96, 70.0 and 19.4 percent of the rural and urban populace were literate.

Table 1.6 Trends in Literacy Rate

	1995/96			1997		
	Urban	Rural	All	Urban	Rural	All
Male	82.3	29.2	36.5	81.0	25.1	33.4
Female	60.4	9.2	18.1	60.8	7.3	16.5
Total	70.0	19.4	27.3	70.0	16.2	24.8

Source: MoFED 2002

Table 1.6 (Continued)

	1998			1999/00		
	Urban	Rural	All	Urban	Rural	All
Male	81.0	28.8	36.3	82.1	33.0	40
Female	59.0	8.8	17.1	61.2	11.0	19.5
Total	69.0	18.8	26.6	70.4	21.8	29.4

Source: MoFED 2002

Looking further at other non-income measures of poverty, in 1999/00 the gross and net primary enrollment rate stood at 59 and 34 percent, respectively. The average distance to elementary schools at national level was three kilometers. The gross and net secondary enrollment rates were 15.5 and 11.5 percent, respectively during the same year. At national level, the prevalence of stunting was 57 percent in 1999/00 while severe stunting stood at 31.3 percent. Around 85% of the households lived in low quality houses made of wood and mud and 65% of the houses were grass-roofed houses. In the same period, the average distance households had to travel in order to obtain water varies between 0.36 km during the rainy season and 0.74 during dry season. The country-wide average distance for households to reach food markets was 5.19 km. Rural households had to travel 5.88 km on average to reach a food market contrasted to 'a mere' 1 km that their urban counterparts travel [MoFED, (2002)].

Scrutiny at the composition of household incomes reveal that rural households mainly derive their income from own agricultural enterprise (72.5%) while wages and salaries account the highest proportion of the incomes of urban residents (41.2%), followed by non-agricultural household enterprise. A study by Bigsten and Negatu (1996) also confirms this story. At national level 63.3% of household income comes from own-agricultural enterprises. (Table 1.7).

Table 1.7 Source of Income for Rural and Urban Households (1999/00)

Sources of Income	Rural	Urban	Total
Own Agricultural Enterprise	72.5	4.6	63.3
Household Enterprise Other than Agriculture	5.4	30.3	8.7
Wages and Salaries, Bonus, Overtime and allowances	2.9	41.2	8.0
Household and Other Rents	0.2	0.5	0.3
Dividends and Profit Shares as well as Bank savings	3.9	8.7	4.6
Gifts and Remittances	3.5	8.1	4.1
Other Receipts	11.6	6.7	11.0

Source: MoFED 2002

In general, the available evidence suggests that a relatively good economic performance has been registered since the reform began in 1992. In addition, the poverty figures disclose that rural poverty has declined in the reform period. On the other hand, there is some indication that urban poverty has not improved during the same period, if not worsened. However, whether the reduction in rural areas or its rise in urban sites can be ascribed to the reforms undertaken is an empirical matter. What makes the issues more problematic is when it comes to isolating the impact of a specific macroeconomic policy, as many of the reform measures were carried out simultaneously.[16]

[16] No attempt is made in this study to investigate the poverty-impact of the macroeconomic policies under consideration when they are undertaken simultaneously. Our objective here is only in understanding how a specific economic policy affects household welfare.

Chapter Two

Literature Survey

In reviewing the relevant literature, I first discussed some points on the definition and measurement of poverty, the link between macroeconomic policy and poverty, and the impact of specific macroeconomic policies, namely, trade liberalization, devaluation and fiscal policy on the poverty situation at micro level. The link between macroeconomic policies and poverty, as many argue, is mainly through the growth impact of the former which necessitated reviewing the growth-poverty relationship in this section. Given the tool that is chosen in this particular study is a Computable General Equilibrium (CGE) model, I had to discuss the theoretical foundations, nature, types, and applications of the model. Lastly, I considered the measurement and analysis of poverty within a general equilibrium framework. Though attempt is made to consider a wide range of issues in the survey, it is by no means exhaustive, and time and space constraints allowed focus only on a few important issues on each subject. In all the sub-sections, the available empirical evidence is presented along with the theoretical framework when appropriate.

2.1 Definition and Measurement of Poverty

As Hartwell (1972) rightly noted, economics is, in essence, the study of poverty. Unfortunately, poverty, just like the discipline that studies it, lacks a universally accepted definition. Nevertheless, no matter hard it may be to come up with an all-purpose definition, it is imperative that we define our terms before we set out to argue at least for the following reasons. First, as Lipton and Ravallion (1995) assert, any poverty analysis, which this particular study claims to be, has the triple tasks of defining and describing poverty,

investigating its causes, and deriving policy implications. But more importantly, a lack of definition at the outset of investigating the impact of macroeconomic policies on poverty would result in a totally misleading conclusion. A study by Glewwe and Gaag (1990) witnessed that different definitions of poverty can lead to the design of very different policy measures to reduce poverty.

Defining poverty inevitably entails passing judgment on who is poor and who is not. Poverty is usually used to refer to the situation when an individual or a certain number of people are unable to meet a level of economic welfare deemed to constitute a reasonable minimum, either in absolute sense or relative to a certain standard. [Lipton and Ravallion (1995)]. Whatever that welfare may mean, and assuming that welfare can be measured as a one-dimensional quantity, someone whose individual welfare lies below a minimum welfare threshold is "poor".: That is,

$$W_i < W_{min} \Leftrightarrow i \, E \, P \qquad (2.1)$$

where W_i is the welfare of individual *i,* W_{min} is the welfare below which a person is considered to be poor and P is the set of poor individuals. [Strengmann-Kuhn (2000)]. The definition of poverty in 'the dismal science' is virtually concerned with economic welfare along with its serious measurement problems. But there is a lot of debate as to whether this 'welfare' should be restricted to economic aspect only. In this 'worldly' definition of poverty, which many say is very limited, non-material utilities are abstracted. The consolation for economists is that *'inadequate command over commodities is the most important dimension of poverty, and a key determinant of other aspects of welfare, such as health, longevity, and self-esteem. And it has been a powerful motive for policy.'* [Lipton and Ravallion (1995, p.2553)].It is recorded that much of the literature on poverty in developing countries has taken consumption of goods and services to represent economic welfare and the reasonable minimum is used to mean predetermined level of basic consumption needs. [Ibid]

Among the contesting alternative definitions of poverty is found the one that perceives poverty as the inability to achieve a politically acceptable living standard. Here, living standard is proxied by real income, after allowances are made for home-made consumption, non-cash income, and the size and composition of the household. [LIU and WU (1998)]. A

radically different definition of poverty comes from Sen (1987) in which poverty is defined as lacking the ability to function. Sen's idea of well being comprises of longevity, being well-nourished, healthy, and educated. [Ibid]. According to him, this definition, which incorporated a 'capability concept', shifts the study of poverty and its causes, to freedoms and capability of individuals to transform available resources into better quality of life. Consequently, those affected by poverty are regarded as actors who can take advantage of various benefits according to their capabilities with a given input of resources. [Ibid.] In somewhat related and broader manner, UNESCO, as cited in Elizabeth (1997), identifies poverty as the relative absence of income, assets, basic services, self respect, opportunities for education and social mobility and participation in decision making

Despite the diversity of definitions of poverty, all definitions share the following characteristics: they are dichotomous (distinguish between who is poor and who is not) and describe lack [Strengmann-Kuhn (2000)]. Furthermore, all of them portray poverty either as having less than an objectively defined absolute minimum, having relatively less than others in society, or feeling one does not have enough to get along. [LIU and WU (1998)].

Clearly, the above definitions perceive poverty as absolute, relative, and a combination of both. In an interesting survey on the definition and measurement of poverty, LIU and WU (1998) discuss the three approaches. Accordingly, the absolutist approach to defining poverty begins with the concept of minimum subsistence level, referring to some bundles of goods and services essential to satisfy the individual or household physical requirements. Those who do not possess the economic resources to obtain these goods and services are considered poor.

One of the most severe criticisms against the absolute approach is that human needs are predominantly confined to physical needs rather than social needs. People are not, it is argued, simply individual organisms requiring replenishment of physical energy. They are social beings having social needs as well. Moreover, the measurement of costs for food is a problematical.

In the relativist definition of poverty, the average or median value of national income serves as the economic indicator which proxies the dominant life style in the population. An individual or a family whose income is less than that value can be defined poor as it has no means to lead that life style.

This approach is not free from criticisms either. First, many say it perpetuates poverty as some fixed proportion of the population is always regarded as poor. Second, while a relative measure of poverty can give an estimate of the size of the poor, it cannot provide any information on the quality of life of the poor.

The third method of defining poverty, the budget standards methods, is based on the perception of a basket of goods and services which are required for subsistence and meeting the requirements of social needs. An important drawback of this method is that it is difficult to produce commonly acceptable criteria for selecting the items to be included into the list. Second, the exposition of need also depends the level of development of the society. In addition, huge effort may be required to develop a budget for such expenditure components and update them when social circumstances change. [Ibid]

One can not be mistaken to suppose that the various definitions of poverty partly arise from the existence of different dimension of poverty. In fact, four dimension of poverty, which may reinforce each other, are identified in the literature. These are: (1) lack of opportunity: lack of access to material goods or services; (2) low capabilities: low achievement in education and health; (3) vulnerability: exposure to risk or low level of security), and (4) powerlessness, being voiceless. [MoFED (2002)]

As the definitions and the dimensions of poverty vary, so do its types. Apart from the absolute and relative types of poverty we can also distinguish between mass, transient and chronic poverty. Mass Poverty exists in communities where almost all of the people are poor. Chronic poverty, or persistent poverty, which is contrasted with transient poverty, is a situation characterized by the inability to move out of poverty from one generation to the next. [Elizabeth (1997); Lipton and Ravallion (1995)]

Measuring poverty is as important and difficult as defining it. It is mainly required to enable poverty comparisons which are required for the purpose of assessing a country's progress in poverty alleviation and/or evaluating policies and projects. [United Nations (1996)] The discussion about poverty measurement can be divided into two different issues. The first is the problem of identification, i.e., the issue of deciding who is poor and who is not. The (identification) problem of poverty measurement therefore can be separated into two steps. The first decision is how to measure welfare and the second is to define or to measure a welfare threshold which separates the poor from the non-poor. As we saw in the previous section, all definitions of poverty are dichotomous. Hence, intuitionally there must be a cut-off point which divides the poor from the non-poor i.e. a poverty line. In setting a poverty line three alternative approaches can be spotted following the different definitions discussed above. These are absolute, relative, and subjective poverty levels. An absolute poverty level is the one which is fixed in terms of the living standard indicator being used, and fixed over the entire domain of the poverty comparison [Ravalllion (1992)]. An alternative way of setting a poverty level is using what is called a relative poverty line. The procedure involves disaggregating the population into various income or expenditure percentiles and subjectively labeling the lowest some percentage of the population as the poor. The last approach is to define poverty based on survey responses on what the individual considers an absolutely minimal income. [Ibid]. This result will give a subjective poverty line.

The other issue here is the choice of poverty indicator. There are various arguments centered on the issue of the appropriate indicators of poverty. There are ideally a number of alternative indicators that can be used to quantify well-being or welfare at individual and household levels. These include income, consumption, and food expenditures; nutritional and anthropometric indicators, and, proportion of household budget spent on food and basic needs. .[Ayalneh and Agedorn(2003)].The conventional approach is using income or consumption in constructing poverty measures in a sample population. Others argue that the most appropriate means of measuring poverty is an absolute and objectively determined poverty line. But Ravallion (1992) argues that the characteristics of poverty are well correlated with income and consumption. Those who form the participatory school, however,

reject the income/consumption approach for being a narrow and reductionist in the sense that it fails to understand the complex, diverse, local realities of the life of the poor. As a solution ,they suggest various subjective poverty indicators among which are states of disability, being widowed, lacking land, being ,bad housing, having vices, and single parents.[Elizabeth (1997)]. Nevertheless, income is usually taken as a single indicator to measure poverty because total consumption of basic needs and essential needs are difficult to quantify.

However, even measurement of poverty based on income has to be qualified. Assessing the standards of living by income alone may understate or overstate the level of living, if the compositions of the families or the market supply situations are not taken into consideration. [LIU and WU (1998)].If income is used as a proxy for consumption, the reference period should capture permanent rather than transitory living standards. Therefore, using permanent income as the indicator would be preferable to an indicator using current income. In the same fashion, indicators derived from annual income should be a better one than the one derived from income in a week or a month. The current level of income cannot fully reflect the actual standard of living of the poor. [Ibid].

Another poverty indicator is consumption. Consumption is typically preferred over income as the former better captures long-run welfare. Even though income is one of the factors that enable consumption, consumption also reflects a household's access to credit and its savings at times when their income is too low. Moreover, in developing countries households are likely to understate their income level more than they do with their consumption level. [MoFED (2002)]

The income proxy method is a behaviorist approach based on the consumption patterns of the people under study. Data on household expenditure are used as an income proxy to measure poverty. The idea behind the theory is that consumption patterns of various family compositions are the results of the relative competition between need and choice. The amount of family income determines whether need or choice overcomes. In simple terms, it means that low income families usually spend a greater proportion of expenditure on necessities, while better-off families will purchase more quality goods and non-necessities as

envisaged in the Engle's theorem. Therefore, a poverty line can be constructed if one can identify a proper proportion of expenditure on necessities against the total expenditure. [Ibid]

The unit of the poverty analysis also bears some impact on the interpretation of the result. Three definitions for unit of analysis are commonly used: Household - one or more persons living together, Family - two or more persons living together and are related by blood or marriage, Individual - one single person. Usually, scale of economy gives multi-member units more effective consumption of economic resources than individuals. In considering the choice among different units, the consumption attributes of different goods and services should be noted. Some items of consumption are individualistic (e.g. food) while others have a public-good characteristics (e.g. housing). However, it is commonly assumed that all members within the unit share the same standard of living. [Strengmann-Kuhn (2000); LIU and WU (1998)] Here the issue of equivalence scale also arises. An equivalence scale gives the weight of the expenditure incurred by a family member against the wholesome of the unit of analysis. In determining the expenditure of the unit allowances will be made to their numbers and ages. This is particularly important when determining the standard of living of a non-individual unit. Apart from measuring poverty at the micro-level, there is also the problem of finding a poverty measure for society as a whole. This is called the aggregation problem ([Lipton and Ravallion (1995]

In general the approaches of measuring poverty can be grouped as welfarisitc and non-welfarisitc approaches [Ravallion (1992)]. The welfarisitc approach compares welfare and public-policy decisions based on the preference of individuals. It avoids passing subjective judgments that are incompatible with individual behavior. Accordingly, the well-being of the individual is assessed by the values attached to commodities by the consumer and her subsequent preference ordering. The non-welfarisitc approach, on the other hand, attempts to assess the well being of an individual based on certain attainments such as being adequately nourished, clothed and sheltered. This approach ignores information on the utilities of the individual [MoFED (2002)].

Though a digression, it is worthwhile to note that a distinction can be made between quantitative and qualitative approaches of measuring poverty. Much of the work on measuring poverty has been quantitative in nature, utilizing statistical techniques to measure and analyze poverty. Quantitative analysis is advantageous in its scale and objectivity. However, it is imperative to look beyond numbers and deeper into the experiences of the poor to gain meaningful insight of poverty [LIU and WU (1998)].

Going back to welfarisitc and non-welfarisitc distinction, it is argued that the welfarisitc framework does not provide a well-defined poverty line for the purpose of measuring poverty. The non-welfarisitc approach, often used for drawing poverty line, is based on the basic needs or minimum caloric requirement. There are three methods of setting poverty lines that use caloric requirement: direct calorie intake, food energy intake, and cost of basic needs methods. In the case of direct calorie intake method, a poverty line is defined as the minimum level of calorie intake, below which the individual will be deemed to be under poverty. The limitation of this method is that it does not take into account the cost of getting the basic calorie requirement. As it completely overlooks the non-food requirement, it will be severely hampered to reveal the extent of poverty in a community. The other non-welfarisitc method of setting a poverty line is known as food energy intake method. The idea behind the method is obtaining the per capita consumption which fulfills the calorie requirement of a given household. Therefore, the poverty line will be the level of per capita consumption that meets the pre-determined minimum calorie requirement of a unit in a society. The third method of setting poverty line is the cost of basic needs method. Here, the food poverty line is defied by selecting a basket of food items which are consumed by the typical poor. Again the quantity of the basket is determined so as to enable the consumer meet a predetermined level of minimum calorie requirement. Then a specific allowance for the non-food component consistent with the spending patterns of the poor is added to the food poverty line[MoFED(2002)].

There exist various poverty indices used to measure poverty. Among the commonly used are the Sen's index, CHU Index, Thon's Index, and the most popular Foster-Greer-Thorbeck (FGT) Index. The ideal poverty index has to satisfy the following properties : ***montonicity***:

the poverty index should increase as the income of the poor drops, and vice versa; ***transfer axiom:*** the poverty index should increase when a transfer is made from a poor individual to a richer one, and vice versa; ***population symmetry axiom***: in cases where two or more identical populations are pooled, the poverty index should remain the same***; proportion of poor axiom***: a rise in the relative number of poor should be reflected in an increase on the value of the poverty index; ***focus axiom***: the poverty index should be independent of the income levels of people above the poverty line; ***transfer Sensitivity Axiom***: the increase of a poverty index as a result of a fixed transfer of money from a poor to a richer person should be increasing in the income of the donor; ***decomposability axiom***: the poverty index should go up when poverty in a sub-group rises, other things being equal and vice versa. [Abebe and Bereket (1996)].

The poverty index used is this particular study is the Foster-Greer-Thorbeck (1984), commonly known as the FGT index. Given a vector of appropriate measure of well-being, Y, is arranged in an increasing order, Y_1, Y_2, Y_3,...,Y_n, where n represents the number of households under consideration, the FGT poverty index ($P\alpha$) can be given as

$$P_\alpha(y,z) = \frac{1}{n}\sum_{i=1}^{q}\left(\frac{z-y_i}{Z}\right)^\alpha \qquad (2.2)$$

Where z is poverty line for the household, q is the number of the poor households, y denotes household income, and α is the poverty aversion parameter ($\alpha \geq 0$). It represents the weight attached to a gain by the poorest. Usually α takes the values of 0, 1, and 2. When we set α equal to 0, then $P\alpha$ will be reduced to the headcount ratio, which measures the incidence of poverty (the proportion of poverty in the total population). When α equals to 1, $P\alpha$ gives the poverty gap. P_1 shows how far the poor, on average, are below the poverty line (intensity of poverty). Setting α equal to 2 gives the severity of poverty or FGT-2 index. This particular poverty index gives greater weight to the poorest of the poor, as it is more sensitive to

redistribution among the poor. The index, apart from being decomposable, also fulfils the monotnicity, transfer and sensitivity axioms.

In many developing countries the absolute definition and measurement of poverty is used in the construction of the poverty line. To facilitate comparability with other studies, and because of the availability of official data in that form, the same definition of poverty is used in the present study. Accordingly, the adjusted food poverty line, which is also used in the poverty reduction strategy paper, is employed. The poverty line is constructed based on a basket providing 2200 kcal per adult equivalent per day. After adjusting for the non-food component, the total poverty line was estimated at Birr 1075.0 in 1995/96 prices. In addition, the use of the absolute measure of poverty avoids subjectivity in deriving the poverty line.[17]

2.2 Macroeconomic Policy and Poverty Reduction

The issue of the link between macroeconomic policies and poverty is directly interwoven with the much debated issue of the impact of structural adjustment and stabilization policies on the economies of virtually all developing countries that adopted those policies. In the 1980's[18], many developing countries experienced macroeconomic instability, with rapidly rising servicing costs on foreign debt, external terms-of-trade shocks, and rising fiscal and external imbalances entailing excess of aggregate demand over supply [Sahn et al (1997)]. Hence, their economic policy in the period focused on structural adjustment, which contains a combination of macroeconomic stabilization measures to restore domestic and external equilibrium and structural changes in policies and institution designed to bring about efficiency and flexibility in the economy, and there by increase growth [(Fischer (1999)]. The typical program combines fiscal contraction (cutting government spending and/or raising taxes) measures aimed at reducing inefficiency, complemented by devaluation, and trade liberalization. [Lipton and Ravallion (1995)]

[17] The national and/or international concern on poverty is mainly focused on fighting absolute poverty rather than the relative one. After all, relative poverty will persist continuously.
[18] This period is commonly referred to as the 'lost decade' for most developing economies.

Here the implicit assumption is that macroeconomic stability, which is the result of good macroeconomic policy, is required for sustained growth. Several economists such as Fischer maintain that macroeconomic policies, particularly monetary, fiscal, and exchange rate policies matter for growth and development [Ibid]. In fact, one major possible link identified in the literature between macroeconomic policies and poverty is that good macroeconomic policies bring about higher growth, and higher growth is transformed into reduced poverty. [Ames et al (2001)]. Concomitant with this assertion, Liption and Ravallion (1995) argued that given the large share of the impact of adjustment on the poor appears to be meditated through its impact on economic growth, a key question regarding the impact of adjustment on the poor should be whether adjustment raised or lowered the rate of growth.

The empirical evidence on the issue of adjustment and poverty is mixed. Simulation exercises exploring the effects of the design of the adjustment packages in Chile, Cote d'Ivoire, Ecuador, Malaysia, Morocco, and Indonesia on poverty and sustainability of the measures undertaken show considerable diversity in the evolution of income distribution during adjustment [Bourguignon et al (1991)]. Indonesia and Malaysia, managed to adjust without any apparent adverse impact on the poor, despite some cuts in social expenditures in Indonesia [Ibid]. In Chile and Equador, it was found that unsustainable macro economic policies prior to adjustment (Chile) or during adjustment (Ecuador) contributed to a worsening distribution of income, though sound structural adjustment policies were pursued. In fact, in Chile tradable output contacted sharply, failing almost two-thirds as much as non-tradable output [Meller (1991)]. Contrastingly, using a micro level panel data in six rural communities in over the period 1989-1995, and by employing an absolute measure of poverty, Dercon (2001) found that overall poverty declined relatively strongly following economic reforms in Ethiopia. .

The impact of adjustment may also be different in different sectors and regions. Bourguignon et al (1991) argued that in Cote d'Ivoire and Morocco urban poverty increased during adjustment while improvement distribution of income is improved in rural areas. Moreover, agriculture, compared to the manufacturing and import-substituting sectors was found to be sheltered during adjustment and to have benefited from liberalization measures and the real

exchange-rate devaluation that accompanied adjustment programs in Zimbabwe and Zambia [Winters (2002)].

Despite the mixed results, the association between discouraging economic and social outcome during adjustment observed in many developing countries led many to question the effectiveness and appropriateness of the economic reform pursued. Critics argue that regardless of the macroeconomic consequences, the poor suffer much more during key macroeconomic and sectoral policy reforms. They regard orthodox adjustment policies too much concerned with short-term macroeconomic stability and, therefore, in addition to their adverse impact on the poor, as inappropriate measures to address the poor economic performance of the developing economies. Hence, they view policy instruments like exchange rate devaluation as ineffective instruments in promoting exports, with adverse consequences like inflation and a misallocation of foreign exchange [Stewart (1992)]. In addition, they contend that indiscriminate import liberalization contributes to the availability of cheap competitive consumer goods, while devaluation drives up the prices of essential inputs and capital goods. Furthermore, fiscal austerity reduces investment in and diversification of production and proves to be an obstacle in achieving the intended efficiency gains of adjustment policies [Sahn et al (1997)].

Proponents of the program, on the other hand, assert that fiscal balance, trade liberalization, and 'getting the prices right' are the appropriate and requisite reforms to improve the current account, increase growth and employment, and reduce inflation [Ibid].

Generally, it is argued that adjustment will reduce domestic demand for both traded and non-traded goods. Producers of traded goods can sell to foreigners instead, but producers of non-traded goods will initially suffer unemployment and reduced incomes. To restore full employment the price of the non-traded goods must fall, relative to the traded goods-a real devaluation [Lipton and Ravallion(1995)].

Hence, there is a consensus that the impact of adjustment depends, among others, on the speed of adjustment, flexibility of prices, supply response of the economy, whether the poor

are consumers of traded goods (and/ or whether the poor are engaged in the tradables sector), direction of change in the share of income devoted to traded goods, the composition of public expenditure cuts, and how factor markets work [Ibid].

Another important aspect is the issue of income distribution. Poverty may rise due to worsening income distribution despite economic growth during adjustment. By and large, it is argued that adjustment programs may fail when they do not recognize the interdependence of the three criteria of efficiency, welfare, and political feasibility [Bourguignon (1991)].

It is not the purpose of this study to indulge in the complex issue of structural adjustment and the poor. This requires showing that the present social value of the future consequence of consumption is higher with adjustment and than without it [Lipton and Ravallion (1995)]. Our interest in this section is to show how macroeconomic polices in general are related to poverty. The next section will take up the issue and attempts to synthesize a theoretical framework on the link between devaluation, fiscal policy and trade liberalization.

Because of the importance of growth for poverty reduction, and of macroeconomic stability for growth, some argue that the role of macroeconomic policy should be establishment, or strengthening of macroeconomic stability, enhancing the quality of growth which is pro-poor, creating a stable environment and level playing field favorable to private sector investment and broad-based economic growth, removing the cultural, social, and economic constraints that prevent the poor from making full use of their existing asset base and accessing markets, and augmenting the human capital base of the poor through provision of basic education and health services [Ames et al (2001)].

Apart from the growth impact of economic policies, macroeconomic shocks can also affect the welfare of the society through changes in relative prices, changes in aggregate labor demand, which can reduce employment levels and wage rates, changes in the rates of return on assets, which include inflation tax, changes in public transfers, and through changes in the provision of public health and public safety [Ferreira et al (2001)]

In a related manner, some interesting findings are also coming to the scene. Ghrua et al (2001) found that certain policies can have direct impact on the income of the poor, even after controlling for the effect of economic growth. These include policies that lower inflation, shrink government, promote financial development, and raise educational achievements. They term these policy-related variables 'super pro-poor' since they raise the income of the poor directly, as well as through the economic growth channel. They argue that the direct and indirect effects are mutually reinforcing, and thus there are no identified trade-offs between growth promotion and poverty-alleviation.

2.3 Growth, Inequality, and Poverty

As discussed earlier, one major link between macroeconomic policy and poverty reduction is through the growth impact macroeconomic policies. Several studies show reduced poverty during economic growth. Lipton and Ravallion (1995), in an estimate for eight developing countries, showed that a 2 percent annual growth in consumption per person resulting in poverty gap index by 2 to 8 percent assuming poverty is distributionally neutral. Dollar and Kraay (2001) found the income of the poorest one-fifth of the population to grow directly proportional to the mean income of the total population.

However, the relationship between growth and poverty is not as straight forward as it seems. This is because not only there are different patterns of growth but there is also the issue income inequality. A pro-poor growth strategy does not only have to focus not only on economic growth but also on income distribution. If rapid poverty reduction can be achieved through reduction in inequality, redistribution will be given priority. On the other hand, if higher inequality leads to rapid growth and faster poverty reduction, policy makers must bear with the inequality. [Bigsten and Levin, (2001)]. Hence, how income growth and inequality are systematically related does matter a lot in assessing the impact of economic policy on poverty.

Kuznet (1955), from a cross- sectional analysis of different countries perceived an initial rise followed by decline in income equality as per capita income rises – an inverted U pattern. In

a recent study Fobes (2000) found a positive relationship between inequality and growth. Some empirical evidence exists suggesting that growth is associated with rising inequality in Ethiopia [Dercon et al,2001]. There is also a group which maintains that there is a vicious circle between inequality and economic growth. Accordingly, higher inequality lead to higher economic growth through higher savings (i.e. the rich have higher marginal propensity to save than the poor), thus leading to higher capital formation and higher growth. Higher growth in turn leads to higher inequality [Bereket and Abebe (1997)].

The Kuznet hypothesis, however, is refuted by various studies. Ravllion and Chen (1997), and Deininger and Squire (1998) found that growth does not consistently affect inequality. In a study reviewing recent research dealing with the relationship between economic growth, income distribution and poverty, Bigsten and Levin (2001) failed to find any systematic pattern of change in income distribution in recent decades and systematic link from fast growth to increasing inequality. On the issue of the causality running from inequality to growth there is a continuous debate. Dinininger and Squire found no stable relationship between inequality and growth. In a similar fashion, Bigsten and Levin argued that initial income inequality is not a robust explanatory of growth. In contrast, Birdsall, Ross,Sabot (1995) found that low inequality of income in East Asia promoted fast growth.

Some argue that the impact of growth on inequality depends on initial distributions of assets, the nature of imperfections in markets, the pattern of growth, factor bias in technology, and government policies [Bradhan(1996)]. There is, however, a growing consensus that policies that foster growth need not be inconsistent with poverty reduction [Ibid].

2.4 Trade Liberalization and Poverty

McCulloch et al (2001) identify three pathways in which trade liberalization can directly affect the poverty status of individuals. The first is through the price mechanism. In this regard trade liberalization changes the prices of the liberalized goods. If these price changes are translated into changes in the prices actually faced by poor households, then the direct impact on poverty depends on whether poor households are net consumers or net producers

of the product whose price has changed. That is the increase in prices benefits net producers and hurts net consumers. However, it should also be noted that the impact of liberalization are much more associated not with changes in prices, but with the creation or destruction of markets, which affect the welfare of households. Moreover, it is vital to know whether the price changes at the border arising from trade liberalization are actually transmitted to the poor. Secondly trade liberalization may affect households through its impact on profits and hence on employment and wages. If wages are flexible and labor is fully employed, then price changes caused by trade liberalization will be reflected in wage changes, with employment staying the same. However, if some part of labor is unemployed, then trade liberalization will cause changes in employment. How this translates to affecting poverty depends not only on how employment changes, but also on the types of labor that poor households supply and where the various wage rates lie relative to the poverty line. Thirdly, the impact of trade liberalization may be transmitted through changes in changes in government revenue, particularly if trade taxation is an important source of revenue. That may lead reduction in government expenditure in the social sector which may affect the poor

There are four remaining fundamental issues with respect to the link between trade liberalization and poverty. The most important one is the impact of trade liberalization on economic growth. The second issue is the short- and medium-term costs of adjustment. These include unemployment and revenue loss from external trade taxes. Third, the nature of change on the nature of the risk and uncertainty that poor households face due to trade liberalization. It can also affect their ability to cope with risk and uncertainty. Finally, there is the issue of supply response: the ability of poor households to respond to the new opportunities presented by trade liberalization. [Ibid]. The above arguments are presented in FIG.2 adopted from the same source.

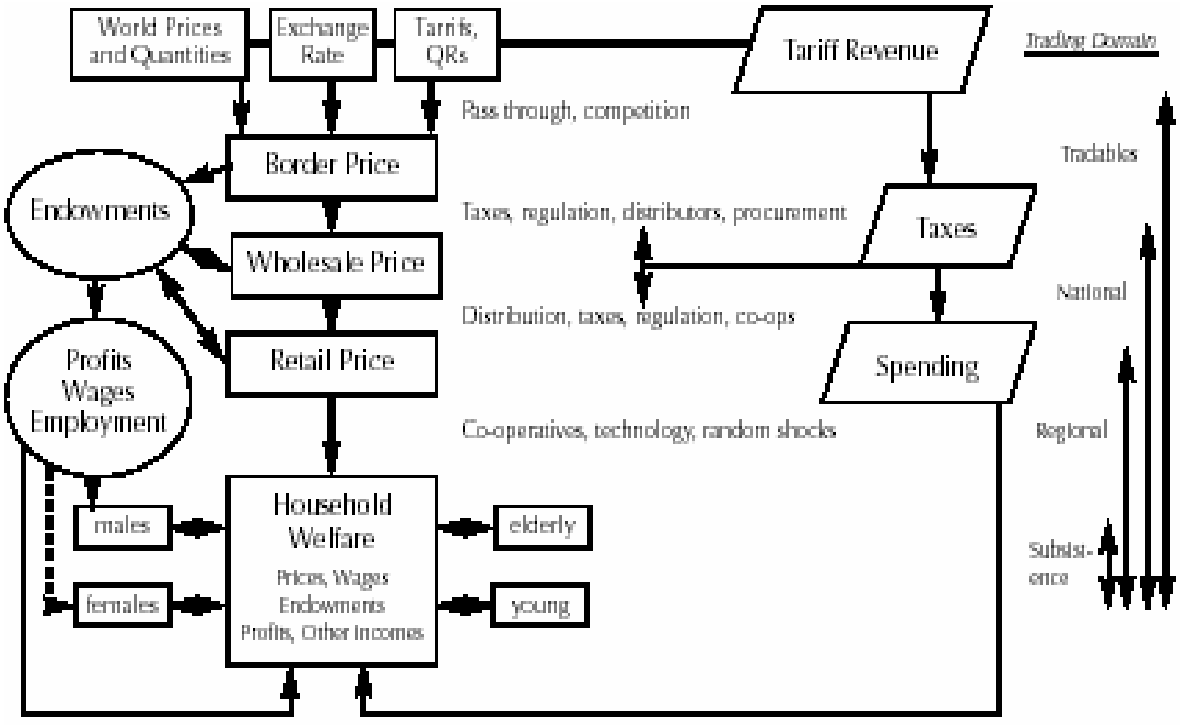
On the empirical front many have argued that trade liberalization benefits the poor. In an attempt to find the link between trade liberalization, growth and poverty, Dollar and Kraay (2001) found that growth rate of the globalizing world far exceeds the non-globalizers in the last three decades. Looking at the growth trends in the 1990s, they observed globalizing

developing economies growing at 5.0% in per capita; rich countries at 2% per capita; non-globalizing developing countries grew at the rate of only 1.4% per capita. Thus, they say, the globalizers are catching up with the rich countries while the non-goblizers are falling further and further behind. They also found that a strong positive relationship between changes in trade volumes and in growth rates. This is consistent with Debel (2001) who found that exports do significantly affect the growth of the Ethiopian economy. And, as they discovered no systematic relationship between changes in trade volumes and changes in the inequality of household income, they conclude that the increase in growth rates that accompanied expanded trade therefore on average translates into proportionate increases in the income of the poor.

But there is as well ample literature which makes it clear that for less developed with inadequate institutions and infrastructure, the effects of trade-led growth to be often irrelevant [Oskam et al (2002)]. Some also argue that even though trade liberalization leads to significant income increases, it should be accompanied by complementary reforms to fully realize the potential gains from the trade reform. Hence they emphasize the role complementary macroeconomic, regulatory, and financial market reforms to allow capital flows and efficient alternate tax collection to realize the large gains [Rutherfrod and Tarr (1998);Kydd et al (2002)].

Still others maintain that the very disappointing growth performance of Sub Saharan Africa, caused by declining market shares for its major export products which, in turn were the result of declining relative importance in world trade, is mainly the results of damaging trade policies, such as higher import tariffs. In fact, Ng and Yats (1998) argued that the share of African exports subject to non-tariff barriers is far lower than that of other developing countries which launched successful sustained export oriented industrialization drives. They assert that trade restrictions and domestic

Fig.2.1 Theoretical Framework on the Link between Trade Liberalization and Poverty



Source: McCulloch et al (2001)

policy interventions often create a bias against tradables, especially exports, that prevents the achievement of otherwise attainable rates of growth. Hertel et al (2000) also found that trade liberalization indeed reduces poverty but the transmission mechanism varies from country to country.

Though there is much evidence suggesting trade liberalization may help reduce poverty, some argue that may not be always the case. Winters (2000), for instance, maintains that trade liberalization may cause some markets to fail, which in turn would affect the poor. Furthermore, the poor cannot always take advantage of the opportunities that liberalization creates because they lack either the skills or capital. Moreover, liberalization can have uneven effects within households. The effects of liberalization also depend what is liberalized. As he noted, in Zambia and Zimbabwe, when the protection for manufacturing, declined, so did their output.

Some, who sympathize with anti-globalization demonstrators we watch often in the media, may feel not very well represented in the above review of arguments,. To do them justice, we conclude with one of such extreme views expressed in reference to Ethiopia:

' …the poor SSA nations and societies are not competitive in the free trade race as we learn from the tests (of SAP) and predictions of many scholars…the free trade-driven development path will simply pass over/discriminate against the economically, politically and technologically unfit, such as the hungry and 'illiterate' Ethiopian mass. At this moment the Ethiopian population (particularly the rural and urban poor) is left vulnerable and unprotected. The free competition race/globalization will simply dismantle particularly the hungry/subsistent Ethiopian rural poor and 'close him off' soon unless the population and the national government, together, come up with a united response. This generation should either revert from corporate globalisation to fairness-justice or the globalisation race will end up in violence or end of the times.' [Asmare (2003, p.36)].

2.5 Fiscal Policy and Poverty

Many believe that public expenditure is the most direct means of reducing balance-of – payments and budget deficits, and is consequently a key aspect of macroeconomic adjustment programs [Sahn (1992)] .The major concern with fiscal policy reform is that it may result in reduced spending on services received by the poor, decrease their earnings through declines in public employment and official wage, and increase the taxes they pay in the name of reducing deficits [Ravallion (2002)]. Fiscal policy, however, can also be used as

an instrument for redistributive policy and may be employed as an instrument for fighting poverty. It is empirically and theoretically well-founded that excessive government expenditure would result in inflation. But the poor, who do not have assets and wealth, are the ones who lose the most when prices continuously pick up [Easterly and Fischer (1999)]. In addition, rising public budget may crowd out private investment, which in turn would adversely affect growth. It may as well lead to the build up of both internal and external debt with all its dire consequences on the economy, in which the poor also partake.

There are people who argue that during aggregate cut in government budget, much of the reduction will be from the areas which benefits the poor as the poor are politically powerless. Nevertheless, some people point out flaws to this argument. Ravallion (2002) contend that if the poor have little or no power, and power is all that matters to the allocation of public spending, then the same reasoning would suggest that the poor gained little from public spending before the cuts; thus, they will not lose much from the cut. Furthermore, he argues that the non-poor may value spending on the currently poor due to altruism, negative externalities of poverty, or other spillover effects. In this case the richer group will want to protect spending on the poor from cuts without further intervention. In addition, since the non-poor can substitute easily between publicly-provided goods and market goods the marginal social gains from protecting spending on the poor will be larger than for the non-poor. The aggregate fiscal contraction may result in a change in the balance of power. Depending on the distribution of income, the resulting fiscal contraction may come with higher or lower relative power of the poor, with corresponding shifts in the composition of spending.

The consensus in this area that the composition of public expenditure cuts, can greatly affect the poverty outcomes of adjustment [(Lipton and Ravallion (1995)]. With this regard, Sahn (1992), after making analysis of spending in three years before and after donor-financed programs in Sub-Sharan Africa, found no pattern of increase or decrease in real levels of total and social sector expenditures or in social sector spending as a share of total expenditures. Our descriptive analysis in chapter one also confirms this, as far as Ethiopia is concerned.

2.6 Devaluation and Poverty

Apart form their growth impact, which might in turn translate into poverty reduction, trade and exchange rate policy reforms primarily affect the welfare of households as a result of changes in relative prices and in access to rents associated with various sorts of rationing and licensing when prices are controlled. [Lipton and Ravallion(1995)].As many of the economic ills of less developed economies were perceived to be the result of excess aggregate demand, the underlying objective of setting the relative price of tradables to non-tradables to be consistent with opportunity costs is to increase the efficiency of resource allocation and thereby to raise output in the economy. [Ibid]. Given that the poor typically posses labor in abundance, and that labor is mobile across the traded and non-traded goods sectors, the Stolper-Samuelson theorem would predict that returns to the abundant factor will rise. Returns to labor will increase only if the traded goods sector is more labor intensive than the non-traded goods sector. Accordingly, the poor should gain as their real wage will rise. [Ibid]

However, pursuit of such policy runs the risk of increasing prices of important tradable goods in the consumption bundle of the poor, which would in turn negatively affect their real income. Also the employment effects of real devaluation are often more ambiguous given that some non-tradables in LDCs are relatively labor intensive such as parts of the construction sector and informal sectors of many other industries. Hence devaluation may adversely affect those who are engaged in the non-tradables sector

In other words, given that expenditure switching component of adjustment favors exports, the benefit or the rise in rural incomes due to such a move largely depends on the proportion of households producing tradables. On the other hand, some non-tradables such as construction and government services are labor-intensive and a switch to tradables may reduce employment and income of the poor especially in the urban centers[Abbi (1996)] Therefore, exchange rate devaluation will help the poor if they produce tradable goods and will hurt them if they consume the same, such as imported necessities.

Some maintain that the impact of devaluation on the overall economy depends on the supply response. And the supply response of farmers to higher prices of traded goods will typically depend on the quality of supportive infrastructure. Hence, devaluation will only result in driving up the prices of important imported commodities and capital goods, which would result in reduced welfare, unless it is accompanied by the provision of such services and an attempt to mitigate the rigidities found in the tradable sector.

Moreover, the assumption that the rural poor tend to be net producers of tradable, many say, is unwarranted since the poor are heterogeneous. Nevertheless, there is some empirical evidence in Sub Saharan Africa suggesting that the distributional effects of real devaluation will tend to be pro-poor since the rural poor tend to be net producers of tradable goods. It was also found that devaluation, if accompanied by a careful mix of public spending would bring about higher growth. In Cote d'Ivoire as well, Lambert et al (1991 observed devaluation helping in reducing income inequality and poverty.

2.7 Computable General Equilibrium Models

Though the first applied Computable General Equilibrium (CGE) model was formulated by Johanson in 1960, its theoretical foundation dates back much further. The theoretical framework of general equilibrium models, as Declauwe et al (1988) note, is that of the general system of L.Walras (1926). Accordingly, in the model

1 There exist a finite number of producers, n, consumers, m, and goods, r, which may be production inputs or outputs.
2 Producer j, where j=1,2,…..,n, confronts a set of production possibilities V_j, whose general element,v_j, is a vector of dimension r, in which the positive elements are outputs and the negative elements are inputs. In the production possibilities: (i) there are no increasing returns to scale production without inputs is impossible; (2) total inactivity (v_j=0) is possible; (3) the production process is irreversible. For a price vector p with dimension r, which is a given to her, the producer chooses to produce the program v_j that maximizes her total profits.

Each consumer i, where i=1,2,…m, possesses an initial endowment of goods given by a vector w_i of dimension r. The consumer faces a set of consumption possibilities x_i, whose general element x_i is a vector of dimension r, called a basket of consumption. This set of possibilities of consumption is such that the consumer i is never saturated in her consumption of goods, and her initial endowment w_i allows her to survive. From a given price vector p, the consumer chooses the basket that maximizes her individual utility $u_i(x_i)$, given his budget constraint.

Through such representation of the economy, a general competitive equilibrium of the Walrasian type is defined by the price vector p which determines the m baskets of consumption x_i ,and the n production programs vj, such that,

1. The excess demands for the goods are non-positive, and, free goods, the goods in excess supply, have zero price
2. The m consumers maximize their individual utility, given their budget constraint.
3. The n producers maximize their total profits subject to their cost outlay.

In the system, only relative prices are important, since the quantities consumed or produced do not change if all the prices vary in the same proportion. Hence, the demand and supply functions, derived from the utility functions of consumers and the production functions of producers, are homogenous of degree zero, while the profit functions of the producers are homogenous of degree one [Ibid]

Applied CGE Models, built also by incorporating some rigidities not envisaged in theory, are based on the socioeconomic structure of a Social Accounting Matrix which is disaggregated in to different sectors and classes. In addition, they incorporate a few macroeconomic components, such as investment and savings, balance of payments, and government budget. Thus, as Sadoulet and de Janvry (1995) put it, they are good policy tools when the socioeconomic structure, prices, and macroeconomic phenomena all are important.

A very nice summary on the theoretical development of CGE models by Wobst (2000) inform us that after Johansen's linear approximation in 1960, much work in that period focused around developing the theoretical proofs concerning general equilibrium models. Empirical applications mostly used linear programming and input-output methods. This was, however, until Scarf (1967) developed another approach in solving general equilibrium models by developing a fixed-point algorithm capable of solving a nonlinear CGE equation system directly, without a prior linear approximation. This approach, known as the Scarf algorithm, was based on specifying an excess demand system characterized by non-negative solution prices, consistent with Arrow-Debreu theory. The algorithm guaranteed a solution for a wide variety of CGE models in a finite number of steps. Nevertheless this particular algorithm had some limitation in that it does not converge quickly.

In the 1970s, two other direct approaches became to be employed to solve nonlinear, empirical, general equilibrium models. The first method was a Walrasian process in which sectoral prices change iteratively as a function of sectoral excess demand. The second approach also treats the general equilibrium problem as a system of algebraic constraints, but uses the matrix of the first partial derivatives, the Jacobian matrix.

Ginsburgh and Waelbroeck (1981) developed yet another approach, in which they tried to incorporate endogenous prices, multiple consumers, and allow for price wedges. These computable general equilibrium models, as Robinson (1989), argues are a natural outgrowth of input-output and linear programming models, fitting in neoclassical substitute ability in production and demand, and an explicit system of market prices and a complete specification of the income flows in the economy, both of which to be determined simultaneously .

The characteristics of any CGE model can be portrayed by specifying agents along with their behavior and the closure rules that bring the different markets in equilibrium along with other macroeconomic characteristics. The agents are those identified in the SAM, but their behavior of will be different from SAM-based multiplier analysis. In CGE

models,producers are profit maximizers and their production decision is made based on prices. Their decision whether upply to the domestic or export market also depends on the relative prices they face in those markets. Domestic products and imports are usually assumed to be imperfect substitutes, and the composition of domestic supply (composite output) depends on their relative prices. imilarly households are assumed to maximize utility make their consumption decision based on their budget constraint and prices [Sadoulet and de Janvry(1995)].

In a standard neoclassical CGE, all the accounts are endogenous and thus must be in equilibrium. Producers sell their total production, factors distribute their income, firms and households spend their income, and available savings determines investment. Government deficit clears the government budget balance. But for the other accounts, there needs to be reconciliation between the independent supply and demand decisions. This occurs through the markets: supply and demand of commodities on the product markets, supply and demand of factors on the factor markets, and supply and demand of foreign exchange on the foreign exchange market. The standard rule in these markets is one of price flexibility and endogenous determination of the equilibrium prices, specified as commodity prices, factor prices, and exchange rate, respectively [Ibid].

The macroeconomic closures in a CGE are given in the external sector (balance of payments), the savings-investment equilibrium, and the government budget, and supply of primary factors of production. These closure rules bear important result on the behavior of the model. Individual agents do not consider these closures in making their decision but the system as a whole should satisfy them. Table 2.1, adopted from Löfgren et al (2001), gives the different macroeconomic closures usually used in standard CGE modeling.

As stated earlier, the behavioral assumptions of a CGE model are usually that agents respond to relative prices rather that to the absolute level of any price. That is all demand and supply functions of the model are homogenous of degree zero in all prices. The system will then only solve for relative prices. One price or price index will normally be set as constant. This price is called the numeraire. Among the possible alternatives are the aggregate producer price, an aggregate consumer price, and the exchange rate. The numeraire defines a unit of account for all the nominal values. In cases where no other price or nominal values are explicitly set exogenously, the real values of the system are independent of the choice of numeraire. (Sadoulet and De Janvry (1995); Löfgren (2001)]

Table 2.1 Alternative Macroclosures

Constraint		
Government	Rest of World	Savings-Investment
GOV-1 Flexible government savings; fixed direct tax rates	ROW-1 Fixed foreign savings; flexible real exchange rate	SI-1 Fixed capital formation ; uniform MPS[19] point change for selected institutions
GOV-2 Fixed government savings; uniform direct tax rate point Range for selected institutions	ROW-2 Flexible foreign savings; fixed real exchange rate	SI-2 Fixed capital formation; fixed MPS for all non-government institutions
GOV-3 Fixed government savings; scaled direct tax rates for selected institutions		SI-4 Fixed investment and government consumption absorption shares (flexible quantities);uniform MPS point change for selected institutions
		SI-5 Fixed investment and government consumption absorption shares (flexible quantities);scaled MPS for selected institutions

Source: Lofgren et al (2001)

In the literature several types of CGE models are identified. Robinson (1989) talks about three types of general equilibrium models: stylized, analytical, and applied. Analytical models, designed to facilitate theoretical analysis are usually simple and much abstracted from empirical complications. They attempt to achieve analytical tractability at the cost of empirical relevance. Hence, they serve more of a pedagogical purpose. Stylized models, on the other hand, try to include representative (typical) economic features that reflect the situation of a class of countries. Applied models, as their name suggest, are designed to allow

[19] MPS denotes marginal propensity to save.

for a country-specific analytical focus. They also incorporate detailed specification of the

institutional side of the economy under investigation which restricts their general applicability. One can also contrast a multi-country model, which focuses on issues like global trade liberalization, regional trade agreements, interregional migration, and the worldwide sustainable exploitation of natural resource, from a single country model which has a relatively narrow national focus. (Wobst, 2000). One can also distinguish between dynamic and non-dynamic CGE models. The non-dynamic models are generally single-period CGE models used for comparative-static analysis while the dynamic ones can be used for multi-period analysis. The former are appropriate in situations of analyzing a one-time shock, such as sudden external or domestic policy changes. Intertemporal interests of policy changes, however, call for dynamic CGE models. CGE models can also be classified as financial and non-financial (real economy-side). Financial CGE models, which are more complicated that the non-financial ones, incorporate money, capital, and asset market explicitly. In the real-side CGE models financial variable are not plainly specified. There is a continuing debate on how to integrate the financial sector with the real sector on CGE models. However many argue in choosing between the two the advantages of incorporating financial intermediation against the disadvantage of the more complex model structure is crucial [Robinson (1989); and Wobst (2000)]. The simple CGE model applied in this study is a non-dynamic and a non-financial one.

2.8 Measurement and Analysis of Poverty Within a General Equilibrium Framework

CGE models are powerful tools in analyzing the external shocks on the domestic economy. They are more so when the indirect sectoral linkages prove to be important. [Sadoulet and De Janvry; Wobst(2000)]. Wobst has also shown that they more appropriate than traditional partial equilibrium models for poverty analysis. Accordingly, common partial equilibrium models do not account for the economy-wide multiplier effect observed in the general equilibrium specification as they typically overestimate sectoral benefits because they do not account for the negative repercussions analyzed in general equilibrium models. This is primarily so due to the fact partial equilibrium analysis are done under implicit fixed-price

assumptions. In comparison, the full CGE specification accounts for economy wide intersectoral linkages and repercussions through relative price changes in commodity and factor markets [Ibid].

Applications general equilibrium models for poverty analysis are numerous. A typical example is studies of the OECD project in 1991[20]. There is also one study by Tadele (2002) in which poverty analysis is made for Ethiopia using social accounting matrix based multiplier analysis. Three approaches are identified in the literature in conducting poverty and income distribution analysis within a general equilibrium framework. The first is the traditional approach which consists of simply disaggregating households as much as possible according to socio-economic or location criteria. Here one is required to assume that there is a single representative household for each identified group. Accordingly, it is possible to evaluate and compare the impact of economic policies on the income and well-being of different groups by running simulation exercises. Clearly this approach, can merely be used to study inter group inequalities and does not indicate the level of poverty or the inter group inequalities.

The second type of exercise is based on the previous one but includes information on intra group income distribution. Using income and expenditure surveys, it is possible to generate the within income distributions prevailing in the same base year as that of the SAM used to calibrate the CGE model. Assuming that the income distributions are stable, one is able to produce counterfactual results on poverty. The simulation of the general equilibrium model thus provides new values with respect to the average income level of each group. Assuming that intra group distribution is unchanged, and applying average variations onto it, one is able to calculate the indicators of poverty. This is the approach that this particular study employs. Furthermore, in this approach it is possible to use the CGE results on relative prices to re-evaluate the cost of a basket of necessary goods and therefore the level of the line of poverty. The limitation of this approach is that it is impossible to see intra- group inequalities.

[20] The results of the studies in the project are reported in World Development, Vol. 19,No. 11,1991.

There is recently a new approach developed to mitigate the above limitation using microsimulation techniques. It incorporates individual data into the CGE model which would enable one to see intra-group income inequality as well. Nevertheless, this is technically more complicated than the other two approaches [Decaluwé, Dumont and Savard (1999)].

Before concluding the literature survey, it is worth mentioning that using general equilibrium models for poverty analysis is not without limitations. Some people argue that unrealistic macroeconomic closures and imported behavioral parameters usually cast doubt on the results of the model [de Maio et al (1999)].

Chapter Three

Model Specification

This chapter has two sections. In the first section a limited discussion on a standard social accounting matrix is presented to be followed by the demonstration of the SAM employed in the study. The second section is devoted to the description of the computable general equilibrium model used in the study. The CGE model is a modified version of the one developed by Lofgren, Harris, and Robinson (2001).

3.1 The Social Accounting Matrix

A computable general equilibrium model is usually calibrated using a Social Accounting Matrix (SAM). A SAM is a comprehensive economy wide data framework representing the economy of an individual country. It is basically the extension of the input-output matrix by including income and consumption aspects of the economy. It is a square matrix in which each transactor or account has its own row and column. The payments of an account are listed in columns and the receipts are recorded in rows. The sum of all expenditures by a given account must equal the total sum of receipts or income for the same account. Hence, the row sums must equal the column sums of the corresponding account, ensured by the principle of double-entry accounting. The standard SAM incorporates six types of accounts. These are the activities/production accounts (producing sectors), the commodities accounts (representing the domestic market), factors (of production) accounts, the institutions account (households, firms, and the government), the capital account and the rest of the world account. The distinction between activities and commodities is required in cases where a

given activity produces multiple commodities or a given commodity is produced by more than one activity. In an aggregate SAM where there is a one-to-one mapping between commodities and activities, there may be no need to have a separate account for commodities.

In the SAM that is applied in the study, which is an aggregated version of a SAM constructed for Ethiopia by Ayele (2000)[21], three activity accounts are present: the Agriculture Sector, the Manufacturing Sector, and the Services Sector. Two factors of production, capital and labor, are employed in the three sectors. In the institutions account, one account for firms is created. Households are disaggregated into urban and rural. There is an aggregate government sector account along with an account for Indirect Taxes. There is a consolidated capital account for all the domestic institutions and the rest of the world account. Finally, there is a single foreign sector account. To facilitate the discussion on transactions among the different accounts, I have adopted a diagram from Thorbecke (1988), as presented in Decaluwe et al (1999).

Figure 3.1 expresses the interaction among the accounts in a standard SAM. The activities account buys inputs among each other (5.5)[22], which is the intermediate demand between sectors. It also spends on intermediate imports. Furthermore, the same account pays indirect taxes to the government as well as the value added to factors of production. (1.5). Factors of production distribute the value-added to institutions (households and firms). It should be noted that while households spend part of their income on consumption of domestic production (5.2) and imports (6.2), firms do not consume. The revenue for the activity account also comes from exports (5.6). With regard to institutions, they make transfer among themselves (2.2). Their income is, on the other hand, augmented by transfers from the rest of the world (2.6) and the government (2.3). The combined capital account derives its receipts

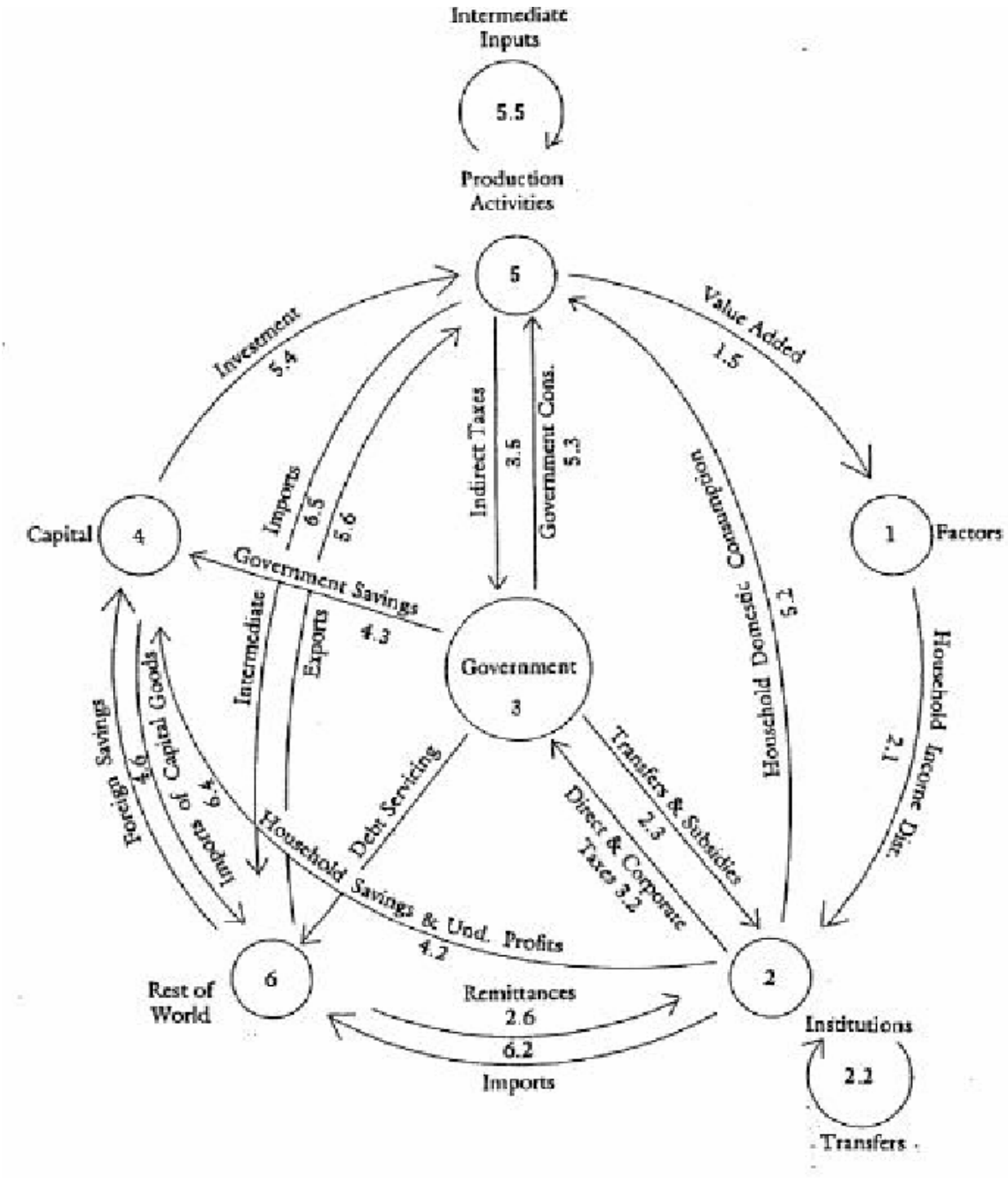
21 The original SAM was designed to analyze urban-rural linkages; therefore, I have aggregated it to suit my purpose.

[22] The numbers refer to those assigned to the arrows in Fig 3.1.

from savings of institutions (4.2), the government (4.3) and foreign savings. This account spends its revenue on investment (5.4) and import of capital goods (4.6). The government account derives its income from direct and corporate taxes on households and firms (3.2), and indirect taxes on activities. The government spends its income on consumption of goods and services in the activity accounts (5.3), makes transfers and subsidies to households and firms (2.3), pays back its external debt, and saves the remaining balance (4.3). The schematic structure of the SAM employed in the study is given in Table 3.1 followed by the actual SAM (Table 3.2) from which many of the base year values and other parameters required for the CGE model are derived in the next chapter. There is no need of describing the theoretical SAM as it can easily be explained using the preceding discussion. The interpretation of the figures in the actual SAM can be found in the theoretical one as the latter is constructed to exactly replicate the former.

The data requirement for the construction of a SAM is usually enormous. Among the different data sources, input-output tables, national accounts, household income and consumption surveys can be mentioned. The degree of the disaggregation of the various accounts depend on the purpose of the study. A study that is concerned with intersectoral linkages will disaggregate the activity and/or commodity accounts in a relative detail. Poverty analysis within a general equilibrium framework requires the household accounts to be much more disaggregated than the former. With regard to the construction of SAM two approaches are suggested. In the first approach, one starts from a highly aggregated SAM (usually based on the country's national accounts) and goes on by further disaggregating the SAM. The second approach reverses this order. Accordingly, from a highly disaggregated data (such as household income and consumption surveys) one will move to an aggregated SAM. An existing SAM can be updated using the Row and Column (RAC) and Cross Entropy methods. An interested reader may refer to Robinson et al (2000) on the estimation and updating of a SAM.

Fig 3.1 Transactions in a Basic SAM



Source: Decaluwe et al (1999).

Table 3.1 The Schematic Specification of the SAM for Ethiopia

		Agri.	Man..	Servi.	Lab.	Cap.	Rural HH	Urban HH	Firms	GOV't	Cap. Acc	ROW	Ind. Tax	Total
		1	2	3	4	5	6	7	8	9	10	11	12=12(a) +12(b)	
1	Agriculture	Intermediate Demand for Agri. from Agri.	Intermediate Demand for Manu.. from Agri.	Intermediate Demand or ser,. from Agri.			Rural HH Con. Of Agri.Com.	Urban HH Con. of Agri.		Gov't Con. of Agri. Comm..	Inv't On Agri.	Exports from Agri.		Agriculture output
2	Manufacturi-ng	Intermediate Demand for Agri. from Man..	Intermediate Demand for Manu. from Man.	Intermediate Demand for Ser. from Man.			Rural HH. con. of Man.	Urban HH. con. of Man.		Gov Con. of Man..Com.	Inv't On Man.	Exports From Man.		Manufactui-rng. Output
3	Services	Intermediate Demand for Agri. from Services.	Intermediate Demand for Man. from Services.	Intermediate Demand for Ser. from Services.			Rural HH Con. of Services.	Urban HH Con. of Services.		Gov Con. of Services.	Inv't On Ser.	Exports From Ser.		Service Ouput
4	Labor	Labor Income from Agri.	Labor Income from Man.	Labor Income from Ser.										Wage Expenditure
5	Capital	Rental Income from Agri	Rental Income from Man.	Rental Income from Ser.										Rental Cost outlay
6	Rural HH				Rural Labor Income				Firms Transfer To Rural Households	Gov't Transfers To Rural HH		Transfers from RoW To rural HH		Rural Household Inocme
7	Urban HH				Urban Labor Income				Firms Transfer To Rural Households	Gov't Transfers To Urban HH		Transfers from RoW To Urban HH		Urban Household Income
8	Firms					Capital Income			Taxes on Firms	Gov't Transfers To Firms.				Firm Income
9	GOV't						Direct Taxes on Rural HH	Direct Taxes on Urban HH				Transfer to Gov. From RoW	Indirec tax revenue	Gov' t Revenue
10	Capital Account						Rural HH Savings	Urban HH Savings	Savings of Firms	Gov't Savings		Foreing Savings		Savings

Table 3.1 (Continued)

		Agri.	Man.	Servi.	Lab.	Cap.	Rural HH	Urban HH	Firms	GOV't	Cap. Acc	ROW	Ind. Tax	Total
		1	2	3	4	5	6	7	8	9	10	11	12=12(a) +12(b)	
11(a)	Row	Agricultural Imports	Imports of Manufacturing	Imports of Serv			Net Transfer From Abroad	Net Transfer From Abroad		Net Transfer From Abroad	Imports of Capital goods [(11(a)+11(b)]			Foreign Exchnage ouflow
11(b)	Goods and services	Agricultural Imports	Imports of Manufacturing	Imports of Serv.			Rural HH Con .of Imports	Urban HH Con .of Imports		Gov't con. Of imports	Imports of Capital goods			Imports of goods and services
11(c)	Transfers						Rural HH Transfers to RoW	Urban HH Transfers to RoW		Gov't transfers to RoW.				Transfers to Row
12a)	Net Indirect Taxes on local Goods						Indirect Taxes on Rural HH con. of local Goods.	Indirect Taxes on Urban HH con. of local Goods.		Indirect Tax Expenditure on Local goods				Indirect Taxes on Local goods
12b)	Import Duties	Import duties from Agri.	Import duties from Man..	Import duties from Ser.			Import tariffs on rural hh con. Of imports	Import tariffs on urban hh con. Of imports		Import Duty Expenditure	Import duties on capital goods			Import Duties
Gross Input		Demand for Agricultural output	Demand For Man. Ouput	Demand for Service output	Labor Income	Capital Income	Rural hh Expenditure	Urban hh Expenditure	Expenditure Of Firms	Gov't Expenditure	Investment	Foreign Exchange Inflow	Indirect Taxes	

Source: Author

Table 3.2 :A Balanced Social Accounting Matrix for Ethiopia 1996 (Millions of Birr)

		1	2	3	4	5	6	7	8	9	10	11	12	Total
		Agriculture	Manufacturing	Services	Labor	Capital	Rural HH	Urban HH	Firms	GOV't	Capital Acct.	ROW	Ind Tax	
1	Agriculture	777	2315	196	0	0	13809	2072	0	40	38	2007	0	21255
2	Manufacturing	179	1101	1864	0	0	3336	2330	0	36	637	551	0	10034
3	Services	179	1651	1142	0	0	957	10391	0	1137	2993	2372	0	20822
4	Labor	16369	1253	7203	0	0	0	0	0	0	0	0	0	24825
5	Capital	2680	1423	8015	0	0	0	0	0	0	0	0	0	12177
6	Rural HH	0	0	0	16742	0	0	0	2640	318	0	0	0	19701
7	Urban HH	0	0	0	8083	0	0	0	8085	186	0	-354	0	16000
8	Firms	0	0	0	0	12117	0	0	0	6637	0	0	0	18754
9	GOV't	0	0	0	0	0	186	203	3461	0	0	0	2862	6711
10	Capital Account	0	0	0	0	0	159	328	4569	-773	0	2964	0	7246
11	RoW	851	1790	1772	0	0	638	316	0	-903	3195	0	0	7657
11(a)	Goods and Services	851	1790	1772			638	316		27	3195	0	0	8588
11(b)	Transfers	0	0	0	0	0	0	0	0	-931	0	0	0	-931
12(a)	Net Indirect Taxes	119	287	419	0	0	106	106	0	27	0	117	0	1181
12(b)	Import Duties	102	215	213	0	0	510	253	0	5	383	0	0	1681
	Total	21255	10034	20822	24825	12117	19701	16000	18754	6711	7246	7657	2862	

Source: Computed from Ayele (2000)

3.2 The Model

The CGE model is the one developed by Löfgren, Harris, and Robinson (2001) albeit with some modifications based on Löfgren (2000). In the model, producers are assumed to maximize profits subject to production functions, with primary factors as arguments. Producer technology is given by Cobb-Douglas function. Households also maximize utility subject to their budget constraints. Again the demand system for household consumption of commodities is derived from Cobb-Douglas utility functions. The model as a whole is homogenous of degree zero in prices. Flexible prices are assumed to clear markets for all commodities. In the savings-investment balance, the closure is saving-driven in which investment value adjusts to changes in the value of total savings. Flexible exchange rate clears the rest of the world account. For the government sector, government savings clear the balance. In the factors market labor is assumed to be unemployed with specific real wages and the quantity of labor supply is the market-clearing variable. Full employment but with no mobility among activities is assumed for capital so as to capture the rigid investment structure of the economy. A flexible market-clearing wage for each factor activity combination is assumed. Domestic products are assumed to be imperfect substitutes for imports, given by constant elasticity of substitution (CES) function. Similarly, imperfect transformability between domestic output for exports and domestic sales is assumed, which is represented by constant transformation function (CET). Three actitivities/commodities namely agriculture, industry, and services are identified. Labor and capital are the available factors of production. The institutions are households, categorized in urban and rural areas, government and the rest of the world. The equations system is divided into four blocks: the price block, production and commodity block, institution block, and system constraint block. The specifications and descriptions of the equations are presented below.

Equations (1) to (6) constitute the Price Block of the System:

Import Price

The domestic import price, PM ,of commodity c is given by world import price expressed in foreign currency, pwm_c , multiplied by the exchange rate , EXR (which is specified as domestic currency per unit of foreign currency), and the tariff adjustment, tm_c . Hence, import tariffs increase the domestic currency price of imports faced by agents in the economy.

$$PM_c = (1 + tm_c) \cdot EXR \cdot pwm_c \qquad c \in \text{CM} (\subset \text{C})^{23} \qquad (1)$$

$$\begin{bmatrix} \text{import} \\ \text{price} \\ \text{(dom.cur)} \end{bmatrix} = \begin{bmatrix} \text{tariff} \\ \text{adjustment} \end{bmatrix} \cdot \begin{bmatrix} \text{exchange rate} \\ \text{(dom.cur.per} \\ \text{unit of for. cur.} \end{bmatrix} \cdot \begin{bmatrix} \text{import} \\ \text{price} \\ \text{(for. cur.)} \end{bmatrix}$$

Export Price

Similarly, the export price of a commodity in domestic currency, PE_c , is the product of the commodity's international export price, pwe_c , the exchange rate, and the export tax levied on the commodity, te_c . As can be seen from equation (2), export taxes reduce the domestic price of exports received by producers.

$$PE_c = (1 - te_c) \cdot EXR \cdot pwe_c \qquad (2)$$

[23] C denotes the set of commodities, while CE and CM are exported and imported commodities. F refers to factors of production. H and A are sets of households and activities, respectively. I represents institutions as a whole.

$$\begin{bmatrix}\text{export}\\ \text{price}\\ \text{(dom.cur.)}\end{bmatrix}=\begin{bmatrix}\text{tariff}\\ \text{adjustment}\end{bmatrix}\cdot\begin{bmatrix}\text{exchange rate}\\ \text{(dom.cur. per}\\ \text{unit fo for. cur)}\end{bmatrix}\cdot\begin{bmatrix}\text{export}\\ \text{price}\\ \text{(for.cur)}\end{bmatrix}$$

Both import and export prices in foreign currency are exogenous to the model, indicating that we are employing 'the small country assumption' in which the country is a price-taker and does not influence international market. This assumption is realistic to the Ethiopian economy, which has a marginal share in world trade.

Absorption

$$PQ_c \cdot QQ_c = [PD_c EQD_C + (PM_c \cdot QM_c)_{cECM}](1+tq_c) \qquad c \in \text{CE} (\subset \text{C}) \qquad (3)$$

$$\left[\text{absorption}\right]=\left(\begin{bmatrix}\text{domestic sales price}\\ \text{times}\\ \text{domestic sales quanitity}\end{bmatrix}+\begin{bmatrix}\text{import price}\\ \text{times}\\ \text{import quanitity}\end{bmatrix}\right)\cdot\begin{bmatrix}\text{sales tax}\\ \text{price}\\ \text{adjustment}\end{bmatrix}$$

Absorption (total domestic spending on the commodity at domestic demander prices) is given as the sum of spending on domestic output sold domestically (QD_c) and imports (QM_c), multiplied by their respective prices, PM_c and PD_c,including an upward adjustment for the sales tax, tq_c. This condition follows from the linear homogeneity of the composite supply (Armington) function (Equation 11). The composite price, PQ_c, is paid by domestic demanders (households, the government, producers and investors). This is derived by dividing equation (3) throughout by QQ_c (composite supply of a commodity).

Domestic Output Value

$$PX_c \cdot QX_c = [PD_c \cdot QD_C + (PE_c \cdot QE_c)_{cECE}] \qquad c \in \text{C} \qquad (4)$$

$$\begin{bmatrix}\text{producer price}\\ \text{times}\\ \text{domestic output quantity}\end{bmatrix}=\begin{bmatrix}\text{domestic sales price}\\ \text{times}\\ \text{domestic sales quanitity}\end{bmatrix}+\begin{bmatrix}\text{export price}\\ \text{times}\\ \text{export quantity}\end{bmatrix}$$

Domestic output value (QX_c) at producer prices, PX_c, is stated as the sum of the value of domestic output sold domestically and the export value, which is the product of export price and quantity, QE_c. This equation reflects the fact that the CET function is linearly homogenous. Similar to equation (3), the producer price (PX_c) can be derived by dividing equation (4) throughout by domestic output quantity, QX_c.

Activity Price

$$PA_a = \sum_{cEC} PX_c \cdot \theta_{ac} \qquad a \in \text{A} \qquad (5)$$

$$\begin{bmatrix}\text{activity}\\ \text{price}\end{bmatrix} = \begin{bmatrix}\text{producer prices}\\ \text{times}\\ \text{yields}\end{bmatrix}$$

In equation (5), activity price, PA_a, is given by the product of producer prices and yield of commodity c per unit of activity a, θ_{ac}.

Value-added Price

$$PVA_a = PA_a - \sum_{cEC} PQ_c \cdot ica_{ac} \qquad a \in \text{A} \qquad (6)$$

$$\begin{bmatrix}\text{valued - added}\\ \text{price}\end{bmatrix} = \begin{bmatrix}\text{activity}\\ \text{price}\end{bmatrix} - \begin{bmatrix}\text{input cost}\\ \text{per actitvity unit}\end{bmatrix}$$

Valued added price, PVA_c, the residual of activity price after input cost is covered, where ica_{ca} represents the quantity of commodity c as intermediate input per unit of activity a.

Equations 7-12 make the production block of the system.

Activity Production Function

$$QA_a = ada \prod QF_{fa}^{\alpha_{fa}} \qquad a \in \text{A} \qquad (7)$$

$$\begin{bmatrix}\text{activity}\\ \text{level}\end{bmatrix} = f\begin{bmatrix}\text{factor}\\ \text{inputs}\end{bmatrix}$$

Equation (7) is the Cobb-Douglas production function used in the model. Accordingly, quantities of factors of production, QF_{fa}, enter as the arguments in total the level of activity in each sector, QA_a. The parameter, ad_α, denotes the production efficiency parameter where as α_{fa} is the value-added share for factor f in activity a. As the sum of α_{fa} for the two factors in a given sector add up to unity, a constant returns to scale in production is assumed. One limitation of using a Cobb-Douglas production function is that the elasticity of substitution between factors of production is always unity. An alternative specification is a Constant Elasticity of Substitution (CES) production function where the elasticity of substitution between factors of production takes a constant value that may be different from one.

Factor Demand

$$WF_f \cdot WFDIST_{fa} = \frac{\alpha_{fa} \cdot PA_\alpha \cdot QA_a}{QF_{fa}} \qquad f \in F,\ a \in \text{A} \qquad (8)$$

$$\begin{bmatrix}\text{marginal cost}\\ \text{of factor f}\\ \text{in activity a}\end{bmatrix} = \begin{bmatrix}\text{marginal revenue}\\ \text{product of factor}\\ \text{f in activity a}\end{bmatrix}$$

As described in equation (8), the first order condition for profit maximization ensures that each factor gets its marginal revenue product. The wage distorting factor, $WFDIST_{fa}$, is the ratio of activity specific wage rate, WF_f, to the average wage rate in all sectors.

Intermediate Demand

$$QINT_{ca} = ica_{ca} \cdot QA_a \qquad a \in \text{A},\ c \in \text{C} \qquad (9)$$

$$\begin{bmatrix}\text{intermediate}\\ \text{demand}\end{bmatrix} = f\begin{bmatrix}\text{activity}\\ \text{level}\end{bmatrix}$$

Intermediate demand for a commodity, $QINT_c$, is given by Leontief technology. Hence, there is fixed share of commodity c that is employed in activity a, ica_{ca}.

Output Function

$$QX_c = \sum \theta_{ac} \cdot QA_a \qquad c \in C \qquad (10)$$

$$\begin{bmatrix} \text{domestic} \\ \text{output} \end{bmatrix} = f \begin{bmatrix} \text{activity} \\ \text{level} \end{bmatrix}$$

In equation (10), the value of domestic output is the expressed as the sum of the yields of the various commodities per unit of activity a, θ_{ac}, times the level of activity in each sector.

Composite Supply (Armington) Function

$$QQ_c = aqc \cdot (\delta_c^q \cdot QM^{-\rho_c^q}{}_c + (1-\delta_c^q) \cdot QD_c^{-\rho_c^q})^{\frac{-1}{\rho_c^q}} \qquad c \in CM\ (\subset C) \qquad (11)$$

$$\begin{bmatrix} \text{composite} \\ \text{supply} \end{bmatrix} = f \begin{bmatrix} \text{import quantity, domestic use} \\ \text{fo domestic output} \end{bmatrix}$$

Domestic economic agents demand composite commodities. The assumed imperfect substitutability between imports and domestic output sold domestically is captured by CES aggregation function in which the domestic composite commodity supply is comprised of domestic output sold domestically and imported commodities. This means that preferences of demanders over imports and domestic output are expressed as a CES function. This is called an Armington function, following the originator of the idea [Armington (1969)]. The value of ρ_c^q, exponent for composite supply function, is restricted as $-1 < \rho_c^q < \infty$ so that the corresponding isoquant is convex to the origin, ensuring diminishing technical rate of substitution. aq_c and δ_c^q denote the shift and share parameters for composite supply (Armington) function, respectively.

Import-Domestic Demand Ratio

$$\frac{QM_c}{QD_c} = \left(\frac{PD_c}{PM_c} \cdot \frac{\delta_c^q}{1-\delta_c^q}\right)^{\frac{1}{1+\rho_c^q}} \qquad c \in \text{CM} (\subset \text{C}) \qquad (12)$$

$$\begin{bmatrix}\text{import -} \\ \text{domestic} \\ \text{demand ratio}\end{bmatrix} = f\begin{bmatrix}\text{domestic -} \\ \text{import} \\ \text{price ratio}\end{bmatrix}$$

Here the mix between imports and domestic output is expressed as their relative prices. Equation (3), (11), and (12) represent the first-order conditions for cost minimization subject to the Armington function and a fixed quantity of the composite commodity given the two prices.

$$QX_C = at_c \cdot (\delta_{tc}^t \cdot QE_c^{\rho_c^t} + (1-\delta_c^t) \cdot QD_c^{\rho_c^t})^{\frac{1}{\rho_c^t}} \qquad c \in \text{CE} (\subset \text{C}) \qquad (13)$$

$$\begin{bmatrix}\text{domestic} \\ \text{output}\end{bmatrix} = f\begin{bmatrix}\text{export quanitity, domestic} \\ \text{use of domestic output}\end{bmatrix}$$

In equation (13), imperfect transformability between domestic output for exports and domestic sales is imposed as CET function is employed. Here the isoquant corresponding to the output transformation function will be concave to the origin as the value of ρ_c^t, exponent for output transformation (CET) function, is restricted between – 1 and ∞. In this equation, the shift and share parameters for output transformation (CET) function are given by δ_c^t and at_c, respectively.

Export-Domestic Supply Ratio

$$\frac{QE_c}{QD_c} = \left(\frac{PE_c}{PD_c} \cdot \frac{1-\delta_c^t}{\delta_c^t}\right)^{\frac{1}{\rho_c^t - 1}} \qquad c \in \text{CE} (\subset \text{C}) \qquad (14)$$

$$\begin{bmatrix}\text{export -}\\ \text{domestic}\\ \text{supply ratio}\end{bmatrix} = f\begin{bmatrix}\text{export}\\ \text{domestic}\\ \text{price ratio}\end{bmatrix}$$

Equation (14) gives the optimal combination between exports and domestic sales as a function of their relative prices. Equations (4),(13), and (14) constitute the first order conditions for maximization of profit subject to the CET function and fixed quantity of domestic output given the relative prices of exports and domestic sales.

Assuming imperfect substitutability between imports and local output (CES function) and imperfect transformability between exports and domestic output locally sold (CET function) has the advantage in that it restricts unrealistic import demand and export supply responses to relative price changes.

The Institution Block of the system is given by equations 15-22.

Factor Income

$$YF_f = \sum_a WF_f \cdot WFDIST_{fa} \cdot QF_{fa} \qquad f \in F\ ,\ h \in \mathrm{H}\ (\subset \mathrm{I}) \qquad (15)$$

$$\begin{bmatrix}income\\ of\\ \text{factor f}\end{bmatrix} = \begin{bmatrix}\text{average wage (rental}\\ \text{price) times}\\ \text{wage distorting factor}\end{bmatrix} \cdot \begin{bmatrix}\text{factor}\\ \text{supply}\end{bmatrix}$$

Factors of production derive their incomes, YF_f, from activities that employ them which depend on the wage rate in each activity and their supply, QF_{fa}.

Tax on Firms

$$FIRMTAX = ftr * YF_{capital} \qquad (16)$$

$$\begin{bmatrix}direct\\ tax\\ \text{on firms}\end{bmatrix} = \begin{bmatrix}\text{average tax rate}\\ \text{on firms}\end{bmatrix} \cdot \begin{bmatrix}\text{Rental}\\ \text{Income}\end{bmatrix}$$

Equation (16) show that taxes paid by firms, *FIRMTAX,*is a fixed share, *ftr* ,of their rental income, $YF_{capital}$

Savings by Firms

$$FIRMSAV = YF_{capital} + tr_{firms,gov} - FIRMTAX - \sum_{h} tr_{h,firms} \qquad (17)$$

$$\begin{bmatrix} firms' \\ savings \end{bmatrix} = \begin{bmatrix} \text{Rental} \\ \text{Income} \end{bmatrix} + \begin{bmatrix} \text{transfers to firms} \\ \text{from the government} \end{bmatrix} - \begin{bmatrix} taxes \\ on \\ firms \end{bmatrix} - \begin{bmatrix} transfers \\ \text{from firms to} \\ \text{households} \end{bmatrix}$$

As opposed to households, firms do not consume, and hence, they spend their income only on tax payments to the government and transfers to households, $\sum_{h} tr_{h,firms}$. The remaining amount $FIRMSAV$, goes the combined capital account. It should be noted that firms' income is augmented by transfers received from the government, $tr_{frims,gov}$.

$$YH_h = \sum_{fEF} shry_{hf} YF_{hf} + tr_{h,gov} + tr_{h,firms} + EXR \cdot tr_{h,row} \qquad h \in \text{H} (\subset \text{I}) \qquad (18)$$

$$\begin{bmatrix} \text{household} \\ \text{income} \end{bmatrix} = \begin{bmatrix} \text{factor} \\ \text{incomes} \end{bmatrix} + \begin{bmatrix} \text{transfers from} \\ \text{government , firms \&} \\ \text{rest of the world} \end{bmatrix}$$

Households in both rural and urban areas derive their income, YH_h , from factor income, $\sum_{fEF} shry_{hf} YF_{hf}$, transfers from the government, $tr_{h,gov}$, and from firms, and the rest of the world (which is converted into domestic currency by multiplying it with the exchange rate) denoted by $tr_{h,firms}$ and $tr_{h,row}$. $shry_{\text{hf}}$ is the share of the income from factor f in household h.

Household Consumption Demand

$$QH_{ch} = \frac{\beta_{ch} \cdot (1 - mps_h) \cdot (1 - ty_h) \cdot YH_h}{PQ_c} \qquad c \in C, \quad h \in H (\subset I) \qquad (19)$$

$$\begin{bmatrix} \text{household} \\ \text{demand for} \\ \text{commodity c} \end{bmatrix} = f \begin{bmatrix} \text{household income,} \\ \text{composite price} \end{bmatrix}$$

Household demand from commodity c, QH_{ch}, is derived from the first order maximization of a Cobb-Douglas utility function. It is expressed as a function of disposable household income and composite commodity price. β_{ch} denotes the share of commodity c in the consumption of household h, where as mps_h and ty_h designate the share of disposable household income devoted to savings and rate of household income tax, respectively.

Investment Demand

$$QINV_c = \overline{qinv} \cdot (IADJ) \qquad c \in C \qquad (20)$$

$$\begin{bmatrix} \text{Investment} \\ \text{Demand for} \\ \text{commodity c} \end{bmatrix} = \begin{bmatrix} \text{base - year investment} \\ \text{times} \\ \text{adjustment factor} \end{bmatrix}$$

Equation (20) expresses investment demand for a commodity, $QINV_c$, as a function of the base year investment, $\overline{qinv}$, and an adjustment factor, $IADJ$.

Government Revenue

$$YG = \sum_{hEH} ty_h \cdot YH_h + EXR \cdot tr_{gov,row} + \sum_{cEC} tq_a \cdot (PD_a \cdot QD_a + PM_a \cdot QM_a)_{aECM}) + \\ + \sum_{aECM} tm_a \cdot EXR \cdot pwm_a \cdot QM_a + \sum t_e \cdot EXR \cdot pwe_a \cdot QE_a + FIRMTAX \qquad (21)$$

$$\begin{bmatrix} \text{government} \\ \text{revenue} \end{bmatrix} = \begin{bmatrix} \text{direct} \\ \text{taxes} \end{bmatrix} + \begin{bmatrix} \text{transfers} \\ \text{from} \\ \text{RoW} \end{bmatrix} + \begin{bmatrix} \text{sales} \\ \text{tax} \end{bmatrix} + \begin{bmatrix} \text{import} \\ \text{tariffs} \end{bmatrix} + \begin{bmatrix} \text{export taxes} \end{bmatrix} + \begin{bmatrix} \text{taxes on} \\ \text{firms} \end{bmatrix}$$

Government's revenue comes from income taxes on households, transfers from the rest of the world, $tr_{gov,row}$, sales tax, external trade taxes, and tax revenue collected from firms.

Government Expenditures

$$EG = \sum tr_{h,gov} + tr_{firms,gov} + \sum PQ_c \cdot qg_c \qquad (22)$$

$$\begin{bmatrix}\text{government}\\ \text{spending}\end{bmatrix} = \begin{bmatrix}\text{household}\\ \text{transfers}\end{bmatrix} + \begin{bmatrix}\text{transfers to}\\ \textit{frims}\end{bmatrix} + \begin{bmatrix}\text{government}\\ \text{consumption}\end{bmatrix}$$

The government uses its revenue to make transfers to households, and firms, and cover for its consumption expenditure, given by the product of government commodity demand, qg_c, and the composite commodity price.

Macroeconomic Closures

The equations in this block are satisfied by the economy as a whole without being considered by individual agents.

Factor Markets

$$\sum_{aEA} QF_{fa} = QFS \qquad f \in F \qquad (23)$$

$$\begin{bmatrix}\text{demand for}\\ \text{factor f}\end{bmatrix} = \begin{bmatrix}\text{supply of}\\ \text{factor f}\end{bmatrix}$$

As noted earlier, labor is not full employed with fixed, activity specific real wages and capital is fully employed but used in fixed amount in each activity.

Composite Commodity Markets

$$QQ_c = \sum_{aEA} QINT_{ca} + \sum QH_{ch} + qg_c + QINV_c \qquad c \in C \qquad (24)$$

$$\begin{bmatrix}\text{composite}\\ \text{supply}\end{bmatrix} = \begin{bmatrix}\text{composite demand; sum of intermeidate,}\\ \text{household, government, \& investment demand}\end{bmatrix}$$

The demand for composite commodity supply comes from household and government consumption, and from intermediate and investment demand. In this equation, PQ_c ,composite commodity price, clears the market.

Current Account Balance for RoW (in foreign currency)

$$\sum_{cEC} pwe_c \cdot QE_c + \sum_{i=I} tr_{i,row} + FSAV = \sum pwm_c \cdot QM_c \qquad (25)$$

$$\begin{bmatrix}\text{export}\\ \text{revenue}\end{bmatrix} + \begin{bmatrix}\text{transfers from}\\ \text{RoW to households}\\ \text{and government}\end{bmatrix} + \begin{bmatrix}\text{foreign}\\ \text{savings}\end{bmatrix} = \begin{bmatrix}\text{import}\\ \text{spending}\end{bmatrix}$$

Obviously, equality is imposed between earning and spending of foreign exchange in the equation. The exchange rate, which is assumed to be flexible, is the market clearing variable. Foreign savings, $FSAV$, represents the current account deficit and is assumed to be fixed. $\sum_{i=I} tr_{i,row}$ is transfers made to all institution from abroad .

Savings-Investment Balance

$$\sum_{hEH} mps_h \cdot (1 - ty_h) \cdot YH_h + (YG - EG) + FIRMSAV + EXR \cdot FSAV = \sum_{cEC} PQ_c \cdot QINV_c + WALRAS \qquad (26)$$

$$\begin{bmatrix}\text{household}\\ \text{savings}\end{bmatrix} + \begin{bmatrix}\text{government}\\ \text{savings}\end{bmatrix} + \begin{bmatrix}savings\\ from\\ firms\end{bmatrix} + \begin{bmatrix}\text{foriegn}\\ \text{savings}\end{bmatrix} = \begin{bmatrix}\text{investment}\\ \text{spending}\end{bmatrix} + \begin{bmatrix}\text{WALRAS}\\ \text{dummy}\\ \text{variable}\end{bmatrix}$$

The saving-investment balance is given as saving-driven in which available savings determine investment. At equilibrium, *WALRAS* , is zero. Domestic savings include savings made by households, the government ($YG - EG$), and firms. *FSAV* is net foreign savings that supplement domestic savings.

Price Normalization

$$\sum_{aEA} PQ_c \cdot cwts_c = cpi \qquad (27)$$

$$\begin{bmatrix} \text{price times} \\ \text{weights} \end{bmatrix} = [\text{CPI}]$$

The consumer price index is set at a constant value in Equation (27) by multiplying the commodity weight in the CPI, *cwts* ,with the respective composite price.

In this simple CGE model there are 76 individual equations along with the same number of variables, ensuring a unique solution.

3.3 Parameter Estimation and Model Calibration

After specifying the method of analysis, the next step is the estimation of model parameters from the given SAM. While all most all the model parameters are derived from the underlying SAM, two parameters (elasticity of substitution between imports and local goods and that of exports and local goods) are econometrically estimated. Lower elasticity of substitution between imports and local goods imply that the goods are imperfect substitutes. Similarly, a higher elasticity of transformation between local goods and exports indicate a higher supply response to changes in the relative prices of the two goods. The results of the econometric estimation of these parameters are given in Appendix 2.

Many of the remaining parameters are fixed shares calculated from the SAM. For instance, ica_{ca} ,quantity of c as intermediate input per unit of activity a, is derived by the formula,

$$ica_a = \frac{\left(\frac{SAM(AP,A)}{PQ0(AP)}\right)}{QA0(A)} \tag{28}$$

where (SAM(AP,A) is payment made by activity A to activity AP. PQO(AP) is the intial value of composite price of commodity AP, which is 1. To facilitate model calibration the initial values of almost all prices were set to unity. Hence, imports, exports, and values given to labor and capital payments in the SAM can be read as quantities. QA0(A) is the initial activity level which is given in the SAM. In a similar fashion , α_{fa} ,value-added share for factor f in activity a , is computed as

$$\alpha_{fa} = \frac{SAM(F,A)}{SUM(FP, SAM(FP,A))}, \tag{29}$$

SAM (F,A) is payment made by activity A to factor F, SUM(FP, SAM(FP,A) represents the sum of all payments made to factor FP from all sectors. Parameter ad_{α}, which represents the production efficiency parameter in the Cobb-Douglas production function, is given by:

$$ad_a = \frac{QAO(A)}{\prod(QFO_{fa})^{\alpha_{fa}}}\ , \tag{30}$$

As noted earlier, the initial values of all variables are taken from the SAM. Hence, the initial quantity of exports from activity A, for example, is computed as :

$$QE0(A) = \frac{SAM(A,'ROW')}{PE0(A)}, \tag{31}$$

where SAM (A, 'ROW') refers to payments made to activity A, from the Rest of the World (i.e. exports from activity A), and PE0 (A) is the initial price of exports in domestic currency which is set to be 1.

The foregoing discussion only aims to given how parameters and initial values are estimated from the SAM. All the formulae used in deriving all model parameters from the SAM and the resulting figures are given in Appendix 1.

CGE models are only calibrated not estimated. Hence, it is imperative to calibrate the model to replicate the initial SAM values that provide the basic solution before embarking on simulation exercises. After deriving the model parameters the model is successfully solved to replicate the original SAM values. The programme for the CGE model is written in the Generalized Algebraic Modeling System (GAMS).

3.4 Poverty Analysis Framework

For the analysis of poverty, the poverty index of Foster Greer and Thorbeck, (1984) is used following Datt (1998). The index denominated as, P_α, measures the proportion of people below the poverty line, (P_0), as well as the depth (P_2) and the severity (P_3) of poverty. P_α is calculated as:

$$P_\alpha = \int_0^z \left(\frac{z-x}{z} \right)^\alpha f(x)dx, \alpha \geq 0, \qquad (32)$$

where α represents aversion, x denotes household consumption expenditure, $f(x)$ designates its density function and z is the poverty line. As discussed in the previous chapter, when α=0, the index represents the proportion of the poor within the group which fall below the poverty line. When α=1, the relative importance given to individuals under the poverty line. This measures the average poverty gap. For values above 1, the more α increases (the more society is averse to poverty), the more importance is given to the increases in the poverty index. Hence P_1 and P_2 measure the depth and severity of poverty.

As we use grouped data from the CSA, we estimate these poverty indices from the Beta and the Generalized Quadratic (GQ) Lorenz functions. The general functional forms for both Lorenz curves is given by:

$$L = L(p;\pi), \tag{33}$$

where L is the share of the bottom p percent of the population and π represent the vector of estimable parameter of the Lorenz curves. The specific functional forms of the Beta and GQ Lorenz functions is given respectively as:

$$L(p) = p - \theta p^{\gamma}(1-p)^{\delta}, \text{ and} \tag{34}$$

$$L(1-L) = a(p^2 - L) + bL(p-1) + c(p-L) \tag{35}$$

where $\theta, \delta, \text{and } \gamma$, in the Beta Lorenz curve, and a,b,and c, in the GQ Lorenz curve represent constant parameters. Therefore, we first establish a relationship between the Lorenz function and density function as:

$$L'(P;\pi) = \frac{X}{\mu} \tag{36}$$

where L' represents the slope of the Lorenz curve and μ is the mean income of the group. When the value is evaluated at the poverty line, it becomes

$$L'(H;\pi) = \frac{z}{\mu} \tag{37}$$

and solving for H gives the head count index. Similarly by writing the FGT class of poverty index as,

$$P_{\alpha} = \int_0^H [1-(\mu/Z)L'(P;\pi)]^{\alpha} dp, \alpha \geq 0 \tag{38}$$

and solving for the above equation at $\alpha \geq 0$ yields the poverty gap index gven by

$$PG = H - (\frac{\mu}{z})L(H;\pi). \tag{39}$$

In addition evaluating the above integral at $\alpha = 2,$ gives the P_2.

Hence, we first estimate the Lorenz functions from the grouped data before we conduct any simulation exercise. And from the Lorenz functions we derive the FGT poverty indices based on the preceding framework. We also estimate the mean income elasticities for the different poverty indices by assuming that within group income inequality remains the same (that is, by holding the Lorenz curve constant). Subsequently, by conducting simulations of devaluation, trade liberalization, and reduction in government expenditure, we see if there are changes on the mean income of both rural and urban households. As we have earlier estimated the mean income elasticities of the FGT class of poverty indices, it would be straightforward to estimate how these indices will be affected after each simulation.

CHAPTER IV

Results and Analysis

As clearly outlined in the first chapter, this study intends not more than investigating the poverty-impact of trade liberalization, devaluation, and fiscal contraction on rural and urban households. Hence in the first scenario, the effect of 50 percent reduction in the average import tariff is explored. The outcomes from the simulation are reported in Table 4.1.

The immediate impact of a reduction in import tariff is to reduce the domestic currency price of imported goods and services by agents in the domestic economy. As can be learned from table 4.1, the reduction in the average import tariff by 50 percent (the choice of which, as is the case in other scenarios, is arbitrary) leads to a rise in the imports of agricultural and industrial commodities, and services by 4.5 %, 4.1 %, and 3.1 %, respectively. (Refer to Table 4.2 for the definition of variables reported in Table 4.1). Though imports, as might be expected, do increase, total government revenue is doomed to decline. But given the fact that part of household income comes from government transfers, the reduction in government revenue is likely to negatively affect household income. Nevertheless, a relatively insignificant fall in government revenue is observed (only 2.7%) as compared to the reduction in the average import tariff. We may identify some plausible factors to explain this phenomenon. One explanation is that a decline in the average import tariff leads to higher quantity of imports, which compensates the import tariff revenue. We are not here suggesting that import demand function is price elastic.

Table 4.1 Base-run Simulation of Trade Liberalization, Devaluation and Aggregate Budget Reduction

Variable	Base Level	50% Reduction in the Average Import Tariff (%Change from the Base)	40% Devaluation (%Change from the Base)	20% Reduction In Government Consumption Expenditure (% change from the base)
GDP	41528	2.31	4.71	0.09
PRVCON	36146	2.58	-0.65	0.79
GOVCON	1217	0.33	-0.52	-20.09
INVEST	3664	0.22	0.39	-0.08
QMAGR	851	4.46	-4.89	0.26
QMIND	1790	4.07	-10.28	0.37
QMSER	1772	3.09	-11.67	-0.19
YG	6712	-2.71	2.42	0.04
YHUH	16000	1.74	2.02	0.08
YHRH	19700	3.00	4.68	0.13
YLAB	24825	3.50	5.46	0.16
YCAP	12118	3.45	2.25	-0.03
QXAGR	20405	3.04	6.82	0.26
QXIND	8245	2.43	0.07	0.34
QXSER	19052	1.45	0.34	-0.14
QQAGR	18779	2.98	4.21	0.26
QQIND	9252	2.69	-3.45	0.35
QQSER	18000	1.50	-3.43	-0.15
QEAGR	2007	4.34	22.92	0.26
QEIND	551	3.49	15.54	0.30
QESER	2374	2.35	15.56	-0.07
QDAGR	18398	2.91	4.76	0.26
QDIND	7694	2.35	-1.31	0.34
QDSER	16678	1.33	-2.26	-0.14
QSS/DDLAB	24825	3.50	5.46	0.16
QAAGR-A	21256	3.04	6.82	0.26
QAIND-A	10335	2.43	0.07	0.34
QASER-A	20824	1.45	0.34	-0.14

Source: Author

Table 4.2 Definition of Variables Reported In Table 4.1

GDP	Gross Domestic Product
PRVCON	Private Consumption
GOVCON	Government Consumption
INVEST	Total Investment
QMAGR	Agricultural Imports
QMIND	Industrial Imports
QMSER	Imports of Services
YG	Government Revenue
YHUH	Income of Urban Household
YHRH	Income of Rural Household
YLAB	Labor Income
YCAP	Capital Income
QXAGR	Domestic Output of Agriculture
QXIND	Domestic Output of Industry
QXSER	Domestic Output of Services
QQAGR	Composite Supply of Agriculture
QQIND	Composite Supply of Industry
QQSER	Composite Supply of Services
QEAGR	Agricultural Exports
QEIND	Industrial Exports
QESER	Exports of Services
QDAGR	Quantity Sold domestically of Agricultural Domestic Output
QDIND	Quantity Sold Domestically of Industrial Domestic Output
QDSER	Quantity Sold Domestically of Domestic Output of Services
QSS/DDLAB	Quantity Demanded /supplied of Labor
QAAGR	Total Agricultural Activity
QAIND	Total Industrial Activity
QAISER	Total Activity of Services

Source: Author

Rather since imports from the three sectors increase by some amount, the resulting increased tariffs will augment government revenue to a certain extent. Secondly, a look at Table 4.1 reveals an interesting story: exports also increase following the reduction in import tariffs.

In fact, exports from agriculture, industry, and services have increased by 4.3, 3.49, and 2.3 percent, respectively. A possible justification for this may be the facts that as imports increase, which also constitute capital goods, sectoral productive capacity will boost as well. This improvement in productive capacity should not only be seen in terms of increased output. Exporters would also be able to import better quality machines, equipment, and intermediate inputs with relatively lower prices which may in turn make them competent in the global market. Furthermore, as they become more productive, the domestic market may be saturated with their product which forces them to look for other markets. A possible candidate obviously is the external sector. The rise in export can also be understood from another perspective. The drop in import tariffs reduces the relative price of imports to that of domestic output supplied in the local market. Though the econometric estimation show only limited substitution between these two types of commodities, consumers will respond to some degree to changes in the relative prices and subitute local output with imports, which may compel producing sectors to switch to the exportable sector. Hence, once again tax revenue from exports might offset some amount of the decline in the average import tariff. Third, along with a reduction in import tariffs, the sales of domestic output in the local market would increase. Thus, government might also observe increased revenue from indirect taxes on domestic activities. This is due to higher amount of imports in the domestic economy, accompanied by a potential rise in the domestic production of local output as a result of a possible improvement in sectoral productive capacity. The domestic output of agriculture, industry, and services that is sold in the local market has risen by 2.9%, 2.4%, and 1.3%, respectively. These explanations may as

well be cited as reasons to why GDP has grown by 2.3 %, despite a rise in imports of agricultural and industrial commodities, and services.

The major question that concerns us is: how did the reduction in import tariffs affected household incomes in both rural and urban areas? We have mentioned several times that we have only identified two households groups (urban and rural) which hides a multitude of sins in addressing this question. However, given those limitations, the simulation results indicate that the incomes of both rural and urban households do increase. The mean income of urban households has shown 1.7 percent increase (which means that everybody's income has risen by the same amount) while that of their rural counterparts rose up by 3 percent. Households' income in both areas is comprised of factor income, transfers from other institutions, including firms, the government and the rest of the world account. The major reason behind a rise in the incomes of households is the rise in employment due to increased activities. As we are assuming a fixed wage in the closure of factors of production, higher profits of producing sectors is not translated to higher real wages but to higher employment.[24] This justification is supported by the results in the Table 4.1 which exhibits that labor income and demand for labor has both increased by 3.5 %. Since labor is assumed to be abundantly available (i.e. an infinitely elastic labor supply curve is assumed), whatever is demanded will be supplied. Capital income of firms, part of which would be transferred to households, has also grown by 3.45%. Nevertheless, the finding that trade liberalization positively affects household income only indicates the average impact of the policy on the relevant household group, and does not

[24] It is to be remembered that we are not assuming full employment for labor as opposed to that of capital. As we are invoking the assumption of perfectly elastic labor supply curve at fixed real wage rate, increased activities in various sectors of the economy following a macroeconomic shock would lead to higher employment which increases labor, thus household, income. Though the assumption of unemployment of labor seems to fit the realties in Ethiopia, this closure may exaggerate the impact of policies that affect labor demand than the full-

necessarily mean that nobody will be hurt in the process. It is in fact possible that some subgroups gain more than others while some other may be worse-off after the liberalization if we further disaggregate the respective household categories..

And yet even though some improvement on the incomes of both rural and urban households on average is observed, two things should catch one's attention. First, the changes in incomes are not as significant as the changes introduced in the average import tariff. Possible explanations include:

1 Trade Liberalization may not have significant impact on household welfare (or poverty reduction) if it is not accompanied by other complementary measures. These may be, for instance, other reform measures or the provision of infrastructures.

2 Households may not always be able to take advantage of the opportunities that liberalization creates (e.g. due to their lack of skills or capital). It should be remembered that we are assuming capital to be full employed but fixed and activity-specific so as to capture the rigid investment structure of the economy.

3 Also, since trade liberalization may have uneven impacts across different household categories, while we only have two households groups in the analysis, the average change in income may be lower.

The second piece of observation is that rural households have relatively gained more than urban residents. These is primarily because the rural household category which has initially the highest share in labor income (67% compared to only 33% for urban households) contains more population that participate in the tradable sector. The fact that agricultural commodities

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employment assumption in which case labor will only be transferred across sectors having relatively lower impact on output and income.

have the lion's share in total exports and that many rural households earn their livelihood from the same sector validates the argument. In addition, if some import-substituting industries fail following the reduction in import tariff, they are more likely to be found in urban areas.[25]

Before moving to analyzing the poverty impact, let us consider how devaluation, of Birr by 40%, affects key economic variables in the economy. Here the only new assumption with regard to the closures in the model is that now, as exchange rate becomes a policy variable (that is exogenous), foreign savings clear the current account. Table 4.1 plainly shows that the impact of devaluation is relatively more pronounced than any of the simulations undertaken. When devaluation of the domestic currency is carried out its instantaneous effect would be to increase the domestic currency price of imports and exports (tradables). In view of that, exports of all goods and services responded positively to the change in export prices. Agricultural exports have increased by 22.9 percent followed by exports from the industrial and services sectors that rose up by around 15.5 percent. Importers have also reduced their activity in the face of higher prices. Imports by the agricultural sector go down by 4.9 percent Industrial imports and that of services also trimmed down by 10.3 and 11.6 percent. Nevertheless, except for agriculture, the domestic output from the other sectors has only slightly increased. Consequently, total composite supplies for these sectors have declined. This clearly shows a shift of production to the tradable sectors. Hence, those who gain the most from devaluation are those participating in the production of exportables. Consequently, the demand for labor, which would mainly come from the external trade sector, has increased by 5.4 percent increasing labor income by the same amount. Rural residents, as a result, observe their incomes rise up by around 4.7 percent as compared to that of urban households which has

[25] Because of the urban-biased development strategy the country was pursuing in past, most of the country's industries are found in urban areas.

grown by 2 percent. Despite the fact that devaluation has relatively increased household incomes more than trade liberalization, the changes in incomes are still not large. Moreover, consistent with the results obtained for trade liberalization, rural households have gained more from the shock than their urban counterparts. The explnation resembles those given in the analysis of import tariff reduction.

One of the policies which are mostly associated with the structural adjustment is contractionary fiscal policy. This is mainly done through reduction in government consumption expenditure. As reviewed in the literature survey, the main concern for those who oppose contractionary fiscal policy is that, during reduction in government expenditure the government will also cut its budget from sectors that employ or benefit the poor. A glance at the simulation in reduction of government consumption expenditure show that there is no evidence to suggest that the incomes of both rural and urban households will be adversely affected during an aggregate budget reduction from the government sector. Probably the poor were not beneficiaries from the prevailing high level of government consumption expenditure before the cut, and, thus, they will not be significantly affected afterwards. In chapter one of this paper it is shown that there is no proof to justify the fear that during an aggregate budget reduction there will be a disproportionate reduction in the social sector expenditure in Ethiopia. Nevertheless, there is no either strong evidence that would support the hypothesis that reduction in government consumption expenditure would also lead to improved welfare at micro level. Following a 20 percent reduction in government consumption expenditure, the incomes of urban and rural households increased by mere values of 0.08 and 0.13 percent, respectively.

After conduction simulations on the impact of reduction in the average import tariff, devaluation, and contraction in aggregate government consumption on the incomes of both urban and rural households, the mean income elasticity of the FGT decomposable class of poverty indices are estimated. This is done on household consumption and expenditure survey conducted during 1995/96. Accordingly, using the data from the Revised Report on the 1995/96 Household Income, Consumption and Expenditure Survey published by the Central Statistical Authority (1998), the Beta and the Generalized Quadratic (GQ) Lorenz curves were estimated. The computer program used for the estimation is POVCAL which is developed by Chen, Datt and Ravallion at the World Bank. While both are valid Lorenz curves for the rural data, only the GQ fits the data for urban income distribution. A full presentation of the estimation results and model parameters are given in Appendix 3. Table 4.3 and 4.4 give the elasticity of the various poverty indices with respect to the mean consumption and Gini index for rural and urban households, respectively, using the GQ Lorenz curve. Hence, the head count ratio in rural areas declines by around 1.3% when the mean consumption of the distribution function increases by 1%. Similarly the poverty gap (the intensity of poverty) and the FGT-2 (the severity of poverty) drop by 1.5% and 1.8% when the mean income of the population rises by one percent. Consistent with the theoretical expectations, income inequality and poverty are positively associated. In this kind of analysis one key assumption is employed: growth is distributionally neutral, which technically means that when the mean income of the population changes, the income distribution function moves horizontally in the same direction, other things remaining constant. The assumption might be reasonable since, as discussed in chapter two, the weight of recent evidence shows that there is no systematic link between and growth and inequality. However, this may not hold always and empirical verification may be required.

Table 4.3 Elasticity of Poverty Indices with respect to Mean Income and the Gini Index (Rural Households)

Poverty Indices	Mean Consumption	Gini Index
Head Count Ratio	-1.2	0.59
Poverty Gap	-1.5	1.13
FGT-2	-1.8	2.19

Source: Author

Table 4.4 tells a similar story as Table 4.3 for urban households, though the magnitudes in the reduction of each poverty indices are lower than what is reported for their rural counterparts. This is due to the initial higher level of inequality observed in the former. Hence, when the mean income of the urban population increases by one percent, the head count ratio and the poverty gap decline by less than one percent where as the FGT-2 drops by the same proportion with the change in income.

Table 4.4 Elasticity of Poverty Indices with respect to Mean Income and the Gini Index (Urban Households)

Poverty Indices	Mean Consumption	Gini Index
Head Count Ratio	-0.6	.45
Poverty Gap	-0.8	2.39
FGT- 2	-1.01	4.28

Source: Author

Given that the mean incomes of both household groups are affected by the macroeconomic shocks analyzed above, any gain or loss of income in the group is shared equally. As Decaluwe et al (1999) noted this implies that within a given group the poorer the households the greater their relative income gain in the case of an increase in group average income and the greater their relative income loss in the case of a drop in mean-income.

In view of that, trade liberalization reduces the head count ratio in rural areas by 3.6 % where as the poverty gap would be closed down by around 4.5 %. The change in FGT-2 shows that the severity of poverty will go down by 5.4 %. A relatively significant impact of the macroeconomic policies on poverty is recorded for devaluation. Accordingly, the head count ratio, the poverty gap and the FGT-2 decline by about 5.6, 7.05, and 8.5 percent, respectively. Reduction in government budget reduction has the slightest of effects on all poverty indices despite its impact being poverty-reducing.

Table 4.5 Poverty Impact of Macroeconomic Policies on Rural Households

Policy Undertaken	Head Count Ratio	Poverty Gap	FGT-2
Tariff reduction (50%)	-3.6	-4.5	-5.4
Devaluation (40%)	-5.64	-7.05	-8.46
Fiscal policy (20%)	-0.156	-0.195	-0.234

Source: Author

While considering the urban households we observe that the outcomes of the policy measures considered are less significant. This is probably due to the fact that the first two policies analyzed (i.e. tariff reduction and devaluation) mainly affecting the tradable sector where relatively higher proportion of the population involved is rural households. Thus devaluation reduces the head count ratio in urban areas by 1.2 percent where as the poverty gap and the FGT-2 indices are reduced by approximately 1.6 and 2 percent. The effect of tariff reduction on these indices is 1 and 1.4, and 1.8 percent. Reduction of aggregate consumption expenditure by 20% has very insignificant impact in reducing poverty.

Table 4.6 Poverty Impact of Macroeconomic Policies on Urban Households

Policy Undertaken	Head Count Ratio	Poverty Gap	FGT-2
Tariff reduction (50%)	-1.044	1.392	-1.757
Devaluation (40%)	-1.212	-1.616	-2.02
fiscal policy (20%)	-0.048	-0.064	-0.0808

Source: Author

Therefore, at last the major findings that come out of the analysis are:

1 Though not very significantly, trade liberalization does reduce poverty in both rural and urban areas while its impact is much more pronounced in rural areas. Moreover, complementary policies such as the provision of infrastructure may be required to reap the full benefit of the liberalization.

2 There is a positive association between poverty reduction and devaluation. However, once again rural households benefit more from the measure than their urban counterparts. But still, the change in poverty observed is less significant compared to the change in devaluation.

3 Reduction in aggregate consumption expenditure does not does not necessarily adversely affect the poor.

CHAPTER V

Conclusions

Many developing countries have been experimenting on several macroeconomic policies to promote growth and reduce poverty. And especially, nowadays it increasingly seems that a world free of poverty is the new global agenda of the 21st century. Nevertheless, there is still a continuous debate on the policies that should be adopted to help reduce poverty. This is mainly because the impact of macroeconomic policies is diverse and complex. Moreover, the impacts of the same policy may differ as to how, when, and where it is carried out.

In this study, a very modest attempt is made to see how devaluation, trade liberalization (import tariff reduction), and reduction in aggregate government consumption expenditure would affect the poverty status of both urban and rural households. More specifically, the poverty-effects of a 50% reduction in import tariff, a 40% nominal exchange rate devaluation, and a 20% reduction in total government consumption expenditure is explored. To be able to capture both the indirect and direct impacts of these policies, a simple general equilibrium model is adopted. By estimating income distribution functions and poverty indices from the 1995/96 household consumption expenditure survey, the poverty-impact of such macroeconomic policies are explored.

From the analysis it is found that both import tariff reduction and devaluation have reduced poverty in both rural and urban areas though rural households have benefited more than their urban counterparts. However, the reduction in poverty is not as significant as the changes introduced. This is probably because such price-policies alone would not bring about significant changes in reducing poverty if not accompanied by other complementary measures. The econometric estimation on the elasticities of substitution between local goods and imports show that the goods are highly imperfect substitutes. In addition, a very low transformation between local goods and exports is found suggesting that not very significant supply response would occur to changes in the relative prices of the goods.

Excess budget deficit is perceived by some as root cause for the economic ills of many developing countries. Hence, expenditure switching and reducing policies are often

recommended to redress the situation. This usually forces governments to cut their expenditure which may adversely affect the poor if the cut is made in the areas that employ and benefit the poor. Some even maintain that during an aggregate budget reduction most of the cut comes from these areas as the poor are powerless. A 20% reduction in aggregate consumption expenditure give no evidence in supporting the above hypothesis.

The study has several limitations and the results should be taken cautiously. First, in the CGE model only two sectors and household groups are identified. Further disaggregating them, especially households, would obviously give a more complete picture. Secondly, in linking the CGE model with households surveys distributional neutral growth is assumed. Though the weight of recent evidence rejects any systematic link between growth and inequality, an empirical investigation is required to explore the realities in Ethiopia.

The implication of the results is that though trade liberalization and devaluation reduce poverty, other complementary policies may be required to reap the full benefits of such measures. Moreover, the study makes it clear that the poverty impact a policy may be different for urban and rural households. Hence, in designing poverty-reducing policies, the target group should be taken into account.

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Appendix 1.

1.1 Definition of Parameters and Variables

Notation

Sets

$a \in$ A	Activities or Commodities (C)
$c \in$ CE ($\subset$ C)	exported Commodities
$f \in F$	factors
$h \in$ H ($\subset$ I)	households
i $\in I$	institutions (households,government,and the rest of the world)

PARAMETERS

ad_{α}	production efficiency parameter
$a\mathrm{q}_{\mathrm{c}}$	shift parameter for composite supply (Armington) function
t_{c}	shift parameter for output transformation (Constant Elasticity of Transformation (CET)) function
cpi	consumer price index
ftr	average tax rate on firms
$\mathrm{cwts}_{\mathrm{c}}$	commodity weight in CPI
ica_{ca}	quantity of c as intermediate input per unit of activity a
mps_{h}	share of disposable household income to savings
pwe_{c}	export price (foreign currency)
pwm_{c}	import price (foreign currency)
qg_{c}	government commodity demand
$qinv_{\mathrm{c}}$	base-year investment demand
$shry_{\mathrm{hf}}$	share of the income from factor f in household h
te_{c}	export tax rate
tm_{c}	import tariff rate
tq_{c}	sales tax rate
$tr_{ii'}$	transfer form institution i' to i
ty_{h}	rate of household income tax
α_{fa}	value-added share for factor f in activity a
δ_{c}^{q}	share parameter for composite supply (Armington) function
δ_{c}^{t}	share parameter for output transformation (CET) function
θ_{ac}	yield of commodity c per unit of activity a
ρ_{c}^{q}	exponent ($-1 < \rho_{c}^{q} < \infty$) for output transformation (CET) function

ρ_c^t	exponent ($-1 < \rho_c^t < \infty$) for output transformation (CET) function
σ_c^q	elasticity of transformation for output transformation (CET) function

Variables

EG	government expenditure
EXR	exchange rate (domestic currency per unit of foreign currency)
$FIRMSAV$	total savings by firms
$FIRMTAX$	total taxes paid by firms
$FSAV$	foreign savings
$IADJ$	investment adjustment factor
PA_a	activity price
PD_c	domestic price of domestic output
PE_c	export price (domestic currency)
PM	import price (domestic currency
PQ_c	composite commodity price
PVA_c	value-added price
PX_c	producer price
QA_a	activity level
QD_c	quantity of domestic output sold domestically
QE_c	quantity of exports
QF_{fa}	quantity demanded of factor f by activity a
QFS_f	supply of factor f
QH_{ch}	quantity of consumption of commodity c by household c
$QINT_c$	quantity of intermediate use of commodity c by activity a
$QINV_c$	quantity of investment demand
QM_c	quantity of imports
QQ_c	quantity supplied to domestic commodity demanders (composite supply)
QX_c	quantity of domestic ouput
$WALRAS$	dummy variable (zero at equilibrium)
WF_f	average wage (rental rate) of factor f
$WFDIST_{fa}$	wage distortion factor for factor f in activity a
YF_{hf}	income for factor f
YG	government revenue
YH_h	household income

1.2 Estimation of Variables and Parameters (GAMS OUTPUT)

ad(A) efficiency parameter in the production fn for a

alpha(F,A) share of value-added to factor f in activity a

aq(A) Armington function shift parameter for commodity a

at(A) CET function shift parameter for commodity a

beta(A,H) share of household consumption spending on commodity a

cpi consumer price index

cwts(A) weight of commodity a in the CPI

deltaq(A) Armington function share parameter for commodity a

deltat(A) CET function share parameter for commodity a

ica(AP,A) qnty of ap as intermediate input per unit of activity a

pwe(A) export price for a (foreign currency)

pwm(A) import price for a (foreign currency)

qg(A) government demand for commodity a

qinvbar(A) base-year qnty of investment demand for commodity a

rhoq(A) Armington function exponent for commodity a

rhot(A) CET function exponent for commodity a

shry(H,F) share for household h in the income of factor f

shrf share for firms in the income of factor f

te(A) export tax rate for commodity a

theta(A,AP) yield of output ap per unit of activity a

tm(A) import tariff rate for commodity a

tq(A) rate of sales tax for commodity a

tr(I,IP) transfer from institution ip to institution i

ty(H) rate of income tax for household h

ftr rate of taxes on firms

fsr firm's saving rate

z share of aggregate import duties levied on institutions to total imp.

Qdst(A) stock change for commodity A.

;

*VARIABLES==========

VARIABLES

EG government expenditures
EXR exchange rate (dom. currency per unit of for. currency)
FSAV foreign savings (foreign currency)
IADJ investment adjustment factor
MPS(H) marginal (and average) propensity to save for household h
PA(A) price of activity a
PD(A) domestic price of domestic output a
PE(A) export price for a (domestic currency)
PM(A) import price for a (domestic currency)
PQ(A) composite commodity price for a
PVA(A) value-added price for activity a
PX(A) producer price for commodity a
QA(A) level of activity a
QD(A) quantity sold domestically of domestic output a
QE(A) quantity of exports for commodity a
QF(F,A) quantity demanded of factor f from activity a
QFS(F) supply of factor f
QH(A,H) quantity consumed of commodity a by household h
QINTA(A) qnty of commodity a as intermediate input to agricultural activity
QINTI(A) qnty of commodity a as intermediate input to industrial activity
QINTS(A) qnty of commodity a as intermediate input to services
QINV(A) quantity of investment demand for commodity a
QM(A) quantity of imports of commodity a
QQ(A) quantity of goods supplied domestically (composite supply)
QX(A) quantity of domestic output of commodity a
WALRAS dummy variable (zero at equilibrium)
WF(F) average price of factor f
WFDIST(F,A) wage distortion factor for factor f in activity a
YF(F) income for factor f

YG government revenue

YH(H) income of household h

FIRMSAV savings of firms

FIRMTAX taxes on firms ;

*ASSIGNMENTS FOR PARAMETERS AND VARIABLES==========

PARAMETERS

*The following parameters are used to define initial values of

*model variables.

EG0, EXR0, FSAV0, IADJ0, MPS0(H), PA0(A), PD0(A), PE0(A), PM0(A),

PQ0(A), PVA0(A), PX0(A), QA0(A), QD0(A), QE0(A), QF0(F,A), QFS0(F),

QH0(A,H), QINTA0(A),QINTI0(A),QINTS0(A), QINV0(A), QM0(A), QQ0(A), QX0(A),

WF0(F), WFDIST0(F,A), YF0(F), YG0, YH0(H),FIRMTAX0,FIRMSAV0

;

Note: SAM refers to the Social Accounting Matrix. Hence, SAM (X,Y) is interpreted as payment from y to x. A refers to activities. S-I represents the capital account. F denotes factors of production. CAP and LAB are the capital and labor accounts respectively. Households are represented by H while I refers to institutions. The government and rest of the world accounts are given as GOV and ROW. SAM ('TOTAL',X) means the total amount in account X. SUM(X,(X,Y)) should be interepreted as the sum of all payments that account X receives from account Y. Other symbols are as defined in the body of the paper. The only new parameters introduced here are as defined as follows.

wfa(F,A) wage for factor f in activity a (only for calibration)

costgap(F,A) gap calibrated factor cost - SAM value (should be zero)

*FACTOR EMPLOYMENT AND PRICES++++++++++

PARAMETERS

*Defining factor employment and supply

```
QF0('LAB',A) = SAM('LAB',A);
QF0('CAP',A) = SAM('CAP',A);
QFS0(F)    = SUM(A, QF0(F,A));

*Computing activity-specific wage
wfa(F,A)     = SAM(F,A)/QF0(F,A);

*Computing average wage
WF0(F)      = SUM(A, SAM(F,A))/SUM(A, QF0(F,A));

*Computing wage distortion factors
WFDIST0(F,A) = wfa(F,A) / WF0(F);

*Checking calibration
costgap(F,A) = WF0(F)*WFDIST0(F,A)*QF0(F,A) - SAM(F,A);



*PRICE BLOCK++++++++++++++++++++++++++++

PARAMETERS
sigmaq(A)  elasticity of substitution bt. dom goods and imports for a
sigmat(A)  elasticity of transformation bt. dom sales and exports for a
;

EXR0      = 1;
PA0(A)    = 1;
PD0(A)    = 1;
PE0(A)    = 1;
PM0(A)    = 1;
PX0(A)    = 1;

PVA0(A)   = SUM(F, SAM(F,A)) / (SAM(A,'TOTAL')/PA0(A));
```

PQ0(A) = 1+ tq(A) ;

QA0(A) = SAM('TOTAL',A)/PA0(A);
QD0(A) = (SAM('TOTAL', A)-SAM('ROW',A)-SAM(A,'ROW'))/PD0(A);
QE0(A) = SAM(A,'ROW')/PE0(A);
QM0(A) = SAM('ROW',A) / PM0(A);
QQ0(A) = (SAM('TOTAL', A)-SAM('ROW',A)-SAM(A,'ROW')
        +SAM ('ROW',A))/PQ0(A);
QX0(A) = (SAM('TOTAL', A)-SAM('ROW',A))/PX0(A);

ica(AP,A) = (SAM(AP,A)/PQ0(AP)) / QA0(A);

theta(A,A) = (SAM('TOTAL', A)-SAM('ROW',A))/PX0(A)/ QA0(A);

ftr   = SAM('GOV','FIRM')/SAM('FIRM','CAP') ;
fsr   = SAM('S-I','FIRM')/SAM('FIRM','CAP') ;

pwe(A) = PE0(A)/((1 + te(A))*EXR0);
z   =0.261 ; (The value is calculated from the SAM).
pwm(A)$CM(A) = PM0(A) / (EXR0*(1 + tm(A)));

*PRODUCTION AND COMMODITY BLOCK++++++++
QINTA0(A) = SAM(A,'AGR-A')/PQ0(A) ;
QINTI0(A) = SAM(A,'IND-A')/PQ0(A) ;
QINTS0(A) = SAM(A,'SER-A')/PQ0(A) ;

alpha(F,A) = SAM(F,A) / SUM(FP, SAM(FP,A));
ad(A)   = QA0(A) / PROD(F, QF0(F,A)$^{alpha(F,A)}$);
sigmat(A) = 0.43; (Value Econometrically Estimated)

```
sigmaq(A)  = 0.26; (Value Econometrically Estimated)
rhot(A)    = 1/sigmat(A) + 1;
rhoq(A)    = 1/sigmaq(A) - 1;

deltat(A) = 1/(1 + (PD0(A)/PE0(A))*(QE0(A)/QD0(A))**(rhot(A)-1));

at(A)     = QX0(A) / ( deltat(A)*QE0(A)**rhot(A)
              + (1-deltat(A))*QD0(A)**rhot(A) ((1/rhot(A)) ;

deltaq(A) = 1/(1 + (PD0(A)/PM0(A))*(QD0(A)/QM0(A))**(1+rhoq(A)));

aq(A)     = QQ0(A) / (deltaq(A)*QM0(A)**(-rhoq(A))
              + (1-deltaq(A))*QD0(A)**(-rhoq(A)))**(-1/rhoq(A));

*INSTITUTION BLOCK++++++++++++++++++++

EG0        = SAM('TOTAL','GOV') - SAM('S-I','GOV')-SAM ('ITAX','GOV')
           - SAM('ROW','GOV');
FSAV0      = SAM('S-I','ROW')/EXR0;
IADJ0      = 1;
MPS0(H)    = SAM('S-I',H) / (SAM('TOTAL',H) - SAM('GOV',H));
QINV0(A)   = SAM(A,'S-I')/PQ0(A);
YF0 (F)    = SAM (F,'TOTAL');
YG0        = SAM('TOTAL','GOV');
YH0(H)     = SAM('TOTAL',H);
FIRMTAX0   = SAM ('GOV','FIRM');
FIRMSAV0   = SAM ('S-I','FIRM');
qg(A)      = SAM(A,'GOV')/PQ0(A);
qinvbar(A) = SAM(A,'S-I')/PQ0(A);
shry(H,F)  = SAM(H,F) / SAM('TOTAL',F);
shrf       = SAM('FIRM','CAP') / SAM('TOTAL','CAP');
tr(H,'GOV') = SAM(H,'GOV');
tr('FIRM','GOV') = SAM('FIRM','GOV');
```

```
tr(I,'ROW') = SAM(I,'ROW')/EXR0;
tr (H,'FIRM')= SAM(H,'FIRM');
ty(H)       = SAM('GOV',H) / SAM('TOTAL',H);


*SYSTEM CONSTRAINT BLOCK+++++++++++++++

cwts(A)     = SUM(H, SAM(A,H)) / SUM((AP,H), SAM(AP,H));
cpi         = SUM(A, cwts(A)*PQ0(A));



PARAMETER wfa  wage for factor f in activity a (only for
                    calibration)

        AGR-A       IND-A       SER-A

LAB     1.000       1.000       1.000
CAP     1.000       1.000       1.000


 PARAMETER costgap  gap calibrated factor cost - SAM value (should
                     be zero)

               ( ALL       0.000 )


  PARAMETER ad  efficiency parameter in the production fn for a

AGR-A 1.675,    IND-A 7.485,    SER-A 2.733


PARAMETER alpha  share of value-added to factor f in activity a
```

	AGR-A	IND-A	SER-A
LAB	0.859	0.468	0.473
CAP	0.141	0.532	0.527

PARAMETER aq Armington function shift parameter for commodity a

AGR-A 1.193, IND-A 1.608, SER-A 1.367

PARAMETER at CET function shift parameter for commodity a

AGR-A 2.620, IND-A 2.886, SER-A 2.478

PARAMETER beta share of household consumption spending on commodity a

	U-HHD	R-HHD
AGR-A	0.148	0.735
IND-A	0.165	0.194
SER-A	0.686	0.071

PARAMETER deltaq Armington function share parameter for commodity a

AGR-A 0.058, IND-A 0.210, SER-A 0.115

PARAMETER deltat CET function share parameter for commodity a

AGR-A 0.752, IND-A 0.789, SER-A 0.726

PARAMETER cpi = 1.025 consumer price index

PARAMETER cwts weight of commodity a in the CPI

AGR-A 0.483, IND-A 0.172, SER-A 0.345

PARAMETER ica qnty of ap as intermediate input per unit of activity a

	AGR-A	IND-A	SER-A
AGR-A	0.036	0.225	0.009
IND-A	0.008	0.107	0.087
SER-A	0.008	0.161	0.054

PARAMETER pwe export price for a (foreign currency)

AGR-A 0.977, IND-A 0.977, SER-A 0.977

PARAMETER pwm import price for a (foreign currency)

AGR-A 0.893, IND-A 0.893, SER-A 0.893

PARAMETER shry share for household h in the income of factor f

	LAB
U-HHD	0.326
R-HHD	0.674

PARAMETER theta yield of output ap per unit of activity a

	AGR-A	IND-A	SER-A
AGR-A	0.960		
IND-A		0.822	
SER-A			0.915

PARAMETER qg government demand for commodity a

AGR-A 40.976, IND-A 35.122, SER-A 1109.268

PARAMETER qinvbar base-year qnty of investment demand for commodity a

AGR-A 37.073, IND-A 621.463, SER-A 2920.000

PARAMETER rhoq Armington function exponent for commodity a

AGR-A -0.091, IND-A -0.091, SER-A -0.091

PARAMETER rhot CET function exponent for commodity a

AGR-A 1.500, IND-A 1.500, SER-A 1.500

PARAMETER te export tax rate for commodity a

AGR-A 0.024, IND-A 0.024, SER-A 0.024

PARAMETER sigmaq elasticity of substitution bt. dom goods and
imports for a

AGR-A 0.268 IND-A 0.268 SER-A 0.268

PARAMETER sigmat elasticity of transformation bt. dom sales and
exports for a

AGR-A 0.43 IND-A 0.43 SER-A 0.43

PARAMETER tm import tariff rate for commodity a

AGR-A 0.120, IND-A 0.120, SER-A 0.120

PARAMETER tq rate of sales tax for commodity a

AGR-A 0.025, IND-A 0.025, SER-A 0.025

PARAMETER tr transfer from institution ip to institution i

	FIRM	GOV	ROW
U-HHD	8085.000	186.000	-354.000
R-HHD	2640.000	318.000	
FIRM		6637.000	

PARAMETER ty rate of income tax for household h

U-HHD 0.013, R-HHD 0.009

PARAMETER ftr = 0.286 rate of taxes on firms

PARAMETER shrf = 1.000 share for firms in the income of factor f

VARIABLE EG.L = 8356.000 government expenditures

VARIABLE EXR.L = 1.000 exchange rate (dom. currency per unit of for. currency)

VARIABLE FSAV.L = 2964.000 foreign savings (foreign currency)

VARIABLE IADJ.L = 1.000 investment adjustment factor

— 531 VARIABLE MPS.L marginal (and average) propensity to save for household h

U-HHD 0.021, R-HHD 0.008

VARIABLE PA.L price of activity a

AGR-A 1.000, IND-A 1.000, SER-A 1.000

VARIABLE PD.L domestic price of domestic output a

AGR-A 1.000, IND-A 1.000, SER-A 1.000

VARIABLE PE.L export price for a (domestic currency)

AGR-A 1.000, IND-A 1.000, SER-A 1.000

VARIABLE PM.L import price for a (domestic currency)

AGR-A 1.000, IND-A 1.000, SER-A 1.000

VARIABLE PQ.L composite commodity price for a

AGR-A 1.025, IND-A 1.025, SER-A 1.025

VARIABLE PVA.L value-added price for activity a

AGR-A 0.896, IND-A 0.267, SER-A 0.731

VARIABLE PX.L producer price for commodity a

AGR-A 1.000, IND-A 1.000, SER-A 1.000

VARIABLE QA.L level of activity a

AGR-A 21256.000, IND-A 10035.000, SER-A 20824.000

VARIABLE QD.L quantity sold domestically of domestic output a

AGR-A 18398.000, IND-A 7694.000, SER-A 16678.000

VARIABLE QE.L quantity of exports for commodity a

AGR-A 2007.000, IND-A 551.000, SER-A 2374.000

VARIABLE QF.L quantity demanded of factor f from activity a

	AGR-A	IND-A	SER-A
LAB	16369.000	1253.000	7203.000
CAP	2680.000	1423.000	8015.000

VARIABLE QFS.L supply of factor f

LAB 24825.000, CAP 12118.000

VARIABLE QH.L quantity consumed of commodity a by household h

U-HHD R-HHD

AGR-A 2240.976 13880.000
IND-A 2493.659 3662.439
SER-A 10357.073 1341.463

VARIABLE QINTA.L qnty of commodity a as intermediate input to agricultural activity

AGR-A 758.049, IND-A 174.634, SER-A 174.634

VARIABLE QINTI.L qnty of commodity a as intermediate input to industrial activity

AGR-A 2258.537, IND-A 1074.146, SER-A 1610.732

VARIABLE QINTS.L qnty of commodity a as intermediate input to services

AGR-A 191.220, IND-A 1818.537, SER-A 1114.146

VARIABLE QINV.L quantity of investment demand for commodity a

AGR-A 37.073, IND-A 621.463, SER-A 2920.000

VARIABLE QM.L quantity of imports of commodity a

AGR-A 851.000, IND-A 1790.000, SER-A 1772.000

VARIABLE QQ.L quantity of goods supplied domestically (composite supply)

AGR-A 18779.512, IND-A 9252.683, SER-A 18000.000

VARIABLE QX.L quantity of domestic output of commodity a

AGR-A 20405.000, IND-A 8245.000, SER-A 19052.000

VARIABLE WF.L average price of factor f

LAB 1.000, CAP 1.000

VARIABLE WFDIST.L wage distortion factor for factor f in activity a

	AGR-A	IND-A	SER-A
LAB	1.000	1.000	1.000
CAP	1.000	1.000	1.000

VARIABLE YF.L income for factor f

LAB 24825.000, CAP 12118.000

VARIABLE YG.L = 6712.000 government revenue

VARIABLE YH.L income of household h

U-HHD 16000.000, R-HHD 19700.000

Appendix 2 Estimating the Elasticity of Substitution between Imports and Local Goods

Table II. 2 Unit root test for variables at their levels

	ADF Statistic.		ADF Statistic.
LOG(IM)	-2.12	LOG(EX(-1)	-1.538
LOG(QD)	-1.8	LOG(EX)	-1.41
LOG(PM)	-2.04	LOG(IMI)	-2.24
LOG(P)	-3.09	RESID07	-4.16
LOG(REER)	-1.31	RESID01	-6.9
LOG(RY(-1))	-2.34		

Note: The critical value of the ADF statistic at 5% level significance is 3.54.

Table II.2 Tests of Stationary For Variables in Their Difference

LOG(IM)	-5.49	LOG(EX(-1)	-4.1
LOG(QD)	-4.50	LOG(EX)	-4.23
LOG(PM)	-3.55	LOG(IMI)	-3
LOG(P)	-6.29		
LOG(REER)	-4.39		
LOG(RY(-1))	-6.54		

In this section the elasticity of substitution between imports and local goods and the elasticity of transformation between exports and domestic goods are estimated. Before running the regression of the equations described below using ordinary least squares (OLS) method (without differencing the variables), the stationarity of all variables is checked. As reported in Table II.1, all variables are non-stationary at level but stationary in their first difference. By estimating the equations when variables are at their levels it was found that the error terms in both equation are stationary indicating a long run linear relationship between the dependent and independent variables. Hence, error correction models are estimated for both functions. Since a log linear function is used the coefficient of PM/P represents the elasticity of substitution between imports and local goods sold domestically. Similarly the coefficient of PE/P yields the elasticity of transformation between exports and local goods supplied in the domestic market.

Estimation Equation:
==========
D(LOG(IMI/QD)) = C(1) + C(2)*D(LOG(PM/P)) + C(3)*D(LOG(REER)) + C(4)*D(LOG(RY(-1))) + C(5)*D(LOG(EX(-1))) + C(6)*RESID07(-1)

Where IMI= intermediate imports
QD= quantity of domestic production sold domestically
PM= import price
P= price of domestic output
REER= real effective exchange rate
RY= real income
EX= exports
RESID= residual form level estimation

Dependent Variable: D(LOG(IMI/QD))
Method: Least Squares
Date: 05/26/03 Time: 00:31
Sample(adjusted): 1967 2001
Included observations: 35 after adjusting endpoints

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	0.020695	0.013092	1.580743	0.1248
D(LOG(PM/P))	-0.266588	0.055735	-4.783112	0.0000
D(LOG(REER))	-0.366090	0.095337	-3.839956	0.0006
D(LOG(RY(-1)))	-0.918014	0.245135	-3.744926	0.0008
D(LOG(EX(-1)))	0.518955	0.080354	6.458373	0.0000
RESID07(-1)	-0.930249	0.168180	-5.531273	0.0000

R-squared	0.813905	Mean dependent var	0.023631
Adjusted R-squared	0.781820	S.D. dependent var	0.141624
S.E. of regression	0.066152	Akaike info criterion	-2.438907
Sum squared resid	0.126908	Schwarz criterion	-2.172276
Log likelihood	48.68087	F-statistic	25.36691
Durbin-Watson stat	1.765030	Prob(F-statistic)	0.000000

Substituted Coefficients:
==========
D(LOG(IMI/QD)) = 0.02069517359 - 0.266588402*D(LOG(PM/P)) - 0.3660899065*D(LOG(REER)) - 0.9180136968*D(LOG(RY(-1))) + 0.5189550608*D(LOG(EX(-1))) - 0.9302491732*RESID07(-1)

2. Estimating Elasticity of Transformation between Exports and Local Goods.

Estimation Equation:
==========
D(LOG(EX/QD)) = C(1) + C(2)*D(LOG(PX/P)) + C(3)*D(LOG(RY)) + C(4)*D(LOG(REER)) + C(5)*D(LOG(IM(-1))) + C(6)*D(LOG(EX(-1))) + C(7)*RESID01(-1)

Dependent Variable: D(LOG(EX/QD))
Method: Least Squares
Date: 05/26/03 Time: 00:15
Sample(adjusted): 1967 2001
Included observations: 35 after adjusting endpoints

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	0.079107	0.023260	3.401055	0.0020
D(LOG(PX/P))	0.430007	0.118597	3.625796	0.0011
D(LOG(RY))	-2.737666	0.551286	-4.965963	0.0000
D(LOG(REER))	1.430337	0.234458	6.100599	0.0000
D(LOG(IM(-1)))	-0.053869	0.105925	-0.508561	0.6150
D(LOG(EX(-1)))	0.196281	0.144783	1.355689	0.1860
RESID01(-1)	-0.013922	0.148579	-0.093701	0.9260

R-squared	0.621719	Mean dependent var	0.011916
Adjusted R-squared	0.540659	S.D. dependent var	0.153396
S.E. of regression	0.103964	Akaike info criterion	-1.512689
Sum squared resid	0.302638	Schwarz criterion	-1.201619
Log likelihood	33.47206	F-statistic	7.669847
Durbin-Watson stat	2.104165	Prob(F-statistic)	0.000062

Substituted Coefficients:
==========
D(LOG(EX/QD)) = 0.07910711255 + 0.4300072663*D(LOG(PX/P)) - 2.737665606*D(LOG(RY)) + 1.430336925*D(LOG(REER)) - 0.05386930661*D(LOG(IM(-1))) + 0.1962806315*D(LOG(EX(-1))) - 0.0139220029*RESID01(-1)

APPENDIX 3 ESTIMATION OF POVERTY INDICES (POVCAL OUTPUT)

THE DATA SET IS rural.txt

6.498504E-01	5.847291E-02
2.244355	3.760659E-01
3.765983	9.365165E-01
8.468918	2.979657
10.076800	4.830122
14.724250	9.183566
13.317080	10.498050
16.133160	15.909550
9.861170	12.627520
11.367700	17.859190
6.111374	13.149560
2.031071	5.931367
6.547605E-01	2.406626
5.935308E-01	3.253724

DATA FOR SUB-GROUP 1

p	L
6.498504E-03	5.847291E-04
2.894205E-02	4.345388E-03
6.660188E-02	1.371055E-02
1.512911E-01	4.350713E-02
2.520590E-01	9.180835E-02
3.993015E-01	1.836440E-01
5.324723E-01	2.886246E-01
6.938039E-01	4.477201E-01
7.924156E-01	5.739953E-01
9.060926E-01	7.525872E-01
9.672064E-01	8.840829E-01

9.875171E-01 9.433965E-01
9.940647E-01 9.674628E-01
1.000000 1.000000

*********GENERAL QUADRATIC LORENZ CURVE********

THE ESTIMATED REGRESSION IS:

PARAMETER ESTIMATE	STANDARD ERROR	T RATIO:
1.041083	.009828	105.933200
-1.336987	.028915	-46.239250
.125923	.014836	8.487476

INPUT POVERTY LINE Z WHICH IS WITHIN THE RANGE:

(177., 3560.)

THE IMPLIED PARAMETERS OF THE GENERAL QUADRATIC LORENZ CURVE ARE:

A	B	C
1.041083	-1.336987	1.259232E-01

INPUT DATA ON MEAN (MU) AND POVERTY LINE (Z):

MU= 1130.64 Z= 1075.00

THE ESTIMATED GINI INDEX(%) IS:

35.024540

THE ESTIMATED POVERTY MEASURES (%) ARE:

HEADCOUNT INDEX	POVERTY GAP INDEX	FGT2 INDEX
H	PG	FGT2
58.3835	23.0310	12.1939

WHICH HAVE THE FOLLOWING ELASTICITIES WITH RESPECT TO

	MEAN CONSUMPTION	GINI INDEX
H	-1.13380	.05868
PG	-1.53500	1.13121
FGT2	-1.77744	2.19551

THE OVERALL SUM OF SQUARED ERROR OF FITTED LORENZ CURVE IS:

SSE–Q= 5.794773E-05

THE SUM OF SQUARED ERROR OF FITTED LORENZ CURVE UP TO THE HEADCOUNT INDEX OF POVERTY IS:

SSEZ–Q= 8.235021E-06

********** BETA LORENZ CURVE **********

THE ESTIMATED REGRESSION IS:

PARAMETER ESTIMATE	STANDARD ERROR	T RATIO:
-.304060	.015928	-19.090050
.958127	.005908	162.176200
.639549	.005333	119.931100

THE IMPLIED PARAMETERS OF BETA LORENZ CURVE ARE:

THETA	GAMMA	DELTA
7.378166E-01	9.581269E-01	6.395489E-01

Z SHOULD BE WITHIN (68.000000, 3204.000000)

THE ESTIMATED GINI INDEX(%) IS:

35.159490

THE ESTIMATED POVERTY MEASURES (%) ARE:

HEADCOUNT INDEX	POVERTY GAP INDEX	FGT2 INDEX
H	PG	FGT2
56.9611	23.4463	12.6860

WHICH HAVE THE FOLLOWING ELASTICITIES WITH RESPECT TO

	MEAN CONSUMPTION	GINI INDEX
H	-1.04462	.05407
PG	-1.42943	1.12574
FGT2	-1.69642	2.19132

THE OVERALL SUM OF SQUARED ERROR OF FITTED LORENZ CURVE IS:

SSE–B= 1.100954E-04

THE SUM OF SQUARED ERROR OF FITTED LORENZ CURVE UP TO THE HEADCOUNT INDEX OF POVERTY IS:

SSEZ–B= 6.365051E-05

BOTH SPECIFICATIONS ARE VALID LORENZ CURVES.

GQ FITS THE DATA BETTER.

THE DATA SET IS urban.txt

3.710196	1.582381E-01
4.955416	4.545716E-01
7.181756	9.801739E-01
10.682180	2.065900
8.544532	2.208714
9.242516	3.183330
7.672687	3.290117
10.145820	5.516373
8.635449	5.855508
9.866701	8.768368
6.868581	15.190330
4.187715	8.040925
2.519427	6.036673
5.787025	38.250780

DATA FOR SUB-GROUP 1

p	L
3.710196E-02	1.582381E-03
8.665612E-02	6.128097E-03
1.584737E-01	1.592984E-02
2.652955E-01	3.658883E-02
3.507408E-01	5.867597E-02
4.431660E-01	9.050927E-02
5.198928E-01	1.234104E-01
6.213510E-01	1.785742E-01
7.077055E-01	2.371293E-01
8.063725E-01	3.248129E-01
8.750584E-01	4.767163E-01
9.169355E-01	5.571255E-01
9.421298E-01	6.174923E-01

1.000000 1.000000

*********GENERAL QUADRATIC LORENZ CURVE********

THE ESTIMATED REGRESSION IS:

PARAMETER ESTIMATE	STANDARD ERROR	T RATIO:
.817407	.073596	11.106600
1.397933	1.031873	1.354753
.169289	.151337	1.118624

INPUT POVERTY LINE Z WHICH IS WITHIN THE RANGE:

(99., 10583.)

THE IMPLIED PARAMETERS OF THE GENERAL QUADRATIC LORENZ CURVE ARE:

A	B	C
8.174065E-01	1.397933	1.692890E-01

INPUT DATA ON MEAN (MU) AND POVERTY LINE (Z):

MU= 1891.73 Z= 1075.00

THE ESTIMATED GINI INDEX(%) IS:

62.147000

THE ESTIMATED POVERTY MEASURES (%) ARE:

HEADCOUNT INDEX	POVERTY GAP INDEX	FGT2 INDEX
H	PG	FGT2
56.8255	30.8810	20.4991

WHICH HAVE THE FOLLOWING ELASTICITIES WITH RESPECT TO

MEAN CONSUMPTION GINI INDEX

H -.59321 .45069

PG -.84014 2.39805

FGT2 -1.01292 4.28906

THE OVERALL SUM OF SQUARED ERROR OF FITTED LORENZ CURVE IS:

SSE–Q= 1.805781E-03

THE SUM OF SQUARED ERROR OF FITTED LORENZ CURVE UP TO THE HEADCOUNT INDEX OF POVERTY IS:

SSEZ–Q= 2.281230E-05

********** BETA LORENZ CURVE **********

THE ESTIMATED REGRESSION IS:

PARAMETER ESTIMATE	STANDARD ERROR	T RATIO:
.028419	.033667	.844098
1.025986	.016287	62.994340
.377538	.017311	21.809610

THE IMPLIED PARAMETERS OF BETA LORENZ CURVE ARE:

THETA	GAMMA	DELTA
1.028826	1.025986	3.775383E-01

Z SHOULD BE WITHIN (228.000000, 9648.000000)

THE ESTIMATED GINI INDEX(%) IS:

61.795890

THE ESTIMATED POVERTY MEASURES (%) ARE:

HEADCOUNT INDEX POVERTY GAP INDEX FGT2 INDEX

H	PG	FGT2
54.4940	30.7419	21.2354

WHICH HAVE THE FOLLOWING ELASTICITIES WITH RESPECT TO

	MEAN CONSUMPTION	GINI INDEX
H	-.61012	.46353
PG	-.77263	2.34675
FGT2	-.89534	4.19973

THE OVERALL SUM OF SQUARED ERROR OF FITTED LORENZ CURVE IS:

SSE–B= 2.066077E-03

THE SUM OF SQUARED ERROR OF FITTED LORENZ CURVE UP TO THE HEADCOUNT INDEX OF POVERTY IS:

SSEZ–B= 1.444123E-04

GQ LORENZ CURVE IS INVALID ONLY AT THE UPPER BOUND WHICH IS .9867 INSTEAD OF 1.

BETA SPECIFICATION IS INVALID.

GQ FITS THE DATA BETTER.