ADDIS ABABA UNIVERSITY
SCHOOL OF GRADUATE STUDIES

IMPACTS OF TRADE LIBERALIZATION ON GROWTH AND POVERTY IN ETHIOPIA: A DYNAMIC COMPUTABLE GENERAL EQUILIBRIUM MODEL

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A Thesis Submitted to the School of Graduate Studies of Addis Ababa University in Partial Fulfillment of the Requirement for the Degree of Master of Science in Economics (Economic Policy Analysis)

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List of Acronyms

CES-Constant Elasticity Substitution
CGE- Computable General Equilibrium
CET-Constant Elasticity of Transformation
COMESA-Common Markets for Eastern and Southern Africa
DTIS-Diagnostic Trade Integration Study
ERP-Effective Rate of Protection
FAO-Food and Agricultural Organization
FDI-Foreign Direct Investment
FGT- Foster, Greer, Thorbecke
GTAP-Global Trade Analysis Project
IFPRI-International Food Policy Research Institute
MoFED-Ministry of Finance and Economic Development
OECD- Organization for Economic Co-operation and Development
SAM-Social Accounting Matrix
SAP-Structural Adjustment Program
VAT-Value Added Tax
WTO- World Trade Organization

Abstracts

This paper presents a dynamic Computable General Equilibrium (CGE) Model for Ethiopia's trade liberalization that allows for quantification of income and welfare effects stemming from tariff reduction. This dynamic model has been built using a Social Accounting Matrix (SAM) of 1999/2000 for Ethiopia. The model is simulated for alternative policies scenarios depicting full and indiscriminating liberalization, full and discriminating liberalization, gradual and rationalized liberalization and instantaneous tariff liberalization. The main findings of these scenarios are a decline in poverty among all households in the long run. In the short run, poverty remains significantly unaffected for most of the simulations' Scenarios. The simulations' results show that static version of the model underestimates trade liberalization's impacts on production, and welfare, since it excludes the accumulation effects. However, from the alternative simulations' scenarios, instantaneous type of liberalization seems performing well in its capacity to increase real GDP, welfare, real output, and real export in the long run. This liberalization also recorded substantial decline in poverty level in the long run.

Key words: Dynamic CGE Model, Trade Liberalization, Poverty, Growth, Ethiopia

CHAPTER ONE

1. Introduction

1.1. Background of the Study

The link between trade reform and poverty are diverse and complex. In developing countries the poor that is households with income falling below the poverty line share common broad features (1) they are generally concentrated in rural (subsistence) agricultural and in urban informal sectors (2) They have limited assets, the most aundant of which is low skilled labor (3) and food is by far the most important item of their expenditure . Both the direct and indirect effect of trade liberalization on the poor is then to be connected with the impact on poverty profile.

Trade reform works directly through the transmission of price signals. Then , if it increases the price of something that poor household sell(unskilled labor ,goods ,services and /or if it forces down the price of something the poor household consumes (goods ,services) ,it will increase the real income (purchasing power) of the poor household and push more poor from below to above poverty line ,and vice verse.
Economic growth is the indirect channel through which freer trade could contribute to poverty alleviation

The aim of this paper is to trace through the dynamic impact of trade liberalization on Ethiopian poor, while accounting for many of the above structural features that Ethiopian poverty profiles shares with the other developing countries. Indeed trade liberalization was an integral part of the structural adjustment program that has been adopted by Ethiopian in 1992. According to World Bank (1991), trade liberalization encompasses structural reforms that denote both import tariff and export tax. Such a reform aim to improve resource allocation in the long run (montiel,1996,p.491).As part of its trade liberalization program ,the new government has embarked on a comprehensive trade reform

program which was aimed at dismantling qualitative and quantitative restrictions and gradually reducing the level and dispersion of tariff rates .Currently ,quantitative restrictions are only applied to used clothing ,harmful drugs and firearms. Both tariff levels and their dispersion have been reduced significantly.

More over ,apart of market oriented reform - initiatives also have taken to facilitate private sector participation in export trade - perhaps the two major reform measures implemented to achieve this objective were the dismantling of government monopoly in coffee trade and abolishing the mandatory approval requirement for export contracts by National Bank of Ethiopia(NBE).Another measure to support exports has been the introduction of foreign exchange retention scheme allowing exporters to retain parts of their foreign exchange earning /proceeds. At present, exporters are allowed to retain 10% of export proceeds with out a time limit. Other measures to assist exporters include a bonded manufacturing warehouse scheme and an import duty rebate scheme aimed at providing exporters of manufactured imported inputs at world prices.

Regarding foreign direct investment(FDI) ,market oriented policy reforms in Ethiopia over the past decade have placed a major emphasis on attracting FDI as a means of achieving rapid economic growth .Since1992/93 more sectors are open to foreign investors than before. In addition ,the current transitional government has been keenly aware of the importance of privatization and has placed a substantial privatization program since 1995.The government also reform the import and export process from two steps (obtain registration of certificate and apply to business license) into a single step. The government tries to encourage exports through export credit guarantee scheme, export promotion agency and demand driven support system. How ever, the legal and regulatory environment for trade and investment hinder the

country's attempt toward free market regime. Weak legal and regulatory environment results in high transaction costs. It reduces both investment return and gains from trade. High transaction cost reduces the Ethiopian products competitiveness in international markets.

1.2. Statements of the Problem

In this part, after assessing few of the theoretical as well as the empirical evidence of the different authors, the research gap will be identified. According to the World Bank (1991), trade liberalization removes market distortion and this is believed to provide incentives for rural producers to increase agricultural production. Thus, getting price right has become an important element of SAP.

Trade liberalization can stimulate economic growth of African economies (Sahn, Dorosh and Younger,1996) while others maintained that trade liberalization may not provide positive contributions to long run growth of African economies (Stewart,De maio, and Hoeven ,1999). Still ,others argue that economic reform may cause African economies to recover from adverse effects of misguided policies of the previous decades(Bediane ,1999).The opposing argument is also gone as follows . According to the Global economic prospects (2002), in developing countries, trade liberalization policies are hard to formulate and implement because the magnitude and distributional impacts tend to be very large. Even though, there are aggregate gains to the economy at least in principle, it may be possible to compensate the loser and still leave some groups better off if we assume a requisite transfers through lump sum are made in a relatively efficient manner. But in Africa, tax instrument are usually lacking and administrative capacity tend to be very limited.

For countries like Ethiopia, the over-arching aim of trade integration to

the global economy is to exploit its opportunity to transform the economy from a largely peasant agriculture to modern economy (DTIS, 2004). They held the view that for Ethiopia, a country with a large diverse resource base and potential, greater participation in world trade provides additional opportunity to address the challenging issues of economic growth and poverty reduction.

Based on the above view, Ayele Gelan (2002) employed urban –rural Computable General Equilibrium (CGE) model to examine the impacts of trade liberalization on structural transformation and over all growth of Ethiopian economy. Philps and Tadele (2005) also built Computable General Equilibrium model to capture the impacts of trade liberalization resulting from the tariff dismantling on the main fiscal, economic and social indicators both at macro –economic and sectoral levels.

The first motivation for this study comes from the ongoing debate with regard to the impacts of economic reform on long term growth and poverty in Africa. Secondly, there is no research work that analyzed the impact of trade liberalization on poverty in Ethiopia using Dynamic Computable General Equilibrium (DCGE) model. Their model fails to capture the economic and poverty effects of capital accumulation, and trade liberalization.

Thus, to address these concerns, the use of dynamic computable general equilibrium (DCGE) model that integrates representative households' characteristics would be necessary in order to properly account for the economic and poverty effects of growth and trade liberalization in Ethiopia. The work of both Ayele Gelan (2002) and Philps and Tadele(2005) did not show the link between the growth enhancement and poverty reduction strategy.

These motivate us to focus on whether trade liberalization is considered

as growth supporting policy and its impact on poverty and inequality. Trade liberalization may affect income level and growth, income distribution, fiscal issues, risk and volatility in different direction. Thus, the link between trade reform and poverty is obtained through the net effects of these impacts which we will try to address. Poverty reduction will be achieved through equality enhancing growth impacts of trade and reduced initial income redistribution. So that, the change in poverty will be decomposed into growth and distribution components in order to examine whether de-protection and factor accumulation are pro-poor or not. This is because there is no general evidence in favor of the view that trade liberalization is always good for growth and that growth is always good for the poor. For the latter case, if the poverty growth elasticity in absolute term is sufficiently high, then poverty reduction strategy based mainly on growth may be justified.

Any growth policies that yield a worsening of income distribution will be much less effective in reducing poverty .As consequences; the problem of supporting economic growth and the problem of reducing poverty are closely linked. We can not address the former ignoring its distributional consequence, and we can not address the latter (problem of reducing poverty) ignoring the way in which growth is achieved

In general, this proposed research attempts to answer what are the economics, sectoral, reallocation, poverty and income distribution effects of growth and trade liberalization in Ethiopia.

1.3. The Objectives of the Study

Here primary objective is to assess the economic and poverty impacts of growth and trade liberalization in Ethiopia. That is to empirically investigate whether a large reduction in poverty is obtained through economic growth owing from trade-growth -poverty linkage. Specifically, the goals of the study are:

1) To assess whether Ethiopia will benefit from free trade in the medium

run.

2) To account for the change in poverty dimension and income distributional structure arising from growth and trade liberalization in the medium run

3) To observe the transition path that the Ethiopian economy will take in light of the policy shift

4) More emphasis will be given to sectoral effect of agriculture in the analysis because of its initial bulk account in employment and GDP contributions to the economy.

1.4. Main Research Questions and the Study's Significance

The importance of analyzing trade -growth - poverty linkage will be shown as follows. Ethiopia started its trade reform program since 1992.The exchange rate of the Ethiopian birr was fixed at 2.07 per US dollar from 1973 to 1992 .The gap between the parallel market and the official exchange rate increased over time with adverse consequence on export competitiveness while these have had an indirect adverse effect on the rural region. With Derg regime, fixed agricultural price policies and fixed quota delivery also add to this effect. As soon as, the military regime was over thrown, an Economic Reform Program (ERP) was adopted by the transitional government of Ethiopia to liberalize the economy in the context of various Structural Adjustment Program (SAP) with the aim of rapidly accelerating economic growth in the hope of encouraging more efficient resource allocation, and reduce macro imbalance. Hence, from 1992 onwards, a more than hundred percent of devaluation of the Ethiopian birr was an important step in this reform process.

Moreover, Ethiopia also applied for membership to World Trade Organization (WTO) on 11 Feb.2003, having an observer since October 1997(DTIS,2004).Since then however, the economic and poverty impacts of growth and trade liberalization have not been investigated. To address this, the proposed research seeks to employ a dynamic Computable General Equilibrium model that will be solved under a sequential dynamic path from 2001 -2019.The rational behind this approach is in order to simultaneously capture the economic and poverty effects of capital accumulation and trade liberalization in Ethiopia. This is because as argued by McCulloch, and Winters (2001) " trade liberalization is an ally against poverty since it tends to increase average incomes, and providing more resource to tackle poverty."

Further more, "recent evidence suggests that greater openness enhance growth at least over the medium term, and that growth benefit the poor" (Winter, 2002).Having recognized the study's significance, eventually, the core research questions will be raised. Perhaps, the relevant research question and hypothesis that must be addressed at this stage are;

1) Is trade liberalization an important policy vehicle to promote economic growth and at the same time reduce poverty in Ethiopia? .In particular, does the linkage really exist? If it does, is it really important to analyze the trade-growth -poverty linkage in Ethiopia?

2) What will be the impact of trade liberalization on growth and through growth on employment and income of the poor?

3) What will happen to poverty and income distribution if Ethiopia implements the WTO negotiation which will be simulated in the form of complete removal of tariffs and with gradual liberalizations both in the short run and in the medium run? Because, currently, there is a hot debate about its merits and demerit. On one side, since WTO accession is part of the global integration, it will be argued that Ethiopia can be protected by well sets of international rules and meeting the obligation

would serve as a guard against groups that lobby for protection at the expense of the national interest (DTIS, 2004). Moreover, as a WTO member, Ethiopia can influence the out come of multilateral trade negotiations by working with other countries that have similar interest to further its own interest and as a result the country can increase the volume and processing level of export to increase income purchasing power of the poor.

On other hand, others argue that with condition of restrictive non -tariff barriers set buy the QUAD markets and rigid supply response of the economy, it will be a mare and big task to exploit market access in the world market. Of course, a concrete and quantifiable answer to these questions will be determined by conducting the proposed research. Fundamentally, as Mcclloch, Winter, and Cirera(2001) suggest that the quantitative answer depends on a) price transmission b) impacts on wages and profit c) Taxes and government spending d) economic growth e) costs of adjustments f) supply response ,risk and uncertainty.

1.5. Limitations and Scope of the Study

The main drawback of the representative approach is the assumption of exogenous within group income heterogeneity. Unlike micro-simulation, this approach does not take into account within group inequality. Moreover, the 1999/2000 Social Accounting Matrix (SAM) was not in a position to include the current value-added tax system (VAT). In addition, the government foreign debt service was not included in SAM as an account. As a result, the debt accumulation equation could not be introduced in the model that will allow the economy in a more flexible manner in both saving and investment decision of the government and households. Though, the paper is partially belonging to elasticity structuralist CGE, it is wholly used the assumption of neoclassical CGE model. Hence, the unavailability of financial SAM precludes its use.

CHAPTER TWO

2. Theoretical and Empirical Literature

2.1. Theoretical Literature

The impact of trade policy on poverty, food security and inequality in developing countries is at the center of a crowded international debate on the role of international trade in development. Rodriguez and Rodrik (1999) argue that empirical literature does not consistently and reliably demonstrate a positive link between trade and economic growth. As a result, there is an ongoing debate on the merits and nature of further trade liberalization toward development. On the one hand, international organizations including WTO support rapid and sweeping liberalization. The appeal of opening up to global market is based on the simple premises that economic integration will improve economic performance. As developing countries, in particular open to international trade, and build the necessary capacity to effectively negotiate within the established rules of the WTO, the expectation is that trade would be enhanced and economic growth will increase. This in turn, will reduce poverty and improve the standard of living for the majority of residents of those countries.

However, in these two sections, we review much of the theoretical and empirical evidence and examine the impacts of both unilateral domestic policy and trade reforms and multilateral trade liberalization on poverty. Poverty is multidimensional and dynamic, with large numbers of vulnerable families moving in and out of poverty over time. Poverty means high level of depreciation, vulnerability to risk and powerlessness. Seeking a better understanding of the links among poverty, economic growth, income distribution remain a permanent issue in development literature.

Poverty in developing countries is concentrated in rural areas, especially in those countries where the level of undernourishment are greater than 25 percent. Most estimates suggest that more than two-thirds of the poor live in rural areas (FAO, 2004).

According to FAO (2004), demographic and migration trends are shifting the poverty balance towards urban areas, the majority of the poor will continue to live in the countryside for at least a few more decades. Moreover, urban poverty is to a large extent of rural deprivation, which encourages rural urban migration. According to FAO, no sustainable reduction in poverty and undernourishment is possible without development of rural areas.

According to the World Bank (1999), country-level surveys highlight the disparity between rural and urban areas. For example, the percentage difference between rural poverty countries ranged from 9 percent in Mozambique to 35 percent in Burkina-Faso, 38 percent in Nicaragua, 41 percent in Mauritania and 42 percent in Bolivia (Ingco and Nash, 2004).Furthermore, their country survey also shows that it is not just the poverty indicators that highlight the rural-urban disparity. Rural population scores consistently lower on every quality of life indicators.

FAO has long argued the virtues of trade's contributions to economic growth and resource efficiency, as well its contributions to food security by providing a stable source of lower priced food from abroad. Winter (2002) in Mexico argued that trade poverty linkages are complex and diverse. The first linkage is at the border. When a country liberalizes its own trade police by, for example, reducing import tariffs, this results in lower prices for imported goods at the border. When other countries liberalize their trade policies, this affects the border prices of goods imported and exported by the first country.

The direction and magnitude of the initial border price changes depend on the precise policy reforms being undertaken.According to Winter, the elimination of all forms of support and protection to agriculture by OECD countries would be expected to increase the border prices of temperate zone agriculture products by 5-20 percent. From the border, the focus to how prices are transmitted to producers and consumers, and households in general. The extent to which households and businesses in the economy experience these price changes varies, and depends on the quality of infrastructure and the behavior of domestic marketing margins as well as geographical factors.

The initial impact of trade liberalization on households occurs once the local market price changes have been determined. Not surprisingly, households that are net sellers of products whose price rise, in relative terms, benefit in this first round, net purchasers of such goods loss. However, the empirical literature demonstrates that first-round effects are altered significantly as households adjust consumption and production in response to changing relative prices. In this second round of effects, households modify their consumption basket, adjust working hours and possibly change their occupation.

one of the important issue to address when considering the potential impact of trade reform on the poor is the extent to which change in prices at the border even reach the households in question. An example from Mozambique underscores the significance of marketing margins in some low-income countries: the producer-consumer margins were as high as 300 percent in the case of Cassava (Arndt et al, 2000).if these marketing costs are solely a function of the quality of transported (i.e. specific as opposed to advolerm in nature), then they dampen the impact of world commodity price changes on domestic consumers and at the same time exaggerate the impact of such price changes on producers of export products (Winters, Mc Culloch and Mc Kay, 2004).

In Uganda, for example, transport margins protected domestic sales while taxing taxed exports over the decade 1987-97 (Milner, Morrissey and Rudaheranwa, 2001). Uganda's traditional exports include coffee, tea, cotton and tobacco. They said that series of trade policy reforms over this period largely eliminated the implicit taxation of exports through trade policies. However, the implicit taxation caused by poor infrastructure and high transport costs remained very high relative to that of competitor countries such as Kenya.

Grossman and Helpman(1991) argued the extent of linkage between growth ,poverty and trade liberalization on different theoretical ground. They argued that the simple Hechscher-Ohlin trade theory suggests that in relative unskilled labor abundant countries trade liberalization will relieve poverty; in practice other factors may not be considered. For instance, trade liberalization may be accompanied by skill biased technical changes, which can mean that skilled labor may benefit relative to unskilled labor. They further argued that, not all developing countries are abundant in unskilled labor. For example, many Latin American and some African countries have very strong endowments and minerals and agricultural resources and so liberalization will stimulate these factors rather than labor-intensive ones. Similarly, if the unskilled are primarily employed in non-traded sectors, while exports draw mainly on the semi-skilled, a liberalization accompanied by real exchange rate depreciation could have adverse effect.

Moreover, according to Grossman and Helpman(1991), economic theory could offer many reasons to expect trade liberalization to stimulate economic growth. In the medium term reaping the static (efficiency) benefits of trade could look rather like growth. In the long run, the potential positive forces include access to technology and to appropriate intermediate and capital goods, the benefit of scale and competition; the flexibility induced by relying on market signals, and the constraints on

government incompetence or corruption.Similarly, economists tried to find a link between economic growth and poverty. Economists maintained that economic growth generally reduce poverty. Many have argued that, on average, growth does not have identifiable systematic effects on income distribution (Ravallion, 1995). Most controversial has been the study by Dollar and Kraay (2001), which examines the relationship between growth and poverty in levels across countries and in changes through time (national growth rate). Dollar and Kraay relate the main income of the poor (bottom 20% of the income distribution) to overall mean income plus some additional variables. They never reject the hypothesis that the main incomes of the poor moves proportionally with overall mean income.

In addition, in endogenous growth models, the impact of trade liberalization on growth can be positive or negative as argued by Matto et.al (2001). If resource allocation effects of trade policy changes promote the sector that generates more long run growth, then the impact is positive, other wise the impact is negative. Similarly, some other groups argue that trade liberalization might lead to vulnerability and risk. It may narrow or widen the portfolio of activities undertaken by the households. Trade liberalization may alter the predictability of existing sources of income. They also argue that trade liberalization can create poverty traps so that negative shocks are much more difficult to bear.

The other point is that to investigate how trade reforms are often associated with creation or destruction of markets. Greater openness can result in a wider variety of commodities being available, or create new opportunities for production (e.g. by allowing imported inputs). At the same time, other markets can cease to exist, for instance, due to the effects of increased import competition on a local market.

To this end from a theoretical perspective, Romer (1994) argued that the most substantial welfare costs of trade restriction come from the goods and services that they exclude from the markets and the loss of productive activities that result from that exclusion. Romer argued that the main cost of trade restriction may come from its adverse impact on the adoption of new technologies, and on the variety of productive activities, output and inputs. In same way, Gisselquist and Grether (2000) reported that significant direct benefits to agricultural products in Bangladesh as liberalization increased the availability of inputs. They said that consumers too benefit from the increased availability of goods. Booth et al (1993), in participatory study in Tanzania, find that, following liberalization, the greater availability of goods at international prices was regarded as substantial improvement compared with the past by women and poor rural people. But according to Winter (2000) if trade liberalization or accompanying changes in domestic marketing arrangements, destroys markets, households can become completely isolated from the market and suffer substantial income losses.

The other important mechanism by which foreign shocks are translated in to poverty impact is through factor markets, especially the labor market. Indeed, obtaining employment is one of the surest ways out of poverty, while the loss of job is probably the most common reason for the precipitate decline in to poverty. The structure of labor market is critical to how trade liberalization gets translated into wage and employment changes.(Andrew McKay; L Alan Winters ,2003)

2.2. Empirical Literature

A number of studies have applied static CGE models to analyze the effect of trade policy reforms on macroeconomic and socioeconomic variables in the context of Bangladesh. Using the 1988/89 SAM of Bangladesh, Khondker (1996) develops competitive and non-competitive variants of Static CGE models and examine the impact of tariff liberalization under different policy scenarios. The study points out that trade liberalization has different impacts on different sectors in the economy and the outcomes of trade liberalization also vary with the model structure; whether the model is competitive or non-competitive. The study finds that in competitive and constant returns to scale model variant, resources move from the heavily protected sectors to the less protected sectors as a result of tariff liberalization.

In contrast, the heavily protected manufacturing sectors turnout to be the main beneficiary of liberalization when imperfect competition is introduced. Expansion of manufacturing output appears to come out from the pro-competitive effects of tariff liberalization. According to this analysis, the income distribution effects of tariff liberalization are captured through the change in income levels of household groups and changes in factor income and factor returns. Similarly, their study showed that the redistribution of income under liberalization appears to favor the low income household groups.

Similarly, Mujeri and Khondlker (1998) apply a CGE model of macroeconomic policy reforms using the SAM for 1992/93 for same country. The SAM based fixed price model and flex price CGE model are adapted to examine the consequence of policy changes on allocation of resources, income distribution, and poverty. This study also reports the pro-competitive effects of tariff liberalization.

In addition, Devarajan and Van Der Mensbrugghe (2000) aim to assess the impact of complete removal of trade barriers on household income and distribution in South Africa. Their model is static and consists of 34 sectors as well as 24 types of households identified by ethnic background and income classification and labor disaggregated in to 13 different categories. Government current expenditures are divided in to five classifications and investment is divided into public and private components.

According to them, production is modeled using nested constant elasticity of substitution (CES) and they assumed constant returns to scale. They modeled household demand using the extended linear expenditure system function. They also modeled trade using the Armington assumption for import demand and constant elasticity of transformation (CET) for export supply. According to them, all markets are assumed to clear through prices except for the labor market for unskilled black workers. In the case of the later, the real wage is fixed and unemployment clears the labor market. Their main finding is that trade reform will most likely improve the average welfare of black households but reduce that of white households. Within ethnic groups, richer black and poorer white households stand to benefit.

Moreover, there has been some work on Zimbabwe focusing on trade policy on growth, income distribution and indirectly on poverty (Devies et al, 1994; Rattso and Torvik, 1998).According to Rattso and Torvik (1998), trade liberalization is characterized by removal of foreign currency rationing in different stages and not by removal of tariffs. They found that, in the short run, there was a contradiction of output and employment after that type of trade liberalization. They also found that there was a consumption boom as people consume previously forced savings leading to rising trade deficits.

They used four income distribution groups and generally found that this type of trade liberalization favored the richer groups.

Another computable general equilibrium micro-simulation analysis is carried out in Zimbabwe. Margaret Chitiga (2005) and Ramos Mabugu (2005) use a micro-simulation computable general equilibrium model to study the impact of trade liberalization on poverty in Zimbabwe. The novelty of their paper is that it incorporated individual households in CGE model as opposed to having representative households allowing for a comprehensive analysis of poverty. They found that complete removal of tariffs favors export oriented sectors and all imports increase. Poverty falls in the economy while inequality hardly changes. Moreover, their results differ between rural and urban areas

Cockburn (2001) investigated trade liberalization and poverty in Nepal using the micro simulation CGE model. He replaced the assumption of representative households by incorporating all the households from a nationally representative survey. In this way, he endogenized intra-group variations. The households in this model are characterized by their sources of income and consumption pattern. He found that trade liberalization has quite complex poverty and distributional impacts. Urban households are the big winners as initial tariffs were highest in agricultural sectors. He also found that poverty falls in urban areas and increases in rural areas, particularly among the moderately poor. According to his finding, the strength of the impacts increases with the level of the household income. He said that strong positive effects are observed in the highest income levels.

Moreover, the impacts of trade reform on poverty in different households groups are analyzed by different authors. Tariff cuts on cereal imports in Morocco have adverse impacts on rural poverty while contribution to a fall in urban poverty.

A study of the distributional consequences of devaluation in Rwanda emphasis the importance of home production (Minot, 1998). This study concludes that a devaluation that raises the price of tradable by about 40% has only a modest negative impact on the poorest rural households whose cash purchases comprise only about one third of total expenditure.

In their study, the largest proportional losses accrue to the wealthiest urban households, who devote 96% of their income to cash purchases. Rural and low income households are likely to be less severely affected either positively or negatively, because home production is more prominent in their over all consumption profile.

Ravalli an (1995) address the impacts of trade reform on factor market in his study of rural labour market on Bangladesh that measures both the short and long run impacts of an increase in prices of rice on rural wages and poverty using a Computable General Equilibrium model. A simple condition was used to determine whether such households gains from an increase in price of rice. The condition required the elasticity of wage with respect to the price of rice to exceed the ratio of net food (rice) expenditure divided by net wage income. On this basis, Ravallian concluded that the average landless poor households loses from an increase in rice price on the short run, but gains in the long run(5 or more years). This is because household income (dominated by unskilled wage) is large enough to exceed the increase in household expenditure of which less than half is comprised of rice for the poor households.

Empirical evidence of the impacts of trade liberalization on economic growth and poverty will also be discussed as follows. Agama (2001), uses a comprehensive data base to examine the link between trade openness and growth for a group of 40 countries in Africa.

She argues that during the 1980-1990 periods, the more open countries experienced higher economic growth rates than those that remained closed. Agama documents that although trade liberalization and economic integration increases economic growth for African countries, increases government consumption expenditure retards such growth. Agama's study follows the findings of a number of empirical cross-countries studies by Dollar (1992), David (1993). Sachsand and Warners(1995) indicate that trade openness is associated with more rapid economic growth .However , the debate about a positive empirical association between trade openness and economic growth remain far from settled.

Rodrik(1998) tests the link between trade policy and economic growth for a group of countries in sub-Saharan Africa over the 1965- 1990 period and finds that the fundamentals for long term growth in sub-Saharan countries are human resources ,physical infrastructure ,macro economic stability and the rules of law. He also examines whether enhanced trade volume in recent years improved efficiency in South Africa economy. They find that a significant positive relationship between trade and total factor productivity growth over time and across sectors. Dollar and Krray(2001) also test the link between trade policy changes and economic growth and conclude that change in growth are highly correlated with change in trade volume.

Ayele Gelan (2002) employed urban –rural Computable General Equilibrium (CGE) model to examine the impacts of trade liberalization on structural transformation and over all growth of Ethiopian economy. His simulation experiments suggest that the impacts of trade liberalization depend on wage setting condition in the urban region. With a fixed urban real wage, trade reform adversely affects overall economic growth mainly because of large contraction in the urban region. If urban nominal wage is fixed but urban real wage is flexible, both rural and

urban region experience expansion in GDP. According to his analysis the success of trade liberalization depends on extent to which product and labor market reforms are synchronized.

Philps and Tadele (2005) built computable general equilibrium model to capture the impacts of trade liberalization resulting from the tariff dismantling on the main fiscal, economic and social indicators both at macro –economic and sectoral levels. The simulation result computed by the model shows both negative and positive effects in which the negative effects were mainly reduction of government revenue while its positive effects are an increase in economic growth through its positive impact on foreign investment and stimulation of domestic demand.

However, there is no empirical analysis being under taken using dynamic computable General equilibrium model to analyze poverty impacts of trade liberalization in Ethiopia. The present research will attempt to address this issue.

CHAPTER THREE

3. Social Accounting Matrix and Structure of Tariff in Ethiopia

3.1. Social Accounting Matrix (SAM)

A SAM is a particular macro and meso -economic accounts of a socio-economic system, which capture the transaction and transfers between all economic agents in the system (Paytt and Round, 1988). Round (2001) reported that in common with other economic accounting systems, SAM records transaction taking place during an accounting period, usually one year.

As defined by Round (1981), a Social Accounting Matrix (SAM) is defined as a single entry accounting system where by each macro economic account is represented by a column for out going and a row for incomings. The main features of SAM are three fold. First, the accounts are represented as square matrix; where the incomings and out goings for each account are shown as corresponding row and column of the matrix. The transactions are shown in the cells, so that the matrix displays the interconnections between agents in an explicit way. Second, it is comprehensive, in the sense that it portrays all the economic activities of the system (consumption, production, accumulation and distribution) Thirdly, the SAM is flexible, in that, although it is usually set up in a standard basic frame work, there is a large measure of flexibility both in the degree of desegregation and in the emphasis placed on different parts of the economic system.

As it is an accounting framework not only is the SAM is square but also the corresponding row and column total must be equal. Any set of macro economic aggregates can be set out in a matrix format. But, this would not be a social accounting matrix in the sense in which the term is

usually used. An overriding feature of SAM is that households and household groups are at the heart of the framework. SAM typically shows much more detail about the circulars flow of income, including transactions between production activities, and in particular recording the transactions between both these sets of agents via the factors and product market (Round, 1981).

Sancho (1995) pointed out that SAM have been used to study (i) growth strategies in developing economics, (ii) income distribution and redistribution, and (iii) fiscal policies and decomposition of activity multipliers that shed lights on the circular flow of income. Thorbecke (1970), also further argued that SAM could be used to address poverty and income distribution in developing country.

SAM can be used for macro-economy planning in two ways: first, a SAM can provide a framework for the organization of information related to economic and social structures of a country's economy. Second, a SAM can serve as a data base for a model of the economy under consideration. Therefore, the most important features of a social accounting matrix is that it provides a consistent and convenient approach to organizing economic data for a country and it can provide a basis for descriptive analysis and economic modeling in order to answer various economic policy question.

SAM is broader than an input-out put table and typically national account, showing more detail about all kind of transactions within an economy. However, an input –out put table records economic transaction alone irrespective of the social background the transactors. A SAM, on the contrary, attempts to classify various institutions to their socio-economic backgrounds instead of their economic or functional activities (Sen, 1996).

3.2. The 1999 /2000 Ethiopian SAM – Key Features And Structures

A SAM is a square table describing quantitatively the transactions taking place in an economy during a specified period of time. Each account in the SAM is represented by a row and column of the table; by convention, each cell of the matrix represents expenditures by the column account and income to the row account. The underlying principle of double-entry accounting requires that total revenue (row total) must equal total expenditure (column total) for each account in the SAM. The SAM integrates national income, input-output, flow-of funds, and foreign trade statistic into a comprehensive and consistent data set.

Usually, aggregate SAM consists of the following accounts. These are: (1) activities account, (2) commodities account , (3) factors account, (4) households account, (5) enterprises account (6) Government account (7) saving investment account, and (8) Rest of the World (ROW) account. Table 3.1 shows the basic structure of the 1999 /2000 aggregate Ethiopian SAM with verbal explanation of the cells.

Table 3.1:– Basic Structure of 1990/2000 Aggregated Ethiopian SAM used in CGE model

Receipts	Expenditure								
	activties	commodities	factors	households	Enterprise	Government	Saving-investment	Rest of world	Total
Activities		Marketed surplus							Activity in come (gross outputs)
Commodities	Intermediate inputs	Transaction costs		Private consumption		Government consumption	Investment	Exports	Demand
Factors	Value added								Factor income
House holds				Intra - household transfers	Dividend	Transfers to households		Transfers to households from rest of world	Households income
Enterprises			Factor income to enterprises						Enterprise income
Government		Tariffs, export tax		Direct tax to government	Direct enterprise tax			Transfers to government from rest of world	Government income
Saving investment				Households saving	Enterprise ssaving	Government saving		Foreign saving	Savings

Receipts	Expenditure								
	activties	commodities	factors	households	Enterprise	Government	Saving-investment	Rest of world	Total
Rest of world		Imports		Household transfer to rest of world		Government transfer to rest of world			Foreign exchange out-flow
Total	Activities expenditure	Supply expenditure	Factors expenditure	Households expenditure	Enterprises expenditure	Government expenditure	Investment	Foreign exchange inflow	

Source: 1999/2000 Ethiopian SAM of World Bank,Tadele and Alemayehu(2002)

The 1990/2000 Ethiopian SAM is a 40x40 matrix and contains an account each for 12 production activities and 4 factors of production, 10 institutions ,eight commodities, transaction cost, and public investment ,saving -investment and three tax accounts. To apply a CGE model, the 12 activities are aggregated into 3 broad activities groups such as industrial, agricultural and services activities. In addition, some institution accounts such as food for work project, food aid program accounts are aggregated into government account. Finally, the public investment is added into saving -investment account. The family labor and labor are lumped together into a single labor category. Hence, the social accounting matrix that is used in CGE model contains 26 accounts.

Below, we try to define the SAM accounts described in table 2.1

1. Activities

In the activity row, goods and non-factor services are produced for sale in the commodity market. This is a receipt for activities account .In the activity column, activity account pays to intermediate input use and it also pays to factors of production their reward in form of wage rate to labor and profits to capital and land.

2. Commodities Account

Commodities are supplied in the column (to the commodity market) by activities in the form of marketed production and from the rest of the world in the form of imports of goods and non-factors services. Domestic agents demand commodities valued in the row for intermediate consumption, private consumption of marketed commodities, government consumption, and investment (both governmental and non governmental). Exports are demanded by the rest of the world. Total expenditure in the commodity column is obtained by adding tariffs and the value of goods supplied at producer price from domestic production

activities. Transaction costs should also be included in the total expenditure.

For this SAM used in CGE model, seven commodities group are identified. These are food crops, traditional agricultural exportables (mainly livestock and live stock products, coffee , and chat), non-traditional agricultural Exportables (including tea, flowers, and vegetables), other agricultural products (forest products and fisheries), agro manufacturing and industrial products (textile, processed food and beverages, leather and leather products, non metallic product ,electricity and water construction, mining and quarrying), public goods (education, health, public administration) and other related services (transport and communications, banking and insurance).

3. Factors Account

Factors typically include labour, capital and land. Total payments to factors from productive activities (in the row) comprise value added at factor cost. Factor income is distributed (in the column) as dividend and wages to households and as capital income net of dividend to enterprises. For the current CGE model, the three factors above are considered.

4. Households Account

SAM used to capture the characteristics of different socio-economic groups of the population. Households differ principally in terms of factor endowments owned and consumption patterns. Total income (in the row) consists of wage, including income from informal enterprises, dividend from formal enterprises, intra-transfers between households and transfers from government and abroad. Income is allocated to (in the column) consumption of commodities, taxes to government, savings and

transfers to other institutions. In this SAM, three household groups namely farm households, wage earners and entrepreneurs are identified.

5. Enterprises Account

Enterprises earn profits. This income is distributed to households in the form of dividend, withheld as retained earnings, and the remaining is paid as direct taxes. There are three types of enterprises in the SAM. These include private, public and peasant household enterprises.

6. Government Account

As an institution, the government levies a variety of taxes to obtain receipts (in the row) and spends it (in the column). The difference between total spending and total revenue represents government savings.

7. Capital Account

The capital account is the balance between investment (in the column) and total saving (in the row). They include retaining earnings by enterprises (enterprises saving), government savings, household savings and foreign savings (net capital inflow).

8. Rest of the World Account (ROW)

Rest of the world account shows the balance between foreign exchange receipts (in the column) and imports of goods, non-factor services from the rest of the world (in the row). Finally, for the SAM used in CGE model, transaction costs are treated as a separate account. Since, transaction cost is major determinant of investment decision; it has its own account in the SAM. This will be consistent with the sequential dynamic CGE model analysis. Thus, a transaction cost account is included explicitly to accommodate marketing and transportation costs (or marketing margins) associated with commodity flows. Marketing margin represent the cost of moving commodities from the point of their

production (for domestic out put) to the point of consumption. It also represents the cost of moving commodities from the boarder (for imports) to the point of consumption and from production to the boarder (for export). Hence, adding a transaction cost account can widen the options in analyzing the impact of alternative investment strategies. It can also provide a handle on the question of market integration.

3.2.1. Structure of production

Table 3.2 shows the structure of production and domestic expenditures from social accounting matrix of 1999/2000 in Ethiopia.

Table:-3.2 Structure of Gross domestic Production and Expenditure

Production and domestic expenditure (1999/2000)		
	As percentage of GDP (%)	*As percentage of gross domestic expenditure.*
Private consumption	*70.54*	*62.95*
Investment	*31.12*	*28.02*
Government consumption	*10.01*	*9.03*
exports	*11.15*	--
Imports	*-22.20*	--
net indirect taxes	*5.24*	--
GDP (factor cost)	*94.76*	--

Source: 1999/2000 SAM of World Bank, Tadele and Alemayehu(2002)

Final demand is composed of private consumption, government consumption, and investment. From the above table, one can see that private consumption is the largest components of the demand side of the Ethiopian economy. It amounted to 63 percent of gross domestic expenditure (GDE), or equivalent to 70 percent of GDP. Investment is amounted to 28 percent of domestic expenditure and 31% of GDP at market price. As indicated above, the largest components of demand are private consumption and investment, which together account for over 101.6% of total GDP at market price.

Domestic production by a firm is assumed to require inputs from itself and from all other productive sectors and value added from the factors of production. Factors employed are compensated in all the sectors. GDP at factors cost consists of value added for the factors of production. As shown in the above table, GDP at factors cost amounted to 95% of GDP at market prices.

Moreover, the structure of production across aggregate sectors for the 1999/2000 SAM will be shown below. As indicated in table 3.3, the bulk of agricultural out put (39%) is generated from the agricultural sector. The service sector is more capital intensive (14%) as compared with other two sectors. The industry sector together accounts for the smallest contribution to gross out put and value added. Agriculture is the least capital intensive sector (5.7%). As expected the labor's value added share from the total production is substantially higher in agricultural sector as compared to land and capital value added share in total output. But the capital value added shares in total output for industry and service sector are higher than the labour value added shares in the same sectors. Finally, value added at factor cost is amounted to 37 percent in agriculture while the lowest is obtained in industry.

Table:-3.3 Structure of Sectoral Production in 1999/2000 (%)

	Share in gross output	Capital value added at factors cost	land value added at factor cost	Value (GDP)added at factor cost	Labor value added
Agriculture	39.35	5.73	9.22	37.47	22.55
Industry	25.42	10.46	0.0	16.1	5.62
Services	35.23	14.43	0.0	23.14	8.72
All sectors (total)	100.00	-	-	--	--

Source: 1999/2000 SAM of World Bank,Tadele and Alemayehu(2002)

3.2.2. Income and Expenditure

As mentioned above, the model identifies three households, farm households, wage earners, and entrepreneurs. Table 3.4 portrays the composition of households' income and expenditures.

Table 3.4: -Households Income Pattern (shares in %)

	Share of household income			share of the source		
	Farm household	Wage earner	Entrepreneur	Farm household	Wage earner	Entrepreneur
labour	56.22	88.73	8.54	67.58	29.97	2.45
Dividends	38.29	0.00	62.78	71.95	0.00	28.05
Government transfers	0.54	4.54	3.38	20.62	48.69	30.7
Foreign receipts	2.13	6.37	16.51	26.53	23.87	49.59
Household transfers.	2.84	0	8.78	57.69	0.00	42.31

Source: computed from the 1999 /2000 Ethiopian SAM

As expected, farm households and wage earners generate most of their income from labour which is amounted to 56% and 88.73% respectively. As shown in table 3.4, entrepreneurs rely on capital income (62.8%). When we compare the income of the households by sources, labour income is by far the most important source for farm households followed by the wage earners. Labour incomes of the entrepreneurs (8.5%) are very small as compared to labour income of wage earners and farm households.

Even though, the contribution of dividend to total income of entrepreneur s is very high, dividend is the least source of income to entrepreneurs as compared with farm households. The most important source of income for farm household is labour and dividend. The capital income of farmhouse hold is mainly from handicrafts and cottage industries located in rural areas.

According table 3.5 below, households devote most of their income to sectoral consumption.

Table 3.5: - Households Expenditure Shares (%)

	Farm household	*Wage earners*	*Entrepreneur*
Personal taxes	*0.58*	*5.3*	*16.51*
Transfers to abroad	*0.0*	*0.0*	*1.02*
Private consumption	*92.33*	*75.53*	*59.34*
savings	*5.36*	*10.79*	*19.57*
Intra-house hold transfers.	*1.73*	*8.39*	*3.56*

Source: Computing from 1999/2000 SAM of World Bank ,Tadele and Alemayehu(2002)

Farm households spend (92.33%) more on consumption than wage earners (75.53%) and entrepreneur (59.34%). Entrepreneurs pay more direct taxes and also have higher saving rates as compared with other two groups of households (see table 3.5).

Table 3.6 portrays the sectoral share of consumption expenditures of households from their total income. As indicated, farm households spend mostly on agricultural goods (73.3%) and with the lowest consumption expenditure on services (6.4%). Surprisingly enough, the consumption expenditure patterns of the wage earners and entrepreneurs are similar. Since most of them are living in urban areas, the consumption behaviors pursue similar patterns. Wage earners and entrepreneurs spend most of their income on consumption of industrial goods. The share of their consumption expenditure on agricultural goods is greater than that of services.

Table 3.6: - Household's Consumption Shares in Income (%)

	Farm households	*Wage earners*	*Entrepreneurs*
Agriculture	*73.33*	*37.0*	*36.98*
Industry	*20.22*	*46.63*	*46.66*
Services.	*6.45*	*16.37*	*16.36*

Source: computed from 1999/2000 SAM of World Bank,Tadele and Alemayehu(2002)

3.2.3. Composition and Structure of Trade

Table 3.7 shows the composition and structure of Ethiopian trade with the rest of the world. Service sector is the significant player in export share (50.64 %) where as industry is dominating the import share. From the second column of the table, we can deduce the export intensity of

sectors. Service sector is also the most export intensive sector, with an export intensity of 13%. Note that, agriculture with a share of 9.8% is more export intensive than industry whose share is only 2.3%. Unlike exports, imports are concentrated within industrial sector accounting over 78 percent of total imports.

Table 3.7:- Trade and Production (%)

	Export share	*Export output share*	*Import share*	*Import demand share*
Agriculture	*42.81*	*9.82*	*4.05*	*1.99*
Industry	*6.54*	*2.32*	*78.08*	*33.11*
Services	*50.64*	*12.97*	*17.87*	*9.37*

Source: computed from 1999/2000 SAM of world Bank,Tadele and alemyehu(2002)

Finally, table 3.8 shows the tariff duties collected on sectoral out put. The average tariff is relatively low at 12.6 percent in service sectors. The highest tariff rate is found in industrial sector, which is two- fold that of agriculture and is amounted to 25.2 percent. Although tariffs have fallen since 1993, there still remain considerable protections on many of Ethiopians major imports.

Table 3.8:- Import Tariff Duty Rate (1999/2000)

	Tariff rate (%)
Agriculture	*15.9*
Industry	*25.2*
Services	*12.6*

Source: 1999/2000 SAM

3.2.4. Structure of tariff in Ethiopia

The trade regime is a part of the over all incentive structure. Trade reforms, are important for the modernization of the economy and is an aspect of the transformation from an inward oriented to an outward oriented economy.

For the country like Ethiopia, which has little in terms of market power in trade, open trade policies are an instrument available to it for the transformation to a modern economy. However, for a variety of reason the country has not fully realized the full benefits from its trade reforms that began in the early 1990s. It is equally true that the country is certainly better off under the liberalized trade regime compared to the highly restricted trade regime of the Derg period.

In august 1993, the new government embarked on a comprehensive trade reform program aimed at dismantling quantitative restrictions and gradually reducing the level and dispersion of tariffs rates. The negative list used to determine eligibility for import through the foreign exchange access was reduced significantly. Currently, quantitative import restrictions are applied only to used clothing, harmful drugs and firearms. Both tariffs levels and their dispersion have reduced significantly.

As results of the reforms, tariffs rates are narrowed down from pre-reform 0-240 percent to 0-80 percent in 1995 and then to 0-35 in 2002 (table 3.9). The average (un-weighed) tariffs rate declined from 28.90 % in 1995 to 18.8 % in 2001.

Table 3.9:- Summary of Import Tariff Structure of 1995 and 2001.

Tariff rate	*1995 Tariff line*	*percent*	*2001 Tariff line*	*Percent*
0-10	*1592*	*31.68*	*2520*	*49.1*
11-20	*1092*	*21.73*	*1019*	*19.84*
21-30	*608*	*12.1*	*669*	*13.2*
31-40	*640*	*12.74*	*927*	*17.86*
41-50	*185*	*3.68*	-	-
51-60	*23*	*0.46*	-	-
61-70	*488*	*9.71*	-	-
71-80	*395*	*7.86*	-	-
Total	*5023*	*100.0*	*5135*	*100.0*
Total tariff bands	*34*		*22*	
range	*0-80*		*0-40*	
Mean	*28.9*		*18.8*	
Coefficient of variation	*82.4*		*69.7*	

Note: CV: coefficient of variation as a percentage of mean

Source: compiled from the tariff schedules for 1995 and 2001(Cited in DTIS, 2004)

In 2003, the government adopted a six band tariff structure based on the harmonized system. Both import and export tariffs are advalorem. There is no other preferential tariff except for imports from COMESA member countries.

Table 3.10: -Distribution of Tariff Bands

Tariff bands(percent advolerem)	*Number of tariff line*	*Share of tariff (%)*	*Average annual Imports in 1000s(2001-02)*	*Share of imports*
0	*167*	*3.08*	*40102*	*4.9*
5	*1385*	*25.53*	*157943*	*19.3*
10	*826*	*15.22*	*95207*	*11.6*
15	*320*	*5.9*	*45186*	*5.5*
20	*996*	*18.36%*	*93543*	*11.4*
30	*635*	*11.7*	*91351*	*11.2*
35	*1092*	*20.13*	*294457*	*36*
Total	*5426*	*100.0*	*817789*	*100%*

Source: Ministry of Finance and Economic Development and Ethiopian Customs (Cited in DTIS, 2004)

As the above table shows the revision replaced the 22 tariff bands in 2001 and 34 in 1995 down to 7 tariff bands in 2002. This reform eliminates fractional rates in tariff as it is shown in the above table. In 1995 and 2001, some of the tariff rates are in fraction .But for simplicity; we arranged the tariff data in the form of interval. However, in 2002 all tariff rates are in the form of Zero or positive integer. These fractional tariff rates may not complicate tariff administration.

According to the Diagnostic Trade and Integration Study (DTIS), there are five prohibited items and hence a very insignificant number of tariff lines. They are opium, ethyl alcohol and other similar spirits and prohibitions are put in place for health reasons and for preventing illegal traders from importing contraband classified as used clothing and rags.

Moreover, the World Bank tried to estimate the effective protection rate and nominal protection rate for major imported items for the year 1995 and 2001 and is indicated in table 3.11. Usually tariff structure impacts on profitability of domestic production through both tariff on final good imports, exports, and tariff on intermediate goods used in domestic production. The analytical tool used to measure the combined effect of both end products and input tariff is the effective rate of protection (ERP). The ERP aims to capture the proportionate increase in per unit value added of a sector in the presence of these two types of tariff.

According to the World Bank, the input coefficient used in these estimates have been derived from the regional input- output table for Sub-Saharan Africa used in Global Trade Analysis Project (GTAP) data base. The World Bank derived the nominal tariff from the official Ethiopian sources. According to World Bank, the estimates are only suggestive of underlying incentive structure arising from tariff on both inputs and out puts. Table 13.1 indicates a comparison of nominal rate of protection (NRP) and ERP.

Table 3.11: -Nominal and effective Rates of protection: 1995 and 2001[1]

Input-output Industry	*Input-output(I-O) sector*	*Nominal tariff rate (%)*		*Effective rate of protection (ERP)[2]*	
		1995	*2001*	*1995*	*2001*
	A) Agriculture, forestry, and fishing	*29.0*	*9.3*	*36.6*	*8.5*
1	*paddy price*	*30.0*	*5.0*	*35.4*	*3.4*
2	*wheat*	*30.0*	*5.0*	*38.2*	*1.7*
3	*cereal grains*	*25.8*	*5.0*	*31.4*	*3.7*
4	*vegetable, fruit, nut*	*35.4*	*19.7*	*42.6*	*23.2*

[1] *Industry classification is based on the global Trade Analysis project (GTAP) data base.*

[2] *Estimated using the formula,*

$$ERP_j = \left[t_j - \frac{\sum (a_{ij} * t_i)}{(1 - \sum a_{ij})} \right]$$

Where, t_j *and* t_i *are the nominal scheduled tariff rates on given industry and input-supply industry respectively, and* a_{ij} *is the input coefficient indicating the share of industry* $i's$ *production used as in puts in* $j's$ *industry out put.*

Input-output Industry	Input-output(I-O) sector	Nominal tariff rate (%)		Effective rate of protection (ERP)[2]	
5	oil seeds	30.0	5.0	38.4	3.9
6	sugar cane, sugar beet	0.0	0.0	-4.4	-2.5
7	plant-based fibers	6.3	6.3	2.9	5.5
8	Row milk	0.0	0.0	-17.7	-7.4
9	wool, silk- worm cocoons	5.0	5.0	-11.1	0.8
10	Forestry	24.1	13.8	26.9	15.0
11	Fishing	38.1	29.4	51.8	40.8
	(B)Mining	5.1	6.7	0.8	-2.6
12	Coal	5.0	5.0	-13.2	-5.6
13	Oil	5.0	5.0	0.9	2.8
14	Gas	5.0	5.0	4.0	4.7
15	Minerals, other	10.3	6.7	-4.8	-2.6
	(C) manufacturing	22.7	14.9	39.1	26.6
16	Food products, other	52.3	28.9	118.3	66.3
17	Beverages and tobacco products	44.6	32.7	85.4	72.8
18	Textiles	47.5	30.1	98.5	63.0
19	Wearing apparels	77.7	39.9	180.2	83.4
20	leather products	50.8	35.5	95.5	71.9
21	Wood products	32.5	20.4	47.7	29.6
22	petroleum, coal products	7.7	5.7	21.4	9.6

Input-output Industry	Input-output(I-O) sector	Nominal tariff rate (%)		Effective rate of protection (ERP)[2]	
23	metal products	22.6	19.8	46.8	44.7
24	motor vehicles and parts	30.8	19.2	61.4	35.3
25	electronic equipment	23.0	21.1	33.6	35.1
26	machinery and equipment	23.0	21.1	33.6	35.1
27	Manufactures not classified else	48.3	32.1	93.4	61.6
	Weighted average	22.2	14.7	36.2	26.0
	simple average	27.5	15.5	48.7	26.3
	Coefficient of Variation	67.1	71.2	110.0	114.9

Source: World Bank estimates (Cited in DTIS, 2004)

The conclusion emerges from level and structures of effective rate of protection are the following. First, ERP Exceeds nominal rate of protection such that the evaluation of the protective structure based only on nominal rate under states the extent of protection accorded many activities.

Second, There is a wide variance in ERP that interfere with greater efficiency in resource allocation and the variance in ERP (as indicated by the coefficient of variation has increased between 1995 and 2001, as the average level has declined).

Third, the estimates also point to clear incentive bias in the protection structure in favor of manufacturing against agriculture. This anti-agriculture bias in effective protection has largely been the out come of high protection enjoyed by input supplying manufacturing industries.

Finally, the presence of the high protection of some imports and the bias against exports suggest they could potentially contribute to appreciate real exchange rate.

The tariff structure in 2002/2003 which is based on the harmonized system would be presented as follows. For all of the following items, the standard unit of quantity for the weight is kilogram. This will facilitate the, comparisons and analysis of international statistics based on the harmonized system.

Table 3.12:- Tariff Structure in 2002(%)

	(A) Products of the chemical or Allied industries	Duty rate (%)
1	Fluorine, iodine	10%
2	Alkaline-earth metals	10%
3	Chromium oxide and hydro oxide	10%
4	lead oxide	10%
5	chlorides oxide and chloride hydroxide	10%
6	carbonates and commercial ammonium	10%
	(B) Pharmaceutical products	
1	Glands and other organs for organ therapeutic uses	free
2	Man blood prepared for therapeutic	free
3	Vaccine for veterinary medicine	free
4	Vaccine for veterinary medicine	free
	(C) Textile Articles	
1	Raw silk	5%
2	Silk yarn	20%

3	Woven fabrics of silk	35%
4	Wool, not carded	5%
5	Wool and fine-corded	10%
6	Woven fabrics carded wool	35%
7	Cotton- not carded	10%
8	Cotton yarn	20%
9	Woven fabrics of cotton	35%
10	Articles of apparel and clothing accessories	35%
11	Knitted or crocheted fabrics	35%
	(D)Vehicles, aircrafts	
1	Rail way or tramway locomotive	free
2	Fish- plates and sole plates	free
3	Vehicles with a seating capacity of less than 15 passengers	35%
4	Vehicles specially designed for traveling on snow: golf cars	35%
5	A ambulance in a complete state	free
6	Balloons and dirigibles; gilders and other non powered aircraft	free
	(E)Machinery and equipment	
1	Electrical machinery	10%
2	Sawing machine	5%
3	Pad locks and locks	20%
4	Iron and steel	

5	Pumps for liquids	10%
	(F) Vegetable products	
1	Edible vegetables and certain roots and tubers	10%
2	Edible fruits and nets	10%
3	Coffee	30%
4	Tea and mate	35%
5	cereals	5%
	(G) Animal products	
1	Fish and crustaceans, Mollusks and other aquatic invertebrates	10%
2	Diary produces, birds Egg, natural honey	30%
3	Meat and edible meat offal	10%

Source: Computed from Ethiopian Customs Authority (2002)

As shown above, most of the pharmaceuticals products are duty free. The tariff rate for chemical and allied industry is 10 percent. For textile products the tariff rate ranges from 5 percent to 35 percent with the highest tariff rate (35 percent) is obtained in wool-carded, woven fabrics of cotton, woven fabrics of silk, and articles of apparel and clothing articles. For Vehicles whose seating capacity is less than 15 passengers, the tariff rate is also amounted to 35 percent. For vehicles such as ambulance, railway locomotive, the tariff rate falls down to zero. The tariff rate for agricultural products range from 5 percent to 35 percent. The tariff rate for imported cereals is 10 percent while the tariff rate for coffee, tea and mate is 35 percent. The tariff rate for coffee whether roasted or not is same

CHAPTER FOUR

4. Methodology and Data Sources

4.1. Data Source and Type

The 1999/2000 Social Accounting Matrix used in this study is a secondary data prepared by the World Bank for Ethiopia. In addition, the 1999/2000 household income and consumption expenditure survey consisting of 17,336 households is also a secondary data and obtained from the central statistical authority.

4.2. Basic Structure of Computable General Equilibrium Model.

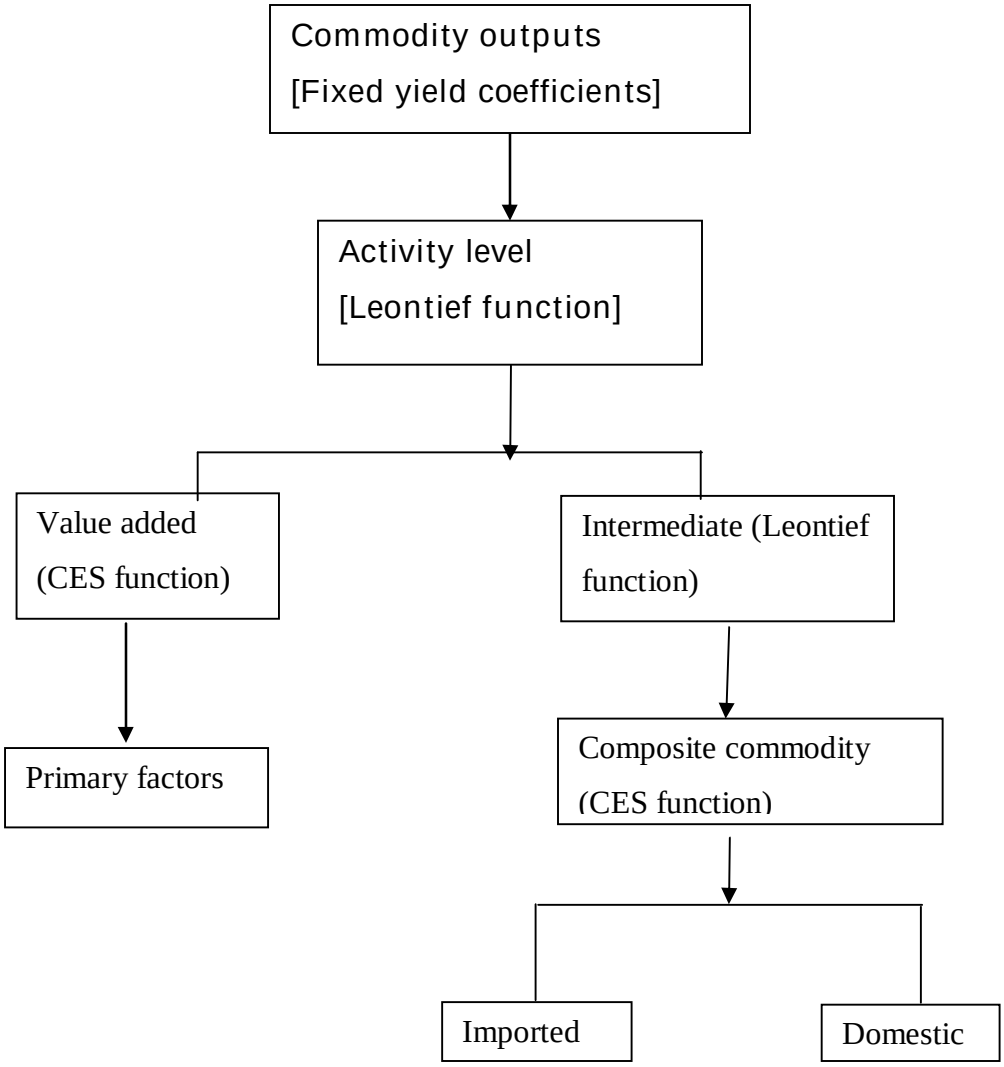
The standard CGE explains all of the payments recorded in the SAM. The model follows the SAM desegregations of factors, activities, commodities, and institutions. It is written as a set of simultaneous equations, many of which are non linear. Unlike dynamic CGE model, there is no objective function in standard CGE model. The equations define the behavior of the different actors. For production and consumption decisions, behavior is captured by non linear first order optimality conditions, production and consumptions decisions are driven by the maximization of profit and utility respectively. The equations also include a set of constraints that have to be satisfied by the system as a whole. These constraints cover, markets for factors and commodities and Macro economic aggregates of saving-investment and current account balance of the rest of the world.

Each producer, represented by an activity, is assumed to maximize profits. Profits are defined as of the difference between revenue earned and the cost of factors and intermediate inputs. Producers maximize profits subject to a production technology as shown below. At the top

level, the technology is specified by a Leontief function of the quantities of value added and aggregate intermediate inputs (figure one).

Value added is itself a CES function of primary factors where as the aggregate intermediate input is a Leontief functions of disaggregate intermediate inputs. Each activity produces one or more commodities according to fixed coefficients. As noted in figure one, a commodity may be produced by more than one activity. The activity revenue is defined by the level of the activity and commodity price at producer level.

Figure 1: Production Technology



Source: Lofgren et al (2002)

As discussed above, CGE model is a customary tool to assess the impacts of the exogenous shocks and change in policy (trade liberalization, structural adjustment policies, energy and environment) on endogenous variables (for instance on growth and income distribution through product and labour markets. How ever, most of them are static in nature which is solved in a single period and is unable to consider the dynamic effects of capital accumulation on poverty in the medium run

Moreover, in contrast to static CGE model, the dynamic counterpart is characterized by the inclusion of a driving force to move the economy from period to period. This driving force may be the growth in the underlying labour force (equation 44 below) and or a change in the level of technology in one or more sectors of the economy. These changes are facilitated by new investments and the growth of the capital stock in the economy (equation 43 below).As a result, the use of dynamic CGE model solves this methodological problem.

The dynamic aspect of representative households approaches are commonly used to analyze issues of income distribution, poverty and inequality. Hence, to assess the potential effects of trade liberalization on production, poverty, and income distribution, a sequential dynamic computable general equilibrium model is developed. To analyze poverty, first the change in income of representative households would be obtained from the outcome of the Sequential Dynamic Computable General Equilibrium (SDCGE) model. Then after, the percentage change in income of the representative households will be directly applied to the 1999/2000 household income and consumption expenditure survey that consists of 17336 households. This survey is one of the inputs for the construction of 1999/2000 SAM that is used in our analysis. Finally, Using the most recent DAD Soft ware (2004) which is commonly used to analyze the three Foster-Greer -Thorbeck(FGT) poverty indicators is adopted. In subsequent sections, the static CGE model is presented followed by dynamic model equations. For the specification of static model, International Food Policy Research Institute (IFPRI, 2002) format of standard CGE model is adopted.

4.3. Specifications for Static Module

This section provides detailed specifications of the applied CGE model, reporting on all variables and parameters and equations used. First, the quantity equations are presented which describe production and value added generation. This is followed by the block of income equations that describe the distribution of factor incomes and institutions. Second, the expenditure equations that characterize the budget constraints of the various actors of the model are described. Third, Foreign trade, saving - investment and price block will also be shown. Finally, equation block of the system constraints will be presented, which defines the market clearing conditions and their related macroeconomic closures of the model.

In this model, the time dimension for each equation is missing for simplicity. Therefore, the subscript presenting the time period will be introduced only when necessary.

4.3.1. Production Block

On the production side, a multistage production function is adopted. In a first stage, sectoral output is a Leontief function of value added and intermediate consumption. Value added is in turn represented by a CES function of labour and capital in non agricultural sectors (industry and services), and a CES function of land and a composite factors in agriculture. The composite factor is also represented by a CES function of primary factors: agricultural capital and labour. In the different production activities, it is assumed that representative firms remunerate factors of production and pay dividends to households. The labour market is assumed to be fully mobile between activities. Capital stock on the other hand is sector specific and is fixed in the short run.

The production function can be written as:

$$QA_a = f\left(LD_a, KD_a, LAN, QINTA_a\right)$$

$$= \min\left(\frac{VA_a}{iva_a}, \frac{QINTA_a}{\text{int } a_a}\right)$$

This can be re-written as:

$$VA_a = iva_a.QA_a \quad \ldots\ldots 1$$

$$QINTA_a = \text{int } a_a.QA_a \quad \ldots\ldots 2$$

Where QA_a is out put of production in activity a, iva_a is the value added requirement per unit of activity output. VA_a is the value added in activity a. LD_a and KD_a are labour demand and stock of capital demand in each activity respectively. LAN is demand for land in agricultural sector. $QINTA_a$ is the demand for aggregate intermediate inputs. $\text{int } a_a$ is the quantity of aggregate intermediate input per activity unit. It represents the fixed input-output coefficients. In this model, three activities have been identified. These include agriculture, industry and service. Value added in agriculture is produced using three factors of production, namely labour, capital and land. Value added in industry and service sector constituted labour and capital.

For each activity, the quantity of value added is a CES function of disaggregated factor quantities. The value added in non agricultural sectors (VA_{nag}) could be represented as follows.

$$VA_{nag} = \alpha_{nag}\left[\delta_{nag} LD_{nag}^{-\rho_{nag}} + (1-\delta_{nag}) KD_{nag}^{-\rho_{nag}}\right]^{\frac{-1}{\rho_{nag}}} \quad \ldots\ldots 3$$

Similarly, the production function for agriculture could be written as:

$$VA_{ag} = \alpha\,.\left[\delta\,.\,LAN^{-\rho} + (1-\delta).CVA^{-\rho}\right]^{\frac{-1}{\rho}} \quad \ldots\ldots 4$$

Composite value added (CVA) is in turn a CES function of primary factors of labour and capital. This can be written as:

$$CVA = \alpha_{ag}\left[\delta_{ag}\,.\,LD_{ag}^{-\rho_{ag}} + (1-\delta_{ag}).\,KD_{ag}^{-\rho_{ag}}\right]^{\frac{-1}{\rho_{ag}}} \quad \ldots\ldots 5$$

Where:

$VA_{nag} = CES\ value-added\ function\ in\ non\ agricultural\ sectors$

$VA_{ag} = CES\ value-added\ function\ in\ agricultural\ sector$

$\alpha_{nag} = Shift\ parameter\ in\ the\ CES\ value-added\ function\ in\ non-agricaltural\ sectors$

$\rho_{nag} = CES\ value-added\ function\ exponents\ in\ nonagricaltural\ sectors$

$\delta = CES\ value-added\ function\ share\ paramater\ for\ factors\ in\ agricalutre$

$\alpha = shift\ parameter\ in\ the\ CES\ value-added\ function\ in\ agricaltural\ sector$

$\rho = CES\ value-added\ exponents\ in\ agricalture$

$\rho_{ag} = CES\ composit\ value-added\ function\ exponent\ in\ agricalture$

$\alpha_{ag} = shift\ parameter\ in\ CES\ composit\ value-added\ function\ in\ agricalture$

$\delta_{nag} = CES\ value-added\ function\ share\ parameter\ for\ factors\ in\ non\ agrecultural\ activities$

$\delta_{ag} = CES\ value-added\ function\ share\ parameter\ for\ factors\ in\ agrecultural\ sector$

After defining the price of each factors of production, the demand for factors can be determined. A profit maximizing firm under perfect competition demand factors at a point where marginal cost of each factor is equal to the marginal revenue product (net of intermediate input costs) of the factors.

Having taken the first order condition given the constraints, the demand for labour could be written as:

$$LD_a = \left[\left(\frac{\alpha_a}{1-\alpha_a}\right)\left(\frac{RK_a}{RL_a}\right)\right]^{\frac{1}{(1+\rho_a^{KL})}} .KD_a \quad \ldots\ldots 6$$

Where:

$RK_a = return\ to\ capital\ in\ sector\ a$

$RL_a = return\ to\ labour\ (wage\ rate)\ in\ sector\ a$

$\rho_a^{KL} = a\ transformation\ of\ elasticity\ of\ factor\ substitution$

$\alpha_a = efficiency\ parameter\ in\ the\ CES\ value-added\ function$

For each activity, the demand for disaggregated intermediate inputs is determined via a standard Leontief formulation as the level of aggregate intermediate inputs use times a fixed intermediate input coefficients. This can be written as:

$$QINT_{ca} = ica_{ca}.QINTA_a \quad \ldots\ldots 7$$

$$\begin{bmatrix} \text{int } ermediate \\ demand\ \ for \\ com\,\text{mod}\,ity\ C \end{bmatrix} = f \begin{bmatrix} aggregate\,\text{int } ermediate \\ input\ \ quantity\ \ for \\ activity\ a \end{bmatrix}$$

Where,

$QINT_{ca} =$ Quantity of commodity c as intermediate input to activity a

4.3.2. Income and saving Block

The income equation block specifies the factor payments of the economy and their distribution to households and other institutions as well as tax payments, savings, remittances, and other foreign payments. In this model, households earn their income from labor. They also receive dividends, intra household transfers, government transfers and remittances. Households pay direct income tax to the government. Value added is distributed to households and firms using a distribution matrix of fixed coefficients defined over factors and institutions (households and firms). Thus firms receive income from selling its endowment of capital and land in the factor market. Firms pay dividends to households and foreigners and pay direct income tax to the government.

Thus, the income YH_h for household group h and income YX_x for firm group x can be written respectively as:

$$YH_h = \lambda_h.RL.\sum_a LD_a + TGH_h + TROWH_h.EXR + DIV_h + \sum_h THH_{hh} \quad \ldots\ldots 8$$

$$YM_x = \lambda_x^k.RK.\sum_a KD_a + \lambda_x^l.LR.LAN \quad \ldots\ldots 9$$

Where, YH_h is income of household $_h$; DIV_h is dividend from firm x to household h; TGH_h is transfers from Government to household; $TROWH_h$ is transfers from rest of the world to household $_h$; THH_{hh} is an intra-household transfer; YX_x is income of firm x, λ_h and λ_x^k are the shares of household h and firm x from total remuneration of labor and capital respectively. λ_x^l is the share of firm x from total remuneration of land. Disposable income or income after tax (equation 10) is either saved or used to buy domestically produced goods and imports, and to payments of transfers.

Households are assumed to save a fixed proportion of their disposable incomes. Disposable income and households savings, SH_h, which is translated directly into demand for investment goods , take the form respectively as:

$$YDH_h = YH_h.(1-ty_h) \quad \ldots\ldots 10$$

$$SH_h = MPS_h.YDH_h \quad \ldots\ldots 11$$

Where, MPS_h is saving rate of household group h, and ty_h is the average rate of income tax paid by household h.

Firms would save what remains after direct tax on revenue and transfer deduction. Firms saving can be written as;

$$SX_x = MS_x.YM_x(1-try_x) \quad \ldots\ldots 12$$

Where MS_x = marginal propensity to save of firm x

YM_x = revenue of firm x

SX_x = savings of firm x

try_x = Income tax rate on firm x

The government obtains its revenue from a wide range of taxes. The government receives direct tax revenue from households and firms and indirect tax revenue on domestic and imported goods. The government

revenue also constitutes transfers coming from the rest of the world. Its expenditure is allocated between the consumption of goods and services (Including public wage) and transfers.

The government income (YG) can be written as:

$$YG = \sum_h ty_h.YH_h + EXR.TROWG + \sum_x try_x.YM_x + \sum_{cm} TIM_{cm} + \sum_{ce} TEX_{ce} \quad \text{.....13}$$

Where, $TROWG$ is the rest of world transfers to government. Import and export tariffs equations represented by TIM_{cm} and TEX_{ce} respectively shall take the following form:

$$TIM_{cm} = txm_{cm}.EXR.PWM_{cm}.QM_{cm} \quad \text{.....14}$$

$$TEX_{ce} = tex_{ce}.EXR.PWE_{ce}.QE_{CE} \quad \text{.....15}$$

Government saves the remaining part of the income after deduction of transfers (to households and the rest on the world) and expenditure (government consumption and government investment).

$$EG = PQ_c.QG_c + \sum_h TG + TGROW \quad \text{.....16}$$

$$SG = YG - EG \quad \text{.....17}$$

Where,

$SG =$ government savings

$EG =$ government expenditure

$QG_c =$ government consumption of commodity c

$TG =$ government transfer to households

$TGROW =$ government transfers to rest of the world

Domestic savings depend on:

1. household-specific marginal propensities to save that are applied to households monetary income net of income taxes (equation 11) and
2. On marginal propensity to save of firms that are applied on capital income net of corporate taxes (equation 12). Total savings is

defined as the sum over households and enterprises savings, and foreign savings in local currency.

4.3.3. Demand Block

This block of equations contains households' group demand, total demand by commodity, total intermediate demand and the total government demand (recurrent and investment).

For household h, in equation (18), the total value of consumption spending is defined as the income that remains after direct taxes, savings, and transfers to other domestic non government institutions.

$$EH_h = YDH_h - SH_h - \sum_h THH_{hh} - THROW_h.EXR \quad \text{.....18}$$

Where, EH_h is household consumption expenditure and $THROW_h$ is transfers from households to the rest of the world.

The quantity demanded of commodity c by household h (QH_{ch}) would be written as:

$$QH_{ch} = \beta_{ch}.{}^{EH_h}\!/_{PQ_c} \quad \text{.....19}$$

Where, β_{ch} is marginal share of consumption on marketed commodity c for household h; PQ_c is the composite price of commodity c.

Investment demand for commodity c $(QINV_c)$ could be written as:

$$QINV_c = ur_c.{}^{IT}\!/_{PQ_c} \quad \text{.....20}$$

Where, ur_c is share of commodity c from total investment, and IT is the value of total investment. Equation (21) explains total investment (IT) equals to sum of households, firms, rest of the world savings and government savings.

$$IT = \sum_x SX_x + \sum_h SH_h + SG + FSAV \quad \text{.....21}$$

Where, $FSAV$ is foreign savings and SG is government savings. Total demand by commodity is the sum of quantity demand of c by household

h, investment demand, intermediate demand and transaction demand. Intermediate demand for commodity c could be written as:

$$QINT_c = ica_{ca}.QINTA_a \quad \text{.....22}$$

Where, $QINTA_a$ is aggregate intermediate demand by activity a and ica_{ca} is a fixed intermediate input coefficient.

Similarly, transaction demand for commodity C shall be written as:

$$DTRCOST_c = sh - cst_c.TRCOST / PQ_c \quad \text{.....23}$$

Where, $TRCOST$ is value of total transaction cost and $sh - cst_c$ is the share of commodity c from the value of total transaction cost.

4.3.4. Foreign trade Block

Aggregate marketed production of any commodity C is defined as sum over the make matrix column coefficients multiplied by their respective activity level. This can be written as:

$$QX_c = \sum_a \theta_{ac}.QA_a \quad \text{.....24}$$

Where, QX_c is domestic output of commodity c and QA_a is activity level. θ_{ac} is the share of commodity c from activity level in sector a.

A. Exports

Given the fact that there are difference in the quality of goods produced for exports and for domestic consumption, following Dervis et al (1982), a constant elasticity of transformation (CET) function between domestically consumed good, QD_{ce} and exported goods QE_{ce} is adopted.

$$QX_c = f^{CET}(QE_{ce}, QD_{ce}) = \sigma^t_{ce}.\left[\delta^t_{ce}.QE_{ce}^{\rho^t_{ce}} + (1-\delta^t_{ce}).QD_{ce}^{\rho^t_{ce}}\right]^{\frac{1}{\rho^t_{ce}}} \quad \text{.....25}$$

Where, σ^t_{ce} and δ^t_{ce} are the shift and share parameter respectively and ρ^t_{ce} is the exponent parameter in the CET function.

Maximizing revenue from a given out put, subject to equation (25) yields the export supply function as:

$$QE_{ce} = QD_{ce} \cdot \left[\frac{PE_{ce}}{PDD_{ce}} \cdot \frac{1-\delta_{ce}^{t}}{\delta_{ce}^{t}} \right]^{\frac{1}{\rho_{ce}^{t}-1}} \quad \ldots\ldots 26$$

Where, PE_{ce} and PDD_{ce} are the export and domestic prices respectively. For non exportable commodities, domestic sales (QD_{cne}) equal to the domestic supply which in turn equals to the output (QX_{cne}).

$$QX_{cne} = QD_{cne} \quad \ldots\ldots 27$$

This specification of export supply works under the small country assumption in which the national export volume has no influence on world market prices. It is assumed that all export sectors in Ethiopia follow the small country assumption, facing exogenously determined (fixed) world market prices. Thus, equation (26) reflects the assumption of imperfect transformability between two alternative destinations: domestic sales and exports. The elasticity of transformation between the two destinations is a transformation of P_c^t, for which the lower limit is one[3]. The values are restricted to assure that the isoquant corresponding to the output transformation function is concave to the origin.

B. Imports (Armington function)

The model adopts a specification of imperfect substitutability between domestic and imported goods (Dervis et al, 1982; Devarajan et al, 1995). This is in line with the Armington (1969) assumption, which treats goods of the same type but different countries of origin as imperfect

[3] *For CET functions,* $\Omega = \frac{1}{\rho_{ce}^{t} - 1}$ *is the elasticity of transformation and* ρ_{ce}^{t} *is the exponent. As* Ω *varies from 0 to infinity, the value of* P_c^t *varies from infinity to one. In equation (27), as* P_c^t *approaches one from above, the elasticity of* $QE - QD$ *ratio with respect to changes in* $PE - PDD$ *ratio increases*

substitutes. According to this assumption, each country produces a unique set of goods, which, to a varying degree, are substitutes for, but not identical to goods produced in other countries. When the domain of a CES aggregation function is limited to commodities that are both imported and produced domestically, it is often called an "Armington function".

Thus, an aggregate or composite commodity (QQ_c) is defined which is a CES function of imports, QM_{cm}, and domestic goods QD_{cm}.

$$QQ_C = f^{CES}(QM_{cm}, QD_{cm})$$

$$= \alpha_{cm}^{q}\left[\delta_{cm}^{q}.QM_{cm}^{-\rho_{cm}^{q}} + (1-\delta_{cm}^{q}).QD_{cm}^{-\rho_{cm}^{q}}\right]^{\frac{-1}{\rho_{cm}^{q}}} \quad \text{.....28}$$

Where, α_{cm}^{q} and δ_{cm}^{q} are shift and share parameter respectively and ρ_{cm}^{q} is the exponent parameter in the CES function for aggregate supply. The elasticity of substitution between commodities from these two sources is a transformation of ρ_{cm}^{q}, for which the lower limit is minus one[4]. The above mentioned formulation implies that consumers will choose a mix of QM_{cm} and QD_{cm} depending on their relative prices. The first order conditions for cost minimization given the two prices and subject to the Armington function and a fixed quantity of the composite commodity yields the following import domestic demand ratio:

$$\frac{QM_{cm}}{QD_{cm}} = \left[\frac{PDD_{cm}}{PM_{cm}}.\frac{\delta_{cm}^{q}}{(1-\delta_{cm}^{q})}\right]^{\frac{1}{\rho_{cm}^{q}+1}} \quad \text{.....29}$$

[4] For CES function $\Omega = \frac{1}{\rho_{cm}^{q}+1}$ *is the elasticity of substitution between imports and domestic products.*

Where, PDD_{cm} and PM_{cm} are the prices of domestic output and import respectively. As result of this specification, PDD_{cm} is no longer equal to PM_{cm} and PDD_{cm} is endogenously determined in the model.

The balance of payments equation requires total payment for imports to be equal to total receipt for exports plus foreign savings and borrowing (equation 30)

$$\beta C = \frac{1}{EXR}\left(\sum_h THROW_h + TGROW\right) + \sum_{cm} PWM_{cm}.QM_{cm} - \sum_h TROWH_h - TROWG - \sum_{ce} PWE_{ce}.QE_{ce} \quad .....30$$

Where, βC is current account balance and EXR, is exchange rate. $THROW_h$ and $TGROW$ are transfers from households and governments to rest of world respectively.Here, βC and $FSAV$ are interchangeably used. The current account balance, which is expressed in foreign currency, imposes equality between the country's spending and its earning of foreign exchange. For the basic model version, foreign savings is fixed; the real exchange (EXR) serves the role of equilibrating variable to the current account balance.

4.3.5. Price Block

The price system of the model is rich; primarily because of the assumed quality differences among commodities of different origin and destinations (exports, imports, and domestic outputs used domestically). The price block consists of equations in which endogenous model prices are linked to other prices (endogenous or exogenous) and to non price model variables.

A. Import prices

On the import side, price taker small country assumption of classical trade theory is adopted. This suggests that the domestic prices of imports are exogenously determined and is linked in world prices in dollars by:

$$PM_{cm} = PWM_{cm}.EXR(1 + txm_{cm}] \quad .....31$$

Where, PM_{cm}, PWM_{cm} are import prices in local currency units and C.I.F. import price in foreign currency units respectively.. The import price in local currency units is the price paid by domestic users for imported commodities (exclusive of cost of trade inputs per import unit). txm_{cm}, is import tariff rate.

B. Export prices

As far as the export is concerned, it is also assumed as the country has no market power. For all its export, the assumed share of world trade for the modeled country is so small that it faces an infinitely elastic supply curve at the prevailing world price. The domestic price of export is defined as follows.

$$PE_{ce} = PWE_{ce}.(1 - txe_{ce}).EXR \quad \ldots\ldots 32$$

Where, PE_{ce} is the export price in local currency unit (LCU) and txe_{ce} is export tax rate. PWE_{ce}, is the f.o.b export price in foreign currency unit (FCU). The export price in LCU is the price received by domestic producers when they sell their out put in export markets.

C. Composite prices

As suggested by Devarajan et al (1995), the composite price (equation 33) and producer prices (equation 34) specified here are the linear approximations of the dual price equations for the import aggregation (CES) and export transformation (CET) functions.

The composite price can be written as:

$$PQ_c = \left[\frac{PDD_c.QD_c + PM_c.QM_c}{QQ_c}\right].(1 + tcst_c) \quad \ldots\ldots 33$$

Where, PQ_c is a composite price, and QQ_c is the composite supply. $tcst_c$ is transaction cost rate per unit of commodity c.

D. Producer prices.

Producer price is a linear approximation of domestic prices of domestic sales and domestic prices of export activities:

$$PXAC_c = \frac{PDD_c.QD_c + PE_c.QE_c}{QX_{C.}} \quad \text{.....34}$$

Where, $PXAC_c$ is producer prices of commodity c. For each domestically produced commodity, the marketed output value at producer price is stated as the sum of the values of domestic sales and exports. It is consistent with expenditure identity.

E. Activity prices

The gross revenue per activity unit, the activity prices, is the return from selling the out puts of the activity. It is defined as yields per activity unit multiplied by the activity- specific commodity prices summed over all commodities. This allows for the fact that a single activity may produce multiple commodities. The activity price may be written as:

$$PA_a = \sum_c PXAC_c.\theta_{ac} \quad \text{.....35}$$

Where, PA_a is the activity price and θ_{ac} is yield of out put c per unit of activity a.

F. Value added prices

A value added is combined in fixed proportion with intermediate input to produce domestic output. The price of value added can be determined from the prices of final out put in each sector. Thus, the price of value added (PVA_a) can be defined as the producer activity price net of indirect taxes and the value of total intermediate demand. The value added price equation is as follows:

$$PVA_a = \frac{PA_a.QA_a - PINTA_a.QINTA_a}{VA_a} \quad \text{.....36}$$

Where, $PINTA_a$ is aggregated intermediate input price for activity a; QA_a is activity level output, and $QINTA_a$ is quantity of aggregate intermediate inputs. Aggregate intermediate input price in itself depends on composite commodity prices, PQC, and intermediate input coefficients, ica_{ca}. It can be defined as follows:

$$PINTA_a = \Sigma_c PQ_c.ica_{ca} \quad \text{.....37}$$

For each activity, total revenue is fully exhausted by payments for value added and intermediate inputs.

G. Consumer Price Index (CPI)

The consumer price index is defined as the geometric average of consumer prices using consumption share weights.

$$CPI = \sum_c PQ_c.cwts_c \quad \text{.....38}$$

Where, $cwts_c$ is weight attached to commodity c and PQ_c is price of composite good.

4.3.6. Saving -Investment Block

Saving investment Balance states that total savings and total investment have to be equal. Total savings is the sum of savings from domestic non government institutions, the government and the rest of the world. The foreign saving should be converted in to domestic currency. Total investment is the sum of the values of investment made on each investment commodities. The saving investment balance equation can be shown as:

$$\sum_x SX_x + \sum_h SH_h + SG + EXR.BC = \sum_c PQ_c.QINV_c + WALRAS \quad \text{.....39}$$

Where, $QINV_c$ is the quantity of investment on commodity c . The variable WALRAS is added in the above equation to satisfy that the numbers of equations are equal to the number of variables. The solution value of this variable should be zero. After this adjustment, the model presented is complete and self contained.

4.3.7. Balance Block

After describing the supply and demand side of the model, the price system, and the income generation and distribution process the market-clearing conditions have to be specified.

Market equilibrium requires the equality between the total supplies of goods on the domestic market be equal to total aggregate demand for these goods. Thus, equation (40) represents the physical balance of all commodity markets, where total composite commodity supply equals the sum over intermediate demand and all final demand categories (consumption demand, intermediate demand, total demand of transaction costs, investment).

$$QQ_c = \sum_h QH_c + QINT_c + DTRCOST_c + QINV_c + QG_c \quad \text{.....40}$$

After commodities market equilibrium, factor labour equilibrium is assured by equation (41). The model allows the mobility of labour factor between activities. Moreover, equation (42) shows the factor market equilibrium where demand for factors equals to supply of factors.

$$LS = \sum_a LD \quad \text{.....41}$$

$$QFS = \sum_a LD + \sum_a KD + LAN \quad \text{.....42}$$

Where,

$LS =$ aggregate labour supply

$LD =$ labour demand in sector a

QFS= total quantity of factor supply

KD =demand for capital by sector a

LAN= unit of land employed by agricultural sector.

4.4. Specifications of the Sequential Dynamic Model

In this case, the Annabi et al. (2004), modeling system of sequential dynamics is attempted to follow. The EXTER+SD (Sequential Dynamic) model is formulated as a static model, which is solved sequentially overtime[5]. In every period, the capital stock is updated with a capital accumulation equation and total labour supply increases at the same rate as exogenous growth.

A. Capital accumulation

Capital accumulation equation describes the law of motion for the sectoral capital stock. It supposes implicitly that the stocks are measured at the beginning of the period and that the flows are measured at the end of the period. In this application, the law of motion is applied at sectoral level by achieving the equality condition of investment by destination and investment by origin. In some case, the law of motion can be applied to the total capital stock rather than at sectoral level (Annabi et al, 2004). In every period, the capital stock (KD) is updated with a capital accumulation equation involving the rate of depreciation (δ) and investment ($Qind_{a,t}$)

$$KD_{a,t+1} = (1-\delta)\, KD_{a,t} + Qind_{a,t} \quad \text{.....43}$$

B. Growth in Labour Supply

With the introduction of equation (44), total labour supply (LS_t) becomes an endogenous variable, although it simply increases at the exogenous

[5] *The model is formulated as a system of non linear equations solved recursively as a constrained non linear system (CNS) with GAMS/conopt 3 solver.*

rate (ng) which is simultaneously the population growth rate and the labour force growth rate. The labour supply equation can be written as:

$$LS_{t+1} = LS_t(1+ng) \quad \text{.....44}$$

C. Investment demand

Here, the question is how new investment will be distributed between different sectors. This can be done either through a distribution function or an investment demand function. The investment here is not the investment by origin (product) that we have already in the static model, but it is investment by sector of destination.

In introducing investment by destination, we respect the equality condition with total investment by origin in the original social accounting matrix.

Given investment demand equation,

$$\frac{QInd_{a,t}}{KD_{a,t}} = y_{1a}\left(\frac{RK_{a,t}}{U_t}\right)^2 + y_{2a}\left(\frac{RK_{a,t}}{U_t}\right) \quad \text{.....45}(a)$$

The elasticity of the investment rate with respect to the ratio of the rate of return of capital to its user cost is:

$$\frac{d\left(\frac{Qind_{a,t}}{KD_{at}}\right).\left(\frac{RK_{a,t}}{U_t}\right)}{d\left(\frac{RK_{a,t}}{U_t}\right).\left(Qind_{a,t}\right)} = V \quad \text{.....45}(b)$$

This implies that:

$$\frac{2-V}{V-1} = \frac{y_{2a}}{y_{1a}\cdot\left(\frac{RK_{a,t}}{U_t}\right)} \quad \text{.....45}(C)$$

The parameters y_{1a} and y_{2a} are therefore positive only if the value of the elasticity of

$\frac{Qind_{a,t}}{KD_{a,t}}$ with respect to $\frac{RK_{a,t}}{U_t}$ is between 1 and 2. If V=1.5, we obtain the following relations:

$$y_{2a} = y_{1a}\frac{RK_{a,t}}{U_t} \quad \text{.....45}(d)$$

y_{1a} and y_{2a} are positive parameters calibrated on the basis of the investment elasticity and the investment equilibrium equation. If we substitute y_{2a} in equation 45(d) in to equation 45(a), we obtain the investment demand equation:

$$\frac{Qind_{a,t}}{KD_{a,t}} = .2y_{1a}\left(\frac{RK_{a,t}}{U_t}\right)^2 \quad \text{.....45}(e)$$

This can be re-written as:

$$\frac{Qind_{a,t}}{KD_{a,t}} = \phi_a\left(\frac{RK_{a,t}}{U_t}\right)^2 \quad \text{.....45}(f)$$

Where $\phi_a = 2y_{1a}$

The capital accumulation rate – ratio of investment $(Qind)$ to capital stock (KD)- is increasing with respect to the ratio of the rate of return to capital (RK) and its user cost (U). The user cost is equal to the dual price of investment $(Pinv)$ times the sum of the depreciation rate and the exogenous real interest rate (r):

$$U_t = Pinv_t(r+\delta) \quad \text{.....46}$$

Where, δ is capital depreciation rate. The dual price of investment shall be written as:

$$Pinv_t = \Sigma_c wiv_c.PQ_c \quad \text{.....47}$$

Where, wiv_c is the weight attached to investment goods.

Moreover, the exogenous dynamic updating of the model includes nominal variables (that are indexed) like transfers and dividends. The

model is formulated as a static model that is solved recursively over a 19 period time horizon.

D. Other dynamic equations

Since the labour supply is assumed to increase at the exogenous population growth rate, all inter-agent transfers in the model also increase at the same rate. Dividend $(DIV_{h,t+1})$ for household h can be written as:

$$DIV_{h,t+1} = DIV_{h,t} \cdot (1+ng) \quad \text{.....48}$$

Similarly, government transfers to households could be written as:

$$TG_{t+1} = TG_t (1+ng) \quad \text{.....49}$$

The equivalent variation for the household groups could also be written as:

$$EV_{h,t} = \Pr od\left[C, \left(\frac{PQ0_c}{PQ_{c,t}}\right)^{\beta_{c,h}} . EH_{h,t}\right] - EH0_h \quad \text{.....50}$$

Where, $EV_{h,t}$ is the equivalent variation for household h at time t and $EH0_h$ is initial consumption expenditure for household h; $PQ0_c$ is the initial composite price of commodity c.

4.5. Intertemporal Dynamic model

A fundamental point of departure of a dynamic CGE model from a static one is the incorporation of intertemporal structure of consumption and investment decision in the dynamic model. A standard CGE model examines one period sectoral reallocation of resources. However, a dynamic CGE model allows us to analyses the path of transitional dynamics towards a new steady state after an initial shock.

Some of the critical problems associated with static CGE models triggered the introduction of dynamic aspects in CGE analysis. Firstly, while the agents in static CGE setting optimize their with-in period decisions, they are not allowed to optimize between-period decisions such as savings and investment. Therefore, the equilibrium price obtained in a static CGE model are not in equilibrium overtime, thus a policy conclusion from a static CGE model could be problematic. Secondly, consequences of most of the policy reforms are dynamic in nature. Therefore impacts of a policy reform like trade liberalization is supposed to be better captured by a dynamic CGE model rather than a static one.

4.5.1. Mathematical specification of intertemporal Dynamic CGE model

A dynamic single-country CGE model is used to assess the key effects of trade liberalization on the Ethiopian economic. The theoretical framework of this model is based on Ramsey's small open-economy model with intertemporal consumer as well as producer optimization and within intra-industry trade. This model is an extension of the work by Devarajan and Go (1998) for the Philippines. Basic assumption of the model is as follows

- Except the first period, capital is mobile across producing sectors.
- The world price of imports is exogenous invoking the small country assumption.
- Imperfect substitution characterizes the competition between foreign and domestic goods as reflected by the so-called Armington substitution elasticity between the domestic and import good.
- Output produced for domestic and export reflects differences in quality.

- Consumers' utility function is separable across time, so that consumers maximize the present valve of the utility of aggregate consumption, subject to an intertemporal budget constraint. Similarly, producers maximize the value of the firm (equal and the present value of net income).
- Since the model can not be solved for an infinite number of periods, we need to specify the post-terminal conditions. The standard approach is to assume that the economy will be in a steady state after the terminal period, T .
- There is a cost to investment that is quadratic in the ratio of investment to capital stock. Such a specification leads to the economy adjusting to the desired capital stock in smooth fashion overtime.

Devarajan et al (1984) elucidates that a CGE model numerically captures, first, the optimizing behaviour of the agents in the economy and second, the consistency of the out come of that behaviour. The demand and supply side specifications of the economy in the model can be done under certain standard assumptions such as monotonicity, convexity, continuity. The income constrained preference maximizing behaviour and technology constrained profit maximizing behaviour of the agents is also a standard assumption as well. The subsequent presentation of the model follows the notation used by Devarajan and Go (1998)

4.5.1.1. Consumption of the Representative Households

Infinitely-lived representative households are assumed. The representative households own labour and all financial wealth. They allocate income to consumption and savings and maximize an intertemporal utility function over an infinite horizon. For the purpose of

numerical implementation, the intertemporal problem is formulated in discrete time. Hence, the representative household maximizes over all utility, U as given by:

$$U_O = \sum_{t=0}^{\infty}\left(\frac{1}{1+\rho}\right)^{(t+1)}.U(CK_t) \quad \ldots\ldots(1)$$

With $U(CK_t)=\frac{1}{1-V}(CK_t)^{(1-V)}$ and $U^{\bullet}(CK)=CK_t^{-V}$

Here, U and CK_t stand for aggregate utility and aggregate consumption of the representative household respectively, and the parameters ρ and v are the rate of time preference and the constant elasticity of intertemporal substitution respectively. The formulation depicted in equation (1) shows that the households utility at time 0, we need to sum all future discounted aggregate consumption of the households.

To determine the consumers' budget constraint, we first define his wealth, W_0 as the discounted flow of current income Y_t (equation 2)

$$W_O = \frac{Y_0}{1+r_o^c}+\frac{Y_1}{(1+r_o^c)(1+r_1^c)}+\ldots\ldots+\frac{Y_t}{\pi_{s=o}^{t}(1+r_s^c)} \quad \ldots\ldots 2$$

$$= \sum_{t=0}^{\infty}\mu(t)Y_t$$

Where $\mu(t)=\pi_{s=0}^{t}(1+r_s^c)^{-1}$ *and* r_s^c is the interest rate facing consumers. The wealth constraint of these households requires that the present value of consumption expenditures not exceed its wealth. Thus, the households' budget constraint would be represented by the following equation:

$$\sum_{t=o}^{\infty}\mu_t\ PC_t.CK_t \le W_O \quad \ldots\ldots 3$$

Where, PC_t represents the consumption price index at time t. Alternatively, it can be called consumer price index (CPI_t). μ_t represents a discount factor.

The household maximize (1) subject to an intertemporal budget constraint (equation 3).The Lagrangian of the intertemporal problem (equation4) is:

$$L = \sum_{t=0}^{\infty}\left(\frac{1}{1+\eta}\right)^{t+1}.U(CK_t)+\lambda\left(\sum_{t=o}^{\infty}\mu(t).PC_t.CK_t - W_o\right) \quad \ldots\ldots 4$$

From the first order conditions of equation (4), we can derive the following ratio of the marginal utility of consumption for two periods, s and t:

$$\frac{U^{\bullet}(C_s)}{U^{\bullet}(C_t)} = \frac{PC_s.(1+\rho)^{s-t}}{PC_t\pi^{s}_{tt=t+1}(1+r^{c}_{tt})} \quad \ldots\ldots 5$$

Equation (5) portrays that the household's consumption pattern is a function of relative prices of consumption in the respective periods, the rate of time preferences and the interest rate faced by the households. Similarly, $U^{\bullet}(C_t)$ is the derivative of the same utility function at time t with respect to aggregate consumption, CK_t.

Thus equation (5) implies that the marginal rate substitution between consumption at time s and t is equal to the ratio of consumption price index at time s and t. A sequence of aggregate household consumption and savings are determined simultaneously from equation (5).

Taking equation (1) and (5) together into consideration for two adjacent periods, the following holds:

$$\frac{CK_{t+1}}{CK_t} = \left[\frac{PC_{t+1}(1+\rho)}{PC_t(1+r^{c}_{t+1})}\right]^{\frac{-1}{v}} \quad \ldots\ldots 6$$

A larger r^c makes future consumption cheaper, so that future consumption increases. The intertemporal rate r^c is determined by the opportunity cost of savings, which in this case the cost of foreign borrowing. The cost of foreign borrowing, r^c (equation 7), is a function of the world interest rate and the forward percentage change in exchange rate, EXR_t^c. EXR_t^c, in turn, is the relative price between imports and domestic goods (equation 8):

$$r_t^c = i^{\bullet} + \frac{EXR_{t+1}^c - EXR_t^c}{EXR_t^c} \quad \text{.....7}$$

Where,

$$EXR_t^c = \frac{APM_t}{APD_t} \quad \text{.....8}$$

Here, APM_t and APD_t represent import and domestic goods price index respectively. Here, the households are assumed to have perfect foresight and the savings consumption decisions are “forward looking”

4.5.1.2. Firms and Investment

As mentioned before, the value added function for a representative firm in each sector is a CES aggregation function. The aggregate capital stock is managed by an independent investor who decides on investment and passes some profits to the households. The investors choose a time path of investment to maximize the discounted profit over on infinite horizon:

$$Max \quad V_0 = \sum_{t=0}^{\infty} \mu(t) R(t) \quad \text{.....9}$$

Subject to equation (10):

$$AK_{t+1} = AK_t \cdot (1-\delta) + ITV_t \quad \text{.....10}$$

Where, AK_t is aggregate capital stock at time t and ITV_t is quantity of new investment at time t. Equation (10) is a familiar capital

accumulation equation with δ being the depreciation rate. $R(t)$ is the gross profit less investment expenditure, $J(t)$. In addition, $R(t)$ can be written as:

$$R_t = RK_t . AK_t + LR_t . LAN_t - J_t \quad \ldots\ldots 11$$

Where, RK_t and LR_t are the return to labour and capital at date t respectively. LAN_t is the unit of land employed in production at date t. J_t is the investment expenditure. R_t can be called the net revenue of the firm.

Here, it is assumed that there is an additional capital installation costs beyond cost of final goods, used in capital good production. Thus, due to an adjustment cost to investment and to achieve a certain level of net investment, ITV_t, the necessary investment outlays, J_t, has the following form:

$$J_t = PK_t . ITV_t \cdot \left[1 + \frac{\beta}{2} \frac{ITV_t}{AK_t}\right] \quad \ldots\ldots 12$$

Where, PK_t is the price of capital, and β is the adjustment cost parameters. A quadratic function with parameters β is treated as external to the firm. It implies that production does not adjust instantaneously to price changes and that desired capital stocks are only attained gradually over time. Finally, firms maximize equation (9) subject to equation (10). One can use either the Hamiltonian or the Lagrangian formulation to come up with the first order conditions:

$$L = R_t + q_t . [(1-\delta) . AK_t + ITV_t - AK_{t+1}] \quad \ldots\ldots 11$$

Differentiating the lagrangian with respect to gross addition to physical capital ITV_t would result in the investment demand function as :

$$ITV_t = AK_t . \frac{1}{\beta}\left[\frac{q_t}{PK_t} - 1\right] \quad \ldots\ldots 12$$

Where q_t is the shadow price of capital good. Equation (12) states that firms continue and invest until marginal cost of investment is equal to the shadow prince of capital, q_t .Moreover, differentiating with a state variable AK_t , result in:

$$r_t^p.q_t = RK_t - PK_t.\frac{\beta}{2}\left(\frac{ITV_t}{KK_t}\right)^2 + \Delta q_t - \delta q_{t+1} \quad \text{.....13}$$

In addition, firms also continue to invest until the required return of capital, $r_t^p q_t$ is equal to marginal revenue product of capital plus capital gains, Δq net of depreciation loss δq_{t+1} .Where r_t^p is interest rate facing producers.

Here, μ_t^p is the discount factor, which depends on the interest rate affecting producers, r_t^p . A gain, r_t^p also depends on the world interest rate, i^* , and the forward percentage change in the real exchange rate, EXR_t^p . EXR_t^p Reflects the price ration of the goods sold by the producer, i.e. exports (APE_t) and domestic goods (APD_t):

$$EXR_t^p = \frac{APE_t}{APD_t} \quad \text{.....15}$$

Hence,

$$r_t^p = i^* + \frac{EXR_{t+1}^p - EXR_t}{EXR_t^p} \quad \text{.....16}$$

4.6. Calibration, Parameters, and Algorism

a) **Sequential Dynamic Calibration**

Calibration is a traditional stage in the construction of applied models, in particular constructing general equilibrium model. In this model, we assume the Armington consumption of imperfect substitutability between goods produced for local markets and those produced for export. The calibration of CET (Constant Elasticity of Transformation) is based on other countries experience similar to our country. For the elasticity of

substitution between labor and capital, we also used other countries data which is similar to the structure of our economy.

With the introduction of investment demand and the accumulation equations, capital stock must be calibrated to achieve consistency (Annabi et al. (2004). In the sequential dynamic models, it is not possible to normalize the return to capital. If the return to capital is normalized, one could obtain unrealistic growth trends (Decaluwe, B. 2004). In our application, we used the steady state condition for capital accumulation. Hence, the investment rate is stood at 10% in order to calibrate the capital stock.

b) Intertemporal Dynamic Calibration

Calibration of all CGE models begins with the assumption that the data are obtained from an economy in some type of equilibrium. In static models, this is usually an equilibrium point. In our dynamic model, we assume the entire path of our reference run represents an economy or steady state of the economy. Parameters are then calibrated for this reference run, which ensures that the model will generate an equilibrium solution with values that mach the benchmark data of the economy. In this case, the benchmark data represents our social accounting matrix constructed for Ethiopia. In this model, we scaled all relevant data for per capita terms (i.e. divided by total population) and we assume the balanced growth rate to be zero.

The parameters in the utility function can then be calibrated from the intertemporal condition for consumption, (equation 6). In steady state, the change in consumption is zero. Hence, the discount rate and the time preference parameters will be equal. Since, in steady state, all prices including the exchange rate are cease to change, the world interest rate and discount rate will be equal. This implies that world interest rate will be equal to the time preference parameter. According to Devarajan and Delfin S. Go (1990), the world interest rate is derived as the ratio of

external debt services to total external debt. According to him, it can be set exogenously. But for our application, we use the first one.

Similarly, to solve the growth model that has an infinite horizon, we follow the usual procedure of imposing steady state condition at some future terminal period. As long as the transversally conditions are satisfied, the sums of various infinite series pertaining to the consumption function (e.g. utility) and the investment equation (e.g. shadow price of capital or value of firm) will be finite and well defined. A sufficient condition is that the discount rate and the preference be positive and greater than the balanced growth rate by the terminal period.

CHAPTER FIVE

5. Interpretations and Simulation Results of Trade Liberalization

In static CGE model, counterfactual analysis is made with respect to the base run that is represented by an initial SAM. However, in dynamic models the economy can grow even without a policy shock and the analysis should be done with respect to the growth path in the absence of any shock.

In all simulation scenario the percentage variation between the Base As Usual (BaU) path and the after simulation path for each variable could be presented. These would allow us and compare whether trade liberalizations enhance capital accumulation effect in the long run. First we will examine the evolution of poverty and in equality along the BaU path and simulation path.

To analyze poverty, Foster, Greer, and Thorbecke (FGT) classes of poverty measures have been used. These indices are the most commonly used poverty indicators. It can be written as follows:

$$P_\alpha = \frac{1}{N} \cdot \sum_{j=1}^{p} \left(\frac{Z - Y_j}{Z} \right)^\alpha$$

Where; j is a sub-group of individual with income below the poverty line Z, N is the total number of households. p is number of poor households. α is a parameter that allows us to distinguish between the alternative FGT indices. When α is equal to 0, this expression simplifies and a measure of the incidence of poverty and also called headcount ratio, poverty depth is measured by the poverty gap, which is obtained with α equal to one. The poverty gap index shows the level of the aggregate income shortfall of the poor as proportion of poverty line and

normalized by the population size. The severity of poverty is measured by setting α equal to 2. As α increases, more importance is given to the short falls of the poorest households and the measures become more distributionally sensitive; society becomes more averse to poverty.

In addition, in order to capture whether the change in poverty would be a result of growth or redistribution effect, we use the approach developed by Datt and Ravallion (1992). According to these authors changes in poverty measures can be decomposed in to growth and distribution components. We assume a poverty measure (P_t) such that (P_t) can be defined as :

$$P_t = P\left(\frac{Z}{\mu_t}, L_t\right)$$

Where, Z is the poverty line, μ_t is the mean income and L_t is a vector of parameters describing the Lorenz curve at date t. The level of poverty may change due to change in the mean income μ_t, relative to the poverty line or to a change in relative inequalities, L_t. The growth component of change in poverty is defined as the change in poverty due to change in mean income while holding the Lorenz curve constant at some reference level L_r. The distribution component is the change in poverty due to a change in the Lorenz curve while keeping the mean income constant at the reference level μ_r. Change in poverty over dates t and $t+n$ can then be decomposed as follows.

$$P_{t+n} - P_t = G(t, t+n; r) + D(t, t+n; r) + R(t, t+n; r)$$

Where, $P_{t+n} - P_t =$ Difference in poverty between t_1 and t_2

$G(t, t+n; r)$ = contribution of growth

$D(t, t+n; r) =$ Contribution of redistribution effect and

$R(t, t+n; r) =$ Residual.

Growth and redistribution components are given by:

$$G(t,t+n;r)=P\left(\frac{Z}{\mu_{t+n}},L_r\right)-P\left(\frac{Z}{\mu_t},L_r\right)$$

$$D(t,t+n;r)=P\left(\frac{Z}{\mu_r},L_{t+1}\right)-P\left(\frac{Z}{\mu_r},L_t\right)$$

For, $r=t$ the residual can be written as:

$$\begin{aligned}R(t,t+n;t)&=G(t,t+n;t+n)-G(t,t+n;t)\\&=D(t,t+n;t+n)-D(t,t+n;t)\end{aligned}$$

This residual is the difference between the growth (distribution) components evaluated at the initial mean incomes (Lorenz curves) respectively. The residual disappears if μ_t or L_t remains constant or if we estimate the average of the components obtained using the initial and final years as the references. Shapley (1997) uses this latter approach and defines the average growth and inequality effects as:

$$\hat{G}(t,t+n)=\frac{1}{2}[P(Z,\mu_{t+n},L_t)-P(Z,\mu_{t+n},L_{t+n})-P(Z,\mu_t,L_{t+n})]$$

$$\hat{D}(t,t+n)=\frac{1}{2}[P(Z,\mu_t,L_{t+n})-P(Z,\mu_{t+n},L_{t+n})-P(Z,\mu_{t+n},L_t)]$$

Changes in poverty can then be decomposed as:

$$P_{t+n}-P_t \quad = \quad \hat{G}(t,t+n) \quad + \quad \hat{D}(t,t+n)$$

(Change in poverty) (Growth component) (Redistribution Component)

In the next sub section decomposition results will be presented for BaU and Simulation path scenario.

5.1. Poverty and distributional effects of unilateral trade liberalization

In this section, a complete unilateral trade liberalization policy on industrial and services commodities has been made. Their implication on poverty will be shown as follows. First, we will examine the evolution of poverty and in equality along the Base as Usual (BaU) path.

For comparison purpose, the base poverty level and the after simulation poverty level together with the trend scenario would be presented. This is because the economy can grow even without the absence of any shock.

Table 5.1 - Poverty status of households in 1999/2000 household survey (%)

Household group	*Poverty incidence*	*Proportion*	*Absolute contribution*	*Relative contribution*
Farm households	*56.6*	*41.16*	*23.3*	*50.5*
Wage-earners	*36.56*	*33.8*	*12.36*	*26.81*
Entrepreneurs	*41.73*	*25.03*	*10.45*	*22.65*
Total	-	*1*	*46.1*	*1*

Source: Own Calculation:

From the above table, we can see that the highest poverty indices are found in the farm-households group (56.6%).This indicates that poverty is a rural phenomenon as most of them live in rural area of the country. The relative contribution of these households to total poverty is amounted to 23.3 percent. The wage -earners have the lowest poverty indices among the three households groups mentioned above. As shown in table 5.1, 46.1 percent of the population is under poverty line. According to MOFED (1999/2000), the poverty line is stood at birr 1075.00 per adult equivalent. This is considered as an absolute poverty line.

The poverty gap ratio is a good indicator of poverty since it measures the extent to which the income of the poor is fall-apart away from the poverty line .It gives more weight to the poorest of the poor households. The following table also shows the poverty gap and poverty severity of the three representative households group.

Table 5.2 Poverty severity and poverty gap ratio (1999/2000) in percent

Group	*Poverty gap*	*Poverty Severity*	*Absolute contribution (Poverty Gap)*	*Relative contribution (Poverty Gap)*	*Absolute contribution (Severity)*	*Relative contribution (Severity)*	*Gini*
Farm household	*18.13*	*7.8*	*7.46*	*52.88*	*3.2*	*54.31*	*33.5*
Wage earner	*10.83*	*4.45*	*36.62*	*25.95*	*1.5*	*25.7*	*39.5*
Entrepreneurs	*11.93*	*4.72*	*29.92*	*21.17*	*1.2*	*2.01*	*36.7*
Total	-	-	*14.1*	-	*5.9*	*1*	*37.78*

Source: Own Calculations

The above table indicates that poverty gaps are also highest among farm-households group followed by the entrepreneurs- households group. This means that for each unit of birr under the poverty line, on the average, the poor farm household need to have 0.183 birr per a birr poverty line and per population to come out from poverty. The lesser the poverty gap ratio, the lesser the amount of money required to completely remove poverty. As shown above, both the poverty gap ratio and poverty severity would be lower for the wage-earners.

Here the following simulation will try to address the effects of different tariff reduction scenario on poverty levels. In all scenarios, comparisons of poverty levels are made with respect to both the base poverty line and the trend scenario as well. The effect of tariff liberalization on poverty level is said to be positive only if the values of poverty indicators are lower as compared to both the trend scenario and base line poverty.

To create a link between the Computable general equilibrium model and poverty, the impacts of the shock on households income is directly obtained from the models output. The increase or decrease in income of the representative households from the simulation directly applied to respective households' member .Then after, the DAD software has been used to analyze poverty on households' member.

The first simulation consists of a complete reduction in tariff on both imported items of industrial and service sectors commodities and the short run and long run impacts of this scenario on poverty will be indicated as follows.

Table 5.3:- Poverty indices for industry and service sectors liberalization

	Farm households		*Wage earners*		*Entrepreneurs*		*Total*	
	2001	*2019*	*2001*	*2019*	*2001*	*2019*	*2001*	*2019*
Head count ratio	*56.6*	*21.9*	*27.11*	*13.58*	*37.25*	*10.51*	*41.8*	*16.23*
Poverty gap	*18.13*	*5.1*	*7.25*	*3.14*	*10.17*	*2.02*	*12.46*	*3.64*

	Farm households		Wage earners		Entrepreneurs		Total	
	2001	2019	2001	2019	2001	2019	2001	2019
Poverty severity	7.80	1.73	2.81	1.07	38.8	0.59	51.31	1.22
Gini	33.5	-	39.5	-	36.7	-	37.8	37.72

Source: model result

In the representative approach, the intra-group inequality is assumed to be constant. We observe from table 5.2 and 5.3 that the intra-group inequality among the households group remain the same before the shock and after shock. The Gini coefficients show that inequality among wage-earners (39.5%) is higher than inequality among farm households (33.5%). But, the inter-group in equality is captured by the Gini coefficient which will contribute to national inequality index as well. For now, only the national inequality indexes will be presented for comparisons purposes.

The inter-group inequality increases by a small amount (0.011%). In this scenario, one can see that a complete reduction in tariff has no impact on poverty status of farm households in the single period simulation. However, the head count ratio for wage earners reduces by 9.45% while it is reduced by 4.48% for the entrepreneurs households group. The national poverty head count ratio is also reduced by 4.3%. This implies that trade liberalization has positive impact on poverty in the medium run for the above scenario.

However, to analyze the impact of tariff reduction on poverty in the long run, we need to compare the evolution of poverty and inequality along the BaU and simulation path. Table 5 and 6 respectively show the evolution of poverty on Base as Usual (BaU) and simulation path by the

base run year of 1999/2000 .If there is no external shock; the long run national poverty headcount ratio will be 18.35 percentage points. In other words, the long run national headcount poverty ratio declines by 27.8 percent as compared to the base poverty level. Similarly, the poverty gap ratio and poverty severity decline from 14 percent and 5.9 percent in the base to 4.2 and 1.43 percent in the long run respectively.

From now onwards, to clearly distinguish the net impacts of trade liberalization on poverty and other macro and sectoral variables, the long run percentage differences between the trend and the after shock simulation results should be taken into account. Since capital accumulation starts after first year, the short run results of trend scenario and the base run values are same for all micro and macro variables.

Table 5.4: BaU Scenario of Poverty and in Equality

	Farm house hold		*Wage earner*		*Entrepreneurs*		*All*	
	2000	*2019*	*2000*	*2019*	*2000*	*2019*	*2000*	*2019*
Headcount ratio	*56.6*	*23.39*	*36.56*	*15.4*	*41.73*	*14.03*	*46.1*	*18.35*
Poverty gap	*18.53*	*5.5*	*10.83*	*3.59*	*11.93*	*2.93*	*14.1*	*4.2*
Poverty severity	*7.8*	*1.9*	*4.45*	*1.3*	*4.72*	*0.92*	*5.9*	*1.43*
Gini	-	-	-	-	-	-	*37.78*	*37.52*

Source: model results

Simulation 2: full and indiscriminating liberalization.

In this simulation, we remove all tariffs on imports. This type of liberalization is indiscriminating as we have not made any distinction among industrial, service and agricultural imported commodities in terms of tariff protection. As table 5.5 illustrates the national headcount ratio by 2019 will be only 16.9% while the poverty gap is estimated to 3.8%.As compared to the base, the long run national headcount ratio is reduced by 29.7 percent. Similarly, the poverty gap ratio is also reduced by 10.5 percent.

However, the static simulation results for poverty would almost remain the same as the base poverty level for all the three poverty indicators .Hence ,for this simulation, tariff reduction would not have significant impact on poverty level in the short run. However, the long run effect is positive .In the long run, the net national headcount ratio declines by 1.42 percent as compared to the trend scenario. This means tariff liberalization would enhance capital accumulation effects and thereby increase the income of the households by more than the increase in income if the economy is doing without any shock. This increase in national income may also be associated with absence of inefficiency in resource allocation created by the tariff itself. The entrepreneurs enjoy most of the benefits of trade liberalization since the net decline in headcount ratio is a mounted to 3.8 percent as compared to headcount ratio in trend scenario. The headcount ratio for all households group decrease as compared to the poverty levels in trend.

Finally, the inter-group inequality in static case and in the long run remains almost same at 25.26 percent. Moreover, the Gini -coefficient at aggregate level for static and long run also remain same at 37.66 and 37.6 percent respectively. The implication is that trade liberalization

would not increases both the inter- group inequality and national level of inequality in the long run and the short run.

Table 5.5: Poverty indices in full and indiscriminating liberalization

	Farm house holds		Wag earners		Entrepreneurs		All	
	2001	2019	2001	2019	2001	2019	2001	2019
Headcount ratio	56.61	22.21	37.89	14.74	41.98	11.2	46.62	16.93
Poverty gap	18.13	5.12	11.38	3.41	12.06	2.2	14.33	3.81
Poverty severity	7.79	1.76	4.76	1.18	4.78	0.66	6.01	1.29
Gini	-	-	_	_	_	_	37.66	37.6

Source: own computation from the model

Simulation 3: instantaneous liberalization

In this simulation, complete tariff reduction has been made on industrial and service sectors accompanied by a 90 percent reduction in tariff for agricultural sectors. In this scenario, the entrepreneurs would enjoy higher benefit in the long run (year 2019) .The head count ratio declines from 14 percent in the trend scenario to 8 percent for entrepreneurs. .However, the wage earners do not get much benefit in the long run .The reason may be associated with the fact that the wage earners heavily depends on industrial and service sectors for their employment .With trade liberalization, some of these incompetent sectors are unable to cope up with the reduction in import price. As the import price decline ,the domestic price of the sector's also act accordingly .This might have a negative impact on the employment capacity of the sectors .In general ,the long run impact of tariff liberalization on the national headcount ratio is a decline of 2.8 percent as compared to the headcount ratio in

the trend scenario. Similarly, the poverty gap ratio and poverty severity also showed a net decline of 0.5 and 0.26 percent respectively as compared to the trend scenario. This shows that tariff liberalization would enhance the accumulation effects in the very long run.

However, the national headcount ratio declines by 0.6 percent in the short run. But, the poverty severity and poverty gap ratio remain almost unaffected in the short run. For the above scenario, the Gini coefficient shows that inter-group inequality would not be widen significantly because of tariff liberalization. This implies that trade liberalization and growth seem pro-poor. Both the inter-group and national level in equality as measured by the Gini coefficients are stood at 25.5 and 37.94 percent respectively both in the short run and in the long run

Table 5.6:- Poverty indices in Instantaneous liberalization

	Farm house hold		*Wage earner*		*Entrepreneurs*		*All*	
	2001	*2019*	*2001*	*2019*	*2001*	*2019*	*2001*	*2019*
Headcount ratio	*56.6*	*21.78*	*34.85*	*13.46*	*41.49*	*8.156*	*45.47*	*15.55*
Poverty gap	*18.10*	*5.02*	*10.11*	*3.1*	*11.83*	*1.44*	*13.85*	*3.48*
Poverty severity	*7.79*	*1.72*	*4.13*	*1.05*	*4.67*	*0.41*	*5.77*	*1.17*
Gin	-	-	-		-	-	*37.94*	*37.94*

Simulation 4: Gradual liberalization

Under this scenario, tariffs on all imported goods are reduced by 20 percent each year over the next 19 years. In this simulation, the national headcount ratio and poverty gap and poverty severity of the static period would remain the same as the base level poverty. Hence, such static simulation results do not have either positive or negative impact on the poverty level. However, in the long run, tariff liberalization would reduce

the poverty headcount ratio, poverty gap, and severity from 18.4, 4.2, and 1.4 percent in the trend scenario to 16.8, 3.8 and 1.3 percent respectively in the above scenario.

Table 5.7:- Poverty Indices in Gradual Liberalization (1)

	Farm house hold		*Wage earner*		*Entrepreneurs*		*All*	
	2001	*2019*	*2001*	*2019*	*2001*	*2019*	*2001*	*1019*
Head count ratio	*56.6*	*22.46*	*38.1*	*14.33*	*41.49*	*10.8*	*46.55*	*16.79*
Poverty gap	*18.13*	*5.22*	*11.49*	*3.33*	*11.83*	*2.12*	*14.31*	*3.8*
Poverty severity	*7.79*	*1.8*	*4.82*	*1.15*	*4.66*	*0.63*	*6.0*	*1.28*
Gini							*37.65*	*37.69*

In addition, 10 percent decrease in tariff over the next 10 years on agricultural sector excluding the first year and an instantaneous 50 percent tariff reduction on imported goods of industrial and agricultural sectors have been simulated. In the short run, the poverty headcount ratio declines from 46 percent base poverty to 41.6 percent for this simulation .similarly, the poverty gap ratio and poverty severity also declines by 1.6 percent and 0.7 percent respectively as compared to the poverty level indicated in the bases. The simulation has positive impact on poverty both in the short run and in the long run .In the long run, the impact of the simulation is a net decline of poverty headcount ratio, Poverty gap ratio , and poverty severity by 1.4 percent, 0.35 percent and 0.13 percent respectively as compared to the trend scenario (see table 5.8).

Table 5.8:- Poverty Indices of Gradual Liberalization (2)

	Farm house holds		*Wage earners*		*Entrepreneurs*		*All*	
	2001	*2019*	*2001*	*2019*	*2001*	*2019*	*2001*	*2019*
Head count ratio	*56.6*	*22.42*	*22.99*	*14.21*	*42.05*	*11.79*	*41.60*	*16.98*
Poverty gap	*18.13*	*5.2*	*5.9*	*3.28*	*12.09*	*2.39*	*12.49*	*3.85*
Poverty severity	*7.79*	*1.79*	*2.21*	*1.13*	*4.8*	*0.72*	*5.16*	*1.3*
Gin	-	-	-	-	-	-	*37.64*	*39.5*

Source: own computation from Model

Simulation 5: Full and Discriminating liberalization

Here the emphasis is laid on the rationalized liberalization of the industrial sector's commodities .Since the highest average tariff rate is found in the industrial sector's commodity; the complete tariff reduction is indispensable for this sector. The major industrial commodities average tariff rate is set from as high as 25 percent in the base to 0 percent. In the short run, there are no pronounced declines in all the three poverty indicators .In contrast, the headcount ratio, poverty gap ratio, poverty severity for farm households group are reduced from 23.4, 5.5 ,and 1.9 percent in the trend scenario to 20.7 ,4.7 and 1.6 percent respectively in the in the long run..

Similarly, the headcount ratio for the wage earners declines from 15.4 percent in the trend scenario to 12.7 percent with a net decline of 2.7 percent. In general, the net declines in all poverty indices are quite high among the farm households and wage-earners.

However, this liberalization impacted negatively on poverty level of the entrepreneurs'. Both poverty headcount ratio and the poverty gap ratio increases by 1.2 percent and 0.3 percent respectively. However, at the

national level, all the poverty indicators have declined in this simulation as compared to the trend scenario.

Table 5.9:- Poverty indices for full and discriminating liberalization

	Farm households		*Wage earners*		*Entrepreneurs*		*All*	
	2001	*2019*	*2001*	*2019*	*2001*	*2019*	*2001*	*2019*
Headcount ratio	*56.60*	*20.72*	*33.39*	*12.69*	*43.47*	*15.29*	*45.47*	*16.65*
Poverty gap	*18.13*	*4.77*	*9.45*	*2.86*	*12.58*	*3.2*	*13.81*	*3.73*
Poverty severity	*7.79*	*1.62*	*3.82*	*0.96*	*5.03*	*1.01*	*5.76*	*1.24*
Gin	-	-	-	-	-	-	*38.11*	*37.61*

Source: own computation from Model

Simulation 6: Gradual and rationalized liberalization.

In this type of liberalization, agricultural is allowed to reduce its tariff rate for the first 10 years by 20 percent. After 10 years, there would be a complete liberalization in the sector. Similarly, since the industrial sector is initially more protected, we assume a 50 percent reduction in tariff rate for the first 10 years and then after a complete liberalization for the remaining years. Moreover, the service sector is allowed to reduce its tariff rate by 50 percent instantaneously. A combination of these liberalization results indicate that the three national poverty indicators almost remain unchanged in the short run .But, in the long run, the national headcount ratio declines from 18.4 percent in the trend to 16.5 percent in the simulation .Similarly, the long run poverty gap and squared poverty gap ratios are decreasing as compared to the trend scenario. In all households group, all poverty indicators fall down with substantial decline in poverty among entrepreneurs.

Table 5.10:-Poverty Indices in Gradual and Rationalized Liberalization

	Farm Household		*Wage Earner*		*Entrepreneurs*		*All*	
	2001	*2019*	*2001*	*2019*	*2001*	*2019*	*2001*	*2019*
Headcount Ratio	*56.6*	*22.03*	*36.08*	*13.68*	*43.27*	*11.15*	*46.3*	*16.48*
Poverty Gap	*18.13*	*5.07*	*10.62*	*3.15*	*12.4*	*2.18*	*14.17*	*3.7*
Poverty severity	*7.79*	*1.74*	*4.38*	*1.08*	*4.98*	*0.65*	*5.93*	*1.24*
Gini	-		-		-		*37.8*	*37.68*

Source: own computation from Model

5.1.1 FGT decomposition into Growth and Redistribution

In most of the above scenarios, the impacts of trade liberations on the short run poverty level more or less remain unaffected. However, its impact in the long run is unambiguously positive. From the above alternative scenarios, 90% tariff reduction in agricultural sector and complete liberalization of industrial and service sectors substantially reduce poverty in the long run. Thus, it is better analyzing the impacts of this liberalization as to whether it enhances growth or redistribution effects in the long run. This analysis should be made with respect to variations in poverty indices of the trend scenario and results are indicated in table 5.11.

Table 5.11: - Decomposition of the BaU and Simulation paths of Poverty Changes

	Growth components (Datt and Ravallion)	Growth component (Shapley)	Distribution component (Datt and Ravallion)	Distribution component (Shapley)	Residual (Datt and Ravallion)	Differences
(a) BaU						
head count ratio	-27.34	-27.42	-0.25	-0.33	-0.16	-27.75
Poverty gap	-9.81	-9.76	-0.19	-0.146	0.1	-9.9
Poverty severity	-4.43	-4.4	-0.1	-0.070	0.069	-4.47
(b) Simulation						
head count ratio	-31.04	-30.86	0.138	0.317	0.357	-30.55
Poverty gap	-10.77	-10.797	0.183	0.162	0.042	-10.63
Poverty severity	-4.81	-4.84	0.141	0.104	0.072	-4.74

Source: Own computation from Model

In the trend scenario, the poverty headcount ratio falls from 46.1 in the base to 18.35% in 2019, a net reduction of 27.7 percent. The decomposition shows that almost all of this reduction is attributable to the growth component. Surprisingly enough, in the trend scenario, redistribution has positive impact on poverty. But, its contribution is very small amounted to 0.25 percent. This implies that growth is pro-poor in the trend scenario. Similar impacts are observed for the poverty gap and squared poverty gap (severity of poverty).

Complete trade liberalization in the industry and service sectors and a 90% reduction in tariff in agricultural sector reinforce poverty reduction. The national headcount ratio declines from 46.1% in the base to 15.5% in the long run with a net reduction of 30.55%. All this reduction is attributable by growth component. Indeed, growth would have reduced the headcount ratio by 31.04 percentage point had it not been for a deterioration in income distribution that actually increased the headcount ratio by 0.138 percentage point. The headcount ratio is further reduced by 2.8 percentage point as compared to the trend. Thus, trade liberation further strengthens the pro-poor growth effect and at

same time the anti-poor increases in inequality. The same trends are also observed for the two other FGT indices.

The Diagram 1 in the appendix is an illustration of a wide range of poverty lines, of the contribution of each of the two components in the trend and simulation scenario. Regardless of the choice of the poverty lines, the growth component always reduces poverty. This is in line with our expectation. However, this reduction is most substantial for households just below the official poverty line of 1075 birr. Moreover, it drops off steeply among the less poor. When we increase the poverty line above birr 1250, the head count ratio falls owing to growth as compared to the head count ratio for the poverty line 1075.

The income distribution effect becomes nil as the poverty line increases. This means distribution becomes neutral and it does not harm or benefit the poor and the rich. The less poor could not appear to benefit more from the accumulation of wealth generated by economic growth. As the diagram1 shows similar results are obtained in both the trade liberalization scenario and the trend scenario.

For a wide range of poverty lines, the diagram also proves that trade liberalization has pro-poor growth effect as compared to the trend scenario. As shown in the diagram; trade liberalization has more poverty reducing effect as compared to the trend scenario regardless of the poverty lines chosen.

5.1.2 Simulation Results for Endogenizing Poverty Line.

In this case, both the income effect and price effects of trade liberalization are simultaneously taken into account to analyze the FGT poverty indicators both in the short run and in the long run. In the short run, trade liberalization may decrease the households' income while the contraction of the most protected sector. With trade liberalization, the

decline in import price leads to shortfall of domestic price. At the end, the composite price may also decline accordingly. With decline in composite prices, the real income of the households increases. In other words, with decline in composite price, the initial poverty line will fall with the rate at which the consumer price index decreases and vice versa.

However, relative import price declines only if the rate at which the exchange rate depreciation is less than the rate at which tariff declines. Having taken this consideration, an instantaneous liberalization scenario would results in a substantial decline for all poverty indicators in the long run. As table 5.12 illustrates, the long run national headcount ratio for the trend and simulation scenario would be 18.15 percent and 13.2 percent respectively. As compared to the trend, poverty headcount ratio declines by 5 percent in the long run .In same way, the poverty severity and poverty gap ratio are considerably low as compared to the trend. In the short run, there are no significant changes in poverty indices. In general, trade liberalization results in a substantial poverty reduction generated from both income and price effect in the long run.

Table 5.12:- Poverty Indices with Endogenizing Poverty Line

	Farm Households			*Wage Earners*			*Entrepreneurs*			*All*		
	2001 (SIM)	*2019 (SIM)*	*2019 (Trend)*	*2001 (SIM)*	*2019 (SIM)*	*2019 (Trend)*	*2001 (SIM)*	*2019 (SIM)*	*2019 (Trend)*	*2001 (SIM)*	*2019 (SIM)*	*2019 (Trend)*
Headcount Ratio	*57.5*	*18.83*	*23.16*	*35.4*	*11.46*	*15.2*	*42.3*	*6.47*	*13.16*	*46.25*	*13.2*	*18.15*
Poverty Gap Ratio	*18.56*	*4.1*	*5.4*	*10.39*	*2.55*	*3.55*	*12.17*	*1.11*	*2.89*	*14.2*	*2.83*	*4.15*
Poverty Severity	*8.02*	*1.37*	*1.87*	*4.3*	*0.84*	*1.24*	*4.8*	*0.3*	*0.9*	*5.95*	*0.92*	*1.41*
Gini	-	-	-	-	-	-	-	-	-	*37.94*	*37.94*	*37.52*

Source: Model Result

5.1.3 Growth elasticity of poverty

In this case, it is tried to calculate the growth elasticity of poverty for 1999/2000 household's income and expenditure survey that consists of 17,336 households. As income of households increase by one percent, the national headcount ratio declines by 1.4 percent (table 5.13). Similarly, a percentage change in income would results in a more than two percentage decline in poverty gap and poverty severity ratio. From the instantaneous liberalization scenario, farm household's income increase by 4 percent while the wage earners income increases by 6.7 percent in the long run. At national level, the net households' income increases by 8.4 percent in the long run. If we assume that the growth elasticity of poverty remains the same and redistribution is neutral, then the national poverty headcount ratio will decline by 11.7 percent point in the long run. Similarly, trade liberalization would result in a substantial decline in poverty in the long run.

Table 5.13 -Growth Elasticity of Poverty

	Farm household	*Wage-earners*	*Entrepreneurs*	*All*
Headcount ratio	-1.6	-1.3	-1.5	-1.4
Poverty gap	-2.7	-1.8	-2.1	-2.3
Poverty severity	-3.5	-2.1	-2.4	-2.8

Source: Model Result

5.2. Welfare effects

Regarding the impacts on household welfare, results are reported for instantaneous liberalization case. As factor remuneration represents the main source of income for households, we observe an increase in income over the long run. However, the short run factor remuneration for all households almost remains unchanged. As shown below, consumer price index (1.15 percent) increases more than income (0.58 percent) leading to a decline in real consumption and welfare for all households groups in the short run. Real consumption and equivalent variation slightly decrease by 0.68 and 0.57 percent respectively in the short run.

However, entrepreneurs are more affected than farm households and wage-earners. This result may be explained by the net buyer status of entrepreneurs. In the long run, the combined income and price effect leads to positive variation in real consumption and welfare. The equivalent variation increases by 11.7 and 12.9 percent for farm households and wage earners respectively. However, in the long run entrepreneurs are more benefited and the equivalent variation increases by 25 percent. Real consumption and equivalent variation increases by 42.3 and 25 percent respectively for entrepreneurs. This result may be explained by an increase in labour and capital income in the long run owing to trade liberalization. At national level, real consumption and welfare increase substantially by 19.5 and 14 percent respectively.

Table 5.14:-Welfare Effects (Percentage change from BaU Path)

	Farm households		Wage-earners		Entrepreneurs		All	
	2001	2019	2001	2019	2001	2019	2001	2019
Income	0.0	4.0	2.88	6.7	0.32	28.9	0.58	8.4
Real consumption	-0.58	12.8	-0.23	17.2	-2.9	42.3	-0.68	19.5
Welfare(EV)	-0.54	11.7	0.23	12.9	-1.6	25.0	-0.57	14.0

Source: Model Result

5.3. Sectoral effects of Unilateral trade Liberalization.

The main determinants of trade liberalization effects are the values of trade elasticities, the share of imports and exports, the cost of inputs, and the general equilibrium effects of supply and demand. The domestic distortion caused by the tariff might lead to less efficient factor reallocation between sectors. The more protected sector would get more benefit. If there is tariff liberalization, the opposite might hold true. The initially less protected sector would enjoy the benefit of trade liberalization. Tariff elimination reduces import prices, which lead to an increase in import demand and a decrease in domestic sale. The change in domestic good demand influences their prices and their supply. In addition, these price changes affect the composite good price, factor demands and remunerations, and the value-added price.

In dynamic model, both the efficiency and the accumulation effects are taken in to account. These two effects are mainly driven by the disposable saving and profitability of investing. The latter is affected by

the capital good price. For instantaneous liberalization, sectoral effects are presented in table 5.14 and interpreted as follows:

Table5.15: - Sectoral effects (percentage change from base)

	Agriculture[i]			*industry*			*Services*		
Sect oral results	*2001 (SIM)*	*2019 (SIM*	*2019 (Trend)*	*2001 (SIM)*	*2019 (SIM)*	*2019 (Trend)*	*2001 (SIM)*	*2019 (SIM)*	*2019 (Trend)*
Import price	*-0.1*	*-13.8*	*1.8*	*-8.9*	*-21.4*	*1.8*	*1.2*	*-12.7*	*1.8*
Domestic price	*-1.87*	*-7.9*	*-4.3*	*11.6*	*10.4*	*4.2*	*-13.5*	*14.4*	*42.2*
Composite price	*-1.75*	*-7.9*	*-4.3*	*2.76*	*-3.8*	*3.3*	*-14.2*	*13.45*	*41.8*
FOB export price	*14.0*	*8.6*	*1.8*	*14.0*	*8.6*	*1.8*	*14.0*	*8.6*	*1.8*
Producer price	*-1.15*	*-7.8*	*-4.2*	*11.7*	*10.1*	*4.2*	*-13.25*	*14.25*	*41.7*
Value added price	*0.45*	*0.45*	*3.8*	*28.91*	*59.0*	*46.9*	*-25.42*	*24.81*	*16.5*
Rate of return to capital	*1.04*	*47.39*	*32.3*	*0*	*47.37*	*31.5*	*-3.2*	*47.81*	*29.3*
Imports	*-0.83*	*69.9*	*43.6*	*7.45*	*37.22*	*11.9*	*5.61*	*11.69*	*5.8*
Domestic goods	*-0.93*	*61.5*	*48.8*	*-6.79*	*8.2*	*10.1*	*-0.7*	*0.64*	*1.3*
Exports	*16.31*	*66.87*	*53.2*	*-2.69*	*-14.4*	*4.9*	*4.63*	*-4.3*	*-9.0*
production	*0.75*	*61.97*	*49.3*	*-6.7*	*7.71*	*10.0*	*0*	*0*	*0*

	Agriculture[i]			industry			Services		
Investment (destination)	-0.95	29.37	15.9	-3.7	25.75	12.5	-9.6	22.2	8.7
Capital stock (SR=2002)	-0.09	-1.51	7	-0.36	-4.1	3.8	-0.97	-7.2	2.7
Labour demand	1.55	73.27	74.2	-0.14	68.54	66.5	-3.9	63.5	62.4
Intermediate demand	0.47	30.78	0.00	-42.51	-100.0	-100.0	42.1	-63.0	-19.50
Private consumption	1.00	75.04	61.2	-1.79	73.55	51.4	-7.85	68.3	46.2

Source: Model Result

The shock of tariff elimination leads to first a decrease in domestic price of imports. It is found that the greatest reduction is in industrial sectors, which had high initial tariff rates (25 percent). The average initial tariff rate in this sector is two-fold of the tariff rate in the service sector. The fall in import price in the sector is amounted to 9 percent in the short run.

Similarly, the long run import price reduced significantly with 21 percentage point in the same sector. The long run import price has also gone down to 13.8 percent and 12.7 percent respectively in agriculture and service. The fall in domestic prices and initial import penetration ratios will influence the sectoral import demand changes. In the short run, the industrial and service sector registered higher import growth .Since the industry sector is more protected, the volume of import increased by 7.5 percent in the short run. This is because the sector's import price declines by 8.9 percent in the short run. Furthermore, we note a decline in domestic demand in all sectors in the short run. However, pronounced decline in domestic demand (6.8%) is found in industry as it was initially more protected sector. Thus, the import -

competing industry sector contracts more in the short run .In the long run, comparison should be made with references to trend scenario. Therefore, the agricultural sector is expanding in the long run. The domestic demand for agriculture increases by 13 percent in the long run. Moreover, the volume of import in agricultural sector is increased by 26.3 percent while the volume of import for the industrial sector increased by 25 percent in the long run. But, the domestic demand for industrial sector falls by 2 percent as compared to the trend scenario.

In the short run, the exchange rate is depreciated. This depreciation in exchange rate would increase the relative prices of export by 14 percent in all sectors. The volume of export increases by 16.3 percent in agriculture and 4.6 percent for the service sector in the short run. The industrial sector is not responding to the rise in export price by increasing its volume of export and it remains import intensive sector.
In the long run the exchange rate is also depreciated as a result the volume of export for agricultural sector and service sectors increased further in the long run. Still, the agricultural sector registered the highest export volume (13.67 percent) in the long run followed by the service sectors as compared with the trend.

The efficiency (reallocation) and capital accumulation effects will determine the impact on production. Both effects are driven, in large extent by, value added price, factor remunerations and the cost of inputs represented by the composite price. The composite price decrease in agriculture and industry both in the short run and in the long runs. The reallocation effects among the sectors are determined by the change in value -added price. The result indicates that resources will move toward agricultural sectors in the short run.

It is important to recall that labour is mobile across sectors in both short and long run , where as capital is mobile only after the first year and

through new investment. In the short run, labour moves to the expanding agricultural sector .In the long run, the patterns of changes are almost the same and the agricultural sectors absorb most of the labour force. In the long run value - added price and rental rate of capital increases .Because of full mobility of capital in the long run ,rental rate of capital increases almost uniformly across all sectors which is amounted to 47 percentage point increase along the simulation path and an average of 31 percent along the trend.

Table5.16:- Sectoral Effects of gradual and rationalized liberalization (percentage change from base)

	Agriculture		Industry		Services	
	2001	2019	2001	2019	2001	2019
Import price	-1.9	-5.2	-5.8	-12.1	-1.1	3.8
Domestic price	0.0	0.4	3.7	18.5	-5.1	19.9
Composite price	0.06	-0.4	-0.28	5.06	-5.5	19.5
FOB Export price	4.8	10.0	4.8	10.0	4.8	10.0
Producer price	0.2	0.7	3.7	18.3	-5.1	19.95
Value added price	0.0	8.3	13.25	59.1	-10.72	17.76
Rate of return to capital	0	42.7	0	43.85	-1.12	43.1
Imports quantity	-1.78	54.1	4.6	26.54	3.72	2.2
Composite good	-1.04	46.88	0.57	11.69	0.3	0.28
Domestic good	-1.02	46.72	-2.15	2.64	0.0	-0.11
exports	3.66	56.8	0	-11.4	-0.6	0.72
production	0.57	47.68	-2.1	2.3	0.0	0.0

	Agriculture		Industry		Services	
	2001	2019	2001	2019	2001	2019
Capital stock (2002))	-0.2	0.62	-0.09	-1.85	-0.46	-4.7
Investment	-0.2	18.14	-0.94	15.1	-4.7	1.12
Labour demand	0.284	73.2	0.95	68.86	-1.34	63.44
Intermediate demand	1.08	35.47	-20.79	-100.0	19.48	-35.98
Private consumption	0	58.44	1.88	54.7	-1.86	49.57

Source: Model Result

Table 5.16 shows the impact of gradual tariff reduction on different sectors .As it is shown in the table, the import price for the agricultural sector is reduced by 5.2 percent while it is reduced by 12.1 percent for the industrial sectors. As compared to the trend scenario, there would be a decline in import price by 14 percent for industrial sector and 7 percent for agricultural sector. In the long run the volume of investment, export, and imports show a net increase of 2.3 percent, 3.6 and 10.5 percent respectively in the agricultural sector.

Relatively speaking, the increase in export price for all sectors is higher than the case in the trend scenario. This implies that all sectors are becoming more export intensive with the service sectors playing a dominant role (9.7 percent). As tariff reduces import price, domestic price will also decline .The decline in domestic price is pursued by a decline in average wage rate of households. Since labour is assumed to be mobile across sectors as well, the single national average wage rate has declined by 8.4 percent as compared to rate of decrease in the national average wage rate in the trend scenario. However, in the long run the decline in wage rate would induce higher level of employment where the labour demand in industrial sector is quite high. Since in the

long run, capital is assumed to be mobile; the return to capital is remarkably high. The average rate of return to capital is as high as 12 percent in all sectors as compared to the trend scenario. Similarly, the demand for capital decreases in all sectors .In general, tariff reduction has positive impact on most of the sectoral variables particularly it augments the export and investment capacity of the country. Most of the sectoral benefit is lean toward to those who are engaged in the agricultural and service sectors. Profound investment would be obtained in the industrial and service sectors.

Table 5.17:- full and discriminating liberalization (percentage change from base)

	Agriculture		*Industry*		*Service*	
	2001	*2019*	*2001*	*2019*	*2001*	*2019*
Import Price	*5.2*	*33.7*	*-15.9*	*6.9*	*5.2*	*33.7*
Domestic Price	*-3.25*	*48.2*	*7.2*	*37.2*	*-10.35*	*36.25*
Composite price	*-3.1*	*16.9*	*-2.77*	*23.92*	*-9.95*	*36.55*
FOB Export price	*5.2*	*33.7*	*5.2*	*33.7*	*5.2*	*33.7*
Producer price	*-2.8*	*17.4*	*7.1*	*37.1*	*-9.95*	*36.65*
Value added price	*0*	*12.33*	*10.84*	*50.6*	*-9.5*	*18.99*
Rate of return of capital	*0.5*	*46.35*	*0*	*43.8*	*-1.37*	*43.44*
Import quantity	*-3.7*	*18.8*	*9.7*	*14.8*	*-4.4*	*-3.7*
Composite good	*1.35*	*29.10*	*-0.8*	*3.5*	*-1.48*	*-24.8*
Domestic good	*1.15*	*29.37*	*-7.4*	*-3.5*	*-1.12*	*-0.93*
Exports	*11.25*	*47.46*	*-10.7*	*-8.3*	*7.4*	*6.2*
Production	*2.4*	*31.1*	*-7.4*	*-3.68*	*0*	*0*

	Agriculture		Industry		Service	
	2001	2019	2001	2019	2001	2019
Investment	-3.7	5.82	-3.1	1.85	-7.20	-2.6
Capital stock	-0.38	3.72	-0.31	2.7	-0.70	-0.8
Labour demand	0.44	73.6	0.86	69.0	-1.70	62.2
Intermediate demand	3.20	1.54	-21.5	-69.0	8.90	-9.7
Real private consumption	3.02	37.50	4.3	30.0	0.00	25.0

Source: Model Result

Table 5.17 illustrates the sectoral effects of complete removal of tariff in industrial sector. In the short run, import price declines in industrial sector by 15.9 percent owing to removal of tariff in the sector. But import price for other sectors increases because of depreciation of exchange rate in the short run. Following the decline in import price, the domestic demand for industrial sector contracts both in the short run and in the long run. The domestic demand contracts by 7.4 percent in the short run and by 3.5 percent in the long run. The volume of export for industrial sector also contracts both in the long run and in the short run.

Because of the depreciation in exchange rate, the relative export price increases in all sectors both in the short run and in the long run with substantial increases in the long run (33.7). Because of this increase in export price, the volume of export substantially increase in agricultural sector (47.5 percent) followed by the service sectors (6.2 percent) in the long run as compared with the base. As the industrial sector contracts in the long run, the volume of production decreases both in the short run and in the long run respectively by 7.4 and 3.7 percentage points from the base. Following decline in production, intermediate demand for

industrial sector has went down both in the short run and long run respectively by 21.5 and 69 percentage points. However the agricultural sector is expanding both in the short run and in the long run. This might be explained by substantial increases in export volume, volume of investment (5.8%), and capital stock (3.7 %) in the long run. In general, resources are shifting toward agricultural sectors. However, the service sector seems to lose its importance in particular in the short run for most sectoral variables.

5.4. Macro- effects of trade liberalization

Table 5.18 illustrates both the short run and long run impacts of unilateral trade liberalization on macro variables. In the short run, GDP at factor cost decreases by 0.39% and 0.01% respectively in instantaneous and gradual type of liberalization. However, GDP at market price decreases in both types of liberalization in the short run. In the short run, value of total output increases by 1.7 % and 0.58 % respectively in instantaneous and rationalized gradual liberalization. But, real out put decreases in both simulations in the short run. In the short run, the value of exports registered faster growth than imports in both types of liberalization owing to depreciation of exchange rate. From above the table , short run results can be summarized that instantaneous liberalization is performing better in exports both in real and nominal value while rationalized gradual liberalization recorded better results in GDP at market price ,real private consumption .It is further noted that GDP at market prices both in real and nominal value decrease in the short run for these simulations. In this regard, gradual and rationalized liberalization seems better performing.

Nevertheless, Instantaneous liberalization recorded the highest performance both in real and nominal value for all macro variables in the long run. GDP at factor cost increases from 49% in the trend to 55.2 % in instantaneous case with a net increases of 6%. In the case of gradual liberalization it increases by 5 percent. For same simulation, real GDP at market prices increases from 44.7% in the trend to 55.2%. This implies that the net impact of this liberalization is an increase of 10.5 % in real GDP. Similarly, real export, real output, and real import increase by 8.0, 4.5, and 22.10 percent for instantaneous liberalization. Real consumption also increases by 19.5 percent from its trend.

In the case of gradual and rationalized liberalization, GDP at factor cost increases by 5.4%. However, real GDP at market price declines by 2.6% from its trend. Real export increases from 17.7% in the trend to 23.2% in this simulation. Real import increases from 12.2% in the trend to 23.8%. Real private consumption also increases from 54.2% in the trend to 56.4% in this simulation. In general, except GDP at market price, all other macro-variables increase significantly as compared to the trend. On the aggregate level, unilateral trade liberalization has positive impacts in the long run for the above scenarios. But instantaneous liberalization registered significant amount of increases as compared with both the trend scenario and gradual liberalization.

In instantaneous liberalization case, the long run capital good price decline by 3.8 percent .Since the price of investment good is cheaper; it will motivate and attract more investment. Similarly, the low consumer price index in instantaneous liberalization implies that the real purchasing power of the consumers increases. Therefore, the welfare, real consumption and investment impacts of instantaneous liberalization are encouraging as compared to the gradual and rationalized liberalization type.

Table 5.18:-Summary of Results of Macro-Impacts of Simulations (%)

	Base Year Value in ($m)	Trend		Instantaneous Liberalization				Gradual and rationalized liberalization			
		Nominal (LR)	Real (LR)	Nominal (LR)	Real (SR)	Nominal (SR)	Real (LR)	Nominal (LR)	Real (SR)	Nominal (SR)	Rea l (LR)
GDP (factor cost)	68,156.00	42.7	-	48.4	-	-0.39	-	47.60	-	-0.01	-
GDP (market price)	71,926.0	51.3	44.7	51.2	-2.8	-5.8	55.24	48.7	-0.4	-2.5	42.1
Total Output	88,844.00	29.62	21.9	29.3	-1.4	1.7	26.4	30.6	-0.76	0.58	20.9
Total Exports	8,017.00	20.6	17.7	36.3	8.9	24.5	25.8	36.3	1.8	6.7	23.2
Total Imports	15,970.00	14.2	12.2	31.8	6.8	21.8	34.3	35.88	4.2	9.2	23.8
Private Consumption	50,290.00	56.4	54.2	64.0	-0.68	0.54	73.7	61.6	0.32	0.93	56.4
Government Revenue	11,984.00	-	-	-3.0	-	-36.1	-	-2.0	-	-12.1	-
Investment	22,386.00	16.14	13.0	21.1	-3.8	-1.0	26.0	20.9	-1.4	-1.2	15.2
Poverty level	45.47	-2.8	-	27.8	-	-	-	30.2	-	-	-

Table 5.19:- Other Macro -Effects (%

	Instantaneous liberalization		Gradual and rationalized liberalization		Full and discriminated liberalization	
	2001	2019	2001	2019	2001	2019
Wage rate	-7.8	-7.8	-2.2	-8.4	2.2	-4.8
Return to land	1.2	41.7	0.2	40.6	0.3	46.4
CPI	1.15	-5.2	0.62	3.29	-2.2	21.0
Capital good price	2.94	-3.8	0.183	4.95	-2.5	23.7

Source: Model Result

5.5. Sensitivity Analysis

As shown in the table 5.19, sensitivity analysis for parametric changes has been undertaken for instantaneous liberalization. The elasticity of substitution between labour and capital is increased by 30 percent .Similarly ,the Armington constant elasticity of substitution between imported and domestic good is reduced by 15 percent .In addition ,the elasticity of substitution between exported and domestically produced good also reduced to 20 percent. A combination of these parameter changes with instantaneous liberalization of tariff would show that significance differences could not be reflected both on macro and micro variables. The model is not susceptible to changes in values of parameters and seems more stable. For instance, in the case of total output, the nominal value of sensitivity scenario would only show 0.7 percentage point higher than the former one .In addition, the values of total import in the sensitivity scenario would be less than by a 2.1 percentage point as compared to its counter part scenario. In investment, a difference of two percentage point exists. In nominal GDP, the sensitivity scenario would reflect a 6.7 percentage point difference. A maximum percentage point difference is obtained in private consumption which is amounted to 7.2 percentage point. The interesting aspects of these scenarios are that the direction and the magnitude of the variables are comparable in both cases. The sensitivity scenario also shows the net impacts liberalization as positive for all variables. When we compare the net impacts of liberalization with their own trend scenario, the difference is becoming closer for all macro and micro variables. For example, nominal GDP increases by 8 percent with references to its trend in the case of sensitivity scenario where as it increases by 6.2 percent with its trend in the case of the former scenario. Similarly, net real output and net real export, increase by 7.9, and 6.4 percent respectively for sensitivity scenario. However, real output, and real export increase by

4.5 and 8.1 percent respectively for original scenario of instantaneous liberalization. Moreover, the net value of investment increases by 6.3, and 5.1 percent respectively for sensitivity and original scenario. In general, there is no significance difference in both scenario and the model look likes more stable.

Table 5.20:-Summary of Sensitivity Results

	Trend (Sensitivity)		*Instantaneous Liberalization (Sensitivity)*		*Instantaneous Liberalization (Basic)*	
	Real	*Nominal*	*Real*	*Nominal*	*Real*	*Nominal*
GDP	-	*53.9*	-	*61.9*	*55.23*	*55.2*
Total Output	*24.6*	*28.5*	*32.5*	*30*	*26.4*	*29.3*
Total Export	*21.4*	*25.3*	*27.8*	*21.9*	*25.8*	*36.2*
Total Import	*12.75*	*15.6*	*37.6*	*29.67*	*34.3*	*31.8*
Private Consumption	*63.1*	*62.8*	*88.1*	*72.2*	*73.7*	*64.0*
Equivalent Variation	-	*53.1*	-	*74.0*		
Investment	*13.5*	*16.7*	*31.9*	*23*	*26*	*21*
Government Consumption	-	*78.1*	-	*29.9*	-	*27.87*
Capital Good Price	-	*2.8*	-	*-6.7*	-	*-3.8*
CPI	-	*-0.26*	-	*-8.4*	-	*-5.5*
Wage Rate	-	*-5.0*	-	*-1.2*	-	*-7.8*

Source: Model Result

Table 5.21:- Sensitivity Scenario for Poverty

	Farm Households			Wage Earners			Entrepreneurs			All		
	2001 (SIM)	2019 (SIM)	2019 (Trend)	2001 (SIM)	2019 (SIM)	2019 (Trend)	2001 (SIM)	2019 (SIM)	2019 (Trend)	2001 (SIM)	2019 (SIM)	2019 (Trend)
Headcount Ratio	56.6	19.53	20.85	37.1	11.19	12.7	42.3	6.9	14.58	46.3	13.6	16.52
Poverty Gap	18.1	4.3	4.79	11.0	2.45	2.9	12.1	1.23	3.0	14.2	2.9	3.7
Poverty Severity	7.79	1.44	1.63	4.59	0.8	0.98	4.8	0.3	0.94	5.9	0.95	1.23

Source: Model Result

As shown in the above table, the sensitivity analysis for instantaneous liberalization is being under taken for all poverty indicators .In the original scenario, the national headcount ratio falls down by 2.8 percent from its trend. In the sensitivity analysis above, the national headcount ratio falls by 2.9 percent from its trend. The poverty gap ratio for the original scenario declines by 0.72 percent while it declines by 0.8 percent from its trend for sensitivity analysis. Moreover, the poverty severity declines by 0.26, and 0.28 percent from their trend for the original and sensitivity scenario respectively. In general, there is no substantial difference between the outcomes of the two scenarios.

5.6. Simulation Results for Intertemporal Dynamics

In the intertemporal analysis, the emphasis is laid on welfare impacts of a complete removal of tariff in industrial and service sectors. In this case the static and long run discounted utility of the representative households should be compared to evaluate to the net impacts of trade liberalization. Moreover, to make the welfare measurement in static case consistent with the dynamic case which is the present value of consumer utility, we assume that the one- period utility in static run is unchanged

in perpetuity. As the result, the discounted utility in the static run is amounted 145 utils while in the dynamic case the discounted utility is amounted to 165.1 utils. This implies that trade liberalization in enhance further the welfare of the consumer by 20 utils.

Table 5.22:- Macro -Effects for intertemporal dynamics (%))

Year	*CPI*	*Average Wage Rate*	*Demand for Capital*	*Imports*	*Value of Total Output*	*Shadow Price of capital*
1	*-34.9*	*50.0*	*0.0*	*-0.5*	*-61.7*	*44.2*
5	*-38.0*	*50.0*	*-47.9*	*0.6*	*20.6*	*53.6*
10	*-41.0*	*50.0*	*-23.3*	*13.3*	*103.6*	*62.4*
15	*-45.0*	*50.0*	*-11.45*	*47.3*	*210.6*	*56.8*
20	*-37.6*	*50.0*	*-10.1*	*22.75*	*215.0*	*68.2*
25	*-25.7*	*50.0*	*0.0*	*60.9*	*800.0*	*50.0*
30	*-27.5*	*50.0*	*0.0*	*76.3*	*800.0*	*72.0*

Source: own computation.

As table 5.22 illustrates, the price effects of trade liberalization is that consumer price index is decreasing over time as compared from the base. But, consumer price index decreases at faster rate in static case as compared with the last 10 years. The sustainable decline in consumer price index implies that real income of the households also increase .The lower the consumer price index implies the higher the purchasing power of the consumer.

Regarding with output effect, total value of output decreases by 61.7 percent in the first period. However, total output boosts up by 800.0 percent for the last 10 years as compared with base value of output.

Since in the first period capital is assumed to be fixed, there is no change in stock of capital demand. But for the first 20 years stock of capital demand declines (Excluding the first period) where as it remains unchanged for the last 10 years. This might be explained by sustainable increases in shadow price of capital over time.

The average wage rate increases uniformly over time by 50 percent. This is because the assumption of balanced growth rate of population to be 0.We in fact scaled all relevant data to per capita terms (i.e. divided by population). Finally except the first period, there is a growing of imports overtime following a sustainable decline in import price.

CHAPTER SIX

6. Conclusions and Policy Implication

6.1. Conclusion

In this paper, a sequential dynamic model is developed to analyze the potential poverty and inequality effects of unilateral liberalization in Ethiopia. The model uses a 1999/2000 social accounting matrix and a 1999/2000 income and consumption survey of 17336 households. In this research paper, both the short run and long run analysis of the linkages between trade liberalization, growth, income distribution and poverty have been carried out.

An instantaneous liberalization consists of a complete removal of tariff in industrial and service sector followed by 90 % tariff reduction in agricultural sector. In this case, the welfare and the real consumption of the households are decreasing in the short run. But the decrease in real consumption is insignificant. Regarding the macro -effects, real GDP and real output decline in the short run. In addition, GDP at factor cost decreases in the short run. In this scenario, real export is growing faster than imports owing to deprecation in exchange rate. Concerning the sectoral effects, agriculture seems expanding as domestic demand for its output increases while industry contracts. The short run impact of instantaneous liberalization on poverty level is positive and results a very small decreases in national poverty. This is because of a small increase in the nominal income of the households' in the short run.

The long run impacts of instantaneous liberalization on poverty, welfare, and macro variables will be indicated as follows. The main finding of this liberalization is that real GDP at market price, real consumption, and welfare of the households increase by 10.5%, 19.5% , and 14%

respectively in the long run. Moreover, both the nominal GDP at market price and GDP at factor cost are substantially increasing in the long run. The decline in consumer price (5.5%) index contributes to an increase in real consumption besides an increase in income of the households. In this scenario, real export, real total output, investment and volume of import increase remarkably by 8.1, 4.5, 13.1, and 22.1 percentage points respectively in the long run. The increase in real investment may be explained by a decline in price index of investment owing to trade liberalization .At sectoral level, agriculture plays a dominant role in production and export. In addition, there is a boom in domestic demand for the sector's output. Similarly, the sector is more responsive to depreciation of exchange rate and become more export intensive. Finally, the Foster, Greer, and Thorbecke measures of poverty indices are decreasing in the long run. In this case trade liberalization does not increase inequality among households group. The Gini coefficients indicate that both inter-group and national level of inequality remain almost unchanged. Furthermore, the decompositions poverty analysis shows that most of the poverty reduction is attributable by the growth components than redistribution components. Thus, trade liberalization further reinforces poverty reduction and growth seems pro-poor. In general, trade liberalization enhances the accumulation effects and there by increases both the welfare and real consumption of the households. Both the efficiency and accumulation effect of trade liberalization also boost the real and nominal GDP in the long run.

The gradual and rationalized type of liberalization is simulated in such h away that agriculture and industry are allowed to reduce their tariff by 20 % and 50% respectively for the first ten years and complete removal of tariff for both of them after 10 years. However, the service sector reduces its tariff by 50 % instantaneously. The findings of this liberalization in the short run indicated that a decline in real GDP at market prices and

an increase in GDP at factor cost. However, the short run export performance of the economy is promising and recorded both an increase in real and nominal value of export owing to deprecation of exchange rate. In the short run, the FGT poverty indices remain unchanged.

Regarding the long run impacts of this scenario, real and nominal GDP at market prices decline by 2.6% and 2.5% respectively. But, GDP at factor cost rises (5.5%) at faster rate in the long run. Similarly, real investment, real export, real import increase by 2.2%, 6.2%, and 11.6% respectively in the long run. However, the increase in import is substantially too high. In this scenario, nominal value of output also increases. At sectoral level, the agricultural sector seems expanding while the industry sector contracts. The domestic demand for industrial sector falls down and the sector become more import intensive. However the sectors contribution to employment level seems to increase due to the decline in average wage rate and a shift from intermediate demand. Gradual and rationalized liberalization results in a profound decline in all poverty indicators among all households group in the long run.

In general, instantaneous liberalization is more important than gradual and rationalized liberalization in the long run. The volume of export, production, real GDP of instantaneous liberalization profoundly increases more than the case in gradual and rationalized liberalization.

Finally, trade liberalization in intertemporal dynamic model shows that the welfare of the representative households increases in the long run as compared to static scenario.

6.2. Policy Implications

Import protection does not seem more applicable in today's globalized world. Indeed, one of the short run negative impacts of trade liberalization is a loss in government revenue as indicated in this paper. However, in the long run the government fiscal deficient decline due to an increase in import volume for some of the sectors that are not completely liberalized instantaneously. The government can institutionalized direct tax system to compensate for the loss of government revenue both in the short run and medium run. However, the low tax administration system and the low saving rates of the households may impede to achieve this objective at least in the short run.

Trade liberalization affects economic growth through efficiency in resource allocation and accumulation effect. The accumulation effect is enhanced by addition of new investment. The allocation of new investment is determined by profitability of the sectors. Hence, focusing on more determinant of economic growth such as investment on human capital physical capital is also pertinent.

It is believed that there is serious supply side problem in the country that impeded its trade as well as growth performance. Failure to effectively utilize trade provision like the African Growth Opportunity Act (AGOA) is a simple manifestation of supply side constraint. As indicated in the paper, the depreciation of exchange rate followed by trade liberalization results in an increase in volume of export. However, the elasticity of export could be too high if there is good investment in infrastructure that narrow the transport -cost margin in particular in agricultural sector and in general for the whole economy. This will also open the chapter in attracting foreign investment that will further augment the capital accumulation effect of trade liberalization.

Finally, we propose a dynamic micro - simulation modeling to dispense the assumption of intra-household homogeneity in analyzing the poverty impacts of trade liberalization.

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Appendices