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**EFFECTS OF TARIFF REDUCTION AND TAX REPLACEMENT
ON GROWTH, POVERTY AND INCOME DISTRIBUTION IN
ETHIOPIA: A CGE-MICROSIMULATION ANALYSIS**

BY
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JUNE, 2011
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*A Project Submitted to the School of Graduate Studies of Addis Ababa University
in Partial Fulfillment of the Requirements for the Degree of Master of Arts in
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By
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ABSTRACT

This study utilizes a 15-sector static CGE model of International Food Policy Research Institute for Ethiopian economy. The study also used the Distributive Analysis (DAD) software to compute poverty and inequality indicators. Increasing domestic tax rates (that is, replacing the tariff revenue lost with either direct tax or indirect tax) increased exports of most agricultural commodities and industrial imports causing the domestic industries to contract in production and employment. Effects on GDP, consumer's welfare, factor rewards, poverty and income distribution are mixed. Replacing tariff by direct tax improved all these variables marginally by increasing changes in factor rewards and decreasing the price level (CPI). On the other hand, replacing tariff by indirect tax has worsening effect by deteriorating the changes in factor rewards and increasing the relative prices (CPI).

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1. Introduction

The formally developed argument that international trade enhances domestic growth goes back at least to the theory of absolute advantage developed by Adam Smith (1723-1790) and the theory of comparative advantage of David Ricardo (1772-1823), the pillars of classical economics. Recent developments in endogenous growth theory by Romer (1986) and Lucas (1988) also provided a more convincing and rigorous theoretical basis for the positive relationship between international trade and long-run economic growth and development. Furthermore, the new theory of endogenous economic growth postulates that lowering trade barriers will speed up the rate of economic growth and development in the long run (Salvatore, 2007).

Even though international trade cannot be expected to be an “engine of growth” as in the case of the mercantilists assumption, today it is widely believed that there are still many ways (besides the static gains from comparative advantage) in which it can contribute to economic growth and development. Most traditional economists agree that trade can lead to full utilization of otherwise under-employed domestic resources (Salvatore, 2007). It also facilitates transmission of new ideas, new technologies and new managerial and other skills. Above all, international trade stimulates and facilitates international flow of capitals from developed to developing nations. Recently too, most economists agree that trade liberalization could positively affect economic growth, but the differences are at what stage of development a country should open its market. Openness to international trade accelerates development: this is one of the most widely held beliefs in the economics profession, one of the few things on which Nobel Prize winners of both the left and the right agree (Kraay *et.al*, 2001).

There are plenty of empirical evidences supporting that trade liberalisation is a right way to enhance economic growth because it reduces distortions in price relativities and allows those

activities with a comparative advantage to develop. Winters (2000) wrote that there is a general consensus that in the long run open economies contribute to long run development. He also argued that in the short run trade liberalization might exert pressure on certain sectors and might even endanger some group of population by aggravating poverty.

Policy makers and politicians in the recent times believe that trade liberalization affects growth through both the static and dynamic effects and growth influences poverty when the growth is nations participatory (creates employment to the working force of the nation). Recently most governments conceived that trade liberalization could affect poverty indirectly through the growth channel and it also directly affects poverty through changes in relative price in both factor and product markets.

In general, the widely-accepted view among economists is that, other things remaining the same, countries with few restrictions on trade will have faster economic growth than countries that heavily restrict trade, and that absolute poverty will be reduced more quickly with faster economic growth (Kraay, 2002). It follows that countries are encouraged to reduce trade barriers in order to reduce absolute poverty.

In 1993, Ethiopia embarked on a comprehensive trade reform program aimed at dismantling quantitative restrictions and gradually reducing the level and dispersion of tariff rates. As a result of this reform, tariff rates narrowed down from pre-reform of the 0-240 per cent to 0 - 80 per cent in 1995 and then to 0- 35 per cent in 2003(MOTI, 2003). Despite the adoption of trade related and fiscal reforms, Ethiopia has not fully realized the full benefits from its trade reform that began in the early 1990s. It is equally true, however, that the country is certainly better off under the liberalized trade regime compared to the highly restricted trade regime of the pre-reform period.

Even though attempts have been made to liberalize trade in Ethiopia so as to gain from international trade, the contribution of trade for the registered economic growth has been

insignificant and consequently trade played little to the poverty reduction process. The merchandise export composition of Ethiopia in particular and the economy as a whole has shown no significant transformation following the trade reform. The export composition has been entirely concentrated into certain primary agricultural and mining (mainly gold) products while its imports have been diversified and increased in quantity following the economic growth—mainly industrial. This trade imbalance widened from time to time and consequently forced the government to revise its monetary policy especially the exchange rate policy.

In 1950's economists such as Prebisch, Singer and Myrdal appeared and influenced the world with the so-called 'Prebisch-Singer Hypothesis ' which generally is sceptical about the benefits of trade, favour import substitution strategies (Harvey et.al 2008). They argued that there was, and will continue to be, a secular decline in the terms-of-trade of primary-commodity exporters due to low income and price elasticities of demand for primary products. These groups of economists contend that import substitution is the strategy that such countries have to follow in order to grow.

The recent policy environment of Ethiopia seem to have been planned based on the conclusion that Ethiopia's terms of trade has been deteriorated as it has been engaged in exporting primary products. The trends in the policy frame work contend that import substitution is the strategy that Ethiopia has to follow to grow. However, this strategy had been tested in the 1960s and 1970s over many Latin American countries as well as other countries of the world and proved to be inefficient (Rodriguez *et.al*, 2006) .There have been shifts from import substitution to export oriented growth strategy in the 1980s and onwards. In line of this, to reap the benefits of international trade, counties like Ethiopia are usually advised to make further liberalization efforts. This liberalization is assumed to result into a gain of both static and dynamic benefits to the economy as well as attract foreign direct investments that can bring production efficiency

and change the composition of the country's export from primary to value added industrial (manufacturing) products by creating competition within the existing local industries.

However, the fact that tariff revenue has retained a significant share in the Ethiopian economic structure has made the attempt of trade liberalization difficult as it contributes more than 35 per cent of the total government revenue over the last seven years (2002/03 to 2009/10). Consequently, reduction of foreign trade tax (tariff rate reduction) will cause substantial fall in revenue of the government. The reduction in revenue will worsen the budgetary deficit. Thus, tariff reduction needs to be coordinated with fiscal reforms.

The general advice of international institutions such as the IMF and the World Bank given to developing countries over the past few decades had been to replace foreign trade tax (import tariff revenue) with domestic consumption tax, particularly with value-added tax (VAT) and to maintain relatively high corporate income tax rates. Michael and Jenny (1999) of the International Monetary Fund (IMF) established a simple and practicable strategy for realizing the efficiency gains from tariff reform without reducing public revenues, showing that for a small open economy a cut in tariff combined with a point-to-point increase in domestic consumption taxes increase both welfare and public revenues.

It seems reasonable for government, therefore, to find other sources of revenue to compensate the decrease in tariff revenue following the tariff reduction. The government can consider various options. One option may be to coordinate the reduction in foreign trade tariffs (tariff revenue losses) with increase in domestic consumption tax revenues so that the revenue of the total government does not fall. This reform is likely to affect the poverty and income distribution of households because households as consumers are affected by changes in prices and the availability of consumer goods. They are also affected as suppliers of factors of production (especially labour) and lastly as producers in the agricultural and non-agricultural sectors.

Currently Ethiopia launched the new Growth and Transformation Plan (GTP) which aims a real GDP growth of a minimum of 11 per cent per annum over the period 2010/11 to 2014/15, with a “best case” target of doubling the size of the Ethiopian economy over that period, which would require annual GDP growth of 14.9 percent. The new plan has given less emphasis to foreign direct investment (FDI) implying less reliance is on FDI inflows than in the past and as much emphasis appears to be placed on import substitution and export expansion to reduce the trade deficit. As in the previous plans, agricultural production is the main basis for economic development, with a projected doubling of basic agricultural output over the plan period to meet domestic food requirements and to provide the raw material for industrial development. The sectoral focus of the plan is on sectors that are labour intensive, use agricultural products as inputs, help achieve technology transfer and are either export oriented with significant export potential or import-substituting: leather and leather products; sugar and sugar products; cement; metal and metal works; chemical products; pharmaceuticals; and agroprocessing. The plan also emphasizes support for small and medium-sized enterprises in general.

The role of import in achieving the planned economic transformation has been given less emphasis. As the plan is to transform the economy to industrial based economy, there is a need of imports of capital goods and other raw material including chemicals and technologies for the industries in the country that should be imported by the private sector as well as the state owned enterprises so as to be competent in the international market. International trade enables the growing economy to keep its momentum by providing capital and intermediate goods through import– critical to long-run economic growth – that would be quite expensive to produce locally.

In this paper a simulation of tariff tax coordination will be done to examine the role of foreign trade towards reducing poverty and helping the economy to grow faster. The issue of tariff reduction and compensation of the tariff revenue loss by domestic tax has not been studied in the

Ethiopian context. It is, therefore, important to see the role of tariff-tax coordination in achieving the goals of reducing poverty and enhancing faster and sustainable growth.

To this end, attempt will be made to address the following questions:

1. What are the effects of these trade liberalization programs on total absorption, Private consumption, Exports, Imports, total out puts of the overall economy?
2. What is the impact of the proposed tariff cut and tax replacement on the performance of different sectors of the economy?
3. What is the implication of different tariff cutting scenarios under alternative government tax replacement policies for the distribution of income and poverty reduction strategy?
4. What impacts will the proposed tariff cuts have on the factor demand and factor returns in the economy? Household welfare?

We utilize Computable General Equilibrium (CGE) model on the Ethiopian economy to answer the above questions.

2. Literature Review

2.1 Theoretical Literature

The traditional explanation of the relationship between trade and economic development are rooted in the principle of comparative advantage. According to that, trade allows a more efficient use of the economy's resources by enabling imports of goods and services that could otherwise only be produced at home at higher resource costs. The theory of comparative advantage arises from the nineteenth century free trade model associated with David Ricardo and John Stuart Mill, which were modified by trade theories embodied in the factor proportions or Heckscher-Ohlin (1933) theory and Stolper-Samuelson (1941) and Rybzyński (1955) effects. These trade models collectively and in various ways predict that an economy will tend to be relatively effective at producing goods that are intensive in the factors with which the country is relatively well endowed.

On the other hand, these trade theories predict that trade barriers such as tariffs result in a loss of welfare for a country (especially for a small country) that participate in the international trade. Hence, reduction of impediments to free trade would make the structure of production in countries more consistent with their comparative advantage resulting in a higher rate of economic growth. This is because of the fact that comparative advantage promotes specialization in goods and services that use abundant local resources (for example, labour in most developing countries) more intensively. This would increase the productive employment, which is most effective and efficient instrument for poverty reduction. That is, through trade a developing nation can move from an inefficient production point inside its production frontier, with unutilized resources because of inefficient internal demand, to a point on its production frontier. This hypothesis is confirmed by East Asian countries' experiences.

In addition, by expanding the size of the market, trade makes possible division of labour and economies of scale. This is especially important in the production of light manufactures in small economies in the early stages of development. Furthermore, international trade is considered as a vehicle for the transmission of new ideas, new technologies, and new managerial and other skills. International trade is also considered to be an excellent anti-monopoly weapon because it stimulates greater efficiency by domestic producers to meet foreign competition. Trade is, therefore, found to affect the long run growth through its impacts on technological changes, i.e. it influences the rate of change in technological progress.

These benefits of trade reflect what John Stuart Mill had earlier referred to as the indirect effects of trade which must also be counted as promoting development. These benefits were of three kinds: 1) those that increase the extent of market induced innovation and increase productivity, 2) those that increase capital accumulation and savings, 3) those that have educative effect in instilling new wants and in transferring technology, skills and entrepreneurship.

In line of these arguments, trade is used to develop the capacity for development by providing the above facilities. Following these arguments, there is a conclusion that if trade increases the capacity for development, then the larger the volume of trade the greater the potential for development (Meier 1995).

The New Trade Theory states that free trade is better than interventionism under international flows of goods and capital, since interventionist trade policies can lead to governments' failure and retaliation. Whereas protected market structures are less efficient.

New endogenous growth models, in turn, generate other results. In particular, these models argue that opening up to trade results in increased rates of economic growth, a result that is often used as an argument for a trade-growth linkage. Yet less known is that endogenous growth "can also yield permanently reduced rates of growth, as when trade pushes an economy to specialize in

sectors with no dynamic scale or other benefits. The theoretical relationship between trade and growth is fundamentally ambiguous.” (Rodrik, 1999).

Nevertheless, the new theory of endogenous economic growth confirms that lowering trade barriers will speed up the rate of economic growth and development in the long run (Salvatore, 2007). This could be enhanced by : (1) allowing developing nations to absorb the new technology developed in the advanced nations at a faster rate than with lower degree of openness, (2) increasing the benefits that flow from research and development, 3) Promoting larger economies of scale in production (4) reducing price distortion and leading to a more efficient use of domestic resources, (5) encouraging greater specialization and more efficiency in the production of intermediate inputs.”

There has also been other justification for the positive effect of openness to growth that openness and international competition increases rivalry among firms in the domestic economy and with outside producers which stimulates innovation leading to efficient production system and growth. By contrast, protectionist policies that restrict trade keep out the competition and this would result in reduced innovation and slowdown growth.

There are at least three ways in which tariffs (protection) can affect exporters. First, exporters often purchase imported inputs subjected to tariff that increases the cost of inputs. Because exporters tend to sell in the competitive markets where they have little ability to dictate the prices they receive, they generally cannot pass on a tariff-induced increase in cost to their buyers. Higher exporters cost thus lead to higher prices and reduced overseas sales. Second, tariffs also raise the cost of living by increasing the price of imports. Workers thus have the incentive to demand higher wages resulting to higher production costs which reduces the competitive position in the international markets. Third, import tariffs have international repercussions that lead to a reduction in a country's exports.

On the other hand, there are groups of economists who contend that standard international trade theory based on comparative advantage was completely irrelevant for the developing nation and the development process. Therefore, they advocated industrialization through import substitution (i.e. domestic production of manufactured goods previously imported) and generally less reliance on international trade by developing nations. According to these groups of economists, this is due to their strong belief that international trade and the functioning of the present international economic systems hindered rather than facilitated development through secularly declining terms of trade and widely fluctuating export earnings for developing nations. They support their argument for this from both the demand side and the supply side as follows:

On the demand side, the income elasticity demand in developed nations for many of the food and agricultural raw materials exports of developing nations is less than one. Furthermore, the development of synthetic substitutes has reduced the demand for natural raw materials. Developed nations imposed trade restriction on many temperate exports (Such as wheat, vegetables, sugar oils and others).

On the supply side, most of today's developing nations are much less well endowed in natural resources (except the petroleum exporting nations) and they are also over populated so that most of the increase in their output of food and raw materials is absorbed domestically rather than exported. Furthermore international flow of capital (FDI) in to these countries is not reliable.

2.2. Empirical Literature

Empirical literature overwhelmingly suggests that increased trade or reduced protectionism is associated with greater growth. Edwards (1998) for example found that, after taking into account the roles of all other factor (including capital accumulation, growth in labour force and the differences in level of technology), countries with lower degrees of protection, on average, tend to grow at a much faster pace than countries with high trade restrictions.

Harrison (1996) synthesised the previous empirical studies between openness and the rate of GDP growth, comparing the results from cross-section and panel estimations while controlling for country effect. Harrison concluded that on the whole, correlations across-openness measures seem to be positively associated with GDP growth –the more open the economy the higher the growth rate or the more protected the local economy the slower the growth in income. This is because of the fact that tariffs reflect additional direct costs that producers have to absorb which could reduce output and growth.

A wide range of empirical research has supported the hypothesis that increased international rivalry and competition results in technological innovation. Porter (1990) in his wide ranging study on innovation and competition concluded that competitive advantage emerges from pressure, challenge and adversity which are powerful motivations for change and innovation. He added that protection in its various forms insulate domestic firms from the pressure of international competition.

Revira-Batiz(1995) presented a simple model showing the mechanism through which trade generates innovation. They demonstrated that by augmenting the rivalry facing producers in the local market, trade could induce domestic producers to increase their research and development (R&D) activities leading to greater innovation and raising domestic total factor of productivity. The model presented in the Ravira-Batiz's paper incorporates gains from trade are related to increased domestic productivity and economic growth associated with foreign competition. Studies of long run growth also suggest that the invention and development of new goods and inputs constitute one of the major sources of economic growth. If trade stimulates competition leading to the creation of new inputs and products, long run growth will raise. Accordingly, trade is associated with technological changes and therefore growth.

There is widespread view by economists and policy makers that trade liberalization or a decline in protection leads to faster economic growth and poverty reduction in poor countries (Dollar and

Kraay, 2001; World Bank, 2002). Accordingly trade liberalization policies encourage exports that benefit the export sector and contribute to GDP growth.

In recent empirical literature, there has been much debate among economists about the effect of trade liberalization on economic performance in the developing countries. De Jong and Ripoll (2006) examined the relationship between tariff rates and growth for 60 countries over a period of 1975-2000 and showed that the marginal effect of tariff on growth is declining in the level of per capita incomes. That is, the relationship between tariff and growth is negative and significant among the world's rich countries but positive among the world poor countries.

Yanikaaya(2002) examined the relationship between import duties and growth for 80 developed and developing countries over the period of 1970-1997 and concluded that trade barriers in the form of tariffs can actually be beneficial for economic growth especially for developing countries.

Meanwhile, there are studies that express pessimism of trade liberalization and little evidence to support link between trade liberalization and economic growth (Grossman and Helpman, 1991; Rodriguez and Rodrik, 2000).

However, there is agreement within a majority of economists and policy makers that liberalizing the economy is advantageous over restriction. However, tariff reform continues to be a pressing policy issue in many developing countries. Reducing trade barriers is frequently a core and problematic element while the prospective scales of liberalization for some countries remain substantial. One of the major concerns of trade liberalization, especially for developing countries, is that it reduces government revenue. In many low income countries, tariff revenue continues to account for a significant share of public revenues and GDP. Recent estimates suggest that, on average, tariff revenue account for around 4 percent in low and middle income

countries' GDP in 1995-2000 while the equivalent estimates in high income countries are below 1 percent (Keen and Baunsgaard, 2004).

Loss of revenue can particularly be a potential source of fiscal instability in African countries as the countries mainly rely on trade taxes for government revenue. Equally true, if the compensatory increases in other taxes are imposed mainly on poor, poverty would be exacerbated (winter, 2000).

Obviously, the key obstacle to fundamental tariff reduction in many developing countries is the revenue loss that it ultimately implies. To implement a dramatic trade reform in a domestic economic environment with increasing personal income disparities, the government has to choose tax policies that will avoid further increases in income inequalities and balance the government budget with minimal social costs.

The changes in prices play crucial role to affect resource allocation, income distribution and poverty alleviation. Tariff reduction changes relative prices, which ultimately changes production incentives. Trade is likely to affect the poverty and income distribution of households because households as consumers are affected by changes in prices and the availability of consumer goods. They are also affected as suppliers of factors of production (especially labour) and lastly as producers in the agricultural and non-agricultural sectors.

There are three channels to affect income distribution in response to adoption of trade liberalization. First, changes in factor rewards directly affect household's income. Secondly, changes in relative product prices affect households' real income differently because consumption expenditure is specified at the household level. If the assumption of similar preference function for all households is made in the economy then we can compare the aggregate consumption with the consumption in the base line solution. If more of every single

commodity is consumed after policy shock that indicates improvement. Thirdly, capital gains and losses affect households' wealth distribution.

Domestic welfare could also be enhanced through three mechanisms: 1) the number of differentiated products consumed increased due to the introduction of foreign varieties, 2) as the number of producers increase the real wage rate of unskilled labour also increases, 3) as R&D per firm rises the demand for skilled human capital rise and consequently the real wage of skilled labour increases.

Nissanke and Thorbecke(2005) noted that growth is indispensable for poverty reduction. As trade affects growth, trade has an indirect effect on poverty. However it is not the rate of growth *per se* that is important but the pattern of economic growth.

CGE models have been used to intensively investigate the effects of policy changes within an economy as they take into account interactions and interdependence within the economy. Siddiqui and Iqbal (2001) used a CGE model for Pakistan to analyse the impact of tariff reduction on income distribution. They examined the effect on income of households through changes in factor prices and concluded that the real income of households increased due to the decline in prices.

Wang and Zhai (1997) used a 22 sector, 12 representative household CGE model for China to analyse the distributional effects of trade liberalization and government tax replacement policies during foreign trade reform. They came up with the conclusion that trade liberalization can enhance both economic efficiency and income equality.

Obi (2003) had used a CGE model to examine the potency of fiscal policy as a tool for redistributing income in Nigeria. The model was for five sectors, two factors of production and six categories of households. The study observed that targeting of government expenditure seems to be the most potent tool for effective redistribution of income.

Aka(2003) had used a CGE model to analyse the effects of fiscal adjustment required to compensate for the drop in fiscal receipt because of the trade liberalization and adoption of external common tariff in WAEMU countries on income distribution and poverty in Cote d'Ivoire. Three simulations were carried out in this study; the first considered the elimination of tax on agricultural exports, the second consisted in elimination of taxes on agricultural imports and the third simulation consisted in elimination of taxes on industrial exports. The conclusion was that the elimination of agricultural exports and imports taxes lead to more poor than in the pre-shock situation. The elimination of taxes on industrial exports reduces the number of households that are poor in comparison to the pre-shock situation.

Bhasin and Annim(2005) used a CGE model for Ghana to examine the impact of alternative fiscal reform ,in which lost tariff revenue is compensated by a lump-sum tax, on the poverty and income distribution of households. The study tested the hypothesis that elimination of import taxes accompanied by an increase in VAT reduces the incidence, depth and severity of household poverty and improves income distribution of households. On the other hand, the study tested the hypothesis that the elimination of export taxes accompanied by an increase in VAT increases the incidence, depth and severity of household poverty and worsened the income distribution of households.

Fekadu *et.al* (2007) used a static CGE micro simulation model for Ethiopia comprising 17,332 households derived from the 1999/2000 HICE survey to investigate the effect of tariff cut on different categories of households, income inequalities in Ethiopia and the domestic outputs and export in Ethiopia. The study used the 2001/2002 Ethiopian SAM constructed by IFPR Addis Ababa. The SAM used contains 10 production sectors, 10 commodities, 4 factors of production, 3 households, 1 enterprise and 4 tax accounts. The findings were that full liberalization has no significant effect on income distribution in Ethiopia.

Bisrat (2009) used a dynamic CGE micro simulation model for Ethiopia to investigate the impact of trade liberalization on growth and poverty reduction. The main findings of the study were that a complete removal of tariff in the Ethiopian economy would lead to a worsening of poverty in the short run and contraction of the initially protected sectors, particularly industry and service sectors. In the long run, however, trade liberalization combined with capital accumulation reduces poverty and swells sectors that were contracted in the short run. The growth effect captured by the model contributed to the expansion of all sectors, particularly agriculture and reduces poverty.

Bisrat's work was based on the World Bank SAM of Ethiopia 1999/2001 and he did not replace the lost government revenue as a result of Tariff reduction. It is found to be vital to see the effect of tariff reduction with a simultaneous increase of domestic tax rate on the growth, income distribution and poverty in the Ethiopian context. This paper is designed to examine the effect of tariff-tax coordination on the stated problems.

3. An Overview of the Ethiopian Economy

Ethiopia's economy has been expanded rapidly in recent years, averaging 10.7 per cent real GDP growth rate over the period 2004/05-2008/09(MOFED, 2009/10). This rapid growth has, however, been accompanied by a widening trade deficit and new fiscal pressure to meet the countries growing infrastructure requirement.

The Ethiopian economy is predominantly agrarian where almost half of the GDP is contributed by the agriculture sector (45 %) and creates employment opportunities for about 85 per cent of the population (MOFED, 2009/10).As to the same report, crop production is the dominant economic activity in the agricultural sector in Ethiopia contributing more than 30 per cent of the GDP. However the dominant sector of the economy is characterized by traditional method of farming with little surplus and heavily dependent on rain fall.

The fact that the economy is agrarian and the farming practice is traditional made the government revenue collected from the sector, as a direct tax, difficult to administer and consequently the total tax revenue contributes a small share in the overall government revenue. The Ethiopian industries are immature and insignificant in terms of absorbing and producing new technology. As a result concerns have been raised about the competitiveness of the Ethiopian industries and that of the fiscal consequences given the important role that border taxes play in Ethiopia's fiscal frame work.

3.1 Trade policies in Ethiopia

During the pre-1974/75, the foreign trade sector was governed by a relatively free market oriented policies with the private sector occupying the larger share in both import and export activities. Although import substitution was the dominant trade strategy of the country, the concern of export diversification was stated in the First Five Year Development Plan (1957-

1961)¹ that gave attention on the economic instability consequences of the dependence on concentrated export products. Import substitution, industrial promotion and infrastructure facilities like road development were the focus in this plan. Diversification of the export structure by exploiting the large livestock population, and the products of agro-processing industries to secure average annual export growth of 9 per cent and 11 per cent share of exports in national income were the major targets.

The Second Five Year Development Plan (1962 -1966) placed great emphasis on structural change and export diversification to achieve high level of foreign exchange earnings. In this plan, structural change and export diversification received priority, new export products of industrial origins and mining products were supposed to play key role, the average annual export growth rate was expected to reach 11%, the share of agricultural exports to trim down to 72.3% in 1966/67 from 93.6% in 1962/63 as well as to wind up manufactured products up to 24.2% from 5.2%. This plan targeted the formation of government foreign trade corporations, revisions of existing customs tariff to protect domestic products and stimulate exports, directing credit and subsidy policies towards the production and promotion of exports, conclusion of a series of bilateral and multilateral agreements and better participation at international trade fairs.

The Third Five Year Development Plan (1967-1974) was concerned to geographic diversification of traditional export products (coffee, livestock products and oilseeds) and the development of non-agricultural exports .The plan envisioned to reduce the share of traditional exports from that of 86% in 1967/68 to 75% in 1973/74 and the share of coffee was planned to plummet from 55% to 40% in the same period partly due to the addition of new products in the export basket. The measures adopted include overvaluation of the exchange rate, high tariff rates, wide-ranging foreign exchange control and non-tariff barriers like restrictions on some items and heavy tax on export.

¹ EEA proceedings ,2005

In the Dergue Regime (1974/75 - 1990/91), the overall policies favoured to the expansion of collective and public enterprises while private enterprises were kept at cove for long. Furthermore, an inward looking strategy behind a highly protective tariffs and quantitative restrictions was the development strategy. The government undertook a ten-year perspective plan (1985/86- 1994/95).The plan was aimed at orienting export structures of the country towards high value added products and increasing the amount and composition of manufactured exports, expanding the foreign exchange earnings, and increasing the socialization of the export sector. However, particular attention was given to state owned export companies heedless of their inefficiency. Geographic diversification of exports towards the markets of socialist countries and neighbouring African countries was the focus.

Since 1992, Ethiopia under the support and guidance of the IMF and the World Bank has undergone liberalization and enhanced Structural Adjustment Programs (SAPs) to restrain internal and external imbalances of the economy. One of the basic tasks of the new policy regime is to increasingly open the economy to foreign competition with a view of benefiting the economy from expanded markets. The tools implemented include: *devaluation* of the Birr and step-by-step liberalization of the foreign exchange market, streamlining import and export licensing system, tariff reduction, and provision of incentives to exporters, abolishing taxes on exports and subsidies to exporting enterprises, encouraging export-oriented investment, introduction of duty draw back and foreign exchange retention scheme, minimizing administrative and bureaucratic procedures.

3.2 The Tax Reform and Tariff Revision

The reform measures are intended to a) encourage trade, investment and hence development b) Broaden the tax bases and increase government revenue to support social programs and alleviate poverty; c) strengthen the enforcement capacity of tax and customs authorities; and d) promote equity in the tax system (Demirew, 2005).

The tax revenue to GDP ratio in 1991/92 and 1992/93 was 6.28 % and 6.68 % respectively indicating a decreasing trend as compared to 10.42 per cent of the pre-1991/92 tax revenue GDP ratio (Table 3.1). Similarly the total domestic revenue GDP ratio during the 1991/92 and 1992/93 came down to 8.57 per cent and 9.66 per cent as compared to 15.64 per cent of the pre-1991/92. At the same time the total expenditure of the government (recurrent and capital expenditure) was higher than 20.5 per cent (Demirew, 2005). Therefore, generating revenue to finance government expenditure was one of the reasons for the tax reform. As a result, after the reform the tax GDP ratio showed significant progress and increased from 6.68 per cent in 1992/93 to 10.10 per cent in 2006/07. The total domestic revenue to GDP ratio progressed as shown below. Import duties and taxes constituted almost close to 50 per cent of the total tax revenue. However, in recent years due to many tax exemptions (example, edible oil) and increase of GDP the revenue GDP ratio is declining.

Table: 3.1. Structure of Tax and Non-Tax Revenue in Ethiopia (1987/08 -2007/08)

Fiscal Year	Tax Revenue (% of GDP)	Domestic direct Taxes (% of GDP)	Domestic Indirect Taxes (% of GDP)	Import Duties and Taxes (% of GDP)	Total Revenue(% of GDP)	Import Duties and Taxes(% of Tax Revenue)	Import Duties and Taxes(% of Total Revenue)
1987/88 -1990/91	10.42	4.63	3.51	1.80	15.64	17.27	11.51
1991/92	6.28	2.58	2.08	1.60	8.57	25.38	18.61
1992/93	6.68	2.23	2.26	2.13	9.66	31.89	22.05
1993/94	8.77	2.69	2.38	3.56	11.23	40.65	31.75
1994/95	9.24	3.13	2.25	3.38	14.09	36.61	24.02
1995/96	10.05	3.73	2.46	3.61	14.83	35.87	24.32
1996/97	10.43	3.71	2.51	3.94	15.34	37.79	25.71
1997/98	9.47	3.35	2.13	3.67	15.13	38.72	24.25
1998/99	9.51	3.42	2.05	3.78	16.08	39.76	23.52
1999/00	9.73	3.55	2.16	3.79	15.23	38.99	24.91
2000/01	10.94	4.02	2.03	4.75	15.55	43.41	30.54
2001/02	11.91	4.69	2.25	4.93	15.74	41.37	31.30
2002/03	11.23	4.10	2.27	4.85	15.18	43.24	31.96
2003/04	12.14	3.61	2.44	6.08	15.22	50.07	39.94
2004/05	11.64	3.69	2.56	5.40	14.64	46.35	36.85
2005/06	10.73	3.36	2.36	5.00	14.81	46.64	33.79
2006/07	10.10	3.01	2.33	4.77	12.69	47.19	37.57
2007/08	9.69	2.86	2.07	4.76	12.13	49.13	39.25

Source: MOFED and EDRI

The major policy measures of direct and indirect taxes under the tax reform include the following:

a) Tax on income and profits

The maximum income tax which was 85 per cent on employment income has been reduced down consecutively after 1991 by the Transitional Government of Ethiopia and latter on by Federal Democratic Republic of Ethiopia to 50 per cent, 40 per cent and 35 per cent by proclamation No 30/1992, 107/1999 and 286/2002 respectively. Similarly proclamation No 62/1992, 107/1999 and 298/2002 reduced business profit tax rates to 45 per cent, 40 per cent and 35 percent respectively. Profit tax rate on corporate enterprises (category A taxpayers) is 30 per cent according to the new proclamation No.286/2002².

Apart from changing the direct tax rates, the government has also introduced rental tax, Urban land lease fee, capital gain tax and interest income taxes in 1993/94, 1994/95, 1997/98 and 2000/01 respectively to broaden the tax base.

Generally the income tax reform of the country by and large is in line with the “good practice” of the tax reforms of developing countries.

b) Commodity tax

The reform under this category covers Sales tax/Value added tax and Excise tax. The value added tax replaced the sales tax. The sales tax base was very much narrow as it limited to imports, manufactured goods and a few selected services and with many exemptions. This made the tax system unable to meet the government revenue requirements to cover its expenditure. Moreover, because no credit is given to input taxes, the tax has cascading effect, distorted efficient resource allocation and more likely impeded economic growth.

² EEA Proceedings, 2005

Value added tax (VAT) is becoming the main source of government revenue in most of the countries who introduced VAT. Ethiopia introduced VAT in January 2003 replacing the sales tax. The VAT is applied at a uniform rate of 15 per cent on most consumption goods and services with the exceptions of exports and exempted goods & services.

Eligible Business enterprises for VAT registration are those who have annual turnover of birr 500,000 and above. For those business enterprises whose annual turnover of taxable goods is less than the VAT registration thresholds, an equalizing turnover tax is introduced at the rate of 2 per cent for goods and 10 per cent for services. VAT registered business enterprises are eligible to claim input tax while non-registered are not given this opportunity.

Table: 3.2. Structure of Business profit tax.

Proclamation No.155/1971 E.C			Proclamation No.286/1994 E.C		
No.	Tax bracket in Birr	Tax rate (%)	No.	Tax bracket in Birr	Tax rate (%)
1	1,200 -3,000	11	1	1,800-7,800	10
2	3,000 -6,000	14	2	7,801-16,800	15
3	6,000 -9,000	20	3	16,801-28,200	20
4	9,000 -12,000	26	4	28,201-42,600	25
5	12,000 -15,000	33	5	42,601-60,000	30
6	15,000 -18,000	40	6	above ,60,000	35
7	18,000-21,000	47			
8	21,000-24,000	54			
9	24,000-27,000	61			
10	27,000-30,000	68			
11	30,000-33,000	75			
12	33,000-36,0000	82			
13	Above 36,000	89			

Source: EEA publication, 2005

c) Import tax/tariff

Import duties are important sources of revenue in Ethiopia. It accounted about 39.49 per cent of tax revenue over the years 1987/88 to 2007/08, its share further increased to 46.64 per cent in 2005/06 and reached to 49.13 per cent in 2007/08(see Table: 3.1).It is an easy to collect tax. Despite their importance and easiness to collect, tariffs are not the considered as optimal sources of revenue because of their distortion effects on the economy when they derive a wedge between

domestic price and international price and introduce inward bias on the economy. Moreover, the current international trends of globalization and regional integration demand liberalization of trade barriers.

Trade liberalization in the country started in 1993 by tariffication of the quantitative restrictions and lowering the tariff rates. The government has undertaken tariff revisions for several times reducing the maximum tariff rate from 230 per cent during the pre-reform period to 35 per cent since January 2003. Accordingly, the weighted average tariff rate has been reduced from 41.6 per cent in the pre-reform period to 17.5 per cent since January 2003. The existing tariff amendment has been worked out on the basis of the version 2002 Harmonized Commodity and coding system of world custom organization. The tariff reduction measures with no doubt have negative effect on government revenue. To minimize the effect and even to raise the revenue, the government has substantially reduced the exempted items and broaden the local tax bases.

Table: 3.3. Tariff structure

Description	Before 1993	First revision (Aug 1993)	second revision (Jan 1996)	Third revision (Dec 1996)	Fourth revision (Jan 1998)	Fifth revision (Dec 1998)	Six revision (Jan 2003)
Maximum tariff rate(%)	230	80	60	50	50	40	35
No. of Tariff exempted	327	138	169	170	168	167	179
Wt. average tariff rate	41.6	29.6	24.6	23.6	21.5	19.5	17.5
Tariff dispersion (%)	225	75	55	45	45	35	30
Total No. of Items	1,821	5,332	5,294	5,295	5,486	5,426	5,608
Tariff band	23	9	8		7	7	6

Source: ERCA, EEA publication

3.3 Foreign Trade Performances

The export structure of the Ethiopian economy in general has been dominated by primary agricultural commodities such as Coffee, Oilseeds, Leather and leather products, Pulses, Chat and Flower. For the last 8 years, these six traditional commodities accounted for more than 80 per cent of the country's total export, signifying the high level of concentration in the country's

export sector. The percentage composition of Ethiopia's export trade over the period 2002/03-2009/10 is shown in table 3.4. Clearly coffee has been the dominant export commodity in Ethiopia contributing most (more than 35 per cent in the years 2002/03 -2009/10 to the country's foreign merchandise export earnings. The figures do, however, indicate a tendency of coffee export share to decline in recent years (went down from 42.77 per cent in 2006/07 to 24.22 per cent in 2009/10).

Oilseeds, chat, Leather & Leather Products, Pulses, Gold and Flowers stood as the second, third, and fourth, fifth, sixth and seventh important export items of the country which account for a respective 15.10 per cent, 10.17 per cent, 8.39 per cent, 6.14 per cent, 5.97 and 3.88 per cent average share over the period 2002/03 to 2009/10.

Despite the huge livestock resources and fertile land for the cultivation of cotton (the raw material for textile) in the country, the export share of leather & leather products and Textiles and Textile products were quite lower (8.39 per cent and 2.20 per cent respectively) in the reviewed period thus requiring a concerted effort both by government and the private sectors so as to exploit such untapped potential. These shares are declining much in the recent periods.

Table: 3.4. Composition of Ethiopian export (1998-2010)

Commodity	Share of Export by product (%)								
	2002/03	2003/04	2004/05	2005/06	2006/07	2007/08	2008/09	2009/10	Average (2002/02- 2009/10)
Live Animals	0.12	0.19	0.62	2.51	3.07	3.39	3.02	4.07	2.12
Animal Products	0.54	1.24	1.35	2.27	2.41	1.38	1.96	1.88	1.63
Flowers	0.01	0.31	0.36	1.38	3.72	7.39	8.03	9.86	3.88
Vegetables, Potatoes, Roots & Other Tubers	1.08	0.81	1.26	0.69	0.66	1.11	0.49	0.54	0.83
Chat	9.03	27.34	1.01	7.53	8.64	8.86	7.58	11.39	10.17
Pulses	7.97	3.52	5.41	3.54	5.24	7.80	8.35	7.31	6.14
Coffee	35.29	31.64	39.76	39.37	42.77	34.90	36.12	24.22	35.51
Oil Seeds	8.77	10.51	14.61	19.42	12.71	13.14	16.52	25.10	15.10
Fruits	0.56	0.28	0.39	0.24	0.21	0.17	0.20	0.19	0.28
Species	0.96	1.06	1.38	1.08	0.68	0.93	0.71	0.79	0.95
Prepared Foodstuffs	5.76	2.74	1.76	3.28	1.93	1.71	1.10	1.17	2.43
Beverages	0.15	0.42	0.39	0.33	0.12	0.16	0.12	0.13	0.23
Leather & Leather Products	13.58	9.76	11.13	7.91	8.11	7.81	5.96	2.83	8.39
Textiles & Textile Articles	2.06	3.60	2.86	1.31	1.82	2.60	1.71	1.65	2.20
Footwear: Shoes & Parts	0.01	0.16	0.07	0.10	0.29	0.68	0.63	0.43	0.30
Articles of Apparel & Accessories	0.00	0.00	0.01	0.00	0.00	0.00	0.00	0.00	0.00
Gold	8.02	1.34	12.91	4.91	5.10	4.28	5.14	6.06	5.97
Other Exports	5.92	4.86	4.48	3.99	2.36	3.54	2.24	2.25	3.71
Animals and vegetable Oils, Fats & Waxes	0.18	0.23	0.24	0.15	0.16	0.16	0.11	0.11	0.17
Total Export	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00

Source: EDRI and ARCA

Like the commodity structure, the country's exports have been concentrated geographically with the large proportions of exports to limited markets. Table 3.5 below shows the geographical distributions of the Ethiopian export in the years 2002/03 to 2010/10. Close to 90 per cent of the export earnings in 2005/06 has been gained from 20 countries, Germany has been the largest market supplying more than 14 per cent of the export receipt followed by China and Japan providing nearly 9 per cent and 8 per cent respectively. The export share to China increases from less than 2 per cent prior 2005 to nearly 9 per cent in 2005 and onwards due the massive export of Oilseeds (the main import of China from Ethiopia) while that of Japan is declining from 8.3

per cent in 2002/03 to 0.63 per cent in 2009/10. The recent economic crisis has severely affected our export market in Japan. The export to Netherland increases from less than 1 per cent in 2002/03 to about 7.6 per cent and 6.96 per cent in 2009/10 and 2010/11 respectively. This do high light the existence of structural rigidity in the geographical structure of the country's exports with a consequent vulnerability to fluctuation in the demand in any of these countries.

Table: 3.5. Geographical structure of Ethiopian Export (2002 -2010)

Share in total Export by Destination (%)								
Country	2002/03	2003/04	2004/05	2005/06	2006/07	2007/08	2008/09	2009/10
Germany	10.72	10.03	12.62	14.12	12.97	10.09	10.66	7.08
China	1.69	1.23	2.42	8.80	7.17	5.72	5.23	9.96
Japan	8.25	7.60	10.12	7.66	8.70	6.45	3.94	0.63
Switzerland	9.41	4.17	8.83	6.78	5.66	4.86	6.31	6.63
Saudi Arabia	6.17	6.17	6.89	6.54	7.01	7.23	7.83	5.97
Djibouti	11.71	22.21	3.51	6.42	5.97	4.74	3.16	3.37
Italy	9.02	6.25	6.29	5.72	6.25	6.82	5.30	2.77
United States	3.78	4.05	6.05	4.89	5.15	5.73	7.26	3.52
Netherlands	0.85	0.98	3.09	3.92	4.47	6.61	7.58	7.63
Somalia	2.04	7.51	0.01	3.91	5.40	6.10	4.99	7.80
United Arab Emirates	1.82	2.06	1.71	3.43	3.06	2.76	4.31	3.91
United Kingdom	4.02	3.19	3.75	3.24	2.88	2.52	2.79	3.25
Belgium	3.10	2.59	3.27	2.37	3.44	3.85	3.37	2.41
Israel	3.5	2.54	3.64	2.36	2.13	2.49	3.15	2.61
Yemen	1.70	2.79	2.60	2.32	2.55	2.25	1.86	1.17
France	2.58	1.52	1.90	1.92	2.65	1.49	1.48	1.01
Egypt	1.00	0.41	0.41	1.77	0.88	0.62	0.85	0.91
Turkey	1.2	1.92	2.55	1.59	1.32	2.35	2.51	1.75
Sudan	0.48	1.28	2.63	1.21	1.77	3.95	4.68	4.42
Canada	0.40	0.29	0.43	1.00	0.63	0.56	0.55	1.34
Others	16.55	11.22	17.28	10.03	9.93	12.83	12.21	21.87
Total	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00

Source: ARCA and own computation

Like many developing countries, Ethiopia exports agricultural and semi-processed primary products and imports capital goods, intermediate and final consumption goods. Ethiopia mainly imports capital goods comprising about 29.69 per cent of total imports followed by consumer goods taking 29.68 per cent of total import share in 2005/06. Imports of semi-finished goods account for 20.88 percent in the same year(2005/06). Over the years 2002/03-2009/10, the share

of import of consumer goods has shown a decreasing trend from 34.1 per cent in 2002/03 to 25.45 per cent in 2010/11. The import share of intermediate, capital goods and energy revealed a significant increase as shown in table 3.6.

Table: 3.6 Composition of Import by end use (percentage of the total import)

Item/Year	2002/03	2003/04	2004/05	2005/06	2006/07	2007/08	2008/09	2009/10
Consumer Goods	34.10	40.26	33.13	29.68	25.15	25.10	26.00	25.45
Durables	11.84	10.56	11.45	7.87	8.35	7.55	5.49	5.92
Non-Durables	22.26	29.71	21.68	21.81	16.80	17.55	20.51	19.52
Intermediate/Semi-Finished Products	21.67	17.74	20.82	20.88	18.36	22.78	20.81	23.11
Energy	12.82	12.68	15.08	16.87	22.77	14.87	25.15	17.27
Capital Goods	28.49	26.59	28.27	29.69	30.18	32.95	25.74	31.85
Machinery	10.38	10.58	10.70	12.32	12.26	14.63	10.78	13.89
ICT Products	3.29	2.18	4.83	5.10	2.37	4.72	6.36	6.66
Transport Equipment, Spare	9.90	9.08	8.26	7.46	11.68	9.65	4.62	5.32
Other Capitals	4.91	4.75	4.48	4.81	3.87	3.95	3.99	5.98
RAW MATERIALS	2.52	2.43	2.53	2.71	2.83	3.24	2.28	2.32
Others	0.41	0.29	0.17	0.17	0.71	1.07	0.01	0.00
Total	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00

Source: EDRI and ARCA

On the other hand, when we look at the geographic origins of import commodities, we observe that there is still a bias in the geographical structure of imports. As shown in Table 3.7, about 15.24 per cent of import was from China (mainly capital goods) and nearly 15.64 per cent of the import was from Saudi Arabia (mainly petroleum) in 2005/06 .The import share from China increased to 24.44 per cent of the total import in 2009/10 and that of Saudi Arabia reached to 12.85 per cent during the same year which was mainly due to petroleum price rise. Imports from India (mainly capital goods) increased over the last seven years while import from USA ,Japan, Germany and Italy decreased from time to time in the years 2002/03 to 2009/10.

The main trade partner in terms of import for Ethiopia is Asia followed by Europe in imports. The share of Ethiopia's import that come from the six Asian countries(China, Saudi Arabia, Japan, India ,Korea Rep and Indonesia) accounts about 46.45 per cent of the total import over

the last eight years followed by eleven European countries(Italy, German, Turkey ,Sweden ,France, Netherlands, UK, Ukraine, Russia, Belgium and Israel) accounting 23.37 per cent over the year 2002/03-2009/10. The import share from USA accounts nearly 7.58 per cent over the period of 2002/03- 2009/10 with a decreasing trend in the recent years.

Table: 3.7 Origin of Ethiopian Import in percent of total merchandise import (2002/03-2009/10)

Country	Share in Total Import Value (%)								Average 2002/03- 2009/10
	2002/03	2003/04	2004/05	2005/06	2006/07	2007/08	2008/09	2009/10	
Saudi Arabia	5.73	4.66	17.49	15.64	18.28	11.44	15.30	12.85	12.68
China	11.83	11.82	13.24	15.24	16.28	18.91	22.07	24.44	16.73
United States	6.89	16.82	8.53	8.40	3.96	4.81	4.86	6.40	7.58
India	6.46	6.59	6.09	7.27	7.13	8.77	6.86	7.93	7.14
Japan	11.65	8.02	6.62	6.78	7.87	5.02	3.75	4.82	6.82
Italy	8.08	8.29	4.74	6.44	7.81	5.52	5.60	4.72	6.40
Germany	4.26	3.16	3.11	3.00	3.38	3.45	1.99	2.34	3.09
Turkey	1.95	2.85	3.49	2.63	1.78	3.11	2.21	3.09	2.64
Indonesia	1.65	1.70	1.43	2.59	1.14	1.30	0.96	1.18	1.49
Sweden	1.24	1.35	2.08	2.14	0.99	0.67	0.40	0.44	1.16
France	1.91	2.69	2.00	1.96	1.88	1.38	1.57	1.01	1.80
Brazil	0.75	0.43	1.13	1.69	1.73	1.21	0.90	1.06	1.11
United Kingdom	8.08	2.74	2.83	1.64	1.92	1.58	0.91	1.03	2.59
Korea, Republic of	1.89	1.70	1.30	1.57	1.85	1.66	1.23	1.52	1.59
Ukraine	0.90	0.91	2.41	1.51	0.81	1.88	1.05	1.47	1.37
Netherlands	1.83	1.96	0.94	1.46	1.30	0.69	0.85	0.91	1.24
Egypt	1.32	1.24	1.24	1.45	1.95	1.49	1.15	1.04	1.36
Russian Federation	1.34	1.27	0.91	1.42	1.01	1.61	2.37	1.20	1.39
Belgium	1.53	0.78	0.94	1.42	1.31	1.01	0.74	0.70	1.05
Israel	0.22	0.54	1.43	1.35	0.58	0.46	0.29	0.23	0.64
Others	20.48	20.48	18.05	14.39	17.03	24.03	24.94	21.61	20.12
Total	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00

Source: EDRI and ARCA

3.4. Poverty and Income Distribution in Ethiopia

The concept of poverty is multidimensional as it is applied to situations at both individual (and household) and country levels. The link between poverty at household levels and poverty at country level are complex: positive economic growth measured as an increase in per capita GDP may be accompanied by impoverishment of the particular sub-population.

Despite the complexity of the concept of poverty, it is essential for policy makers and social actors in general to have access to a quantitative assessment of the poverty situation. Quantitative knowledge is required both to follow the changes over time (to evaluate the impact of the policy changes) and to compare the situation with other countries. Individual income and consumption values can be used as a basis for poverty assessment. In most developing countries, consumption values have been selected as the basis to quantify poverty. The main reason for selecting consumption rather than income as the basis for poverty indices is that discrepancies are often observed between declared income and declared consumption, with the declared income being less than the declared consumption. The other reason is that there is more information available on consumption than income as the socio-economic surveys of countries focus on consumption assessment. Further more income is more variable than consumption due to different business cycles while consumption is relatively invariant to these changes due to consumption smoothing (people reduce consumption gradually by dissaving or borrowings).

The consumption level that separates the poor from the rest of the population is called the poverty line. Once a poverty line has been set, a number of summary statistics describing the incidence, depth and severity of poverty may be calculated. These include the head count index (which measures the incidence of poverty), the poverty gap (which measures the depth of poverty) and the squared poverty gap (which measures the severity of poverty). Foster, Greer and Thorbecke, FGT (1984), showed that these three poverty measures may all be calculated using the following formula:

$$P_{\alpha} = \int_0^z \left(\frac{z - y_i}{z} \right)^{\alpha} f(y) dy \text{ , for the continuous distribution and}$$

$$P_{\alpha} = \frac{1}{N} \sum_{i=1}^M \left(\frac{z - y_i}{z} \right)^{\alpha} \text{ , for the case of discrete distribution}$$

where , $\alpha \geq 0$ and can be interpreted as the degree of aversion to poverty, y_i is the average real spending of the household member i (per capita expenditure for adult person i), z is the poverty line,

N is the number of people in the sample population (all household members in adult equivalents),

M is the number of poor people (all household members in adult equivalents below the poverty line).

Poverty indices: By comparing the individual consumption with the corresponding poverty line value, a series of indices may be derived for the purpose of describing and comparing the poverty situations. The indicators most often used are the followings:

i) Incidence of poverty

This index is frequently called head count ratio which gives the percentage of the population classified as poor. It is the index obtained from the Foster, Greer and Thorbecke(FGT) equation when $\alpha = 0$. The FGT equation above reduces to $p_0 = M/N$, the number of poor people in the population divided by the number of population in the sample population when $\alpha = 0$. This is the commonly used and easy to interpret measure of poverty incidence. Although it is easy to interpret, the headcount index is not sensitive to how far below the poverty line poor people are. More simply, the headcount index is the share of the population whose consumption is below the poverty line, that is, the share of the population that cannot afford to buy a basic basket of goods and essential nonfood items.

ii) Intensity of poverty (depth of poverty index)

When $\alpha = 1$, $P_1 = \frac{1}{N} \sum_{i=1}^M \left(\frac{z - y_i}{z} \right) = \frac{M}{N} \left(\frac{z - y_i}{z} \right)$ is the aggregate poverty gap for the discrete case. The poverty gap provides information regarding how far the households are from the

poverty line. This measure captures the mean aggregate consumption shortfall relative to the poverty line across the whole population. In other words, it estimates the total resources needed to bring all the poor to the level of the poverty line.

iii)Severity of poverty index

When $\alpha = 2$ the FGT equation above reduces to $P_2 = \frac{1}{N} \sum_{i=1}^M \left(\frac{z - y_i}{z} \right)^2 = \frac{M}{N} \left(\frac{z - y_i}{z} \right)^2$ and this is the

poverty severity index which is sensitive to the distribution of living standards among the poor. Poverty severity (squared poverty gap index) takes into account not only the distance separating the poor from the poverty line (the poverty gap), but also the inequality among the poor. It places a higher weight on those households further away from the poverty line.

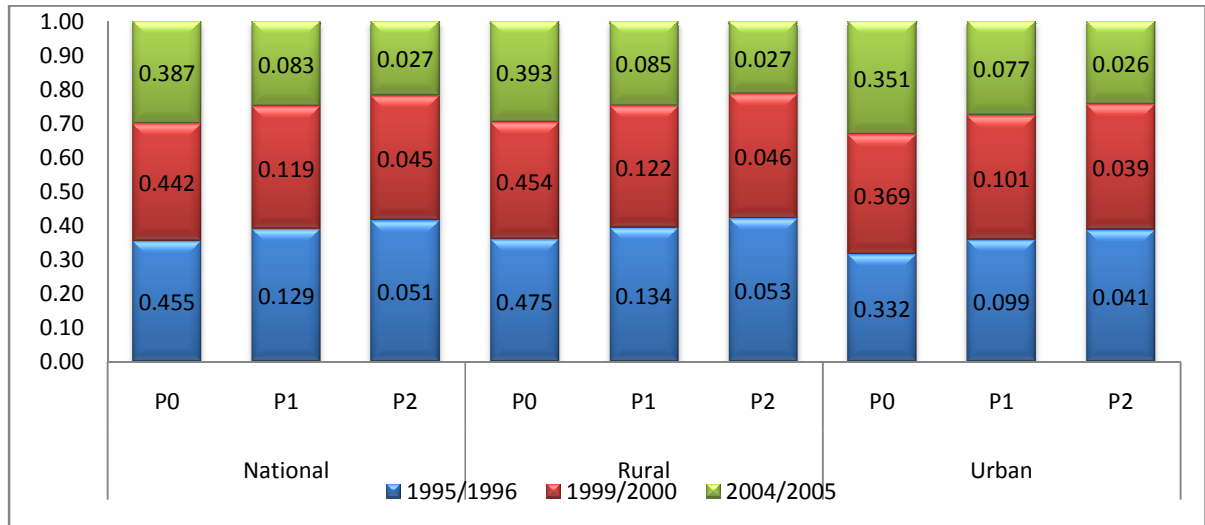
The state of poverty in Ethiopia is widespread and deep-rooted. Over the last decades, the country faces chronic food deficits as a result of which millions of people annually depend on food aid. Government statistics (MOFED, 2008) based on the CSA HICES (2004/05) illustrated that in terms of a consumption-based measure of poverty, 38.7 percent of Ethiopians were poor in 2004/05, implying that 27.5 million people were living below the poverty line. Poverty is slightly higher in rural areas (39.3 percent) than it is in urban areas (35.1 percent). According to this report the poverty gap got reduced and so did the severity of poverty in Ethiopia.

The report revealed that the headcount poverty rate fell in rural areas from 0.475 in 1995/96 to 0.393 in 2004/05. Over the same period, in urban areas it rose slightly, from 0.332 to 0.351. Consequently, while the incidence of poverty remains higher in rural areas, the rural-urban poverty gap has narrowed appreciably. A study by Tassew *et.al* (2008) confirmed that poverty is still pervasive in Ethiopia although declined over the period 1995/96 to 2004/05 by 6.7 per cent.

It is evident from the head count, the depth and severity of poverty indices that poverty is a rural phenomenon in Ethiopia though it is acute to some urban peoples. However, there is an indication of a fall in poverty in rural areas while in general speaking there is a tendency of rise

in poverty over the urban people (Fekadu *et.al*, 2007).The report supports this conclusion and need to work towards reducing poverty in urban areas.

Figure: 3.4.1 Poverty in Ethiopia(the order from bottom:1995/96,1999/00,and 2004/05)



Inequality indices

The most widely used single measure of inequality is the Gini coefficient. It is based on the Lorenz curve, a cumulative frequency curve that compares the distribution of a specific variable (for example, income) with the uniform distribution that represents equality. To construct the Gini coefficient, it is important to graph the *cumulative* percentage of households (from poor to rich) on the horizontal axis and the *cumulative* percentage of expenditure (or income) on the vertical axis (Khandker *et.al*, 2009).

Here, the diagonal line represents perfect equality. Accordingly, the Gini coefficient is defined as

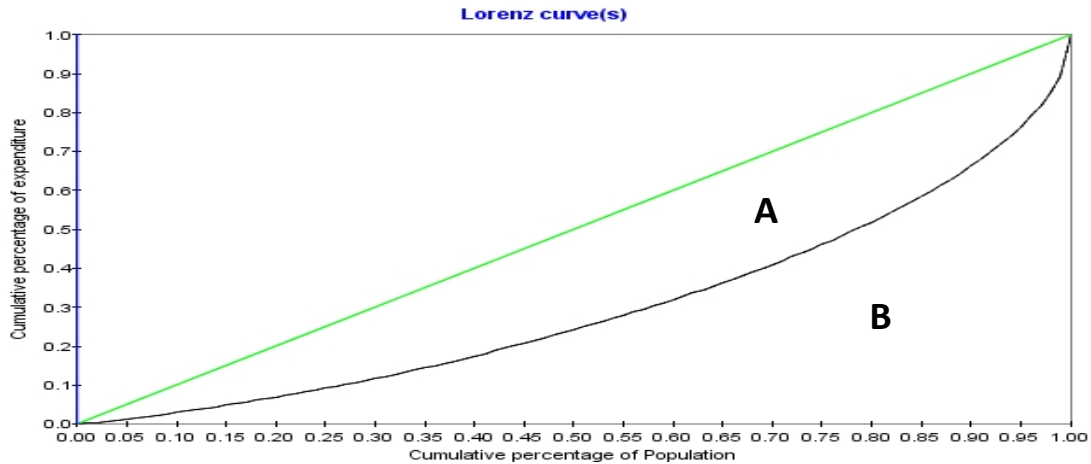
$\frac{A}{A+B}$, where A and B are the areas shown in the figure below. If A = 0, the Gini coefficient

becomes 0, which means perfect equality, whereas if B = 0, the Gini coefficient becomes 1, which means complete inequality. In the figure below, since the rectangle is a unit area rectangle,

the area below the 45-degree line is half of the unit area of the rectangle i.e $A+B=\frac{1}{2}$. It

follows that, $Gini = \frac{A}{A+B}$ implies that $Gini = \frac{A}{A+B} = 2A$. Thus, $\frac{Gini}{2} = A$.

Figure 3.4.2 Lorenz Curve



If all had the same income, the cumulative percentage of total income held by any bottom proportion p of the population would also be p . The Lorenz curve would then be $L(p) = p$: population shares and shares of total income would be identical. A useful informational content of a Lorenz curve is thus its distance, $p - L(p)$, from the line of perfect equality in income. Compared to perfect equality, inequality removes a proportion $p - L(p)$ of total income from the bottom $100.p$ % of the population. If we were then to aggregate that deficit between population shares and income shares in income across all values of p between 0 and 1, we would get half the well-known Gini index ,that is,

$$\frac{Gini}{2} = \int_0^1 (p - L(p)) dp.$$

Another useful interpretive property of the standard Gini index demonstrated by J.Duclos et.al(2006)is that it equals half the mean-normalized average distance between all incomes i.e the Gini $(\rho = 2)$ can be defined as:

$$I(\rho = 2) = \frac{\int_0^1 \int_0^1 |Q(p) - Q(q)| dp dq}{2\mu}, \text{ where } Q(.) \text{ are incomes(or expenditure)}$$

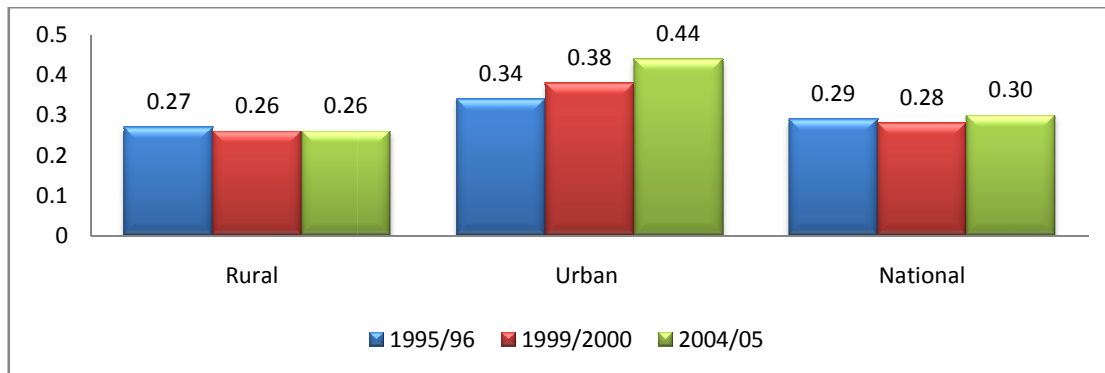
Thus, if we find that the Gini index of an income distribution equals 0.4, then we know that the average distance between the incomes of that distribution is of the order of 80% of the mean.

According to Duclos *et.al* (2009), the Gini index can also be computed as the integral of a simple transformation of the familiar cumulative distribution function. Recalling that $F(y)$ and $1 - F(y)$ are simply the proportions of individuals with incomes below and above y . If we integrate the product of these proportions across all possible values of y , we again obtain the Gini coefficient:

$$I(\rho = 2) = \frac{\int F(y)(1 - F(y))dy}{\mu}.$$

Like any developing countries, income distribution is one of the problems that Ethiopia needs to work on. According to MOFED (2008), trends in consumption inequality as measured by the Gini coefficient increased at the national level from 0.28 to 0.30. For Urban areas the increase in the Gini coefficient is substantial which is from 0.38 to 0.44 while the Gini coefficient for the rural areas has not been changed at all indicating that the overall increase in income is due to the increase in urban areas.

Figure: 3.4.3 Trends in inequality, Gini Coefficient (Bar orders left to right: 1995/06, 1999/2000, 2004/05)



Source: MOFED

4. Model Specification and Data Analysis

4.1 Introduction

Computable general equilibrium (CGE) models are widely used for assessing policy impacts and are recognized as powerful tools in economic analysis. The CGE model captures economy-wide growth linkages, which the partial equilibrium approach cannot do.

The CGE model used here is based on those of Dervis, deMelo and Robinson (1982) and Lofgren *et.al* (2001). Value added in production is modelled using constant elasticity of substitution (CES) production function of factor inputs (land, livestock ,capital and various types of labour). Intermediate inputs into production are determined as fixed share of the quantity of output. Imported goods are assumed to be imperfect substitutes of the domestically produced and consumed goods; similarly exported goods are assumed to be imperfect substitutes of the domestically produced and consumed products. Incomes of the various factors are allocated to households and other institutions on the basis of factor endowments reflected in the factor payment shares in the base SAM. Household consumption is modelled using a Linear Expenditure System (LSES) specification.

In this study we employ a static general equilibrium model (the International Food Policy Research Institute's (IFPRI) standard, static CGE model) to examine effects of tariff reduction and tax replacement on growth, poverty and income distribution. The base data is the EDRI/IDS 2005/06 Ethiopian National Social Accounting matrix and the 2004/05 Household Income, Consumption and Expenditure Survey (HICES) are also used.

The model is calibrated to the Ethiopian Development Research Institute's National social accounting matrix (EDRI/IDS SAM) of 2005/06. The GAMS software is used to check for the consistency of the data with the equilibrium conditions and to perform the simulations. The benchmark equilibrium must be replicated with the use of calibrated parameters and base year

data. The pre-shock values for the variables are obtained from the solution of the specified model. The post shock effects of these simulations are used to find the effects on poverty and the incomes of households. The DAD software is used to evaluate the poverty and inequality measures.

The EDRI/IDS SAM USED

This paper is based on the 2005/06 EDRI/IDS SAM. This SAM is a complete and new construction, separate from the 2001/02 SAM. It distinguishes 99 productive sectors or activities and 93 commodities, including 24 distinctly identified own-consumed commodities (non-marketed commodities that are produced and consumed by farmers). This SAM included 14 household groups, distinguishing rural households by different income levels in each of the five regions (agro-ecological zones).

Urban households are also distinguished by income and size of urban settlement. The SAM also distinguishes 26 factors of production, five labour types disaggregated based on occupational category, i.e. agriculture labour, administrative workers, professional workers, unskilled and skilled workers. There are also 10 rural capital and land factor disaggregation- two for each agro-ecological zone, and another 10 rural livestock capital that explicitly take into account livestock that is used in production in each agro-ecological zone. Finally, a non-agricultural capital/land factor of production is also distinguished. This level of disaggregation of the factors of production in the economy not only fully captures the production heterogeneity of the country, but also traces factor income flows from the regionally differentiated activities to the different households. Finally, the regionalized SAM also distinguishes other final demanders like the government, rest of the world, savings and investment, and “stock change” accounts. It also has a detailed accounting of the existing tax system by separately identifying nine direct and eight indirect taxes.

For the purpose of this study, the initial disaggregated SAM is aggregated into the new SAM that is compatible to the IFPRI's 15 sector standard CGE model of Ethiopian economy developed by Paul Dorosh and his staff. The final SAM contains 15 activities, 15 commodities, 4 factors of production, 4 household groups, 3 tax accounts. Finally, the aggregated SAM includes other final demanders like the government, rest of the world, savings and investment.

4.2 Description of the Model

As stated above, in this study we employ a static general equilibrium model (the International Food Policy Research Institute's (IFPRI) standard, static CGE model) to examine effects of tariff reduction with a simultaneous tax replacement on growth, poverty and income distribution. The major description of this model includes the derivation of production and prices, commodity flow, the generation of institutional income and demand. Equilibrium is maintained through a series of system constraints.

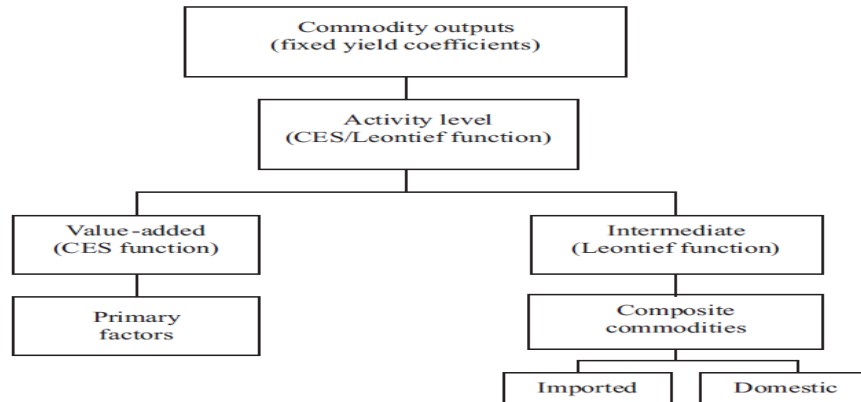
Production and prices

Producers in the model make decisions in order to maximize profits subject to production technology. The CGE model incorporates the first-order conditions for profit maximization for producers (Lofgren *et al.*, 2002). In the first stage, each activity j is a combination of value added and total intermediate consumption according to Leontief production function.

Producers respond to changes in relative factor returns by smoothly substituting between available factors so as to derive a final value-added composite.

Profit maximization implies that the factors receive income where marginal revenue equals marginal cost based on endogenous relative prices. The factors are combined with fixed-share intermediate input using a Leontief specification. The use of fixed-shares reflects the belief that the required combination of intermediates per unit of output, and the ratio of intermediates to value added, is determined by technology rather than by the decision-making of producers.

Figure 4.1 Production Technology



Source: Lofgren et.al (2002)

The final price of an activity's output is derived from the price of value-added and intermediates, together with any producer taxes or subsidies that may be imposed by the government per unit of output. Consumer price index (CPI) is endogenous and domestic producer price index (DPI) is exogenous variable.

Commodity flow

It shows the flow of a single commodity from being supplied to the market to its final demand.

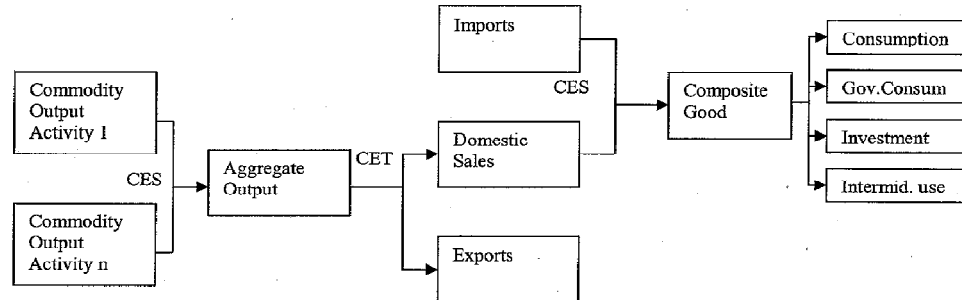
The main features are as follow:

The supply of a particular commodity from each producer is combined to derive aggregate commodity output. The aggregate commodity output is governed by a CES function which allows demanders to substitute between the different producers supplying a particular commodity, in order to maximize consumption subject to relative supply prices. The decision of producers is governed by a constant elasticity of transformation (CET) function, which distinguishes between exported and domestic goods, and by doing so, captures any time or quality differences between the two products.

Profit maximization drives producers to sell in those markets where they can achieve the highest returns. Domestically produced commodities that are not exported are supplied to the domestic

market. Substitution possibilities exist between imported and domestic goods under a CES Armington specification. It takes place both in final and intermediates.

Figure 4.2 Flow of marketed commodities



Source: Morley and pineiro (2006)

The Armington elasticities vary across sectors, with lower elasticities reflecting greater differences between domestic and imported goods. The small country assumption implies that Ethiopia is assumed to face infinitely elastic world supply at fixed world prices. The final ratio of imports to domestic goods is determined by the cost minimizing decision-making of domestic demanders based on the relative prices of imports and domestic goods (both of which include relevant taxes)

Institutions and Domestic demand

The model distinguishes between various institutions based on the Ethiopian SAM, including enterprises, the government, households and Rest of the world. Enterprises are the sole recipients of capital income which they transfer to household after having paid corporate taxes, saved and remitted profits to the rest of the world.

Based on macro SAM, Households are divided into four income divisions as rural-poor, rural-nonpoor, urban-poor and urban- nonpoor. Households within each income category are assumed to have identical preferences, and are therefore modelled as ‘representative’ consumers. Consumer preferences are represented by a linear expenditure system (LES) of demand, which is

derived from the maximization of a Stone-Geary utility function subject to a household budget constraint.

Government earns most of its income from direct and indirect taxes, and then spends it on consumption and transfers to households. Both of these payments are fixed in real terms. Government has both revenue and expenditure part. Domestic demand is the sum of household consumption demand for home and marketed commodity, investment demand, government consumption demand, transaction demand for service inputs and intermediate consumption demand.

System constraints

Equilibrium in the goods market requires that demand for commodities equal supply. Aggregate demand for each commodity comprises household and government consumption spending, investment spending, and export and transaction services demand. Supply includes both domestic production and imported commodities. Equilibrium is attained through the endogenous interaction of domestic and foreign prices, and the effect that shifts in relative prices have on sectoral production and employment, and hence institutional incomes and demand. The supply of this factor is responsive to changes in real wage, which adjust to ensure that demand and supply are equal in equilibrium (Throw, 2004).

The system constraint includes factor market, composite commodity market, and current account balance for the rest of the world, government balance and saving –investment balance.

Macroeconomic closures

The model includes three broad macroeconomic accounts: the current account, the government balance and the savings and investment account. In order to bring about equilibrium in the various macro accounts, it is necessary to specify a set of ‘macroclosures’ rules which provide a mechanism through which adjustment is assumed to take place(ThurLOW,2008).

Rest of the World Closure (ROWCLOS): the level of foreign savings is fixed in foreign currency terms. In the context of a trade shock, any widening of the trade deficit due to growth in imports exceeding growth in exports must therefore be offset through an overall reduction of spending on imports from all sources together with an overall increase in export earnings. This response is implicitly affected through a real exchange rate adjustment. Therefore the study use flexible exchange rate and fixed foreign saving.

Government Balance (GOVCLOS): real expenditures and tax rates are fixed and government savings are flexible. Accordingly, the budget balance adjusts through a change in direct and indirect tax receipts, these are policy measures. Thus the study chooses that government savings are flexible and taxes are at fixed rate.

Savings-Investment Balance: the savings rates of non government institutions are fixed, and investment adjusts to ensure that savings equals investment in equilibrium. Hence, an increase in government dis-saving implicitly “crowds out” investment by drawing down the amount of loanable funds available to the private sector. Therefore the study chooses that investment is saving driven closure.

At the end, the consumer price index is assumed to be flexible while the producer’s price index (DPI) is chosen as the numéraire, such that all prices in the model are relative to the weighted unit price of producers’ initial consumption bundle. The model is homogenous of degree zero in prices, implying that a doubling of all prices does not alter the real allocation of resources. Accordingly, the model cannot capture interactions between the financial and real sectors of the economy.

4.2.1 The Microsimulation Model

There are two approaches in analysing poverty and income distribution using CGE .The first approach is the traditional or representative approach in which the representative household rather than the actual households are used. This approach disaggregates households as much as

possible based on socio-economic or location criteria. Then analysis will be made about the impact of the policy on income and welfare. However, this approach does not provide information on poverty within group distribution.

The second approach in poverty and inequality analysis is the microsimulation analysis. Unlike the representative approach it makes explicit use of the household survey data. There are two alternative ways in this approach; the integrated approach and the layered (the top-down) approach (Davies, 2004). The integrated approach includes large or all of the household data into the CGE model, however, this approach is difficult to manage and reconcile the data.

On the other hand, in the sequential (top-down) approach there two layers: first layer and second layer. In the first stage called the top layer, the CGE model is made to capture changes in prices, income, consumption and other macro variables. The second layer is the household microsimulation model incorporating the entire household income and consumption survey data (Davies, 2004, 2009).

To link the CGE results with the household data, the CGE results of before and after simulation (policy shocks) on consumption and income are used as inputs into the microsimulation model. This is how the top-down the sequential or approach of analysing poverty and inequality all about using CGE (Davies, 2004).

In this paper, we implement the sequential (top-down) microsimulation model. We first solve the CGE model and feed the changes in consumption into the household microsimulation model. The model utilizes the Central Statistics Agency (CSA) household survey data of 2004/05 which was used for the construction of the EDRI SAM that is being used in this study. The analysis of poverty and income distribution will be analysed using the DAD software.

4.3 Base-Run Statistics and Simulation Results

4.3.1 Base-Run Macroeconomic and Sectoral Statistics

The structure of Ethiopian economy in the benchmark year revealed that agriculture constitutes a large share (48.1 per cent) of the total value added and about 29.2 per cent of the total gross value of production (Table 4.3.1). However, it accounted only 22.4 per cent of the market supply implying that production of the agricultural sector is own consumed (non-traded). The non-tradable agricultural production (cntag) and the livestock sub sectors generated about 15 per cent of the total value added (15.0 percent and 14.4 per cent respectively). The industrial sector generates only 11.5 per cent of the total value added. The service sector, on the other hand, generates more than 40 per cent of the total value added. The industrial sector accounts for 28.6 percent and that of the service sector accounts about 42.2 percent of the gross value of production. Nearly 5.6 percent of the GDP are agricultural exports while about 1.8 percent of the GDP are agricultural imports. Industrial exports account for 2.6 percent of the gross value added while industrial imports account for about 27.2 percent of the gross value added, mean while, the service export account for 6.7 percent of the gross value added and service imports account for 11.4 per cent of the gross value added. In aggregate export accounts for 13.7 percent of the gross value added while imports account for 38.4 percent of the gross value added.

The agricultural labour accounts for about 73.5 per cent of the total value added in the sector while the agricultural land generates about 100 per cent of the value added that the factor could have generated in the entire sector and capital generates only 1 per cent of the total value added in the agricultural sector. On the other hand, labour generates about 7.6 per cent and 19 per cent in the industrial and services, respectively. Capital generates about 20 per cent and 79 percent in the industrial and services sectors, respectively. This implies that agriculture is land and labour-intensive while the service sector is capital-intensive.

We can also observe that the agriculture sector constitutes the bulk of Ethiopia's export value followed by the service sector. It accounted for more than 41 per cent of the total export value (5.6 per cent of GDP) while the agricultural import is less 5 per cent of the total import (less than 2 per cent of the GDP), implying that Ethiopia is net exporter of agricultural products. On the other hand, the country's export of industrial products (only 3.19 billion birr) which is much less than the industrial imports (33.30 billion birr) indicating that the highest trade deficit originated from the industrial trade imbalance.

Table: 4.3.1 Share of Sectoral Economic variables

Sector	GDP at FC		EXPORT		IMPORT		OUTPUT		% of Composite goods supply	Share of GDP generated by sectors at FC		
	Value	% of GDP at FC	Value	% of GDP at FC	Value	% of GDP at FC	Value	% of Total production		Labour	Land	Capital
Cteff	4.4	3.6	0.0	0.0	0.0	0.0	5.2	2.8	2.2	6.1	9.2	0.0
Cmzwh	8.1	6.6	0.0	0.0	1.6	1.3	9.6	5.1	4.9	11.1	16.8	0.0
Cntag	18.4	15.0	2.6	2.1	0.3	0.2	23.2	12.4	9.3	25.3	30.3	1.1
Cxcrp	10.3	8.4	3.7	3.1	0.3	0.2	9.0	4.8	2.8	10.9	43.7	0.0
Clive	17.6	14.4	0.5	0.4	0.0	0.0	7.7	4.1	3.2	20.1	0.0	0.0
Total Agricul	58.8	48.1	6.9	5.6	2.2	1.8	54.7	29.2	22.4	73.5	100.0	1.1
Cfood	2.9	2.4	1.1	0.9	1.6	1.3	17.8	9.5	8.2	1.7	0.0	3.9
Cfuel	0.0	0.0	0.0	0.0	5.7	4.7	0.0	0.0	3.6	0.0	0.0	0.0
Cchem	0.4	0.3	0.3	0.3	5.8	4.7	1.6	0.9	3.6	0.2	0.0	0.6
Cmach	0.1	0.1	0.4	0.3	12.3	10.0	0.7	0.4	6.8	0.0	0.0	0.2
Coman	2.4	1.9	1.3	1.1	7.9	6.5	8.3	4.4	7.9	2.0	0.0	2.4
Ccons	6.0	4.9	0.0	0.0	0.0	0.0	22.0	11.7	9.6	2.6	0.0	9.2
Cutil	2.3	1.9	0.1	0.0	0.0	0.0	3.1	1.7	1.3	1.1	0.0	3.4
Total Indust.	14.1	11.5	3.2	2.6	33.3	27.2	53.5	28.6	41.1	7.6	0.0	19.7
Ctrad	22.7	18.6	5.9	4.8	9.0	7.3	44.1	23.5	20.6	7.9	0.0	37.4
Cpsrv	15.4	12.6	0.8	0.7	2.4	2.0	17.9	9.6	8.5	3.7	0.0	27.3
Cgsrv	11.3	9.3	0.1	0.0	0.1	0.1	17.1	9.1	7.5	7.3	0.0	14.4
Total Service	49.4	40.4	6.7	5.5	11.4	9.3	79.1	42.2	36.5	18.9	0.0	79.2
Total	122.2	100.0	16.8	13.7	46.9	38.4	187.3	100.0	100.0	100.0	100.0	100.0

Source: Computed from EDRI SAM, 2005/06

The sources of household income differ among households slightly. The poor households generate a larger share of their income from labour where as labour is not the major source of income for the non-poor households (Table: 4.3.2). More than two-third of the income for poor rural households is generated from labour, about 63 per cent of the income for urban poor

households is generated from labour. On the other hand, the rural non-poor households generated about 40 per cent of their income from labour and only 37 per cent of the income of urban households is generated from labour.

Nevertheless, households don't differ in the way they use their income. A large share of their income (86 per cent) is spent on consumption (Table: 4.3.2). The rural poor households consume about 85 per cent of their income and they save about 15 per cent of their income where as they pay as tax to the government less than 1 per cent of their income. The rural non-poor households consume about 90 per cent of their income, save about 10 per cent of their income paying less than 1 per cent to government as an income tax. Similarly the urban poor households expend more than 86 per cent of their income, save about 13 per cent of their income paying nothing as income tax. Slightly different to other households, the urban non-poor households consume about 78 per cent of their income, pay about 9 per cent of their income to the government as income tax and save about 12.5 per cent of their income.

We can draw an implication from such structure of direct taxes that it may be possible to compensate the lost import tariff revenue with direct tax in which the poor will be affected less as their share of direct tax is the least (less than 1 per cent). The tariff reduction affects consumption, and hence poverty, through changes to price of imports and domestic sales. The changes of consumer price accompanying the reduction of imports and domestic sales price affects poor household as more than 84 per cent of their income is spent on consumption.

Table:4.3.2 Source and Uses of Household Income (Percentage of Total Income)

Household	Factor Income			Total Factor Income	Other Income	Total Income	Income Used			
	Labor	Land	Livestock				Consumption	Direct tax	Saving	Total Expenditure
hhd-rurp	66.36	3.61	7.31	77.28	22.72	100	84.77	0.18	15.05	100
hhd-rurn	40.19	30.47	5	55.54	44.46	100	89.8	0.13	10.07	100
hhd-urbp	62.79	0	0	62.79	37.21	100	86.34	0	13.66	100
hhd-urbn	37.54	0	0	37.54	62.46	100	78.91	8.62	12.47	100
Total	45.33	34.08	4.12	55.81	44.19	100	86.27	2.05	11.68	100

Source: Computed from EDRI SAM, 2005/06

4.3.2 Simulation Results

In the present experiment, we assume that government introduces tariff rate reduction on imports which change the import prices and inflows of goods. In this exercise a tariff rate is assumed to be reduced by 50 per cent. However, since tariff revenue accounts a significant share of total government revenue, we also assume that the government plans to replace the tariff revenue lost due to tariff rate reduction by rising domestic tax rates. To this end the government could have two possible tariff revenue replacement mechanisms. One of the ways by which government could replace the lost tariff revenue may be by raising domestic direct tax rate (household income tax, corporate income tax, etc). The other mechanism of replacing the tariff revenue loss may be by increasing the indirect tax rate (i.e by increasing the domestic consumption tax rate like VAT).

Consequently, this paper considers three simulation exercises so as to study the effect of tariff-tax coordination on the economy as a whole and household consumptions, poverty and income distribution in Ethiopia. Hence we have the following simulations in analysing the effects of tariff reduction and tax replacement in the Ethiopian context. In each simulation the tax rates are fixed at the rate which generates tax revenue that is equal to the tariff revenue lost.

Simulation 1 (SIM1): In the first simulation, we reduce the import tariff rate on all imports by 50 per cent and a simultaneous increase in the direct tax rate by 75 per cent to make the liberalization policy government revenue neutral. The rate by which direct tax rate is increased is determined in such a way that the total tariff revenue lost due to tariff rate reduction is equal in magnitude to the tax revenue collected by imposing the proposed tax rate(in the present case 75 % increase of direct tax rate).

Simulation 2(SIM 2): In the second simulation, we reduce the import tariff rate by 50 per cent. Simultaneously we increased indirect tax rate by 98 percent so that indirect tax revenue collected is equal in magnitude to the tariff revenue lost while reducing tariff rate. This tariff-tax coordination policy remained government revenue neutral as in the first simulation.

Simulation 3(SIM 3): In the third simulation, there is only a 50 per cent import tariff rate reduction with no tax replacement. This simulation is introduced to examine the effect of tariff reduction without any other tax imposition on the economy and households.

In order to assess the effects of tariff change, the deviation of the variables from the base line values are calculated where the base solutions are the values in the original SAM. The simulation results are presented and discussed below.

4.3.2.1 Macroeconomic Impacts

In the first simulation (SIM1), following the reduction of tariff rate, import price of the industrial goods declined and consequently import quantity increased by 2.5 per cent (Table: 4.3.3). However, due to the assumption of flexible exchange rate, the domestic currency (Birr) depreciates by about 2.3 per cent and exporters get motivated to export more leading to about a 7 per cent increase in the quantity of exports. Due to the more tariff reduction effect (pressing the price down) over the exchange rate effect (pushing the domestic price up), the consumer price index (CPI) declined by almost 1 per cent and hence real private consumption increased by

about 0.1 per cent. As a result, real absorption and real DGP at market price increased by 0.5 per cent and 0.6 per cent, respectively. However, the increase in real GDP at factor cost is less than that at market prices (only about 0.4 per cent). Consumption expenditure increased for all households except for the urban non-poor households in which case it declined by about 6 per cent as these households are principal tax payers.

In the second simulation (SIM2) due to the reduction of tariff rate, import price of industrial goods declined and consequently import quantity increased by 2.1 per cent. The increase in import caused depreciation of exchange rate by almost the same quantity as in the first simulation (about 2.3 per cent) and exports increased by about 6 per cent. However, since the tariff replacement tax is imposed on the domestic consumption commodities, the domestic price level increases as indicated by a consumer price index (CPI) rise of 0.6 per cent.

As a result, real private consumption declined and so did the real GDP at factor cost (Value added). However, real GDP at market price and real absorption slightly increased by 0.2 per cent and 0.15 per cent, respectively.

In spite of the increase in CPI, expenditure for all household types increased as most expenditure, especially in poor households, is on basic needs (Food, shelter and clothing).

In the third simulation (SIM3) the reduction in tariff rate with no tax replacement induced the import price to decline and consequently quantity import increases by 2.34 per cent. However, the exchange rate depreciated by almost 3 per cent which triggered exporters to export more leading to a 6.6 per cent increase in exports. This exchange rate effect on domestic price level is offset by the reduction of tariff rate and the domestic CPI declined by about 0.3 per cent. As a result, private consumption, real GDP, the household consumption expenditure for all household types increases.

The quantity of fixed investment increased nearly by 2.6 per cent in the first simulation and 2.0 per cent in the second simulation. However, fixed investment has declined by about 3.6 per cent in the third simulation which is not good for the country's future growth. The decline in fixed investment in the third simulation may have been the result of two consequences of trade liberalization: First, since tariff reduction reduced import prices and consumers shift to cheap imports, local firms' sales would decline and hence investment may not be profitable. As a result fixed investment by private sector generally may decline and only those firms in the export sector would be profitable while those import competing firms would either reduce production or shutdown. Second, given that tariff revenue accounts a significant share of the total government revenue and massive investment are being implemented by government on services, health and other infrastructures, tariff reduction without tax replacement by drain governments financing capacity. Consequently, government may reduce public investments and hence fixed investment declined.

Table: 4.3.3 Macroeconomic Results (% change from Base run)

Sector	BASE	Simulation 1	Simulation 2	Simulation 3
ABSORPTION	162.48	0.51	0.15	0.77
PRIVATE CONSUMPTION	114.75	0.08	-0.27	1.97
FIXED INVESTMENT	28.18	2.59	1.97	-3.59
EXPORTS	16.77	6.86	5.82	6.56
IMPORTS	-46.93	2.45	2.08	2.34
GDP (MARKET PRICE)	132.32	0.62	0.19	0.94
NET IDIRECT TAX	10.10	4.22	3.71	3.91
GDP(FACTOR COST)	122.22	0.37	-0.06	0.74
CPI	1.13	-0.95	0.59	-0.27
REER	1.00	2.30	2.30	2.75
Consumption Expenditure by Households				
Rural poor households	21.06	0.56	0.02	1.66
Rural non-poor households	65.68	0.60	0.29	1.80
Urban poor households	4.31	1.05	0.58	1.77
Urban non-poor households	23.70	-6.13	0.80	1.83

Source: Model simulation

4.3.2.2. Sectoral Effects

As import prices are negative functions of the tariff rate, but directly related to exchange rate and other import trade margins, the reduction of tariff rate induced a fall in import prices on industrial commodities (Food, Chemicals, Machinery and vehicles, Other manufacturing) that were highly protected while the prices of non-industrial commodities which originally faces lower tariff rate increased. This was due to the fact that for the highly protected commodities (industrial commodities), the import tariff rate effect dominated the exchange rate effect. The price adjustment induced a decrease of quantities in the non industrial commodity imports and an increase in industrial commodity imports (Table: 4.3.4). Consequently, the domestic demand price of the industrial commodities declined and the local producers of industrial commodities confront with a decrease in domestic demand and hence their sales declined in all the simulations.

Table:4.3.4 Effect of tariff reduction on prices³(% change from the base)

Sectors	Import price			Price of domestically produced & sold goods			Producers price			Price of exports		
	pm ₁	pm ₂	pm ₃	pd ₁	pd ₂	pd ₃	px ₁	px ₂	px ₃	pe ₁	pe ₂	pe ₃
Teff	nm	nm	nm	0.08	0.15	0.41	0.01	0.03	0.31	ne	ne	ne
Mzwh	2.28	2.35	2.75	0.15	0.24	0.50	0.04	0.07	0.36	ne	ne	ne
Cntag	2.26	2.42	2.75	0.28	0.49	0.67	0.28	0.30	0.59	2.37	2.14	2.73
Cxcrp	2.17	2.40	2.69	0.18	0.29	0.97	0.56	0.41	1.15	2.41	2.04	2.73
Clive	nm	nm	nm	0.43	1.30	0.86	-0.32	-0.78	0.43	2.33	2.24	2.74
Cfood	-3.98	-3.80	-3.51	-0.64	-1.60	0.43	-0.85	-1.96	0.28	2.38	2.13	2.73
Cfuel	1.08	1.43	1.63	np	np	np	np	np	np	ne	ne	ne
Cchem	-4.30	-4.03	-3.80	-2.46	-1.99	-1.73	-2.62	-2.47	-1.99	2.44	1.98	2.72
Cmach	-5.39	-5.22	-4.92	-2.83	-2.52	-2.65	-0.94	-0.91	-0.67	2.37	2.13	2.73
Coman	-8.36	-8.10	-7.88	-3.84	-3.12	-3.50	-4.28	-3.85	-4.07	2.44	1.98	2.72
Ccons	nm	nm	nm	0.31	0.82	-4.94	0.30	0.80	-5.03	ne	ne	ne
Cutil	nm	nm	nm	-1.72	-1.54	0.17	-1.57	-1.41	0.20	2.30	2.30	2.75
Ctrad	2.30	2.30	2.75	1.87	1.75	2.82	1.93	1.83	2.81	2.30	2.30	2.75
Cpsrv	2.30	2.30	2.75	-0.18	-0.60	1.50	-0.07	-0.47	1.55	2.30	2.30	2.75
Cgsrv	2.30	2.30	2.75	-0.51	0.13	-0.14	-0.50	0.14	-0.13	2.30	2.30	2.75

Source: Model simulation

This domestic Sales decrease in the industrial commodities reduced the output (production) of industrial activities and as a result the domestic industries tend to shrink. However, the increase in the export price of industrial commodities might have some degree of motivation for the domestic producers to continue production rather than shutting down at least to exist in the market. Similarly, the import price of service sector (trade, private service and government

³ Pm₁ =import price in simulation1 (SIM1), Pm₂ =import price in simulation2 (SIM2), Pm₃ =import price in simulation3 (SIM3)

Pd₁ =domestic demand price in simulation1 (SIM1) ,Pd₂ = domestic demand price in simulation2 (SIM2)

Pd₃ = domestic demand price in simulation3 (SIM3),Px₁ = producers price in simulation1 (SIM1)

Px₂ = producers price in simulation2 (SIM2),Px₃ = producers price in simulation3 (SIM3)

Pe₁ = export price in simulation1 (SIM1),Pe₂ = export price in simulation2 (SIM2)

Pe₃ = export price in simulation3 (SIM3), nm= no import ,np=no production ,ne=no export

services) tends to increase. However, the domestic sales price especially in the private service declined particularly in the first and second simulations. Nevertheless, increase in the export prices of these commodities may have increased the interest of private service producers to export their service to the rest of the world.

Table: 4.3.5 presents the effects of tariff reduction on quantities. As the import price of commodities in the agricultural and service sectors increased, the quantity of imports in these sectors decreased. This led to the decrease in the quantity of import of agricultural and service commodities which further increased domestic sales quantity especially in the commodity teff, wheat and maize. However, quantity of domestic sales in the cash crops (Cxcrp) and live animals(Clive) decreased as the increase in the export price diverted the domestic sales quantity to be exported in the case of cash crops .

In the first simulation (SIM1), the domestic demand price of commodity teff (cteff) increased marginally (by only 0.08 per cent) and consequently the output price of activity teff(ateff) increased very marginally as well(only 0.01 per cent). This caused the production of teff (ateff) to decrease by 0.81 per cent as production of other commodities is rewarding than it is. As a result, quantity of domestic sales of commodity teff declined by about 0.81 per cent. We can see, however, that the increased price of agricultural commodities' and reduction in import quantity of these commodities increased the domestic sales of these commodities (except for commodity teff and commodity cash crop) and hence quantity of domestic production in these sector increased. The decrease in the import price of industrial commodities resulted in a massive quantity of import of industrial commodities. This induced the quantity of domestic sales to decline and the level of domestic production to shrink as well. To cope this, the domestic industrial commodity producers limit their level of production and need to export some of their

commodities just to survive in all the three simulations. These two conditions induce a rise in the level of domestic production and quantity of export in the agricultural activities.

In the second simulation (SIM2), reduction in import tariff rate caused a decline in the quantity of import in the agricultural commodities. However, it increased the quantity of import in the industrial commodities. This increase in the import demand of the cheap industrial commodities in the local market caused the sales of domestically produced industrial goods to decline which causes the domestic industries to reduce their production and partly to look for market elsewhere thereby increasing the export in such commodities.

Table 4.3.5 Effect of tariff reduction on Quantities ⁴(% change from the base)

Sectors	Quantity of import			Quantity of domestic sales			Domestic production			Quantity of export		
	QM ₁	QM ₂	QM ₃	QD ₁	QD ₂	QD ₃	QX ₁	QX ₂	QX ₃	QE ₁	QE ₂	QE ₃
cteff	nm	nm	nm	-0.81	0.07	1.27	-0.81	0.07	1.27	ne	ne	ne
cmzwh	-7.8	-8.06	-7.22	1.26	0.88	2.41	1.26	0.88	2.41	ne	ne	ne
cntag	-6.07	-6.19	-5.54	0.07	-0.21	0.96	0.73	0.37	1.67	7.87	6.62	8.99
cxcrp	-4.92	-5.52	-3.38	-0.22	-0.57	0.7	1.86	1.29	2.4	6.23	5.21	5.97
clive	nm	nm	nm	-0.74	-1.52	0.5	-0.5	-1.39	0.74	3.25	0.57	4.54
cfood	12.57	5.76	16.44	-1.35	-3.07	-0.19	-0.8	-3.06	-0.15	12.57	15.45	10.59
cfuel	0.37	0.08	-1.21	np	np	np	np	np	np	ne	ne	ne
cchem	2.5	2.39	3.84	-3.74	-4.5	-3.21	-0.56	-1.78	-0.27	17.54	13.81	16.46
cmach	2.18	2.8	0.4	-8.28	-8.25	-8.74	3.83	2.69	3.65	16.48	14.51	17.14
coman	10.27	9.79	9.35	-7.96	-9.93	-8.12	-4.11	-6.75	-4.23	23.64	16.28	23.77
ccons	nm	nm	nm	2.23	1.69	-3.14	2.23	1.69	-3.14	ne	ne	ne
cutil	nm	nm	nm	-0.36	-0.47	0.38	-0.22	-0.33	0.47	7.54	7.05	5.35
ctrad	-0.28	-0.86	0.98	0.53	0.16	0.84	0.64	0.3	0.82	1.35	1.19	0.71
cpsrv	-4.77	-5.65	-2.12	-0.22	-0.34	0.17	0.00	-0.09	0.28	4.55	5.27	2.53
cgsrv	-5.21	-3.99	-5.13	-0.06	0.00	0.14	-0.04	0.02	0.16	5.37	4.17	5.7

Source: Model simulation

With the exception of live animal production, the price of value added and the quantity of value added increased(in the agricultural activities) in all the simulation, suggesting that there is an increase in the effective demand for labour and improved wages in the agricultural areas(see Table 4.3.6). Generally, a tariff cut is likely to bring about demand linkages in the rural areas. As

⁴ QM₁ =Quantity of import in simulation1 (SIM1) ,QM₂ =Quantity of import in simulation2 (SIM2)
QM₃ =Quantity of import in simulation3(SIM2) ,QD₁ =Quantity of Domestic Sales in simulation1 (SIM1)
QD₂ =Quantity of Domestic Sales in simulation2 (SIM2), QD₃ =Quantity of Domestic Sales in simulation3(SIM2)
QX₁ =Quantity of Domestic production in simulation1 (SIM1), QX₂ =Quantity of Domestic production in simulation2 (SIM2)
QX₃ =Quantity of Domestic production in simulation3(SIM2), QE₁ =Quantity of Exports in simulation1 (SIM1)
QE₂ =Quantity of Exports in simulation2 (SIM2) QE₃ =Quantity of Exports in simulation3(SIM2)

the price of agricultural commodities increased following the tariff reduction, agricultural production has increased. This entails increased demand for labour and higher wages in the rural areas. That is, as the valued added in rural areas increased and the price of value added increased in rural area, the real income of the landless and the labour surplus households is likely to increase, thus leading to improved welfare of vulnerable groups. However, following the cheap industrial commodities import, there might be unemployment in the industrial sector as the demand for labour in these sectors declined in all the simulations causing some industries to shutdown or cut their production which led to a reduced real income of workers in the industrial areas (except for those workers in the construction and mining).

Table: 4.3.6 Sectoral value added effects of the tariff reduction ⁵(% changes from the base)

Sector	BASE	Quantity of aggregate value added			Value added price		
		QVA ₁	QVA ₂	QVA ₃	pva ₁	Pva ₂	Pva ₃
ateff	4.45	-0.81	0.07	1.27	0.36	0.26	0.65
amzwh	8.09	1.26	0.88	2.41	0.37	0.26	0.65
antag	18.36	0.73	0.37	1.67	0.33	0.23	0.60
axcrp	10.29	1.86	1.29	2.40	0.75	0.53	1.33
alive	17.60	-0.50	-1.39	0.74	-0.30	-0.84	0.45
afood	2.92	-0.80	-3.06	-0.15	-1.94	-7.23	-0.38
achem	0.37	-0.56	-1.78	-0.27	-1.85	-5.74	-0.91
amach	0.11	3.83	2.69	3.65	15.43	10.57	14.64
aoman	2.37	-4.11	-6.75	-4.23	-5.06	-8.21	-5.20
acons	5.99	2.23	1.69	-3.14	8.92	6.67	-11.24
autil	2.29	-0.22	-0.33	0.47	-0.73	-1.10	1.56
atrad	22.71	0.64	0.30	0.82	3.29	1.53	4.27
apsrv	15.37	0.00	-0.09	0.28	-0.02	-0.69	2.20
agsrv	11.31	-0.04	0.02	0.16	-0.09	0.04	0.33
	122.23	0.37	-0.06	0.74	-	-	-

Source: Model simulation

As shown below (Table 4.3.7), the labour demand in all industrial activities, except for the mining and construction sectors, declined in the first and the second simulations. Nevertheless, the aggregate labour demand in the overall industrial activities increased marginally in first simulation from 4.60 units to 4.62 units where as it declined in the other two simulations from

⁵ QVA₁ stands to quantity of value added in simulation 1, QVA₂ stands to quantity of value added in simulation 2 QVA₃ stands to quantity of value added in simulation 3.

the base demand of 4.60 units to 4.45 units and 4.32 units, respectively. Contrary to this, the aggregate labour demand in the service sector revealed a slight increase from 11.38 units in the base-run to 11.53 units in first simulation (SIM1), 11.44 units in the second simulation (SIM2) and 11.63 units in the third simulation (SIM3). In fact, all the increase in the labour demand came from the trade activity (atrad) and there was no change of the labour demand in activities of government services (agsrv) in the first and second simulations though there has been observed a marginal increase in the third simulation.

However, the aggregate labour demand in the in the economy has increased from the base-run of 60.30 units to 60.78 units in first simulation (SIM1), 60.23 units in the second simulation (SIM2) and 61.21 units in the third simulation (SIM3). There hasn't been any significant change in the demand of other factors (land, capital and livestock) following the tariff-tax coordination policy (different simulations). However, the labour demand in the agricultural sector increased in all the simulation results suggesting that liberalising trade leads the economy once again to concentrate in agriculture ignoring the industrial sector.

Table:4.3.7 Quantity Demanded of Factors from activity a

Sector (Activit)	Labor				Land				Livestock				Capital			
	BASE	SIM1	SIM2	SIM3	BASE	SIM1	SIM2	SIM3	BASE	SIM1	SIM2	SIM3	BASE	SIM1	SIM2	SIM3
ateff	3.67	3.65	3.68	3.73	0.78	0.76	0.77	0.77	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
amzwh	6.66	6.77	6.73	6.86	1.42	1.42	1.42	1.43	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
antag	15.27	15.42	15.35	15.59	2.57	2.55	2.55	2.55	0.00	0.00	0.00	0.00	0.52	0.52	0.52	0.52
axcrp	6.59	6.75	6.70	6.82	3.70	3.73	3.72	3.72	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
alive	12.13	12.04	11.88	12.26	0.00	0.00	0.00	0.00	5.47	5.47	5.47	5.47	0.00	0.00	0.00	0.00
AAgr	44.32	44.63	44.34	45.26	8.47	8.46	8.46	8.47	5.47	5.47	5.47	5.47	0.52	0.52	0.52	0.52
afood	1.03	1.01	0.94	1.02	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	1.89	1.89	1.89	1.89
achem	0.11	0.10	0.10	0.11	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.26	0.26	0.26	0.26
amach	0.03	0.03	0.03	0.03	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.08	0.08	0.08	0.08
aoman	1.22	1.13	1.07	1.12	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	1.15	1.15	1.15	1.15
acons	1.55	1.69	1.66	1.37	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	4.44	4.44	4.44	4.44
autil	0.66	0.66	0.65	0.67	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	1.63	1.63	1.63	1.63
AIND	4.60	4.62	4.45	4.32	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	9.45	9.45	9.45	9.45
atrad	4.74	4.89	4.81	4.93	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	17.97	17.97	17.97	17.97
apsrv	2.25	2.25	2.24	2.29	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	13.12	13.12	13.12	13.12
agsrv	4.39	4.39	4.39	4.41	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	6.92	6.92	6.92	6.92
Aserv	11.38	11.53	11.44	11.63	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	38.01	38.01	38.01	38.01
Total	60.30	60.78	60.23	61.21	8.47	8.46	8.46	8.47	5.47	5.47	5.47	5.47	47.98	47.98	47.98	47.98

Source: Model simulation

4.3.2.3. Impacts on Income, Welfare, Poverty and Inequality

a) Income and Welfare effects

As most poor households generate their income mainly from labour and land, the policy that brings higher factor income in the form of wages and income from land (rent) can have a significant role in improving the lives of poor. As shown in the following table (Table 4.3.8), the factor income from labour (wage) increases by 0.77 per cent, income from land (rent) increases by 2.09 per cent but income from Livestock declined nearly by 1 per cent on average in the first simulation. Factor income from capital increases by 2.3 per cent in the same simulation.

Incomes from these factors in the second simulation are generally smaller than the case in the former simulation (first simulation). Wage income declined by 0.10 per cent and income from livestock declined by about three folds as compared to the first simulation (declined by 2.68 per cent) while return from land (rent income) increased only by 1.48 per cent. Capital income(return to capital) increased by less than 1 per cent(about 0.47 %) in the second simulation suggesting that the first simulation produces incentives to capital accumulation as compared to the second simulation.

In the third simulation, wage income increases by about 1.54 per cent, returns from land increases by 3.73 per cent, return from livestock increases by 1.45 per cent and the return for capital increases by 1.30 per cent.

Table: 4.3.8 Effect of tariff reduction and tax replacement on Factor incomes (% change from the base)

House Hold Groups	Source of Income	BASE(Billion .Birr)	Simulation 1	Simulation 2	Simulation 3
Rural Poor Households	Labor	16.48	0.77	-0.10	1.54
	Land	0.90	2.09	1.48	3.73
	Livestock	1.82	-0.96	-2.68	1.45
Rural Non-Poor Households	Labor	29.4	0.77	-0.10	1.54
	Land	7.57	2.09	1.48	3.73
	Livestock	3.66	-0.96	-2.68	1.45
Urban Poor Households	Labor	3.14	0.77	-0.10	1.54
Urban Non-Poor Households	Labor	11.28	0.77	-0.10	1.54
Enterprises	Capital	48.23	2.3	0.47	1.30

Source: Model simulation

Consumption expenditure can be used as a proxy for measuring welfare based on the assumption that the more a consumer spends the improved welfare the consumer has. When we examine welfare from this context, consumption expenditure at household levels increased for all household types except for that of urban non-poor households in the first simulation exercise. In this simulation, the consumption level of only urban non-poor households declined since the tariff compensation tax (direct tax) is imposed on these groups of the household. In the second simulation (SIM 2), however, consumption in all households declined except for that of the urban non-poor households. This is because of the fact that the tariff replacement tax imposed on consumption does not discriminate the poor and non-poor causing the price of consumer goods to rise. In response to this, poor households may reduce their consumption where as the urban non-poor household may not cut their consumption even though the price of the goods has risen, since they can afford to buy their consumption demand. Contrary to these, in the third simulation, consumption increased in almost all household types and hence welfare has been improved but government loses tariff revenue.

Table:4.3.9 Quantity Consumed of Marketed Commodity by household(% change from the base)

Sector\hhd type	Simulation1(SIM1)				Simulation 2(SIM 2)				Simulation 3(SIM 3)			
	hhd-rurp	hhd-rurn	hhd-urbp	hhd-urnb	hhd-rurp	hhd-rurn	hhd-urbp	hhd-urnb	hhd-rurp	hhd-rurn	hhd-urbp	hhd-urnb
Teff	0.48	0.51	0.97	-6.20	-0.31	-0.04	0.26	0.47	1.24	1.38	1.35	1.42
Wheat and Maiz	0.11	0.15	0.60	-6.55	-0.64	-0.38	-0.08	0.13	0.84	0.98	0.95	1.02
Non-Traded Aggr.Commodoties	0.25	0.28	0.74	-6.42	-0.64	-0.37	-0.07	0.14	0.95	1.10	1.06	1.13
Cash Crops	0.30	0.34	0.79	-6.37	-0.63	-0.36	-0.06	0.15	0.61	0.75	0.72	0.78
Livestocks	0.13	0.17	0.62	-6.53	-1.66	-1.39	-1.10	-0.89	0.79	0.93	0.90	0.97
Food	1.57	1.61	2.07	-5.18	-3.13	-2.87	-2.58	-2.38	1.65	1.80	1.76	1.83
Fuel	-0.51	-0.48	-0.03	-7.13	-1.39	-1.13	-0.83	-0.63	0.03	0.17	0.14	0.20
Chemicals	4.75	4.79	5.27	-2.21	2.90	3.18	3.48	3.70	5.31	5.46	5.42	5.49
Machineries and Manufacturing	6.22	6.26	6.74	-0.85	4.78	5.06	5.37	5.59	6.86	7.01	6.98	7.04
Other Manufacturing	7.71	7.75	8.23	0.55	4.43	4.71	5.02	5.24	8.39	8.54	8.50	8.57
Construction	0.24	0.28	0.74	-6.42	-0.93	-0.67	-0.37	-0.16	6.95	7.10	7.06	7.13
Utilities	2.32	2.36	2.82	-4.48	-0.83	-0.57	-0.27	-0.06	1.49	1.63	1.60	1.66
Trade	-1.37	-1.33	-0.88	-7.92	-3.07	-2.81	-2.52	-2.31	-1.12	-0.98	-1.01	-0.95
Private Services	0.44	0.48	0.93	-6.24	-1.79	-1.53	-1.24	-1.03	0.01	0.15	0.12	0.18
Gov't Services	1.06	1.10	1.55	-5.66	-0.65	-0.39	-0.09	0.12	1.79	1.93	1.90	1.96

Source: Model simulation

The other indicator of welfare used in this study is the equivalent variation. In the present context, equivalent variation of reducing tariff is the amount of income, measured in current prices, that consumers (households) would be willing to forego and still have the same level of well-being as before the tariff was reduced.

The welfare of households in our simulation exercises, as captured by equivalent variation (EV), confirmed the previous result. In first simulation (SIM1), the reduction of tariff rate followed by an increase in the direct tax rate resulted to positive values of equivalent variation for all households except to that of the urban non-poor households. Consequently, the society as a whole marginally benefited from the tariff reduction when the lost government tariff revenue is compensated by direct tax. However, most of the welfare gained has been taken by the rural non-poor households (about 0.87 billion birr of the total 2.22 billion birr) and very little is addressed to the poor households (about 0.22 billion birr to rural poor and 0.08 billion birr to urban poor households) implying that this policy has

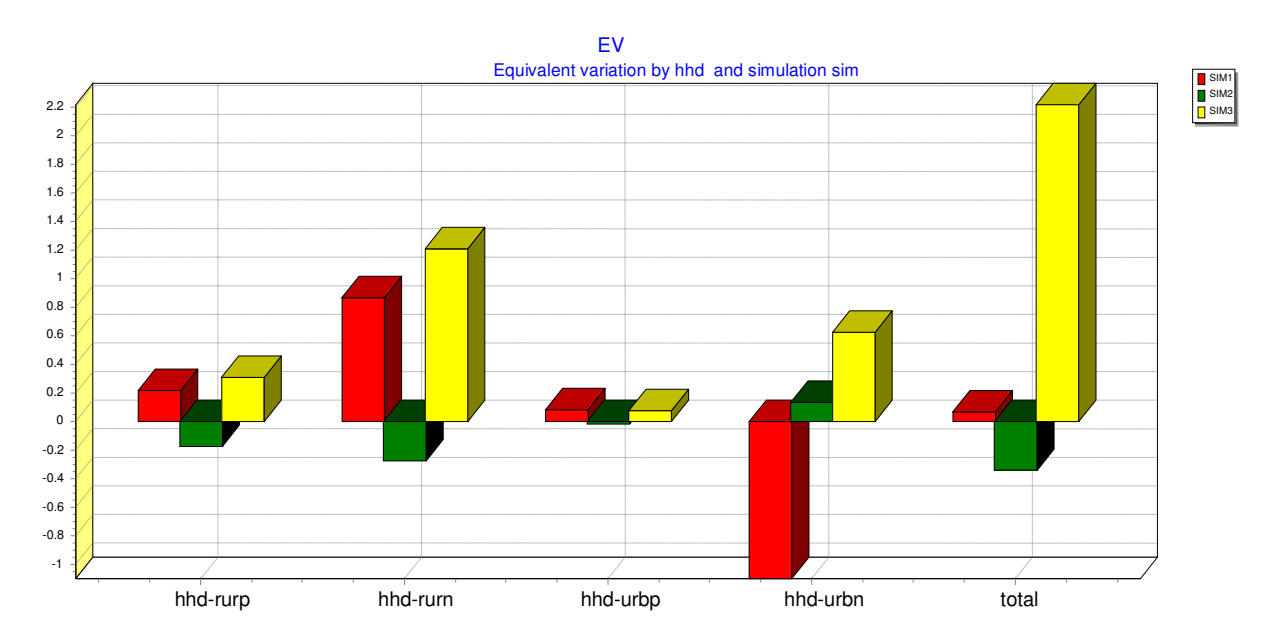
insignificant role in reducing poverty. On the other hand, the urban non-poor are suffering from losses in this scenario (loss of 1.10 billion birr).

In the second simulation (SIM2), the welfare indicator (equivalent variations), for all households (except to those of urban non-poor households) are negative indicating that these households loss their welfare where as the urban non-poor households benefit from the policy. The society as whole loses welfare from this policy as indicated by negative values of equivalent variation (EV).

In the third simulation (SIM3), all household types (poor as well as the non-poor) benefit from the policy with improved welfare to the society too. This is indicated by a positive value of welfare indicator, equivalent variation, (See Figure 4.3 below). The fact that the society as a whole benefit from this policy does not necessarily mean that it has an important role in reducing poverty as most of the welfare gains are directed to non-poor households (of the total 2.22 billion birr of additional welfare gained, about 1.21 billion birr goes to rural non-poor and about 0.62 billion birr goes to urban non-poor households). It is very small proportion of the welfare gained that has been directed to poor households (from the total 2.22 billion birr of additional welfare gained, only 0.31 billion birr and about 0.08 billion birr are shared respectively by rural poor and urban poor households).

The three simulation analysed witnessed that the tariff-tax coordination (trade liberalization) has insignificant role in reducing poverty and there are possibilities that such policies (especially tariff replacement by indirect tax) end up with a deterioration of welfare.

Figure 4.3 Effects in Welfare (Bar orders, left to right: simulation 1, simulation 2 and simulation 3)



Source: Model simulation

b) Poverty and Inequality Effects (The Microsimulation)

In the analysis of poverty and income inequality, the calculation of poverty indices (incidence of poverty, depth or intensity of poverty and severity of poverty) and inequality index (Gini coefficient) are obtained by providing the DAD software the before and after simulation consumption expenditures of households by adjusting these values using the percentage changes that are solved in the CGE model.

The EDRI SAM classified households groups as poor and non-poor by taking the bottom two quintiles (40 per cent) as poor and the upper three quintiles (60 per cent) as non-poor in both rural and urban households. However this classification may result in slightly different poverty indices from that of indices produced by MOFED. The objective of this paper is not to calculate these indices, rather to see the impact of the policy changes on these indices. Once the disaggregation of the CSA HICES data as poor and non-poor is made, based on the EDRI SAM classification and finding the before and after simulation consumption level of households, the

poverty lines are set in such a way that the calculated poverty indices at the base are as closer as possible to those calculated by MOFED .

In the analysis, some 21,594 households (of which 12,100 urban households and 9,494 rural households) were used. The total household expenditure was converted to consumption per adult per year by using the adult equivalent conversion factor and this value of consumption expenditure was considered to classify households as poor and non-poor. To make the base line indices consistent to those calculated by MOFED, once the households are classified as urban and rural, the bottom 39.3 per cent of the rural households and 35.1 per cent of the urban households were treated as poor.

Based on this argument the poverty line was set for both rural and urban households. For the rural household the poverty line was set to be birr 1,739 and for that of urban households it was set to be birr 2,006. However, for the national level the poverty line was calculated as the weighted average of the poverty lines of the rural and urban households weighted by the probability of strata in the sampling. The national poverty line, even though it is not used to calculate poverty indices, was found to be birr 1,782. These base year poverty lines for the different simulations were adjusted for price variability induced in every simulation for each household type by the changes in CPI calculated in CGE model.

The post simulation consumption levels of each household group were found by scaling up (down) the consumption expenditures at the base year by the rates of changes of their consumptions expenditure which can be calculated in the CGE model. These consumption levels were provided to the DAD software to calculate the Foster, Greer and Thorbecke (FGT) poverty indices and inequality indices. The results of this microsimulation models are presented and discussed below.

Table 4.3.10 below presents information on the incidence ($\alpha=0$), depth ($\alpha=1$) and severity ($\alpha=2$) of poverty for the base year and variations in these measures after the shocks. In the base year, the incidence of poverty was higher in the rural households than the urban households; however, the depth and severity of poverty were higher among the urban households than the rural ones.

In the first simulation (SIM1), the incidence of poverty (headcount poverty index) decreases for both rural and urban households by about 3.30 and 4.31 per cent respectively causing a decline of the incidence at the national level approximately by 3.45 per cent. The depth of poverty declined nearly by more than 4 per cent among all household types and the severity of poverty also declined by more than 5 per cent among all household types (Table: 4.3.11).

In the second simulation, the incidence of poverty marginally increased among the rural households and at the national level but has no significant effect among urban households. The depth of poverty increased in the rural and at the national level by about 1 per cent where as it has no significant effect on the urban households. It further worsened the severity of poverty at the national and rural households nearly by 1 per cent even though it has no sensible effect on urban households.

In the third simulation (SIM3), all measures of poverty declined. Particularly, the incidence of poverty declined at the national and rural levels by about 4.5 per cent and the decline in urban households is nearly 4 per cent. The depth and severity of poverty declined in this simulation by about 5.2 per cent at the national and by about 5.5 per cent in the rural households while the decline at the urban households is nearly 3.9 percent.

Generally, the depth and severity of poverty declined with the highest rate of magnitude in the third simulation followed by the first simulations. The second simulation, on the other hand, worsened the incidence, depth and severity of poverty. The fact that the first and third simulations have the tendency of reducing poverty indices while poverty indices tend to increase

in the second simulation clearly indicates that reducing tariff by replacing tariff revenue with indirect tax (sales tax and VAT) tend to make things worse than they are to date. Furthermore, the simulation result indicated that the role of liberalising trade to reduce poverty is not significant compared to the pervasiveness of poverty in Ethiopia and conclude that it has little to do with poverty reduction in Ethiopia.

Table: 4.3.10 Poverty Measures for the Base Year and Simulations ⁶

Indicator		National	Rural	Urban
$\alpha=0$ (poverty incidence)	Base	38.63%	39.30%	35.13%
	Simulation 1	37.30%	38.00%	33.62%
		(-3.45%)	(-3.30%)	(-4.31%)
	Simulation 2	38.908%	39.62%	35.13%
		(0.71%)	(0.83%)	(0.00%)
$\alpha=1$ (poverty depth)	Simulation 3	36.91%	37.50%	33.80%
		(-4.46%)	(-4.57%)	(-3.80%)
	Base	10.80%	10.60%	11.81%
	Simulation 1	10.33%	10.16%	11.26%
		(-4.30%)	(-4.22%)	(-4.71%)
$\alpha=2$ (poverty severity)	Simulation 2	10.87%	10.68%	11.82%
		(0.64%)	(0.77%)	(0.04%)
	Simulation 3	10.23%	10.02%	11.35%
		(-5.22%)	(-5.50%)	(-3.88%)
$\alpha=2$ (poverty severity)	Base	4.05%	3.87%	5.03%
	Simulation 1	3.83%	3.66%	4.70%
		(-5.62%)	(-5.40%)	(-6.47%)
	Simulation 2	4.09%	3.91%	5.03%
		(0.80%)	(0.99%)	(0.05%)
Sampling	Simulation 3	3.78%	3.60%	4.76%
		(-6.71%)	(-7.04%)	(-5.33%)
	Strata code	-	1	2
	Sample size	21,594	9,494	12,100
	Weight=prob(strata)	1.00	0.84	0.16
Poverty line	Base	1,782	1,739	2,006
	Simulation 1	1,765	1,722	1,987
	Simulation 2	1,792	1,749	2,018
	Simulation 3	1,777	1,734	2,001

Source: own computation using DAD software

⁶ Values in brackets are percentage changes from the base

On the other hand, measures of inequality as indicated by the Gini coefficients are higher among the urban households than the rural counter parts. In the base year, the Gini coefficient was 44.2 per cent among urban households while it was 26.7 per cent among the rural households. This implies that the average distance in the income distribution among the urban households is in the order of almost 90 per cent of the mean among the urban households while it is about 50 per cent among the rural households.

In the first simulation (SIM1), inequality among urban households declined by 2.8 per cent and it declined by about 0.7 per cent at the national level. There was no change in the inequality at all among the rural households. Meanwhile, the second simulation (SIM2) (tariff replacement by indirect tax) slightly worsened the inequality among urban households and at the national level although it had no effect among rural households. The third simulation had little effect on aggravating inequality among urban households and it also has no effect on reducing inequality in rural households and at the national level.

Table: 4.3.11 Gini coefficient for households in urban and rural base

Inequality Indicator		National	Rural	Urban
Gini Coefficient	Base	29.51%	26.72%	44.19%
	Simulation 1	29.31%	26.72%	42.96%
		(-0.66%)	(0.00%)	(-2.78%)
	Simulation 2	29.51%	26.72%	44.22%
		(0.02%)	(0.00%)	(0.07%)
	Simulation 3	29.51%	26.72%	44.20%
		(0.01%)	(0.00%)	(0.02%)

Source: own computation using DAD software

5. Conclusions and Policy Recommendations

5.1 Conclusions

This study has attempted to look at the effect of tariff reduction and tax replacement on growth, poverty and inequality using a CGE microsimulation analysis. Examination of the proposition that import tariff stifled the flow of goods and services and hence reduced consumers' consumption (through high price and lack of varieties of goods and services) thereby affecting the society's welfare and national income were the focal points of the study. Assessing the effect of reducing tariff on poverty reduction and reducing income inequality were the other dimensions of the study. For the purpose of this study, the EDRI/IDS SAM and the HICES of CSA 2004/05 covering some 21,594 households were used.

As expected, reduction of tariff rate leads to increased production and exports of most agricultural commodities and increased industrial imports causing the domestic industries to contract in production and employment. Effects of reducing tariff rate and simultaneously increasing domestic tax rates (that is, replacing the tariff revenue lost with either direct tax or indirect tax) on consumers welfare, poverty and income distribution are mixed. The effect of tariff-tax coordination on factor returns are different for different financing tax systems selected.

If tariff rate reduction is followed by a simultaneous direct tax rate rise, real GDP, export, import and absorption would increase. The decrease in import prices accompanying the tariff rate reduction caused the general prices level (represented by consumers price index, CPI) to decrease. As a result of this, consumption by consumers, except that of non-poor urban households, increased. Imported commodities constitute a bulk of food items, consumer goods including textile and other manufacturing, capital goods (machinery and vehicles), chemicals and other raw materials.

Production of some of these imported industrial consumer goods such as textile and footwear use labour-intensive technology hence increased importation of these items in to the labour abundant

country is not in-line with the economic theory. However, since food accounts a significant share in the expenditure of the poor households, reduction in the price of commodities (including food) has led to increased consumption in all households (especially to food deficit urban and rural households) except for that of urban non-poor households. On the other hand, surplus producing farmers are likely to benefit from the increased producer prices. This increases real income of farmers, therefore, may generate strong demand for labour and finally the increased demand for labour in those geographic areas causes the wage of labour to rise. This may produce strong demand linkage and multiplier effect in rural areas. Furthermore, it was found that the poverty incidence has been reduced in all rural, urban and at national level though the degree is not that much promising. So did the depth and severity of poverty in all household types. As for income distribution, when the first simulation (SIM1) is applied income inequalities declined by about 1.0 per cent at the national level and by about 2.8 per cent among urban households but has no effect on rural households.

On the other hand, when the tariff revenue lost is replaced by increasing the indirect tax rate, consumer price index increases and labour income (value added) declines. This ends up with a declined aggregate private consumption. Consequently, there would be a shrinking in the national output (real GDP at factor costs) even though the real absorption, export and import have increased. With the exception of urban non-poor households, consumption of all households has decreased in this simulation as more than 85 per cent of the labour wage is used for consumption for the poor households. This was due to a reduction of factor incomes. Returns of factors declined (wage declined by 0.10 per cent, return from livestock declined by 2.7 per cent, returns from land and capital increased only by 1.5 per cent and 0.50 per cent respectively). Incidence, depth and severity of poverty tend to increase in this simulation, and there has been increasing tendency of income inequality in same simulation (income inequality marginally widened when the tariff tax rate reduction is accompanied by the indirect tax rate increase).

The welfare effect of tariff-tax coordination measured in terms of equivalent variation has mixed results. While net welfare has increased in the first simulation, it has declined in the second simulation. This holds for all household groups except urban non-poor households. However, the positive effect in welfare accompanying the first simulation is minimal.

In the third simulation, all poverty indices declined indicating that the policy option has significant poverty reducing effect and raising household's as well as society's welfare effect. Inequality index among the urban households hardly increases with any effect at the national and rural household levels. In this simulation, however, government loses about 17 per cent of total revenue following tariff reduction which may force government to cut its public investment expenditure.

Generally, when tariff rate reduction is accompanied by either increased direct tax rate or increased consumption tax rate, no promising effects have been detected on the economy as a whole, poverty reduction and income distribution in Ethiopia. In fact, it is found that replacing tariff revenue lost by increasing direct tax rate has some insignificant positive effects in promoting growth, increasing social welfare, reducing poverty and narrowing income inequalities.

Over all this study attempted to test the hypothesis advanced by developed countries as well as international financial institutions that tariff rate reduction when replaced by domestic direct tax or consumption tax resulted in prosperous economic growth, reduced poverty and increased welfare. However, in this study, our simulations don't support such hypothesis, especially replacing tariff by consumption tax in Ethiopia.

5.2 Policy Implication

The option of financing the tariff revenue lost by increasing direct tax rate seems to be pro-poor as confirmed by the equivalent variation (EV) measure of welfare as well as the poverty and inequality measures. However, the fact that Ethiopian economy is predominantly agricultural, less diversified tax base coupled with inefficient tax system made the tax burden to be high on the urban non-poor

tax payers. That is, the less broadened tax base practiced in Ethiopia currently made the tariff revenue replacing tax rate relatively higher (75 percent increase of direct tax rate for a 50 per cent decrease in tariff rate in the present simulation). This may discourage profit making private companies causing capital outflow and allocating resources in unproductive economic activity (luxury consumer goods, expensive cars and etc) thereby affecting the economy in the long run by pushing the economy to specialize in activities with no dynamic scale or other benefits.

On the other hand, financing the tariff revenue lost due to liberalization by indirect taxes has negative implication on consumption and societies' welfare. This option tends to worsen the incidence, depth and severity of poverty (especially in rural and national level). It also widened the income inequality among the urban household groups and at the national level. The fact that indirect tax collection is difficult to administer together with inefficient tax collection practices and less broad indirect tax bases in Ethiopia made the tariff revenue replacement tax rate higher (50 per cent tariff reduction needs 98 per cent increase in indirect tax rate in the present case). This causes the price level to rise and hence forced poor households and rural non-poor households to cut their consumption, as a result, there has been negative effect on the economy, welfare and poverty in Ethiopia.

If there was no tax replacement following the reduction of import tariff, real GDP, export, import and absorption would have all increased. Welfare of all households would have increased and poverty and inequality have decreased as well. However, this simulation leads to deterioration of fixed investment in Ethiopia. It may erode government's ability to finance import demands of huge public investment projects that are needed for development hence reduces fixed investment. Furthermore, the cheap import of industrial commodities reduces profitability of domestic private investment and this ends up with a decreased in fixed investment.

Therefore, based on the simulation results we recommend the following.

- Reducing tariff rate by financing the tariff revenue lost through direct tax, even though not significant, has positive implication for the economy as a whole and consumers. However, tariff replacement by indirect tax has a negative impact on the growth, poverty and welfare. Hence it is important to reconsider these issues while liberalizing the economy.
- Before liberalizing the economy it is important to broaden the domestic tax bases so that tariff replacement tax rates become small enough and hardly brings inflation in the domestic market.
- Building tax administration efficiency and training the business community about the tax system and roles of tax to development need to be prioritised.
- Since government need much money to finance public investments, it is reasonable to make tariff-tax coordination once after these public investments have been completed and at the time when tariff revenue is replaced by domestic tax in such a way that a tax rate change couldn't cause inflation (no price level rise).
- As industries in our country are at infant stage, the experiences of China, India and Brazil teach us that it is important to protect such industries until they are capable and mature to foreign competition. So build the capacity today and open the market tomorrow.

This study was conducted based on the static CGE model developed by IFPRI and hence there is a need to see effects by using the dynamic CGE modelling. It is also important to investigate the economy wide effect of tariff reduction on industrial commodities, on agricultural commodities independently and at a combination of different rates.

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APPENDICES

Appendix A: LIST OF ABBREVIATIONS

ateff	activity of teff production
amzwh	activity of maize and Wheat production
antag	activity of nontrade agricultural production
axcrp	activity of cash crop production
alive	activity of live animal production
afood	activity of food production
achem	activity of chemical production
amach	activity of machinery and electric appliances
aoman	activity of other manufactured production
acons	activity of construction
autil	activity in utility production
atrad	activity in trade
apsrv	activity of private services
agsrv	activity of government services
cteff	Commodity teff production
cmzwh	Commodity maize and Wheat production
cntag	Commodity nontrade agricultural production
cxcrp	Commodity cash crop production
clive	Commodity live animal production
cfood	Commodity food production
cchem	Commodity chemical production
cmach	Commodity machinery and electric appliances
coman	Commodity other manufactured production
ccons	Commodity construction
cutil	Commodity in utility production
ctrad	Commodity in trade
cpsrv	Commodity of private services
cgsrv	Commodity government services
hhd-rurp	rural poor households
hhd-rurn	rural non-poor households
hhd-urbp	urban poor households
hhd-urbn	urban non-poor households

Appendix B: Sets, Parameters and Variables in the model

Sets

$\alpha \in A$ – activities

$\alpha \in ACES(\subset A)$ – activities with a CES function at the top of the technology nest

$\alpha \in ALEO(\subset A)$ – activities with a Leontief function at the top of the technology nest

$c \in C$ – commodities

$c \in CD(\subset C)$ – commodities with domestic sales of domestic output

$c \in CDN(\subset C)$ – commodities not in CD

$c \in CE(\subset C)$ – exported commodities

$c \in CEN(\subset C)$ – commodities not in CE

$c \in CM(\subset C)$ – imported commodities

$c \in CMN(\subset C)$ – commodities not in CM

$c \in CT(\subset C)$ – transactions service commodities

$c \in CX(\subset C)$ – commodities with domestic production

$f \in F$ – factors

$i \in INS$ – institutions (domestic and rest of the world)

$i \in INSD(\subset INS)$ – domestic institutions

$i \in INSDNG(\subset INSD)$ – domestic nongovernmental institutions

$h \in H(\subset INSDNG)$ – households

Parameters

Latin Letters

$cwts_c$ – weight of commodity c in the *CPI*

$dwts_c$ – weight of commodity c in the producer price index

ica_{ca} – quantity of c as intermediate input per unit of activity a

$icd_{cc'}$ – quantity of commodity c as trade input per unit of c' produced and sold domestically

$ice_{cc'}$ – quantity of commodity c as trade input per exported unit of c'

$icm_{cc'}$ – quantity of commodity c as trade input per imported unit of c'

$inla_a$ – quantity of aggregate intermediate input per activity unit

iva_a – quantity of value-added per activity unit

$\overline{mps}_i$ – base savings rate for domestic institution i

$mps01_i$ – 0-1 parameter with 1 for institutions with potentially flexed direct tax rates

pwe_c – export price (foreign currency)

pwm_c – import price (foreign currency)

$qdst_c$ – quantity of stock change

$\overline{qg_c}$ – base-year quantity of government demand

$\overline{qinv_c}$ – base-year quantity of private investment demand

$shif_{if}$ – share for domestic institution i in income of factor f

$shii_{ii}$ – share of net income of i' to i ($i' \in INSDNG'$; $i \in INSDNG$)

$t\alpha_a$ – tax rate for activity a

te_c – export tax rate

tf_f – direct tax rate for factor f

$\overline{tins_i}$ – exogenous direct tax rate for domestic institution i

$tins01_i$ – 0 1 parameter with 1 for institutions with potentially flexed direct tax rates

tm_c – import tariff rate

tq_c – rate of sales tax

$trnsfr_{if}$ – transfer from factor f to institution i

tva_a – rate of value-added tax for activity a

Greek Letters

α_a^a – efficiency parameter in the CES activity function

α_a^{va} – efficiency parameter in the CES value-added function

α_a^{ac} – shift parameter for domestic commodity aggregation function

α_c^q – Armington function shift parameter

α_c^t – CET function shift parameter

β_{ach}^h – marginal share of consumption spending on home commodity c from activity a for household h

β_{ch}^m – marginal share of consumption spending on marketed commodity c for household h

δ_a^a – CES activity function share parameter

δ_{ac}^{ac} – share parameter for domestic commodity aggregation function

δ_c^q – Armington function share parameter

δ_c^t – CET function share parameter

δ_{fa}^{va} – CES value-added function share parameter for factor f in activity a

γ_{ch}^m – subsistence consumption of marketed commodity c for household h

γ_{ach}^h – subsistence consumption of home commodity c from activity a for household h

θ_{ac} – yield of output c per unit of activity a

ρ_a^a – CES production function exponent

ρ_a^{va} – CES value-added function exponent

ρ_c^{ac} – domestic commodity aggregation function exponent

ρ_c^q – Armington function exponent

ρ_c^t – CET function exponent

Exogenous Variables

$\overline{DPI}$ – producer price index for domestically marketed output

$\overline{DTINS}$ – change in domestic institution tax share (=0 for base; exogenous variable)

$\overline{FSAV}$ – foreign saving(FCU)

$\overline{GADJ}$ – government consumption adjustment factor

$\overline{EG}$ – government expenditure

$\overline{IADJ}$ – investment adjustment factor

$\overline{TINS}_i$ – direct tax rate for institution i ($i \in INSDNG$)

$\overline{MPSADJ}$ – savings rate scaling factor (=0 for base)

$\overline{QFS}_f$ – quantity supplied of factor

$\overline{TINSADJ}$ – direct tax scaling factor (=0 for base; exogenous variable)

$\overline{WFDIST}_{fa}$ – wage distortion factor for factor f in activity a

Endogenous Variables

CPI – consumer price index

$DMPS$ – change in domestic institution savings rates (=0 for base; exogenous variable)

EH_h – consumption spending for household

EXR – exchange rate (LCU per unit of FCU)

$GOVSHR$ – government consumption share in nominal absorption
 $GSAV$ – government savings
 $INVSHR$ – investment share in nominal absorption
 MPS_i – marginal propensity to save for domestic non-government institution (Exogenous variable)
 PA_a – activity price (unit gross revenue)
 PDD_c – demand price for commodity produced and sold domestically
 PDS_c – supply price for commodity produced and sold domestically
 PE_c – export price (domestic currency)
 $PINTA_a$ – aggregate intermediate input price for activity a
 PM_c – import price (domestic currency)
 PQ_c – composite commodity price
 PVA_a – value-added price (factor income per unit of activity)
 PX_c – aggregate producer price for commodity
 $PXAC_{ac}$ – producer price of commodity c for activity a
 QA_a – quantity (level) of activity
 QD_c – quantity sold domestically of domestic output
 QE_c – quantity of exports
 QF_{fa} – quantity demanded of factor f from activity a
 QG_c – government consumption demand for commodity c
 QH_{ch} – quantity consumed of commodity c by household h
 QHA_{ach} – quantity of household home consumption of commodity c from activity a for household h
 $QINTA_a$ – quantity of aggregate intermediate input
 $QINT_{ca}$ – quantity of commodity c as intermediate input to activity a
 $QINV_c$ – quantity of investment demand for commodity c
 QM_c – quantity of imports of commodity c
 QQ_c – quantity of goods supplied to domestic market (composite supply)
 QT_c – quantity of commodity demanded as trade input

QVA_a – quantity of (aggregate) value-added

QX_c – aggregated marketed quantity of domestic output of commodity c

$QXAC_{ac}$ – quantity of marketed output of commodity c from activity a

$TABS$ – total nominal absorption

$TRII_{ii'}$ – transfers from institution i' to i (both in the set INSDNG)

WF_f – average price of factor f

YF_f – income of factor f

YG – government revenue

YI_i – income of domestic nongovernment institution

YIF_{if} – income to domestic institution i from factor f

Appendix C: Model Equations (Numbers in braces [] connote ‘equation number’)

Price Block

[1] Import price

$$PM_c = pwm_c \cdot (1 + tm_c) \cdot EXR + \sum_{c' \in CT} PQ_{c'} \cdot icm_{c'c} \quad c \in CM$$

[2] Export price

$$PE_c = pwe_c \cdot (1 - te_c) \cdot EXR - \sum_{c' \in CT} PQ_{c'} \cdot ice_{c'c} \quad c \in CE$$

[3] Demand price of domestic non-traded goods

$$PDD_c = PDS_c + \sum_{c' \in CT} PQ_{c'} \cdot icd_{c'c} \quad c \in CD$$

[4] Absorption

$$PQ_c \cdot (1 - tq_c) \cdot QQ_c = PDD_c \cdot QD_c + PM_c \cdot QM_c \quad c \in (CD \cup CM)$$

[5] Marketed output value

$$PX_c \cdot QX_c = PDS_c \cdot QD_c + PE_c \cdot QE_c \quad c \in CX$$

[6] Activity price

$$PA_a = \sum_{c \in C} PXAC_{ac} \cdot \theta_{ac} \quad a \in A$$

[7] Aggregate intermediate input price

$$PINTA_a = \sum_{c \in C} PQ_c \cdot ica_{ca} \quad a \in A$$

[8] Activity revenue and costs

$$PA_a \cdot (1 - ta_a) \cdot QA_a = PVA_a \cdot QVA_a + PINTA_a \cdot QINTA_a \quad a \in A$$

[9] Consumer price index

$$CPI = \sum_{c \in C} PQ_c \cdot cwts_c$$

[10] Producer price index for non-traded market output

$$\overline{DPI} = \sum_{c \in C} PDS_c \cdot dwts_c$$

Production and Trade Block

[11] CES Technology: Activity production function

$$QA_a = \alpha_a^a \cdot (\delta_a^a \cdot QVA_a^{-\rho_a^a} + (1 - \delta_a^a) \cdot QINTA_a^{-\rho_a^a})^{-\frac{1}{\rho_a^a}} \quad a \in ACES$$

[12] CES Technology: Value-added-intermediate-input ratio

$$\frac{QVA_a}{QINTA_a} = \left(\frac{PINTA_a}{PVA_a} \cdot \frac{\delta_a^a}{1 - \delta_a^a} \right)^{\frac{1}{1 + \rho_a^a}} \quad a \in ACES$$

[13] Leontief Technology: Demand for aggregate value-added

$$QVA_a = iva_a \cdot QA_a \quad a \in ALEO$$

[14] Leontief Technology: Demand for aggregate intermediate input

$$QINTA_a = inla_a \cdot QA_a \quad a \in ALEO$$

[15] Value-added and factor demands

$$QVA_a = \alpha_a^{va} \cdot \left(\sum_{f \in F} \delta_{fa}^{va} \cdot QF_{fa}^{-\rho_a^{va}} \right)^{-\frac{1}{\rho_a^{va}}} \quad a \in A$$

[16] Factor demand

$$WF_f \cdot \overline{WFDIST}_{fa} = PVA_a (1 - tv_a) \cdot QVA_a \cdot \left(\sum_{f \in F'} \delta_{fa}^{va} \cdot QF_{fa}^{-\rho_a^{va}} \right)^{-1} \cdot \delta_{fa}^{va} \cdot QF_{fa}^{-\rho_a^{va}-1} \quad a \in A; f \in F$$

[17] Disaggregated intermediate input demand

$$QINT_{ca} = ica_{ca} \cdot QINT_a \quad a \in A; c \in C$$

[18] Commodity production and allocation

$$QXAC_{ac} + \sum_{h \in H} QHA_{ach} = \theta_{ac} \cdot QA_a \quad a \in A; a \in CX$$

[19] Output aggregation function

$$QX_c = \alpha_c^{ac} \cdot \left(\sum_{a \in A} \delta_{ac}^{ac} \cdot QXAC_{ac}^{-\rho_c^{ac}} \right)^{-\frac{1}{\rho_c^{ac}-1}} \quad c \in CX$$

[20] First-order condition for output aggregation function

$$PXAC_{ac} = PX_c \cdot QX_c \left(\sum_{a \in A'} \delta_{ac}^{ac} \cdot QXAC_{ac}^{-\rho_c^{ac}} \right)^{-1} \cdot \delta_{ac}^{ac} \cdot QXAC_{ac}^{-\rho_c^{ac}-1} \quad a \in A; c \in CX$$

[21] Output transformation (CET) function

$$QX_c = \alpha_c^t \cdot \left(\delta_c^t \cdot QE_c^{\rho_c^t} + (1 - \delta_c^t) \cdot QD_c^{\rho_c^t} \right)^{\frac{1}{\rho_c^t}} \quad c \in (CE \cap CD)$$

[22] Export – Domestic supply ratio

$$\frac{QE_c}{QD_c} = \left(\frac{PE_c}{PDS_c} \cdot \frac{1 - \delta_c^t}{\delta_c^t} \right)^{\frac{1}{\rho_c^t-1}} \quad c \in (CE \cap CD)$$

[23] Output transformation for domestically sold outputs without exports and for exports with out domestic sales

$$QX_c = QD_c + QE_c \quad c \in (CD \cap CEN) \cup (CE \cap CDN)$$

[24] Composite supply (Armington) function

$$QQ_c = \alpha_c^q \cdot \left(\delta_c^q \cdot QM_c^{-\rho_c^q} + (1 - \delta_c^q) \cdot QD_c^{-\rho_c^q} \right)^{-\frac{1}{\rho_c^q}} \quad c \in (CM \cap CD)$$

[25] Import- domestic demand ratio

$$\frac{QM_c}{QD_c} = \left(\frac{PDD_c}{PM_c} \cdot \frac{\delta_c^q}{1 - \delta_c^q} \right)^{\frac{1}{1 + \rho_c^q}} \quad c \in (CM \cap CD)$$

[26] Composite supply for non-imported output and non-produced imports

$$QQ_c = QD_c + QM_c \quad c \in (CD \cap CMN) \cup (CM \cap CDN)$$

[27] Demand for transactions services

$$QT_c = \sum_{c' \in C'} (icm_{cc'} \cdot QM_{c'} + ice_{cc'} \cdot QE_{c'} + icd_{cc'} \cdot QD_{c'}) \quad c \in CT$$

Institutional Block

[28] Factor income

$$YF_f = \sum_{a \in A} WF_f \cdot \overline{WFDIST}_{fa} \cdot QF_{fa} \quad f \in F$$

[29] Institutional factor incomes

$$YIF_{if} = shif_{if} \cdot \left[(1 - tf_f) \cdot YF_f - transfr_{rowf} \cdot EXR \right] \quad i \in INSD; f \in F$$

[30] Income of domestic, non-government institutions

$$YI_i = \sum_{f \in F} YIF_{if} + \sum_{i' \in INSDNG'} TRII_{ii'} + transfr_{igov} \cdot \overline{DPI} + transfr_{irow} \cdot EXR \quad i \in INSDNG$$

[31] Intra-institutional transfers

$$TRII_{ii'} = shii_{ii'} \cdot (1 - MPS_{i'}) \cdot (1 - TINS_{i'}) \cdot YI_{i'} \quad i \in INSDNG; i' \in INSDNG'$$

[32] Household consumption expenditure

$$EH_h = \left(1 - \sum_{i \in INSDNG} shii_{ih} \right) \cdot (1 - MPS_h) \cdot (1 - TINS_h) \cdot YI_h \quad h \in H$$

[33] Household consumption spending on marketed commodities

$$PQ_c \cdot QH_{ch} = PQ_c \cdot \gamma_{ch}^m + \beta_{ch}^m \cdot \left(EH_h - \sum_{c' \in C} PQ_{c'} \cdot \gamma_{c'h}^m - \sum_{a \in A} \sum_{c' \in C} PXAC_{ac'} \cdot \gamma_{ac'h}^h \right) \quad c \in C; h \in H$$

[34] Household consumption spending on home commodities

$$PXAC_{ac} \cdot QHA_{ach} = PXAC_{ac} \cdot \gamma_{ach}^h + \beta_{ach}^h \cdot \left(EH_h - \sum_{c \in C} PQ_c \cdot \gamma_{c'h}^m - \sum_{a \in A} \sum_{c' \in C} PXAC_{ac'} \cdot \gamma_{ac'h}^h \right) \quad a \in A; \quad c \in C;$$

$$h \in H$$

[35] Investment demand

$$QINV_c = \overline{IADJ} \cdot \overline{qinv}_c \quad c \in CINV$$

[36] Government consumption demand

$$QG_c = \overline{GADJ} \cdot \overline{qg}_c \quad c \in C$$

[37] Government revenue

$$\begin{aligned} YG = & \sum_{i \in INSDNG} TINS_i \cdot YI_i + \sum_{f \in F} tf_f \cdot YF_f + \sum_{a \in A} tva_a \cdot PVA_a \cdot QVA_a \\ & + \sum_{a \in A} ta_a \cdot PA_a \cdot QA_a + \sum_{c \in CM} tm_c \cdot pwm_c \cdot QM_c \cdot EXR + \sum_{c \in CE} te_c \cdot pwe_c \cdot QE_c \cdot EXR \\ & + \sum_{c \in C} tq_c \cdot PQ_c \cdot QQ_c + \sum_{f \in F} YIF_{govf} + trnsfr_{govrow} \cdot EXR \end{aligned}$$

[38] Government expenditure

$$EG = \sum_{c \in C} PQ_c \cdot QG_c + \sum_{i \in INSDNG} trnsfr_{igov} \cdot \overline{DPI}$$

System Constraint Block

[39] Factor markets

$$\sum_{a \in A} QF_{fa} = \overline{QFS}_f \quad f \in F$$

[40] Composite commodity markets

$$QQ_c = \sum_{a \in A} QINT_{ca} + \sum_{h \in H} QH_{ch} + QG_c + QINV_c + qdst_c + QT_c \quad c \in C$$

[41] Current account balance for the ROW (in foreign currency)

$$\sum_{c \in CM} pwm_c \cdot QM_c + \sum_{f \in F} trnsfr_{rowf} = \sum_{c \in CE} pwe_c \cdot QE_c + \sum_{i \in INSD} trnsfr_{irow} + \overline{FSAV}$$

[42] Government balance

$$YG = EG + GSAV$$

[43] Direct institutional tax rates

$$TINS_i = \overline{tins}_i \cdot (1 + \overline{TINSADJ} \cdot \overline{tins01}_i) + \overline{DTINS} \cdot \overline{tins01}_i \quad i \in INSDNG$$

[44] Institutional savings rates

$$MPS_i = \overline{mps}_i \cdot (1 + \overline{MPSADJ} \cdot \overline{mps01}_i) + \overline{DMPS} \cdot \overline{mps01}_i \quad i \in INSDNG$$

[45] Savings-investment balance

$$\sum_{i \in INSDNG} MPS_i \cdot (1 - TINS_i) \cdot YI_i + GSAV + EXR \cdot \overline{FSAV} = \sum_{c \in C} PQ_c \cdot QINV_c + \sum_{c \in C} PQ_c \cdot qdst_c$$

[46] Total absorption

$$\begin{aligned} TABS = & \sum_{h \in H} \sum_{c \in C} PQ_c \cdot QH_{ch} + \sum_{a \in A} \sum_{c \in C} \sum_{h \in H} PXAC_{ac} \cdot QHA_{ach} + \sum_{c \in C} PQ_c \cdot QG_c \\ & + \sum_{c \in C} PQ_c \cdot QINV_c + \sum_{c \in C} PQ_c \cdot qdst_c \end{aligned}$$

[47] Ratio of investment to absorption

$$INVSHR \cdot TABS = \sum_{c \in C} PQ_c \cdot QINV_c + \sum_{c \in C} PQ_c \cdot qdst_c$$

[48] Ratio of government consumption to absorption

$$GOVSHR \cdot TABS = \sum_{c \in C} PQ_c \cdot QG_c$$

