

THE IMPACT OF TRADE LIBERALIZATION ON POVERTY IN KENYA: A MICROSIMULATION

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1 INTRODUCTION

The debate on trade liberalization and its impact of poverty has remained a subject of debate in several forums both at international and local level. This debate has been lengthened by the fact that there are not theoretical underpinnings that directly link trade liberalization to poverty. Trade liberalization is the removal or reduction of barriers to trade that ensures free movement of goods and services from one nation to another. Trade liberalization affects the direct determinants of poverty such as consumption, employment and incomes. McCulloch *et al* (2000) have attempted to draw the linkage between trade liberalization and poverty. In their work, they show that one major pathway through which trade liberalization affects poverty is in trade creating liberalization where there are economic effects on prices changes of traded goods, labour market and government revenue. All these in turn affect the level of consumption, income and endowments at the household level.

Cicowiez and Conconi (2008) provide a good perspective on the trade-poverty relationship, according to them, poverty is a public policy challenge that needs to be addressed, while trade liberalization is an important part of a policy package that can be used to spur economic growth and potentially reduce poverty. Cloutier *et al* (2008) further explain that from the income perspective, trade liberalization tends to affect incomes since it affects resource allocation in the economy, as a result any changes in factor remunerations affects household incomes. Hence if the factors that households use abundantly are positively affected, then incomes tend to increase. Furthermore, trade liberalization also affects the structure of consumption through prices, if households consume more goods with lower prices, then consumption tends to increase depending on the nature of the good in question. The income and consumption effects will determine whether poverty levels rise or decline.

At the same time, if trade liberalization is accompanied by compensatory taxes, then the nature of the liberalization, the structure of the economy and the actions of the economic agents will determine its impact on poverty. It is for this reason that the impact of trade liberalization on poverty has remained hotly debated since different countries have experienced varied impacts. It is therefore important to examine the impact that trade liberalization has had on poverty in Kenya under the World Trade Organization's multilateral trading system.

1.1 Statement of the problem

Trade liberalization is not a new phenomenon in Kenya. The country has had varied trade regimes since independence to date, under which different trade policy instruments were used to achieve trade liberalization. From 1963 to 1979, the country was more focused on import substitution industrialization, where imports were discouraged in order to protect the infant industries and to provide them with an opportunity for growth and to be able to compete globally. However, in the late 1970's, the country suffered severe economic shocks such as the four-fold increase in oils prices, the breakup of the East African community and the drop in commodity prices led the country to adopt stabilization policies that included trade liberalization. From 1979-1994, Kenya adopted several structural adjustment programmes under the Breton Woods institutions: World Bank and the International Monetary Fund (IMF). During this period, quantitative restrictions were removed and others were turned to tariffs after which there was the commencement of tariff reduction. Kenya joined the World Trade Organization in January 1995 and has

committed to further tariff reductions on goods, she has commit to binding and lowering her tariffs so as to ensure free movement of goods in and out of the country.

While Kenya has been strong in the WTO negotiations on tariff removals and ensuring that trade liberalization results in development and poverty reduction. Poverty reduction in Kenya has remained central in the public policy agenda as articulated in the Country's economic blue print "Vision 2030: A Globally Competitive and Prosperous Kenya", under the pillar on macroeconomic strategy for long-term development, equity and poverty reduction is one of the main focus areas. In trying to combat poverty using different policies, there has been mixed debate on the impact of trade liberalization on poverty. Several perspectives have been put forward by different stakeholders. Policy makers for instance argue that trade liberalization is good for the country as there are development opportunities that accompany free trade such as transfer of technology which improves productivity and hence results in economic growth. The civil society on the other hand holds the position that trade liberalization does not result in much gains for segments of the population such as farmers, who tend to be the greatest casualties when liberalization takes place.

While these arguments could hold water depending on the angle of observation, there is limited evidence that backs these arguments. It is therefore not easy to provide policy prescriptions on how trade liberalization can be a tool for development and poverty reduction. Furthermore, the policy makers are also not in a position to negotiate confidently at the WTO given that they do not have evidence on the true impact of trade liberalization on poverty. This study will therefore provide evidence on who gains from trade liberalization, and can therefore be used by both policy makers, and non- state actors to inform their actions in trying to achieve development and poverty reduction through trade liberalization.

1.2 Objectives of the Study

The main objective of this study is to:

- 1) Review the important trade liberalization issues emerging under the WTO trade negotiations.
- 2) Establish the impact of trade liberalization on poverty using a static computable general equilibrium (CGE) model.
- 3) Provide policy recommendations.

1.3 Significance of the Study

Trade liberalization is currently being negotiated within the WTO multilateral trading framework under the Doha Development Agenda (DDA). Once an agreement is reached on modalities for undertaking trade liberalization, member countries will then proceed to open up their markets to international trade and competition. Most developing countries and least developed countries hope to achieve their development targets with more open economics, at the same time, they do hope that poverty, which is central in the public policy agenda, will also be reduced. It is important to determine what the likely impact of opening up the Kenyan economy would be. Of importance is the manner in which resources will be allocated and the resulting impact on consumption, incomes and the labour market in general as this are the direct determinants of poverty.

This study will provide background information to the negotiators who take part in the negotiations and debates at the WTO. Under the DDA, trade liberalization should result in tangible development. However, from the negotiations, developing and least developed countries are quite skeptical on whether there will be development and poverty reduction after trade liberalization. While this sentiment can be justified by the fact that the Uruguay round of negotiations did not result in development, it would be important to determine a priori the true impacts of trade liberalization so that negotiations are informed by evidence. In this way both the proponents and opponents of trade liberalization will be able to ascertain the true impact of trade liberalization.

1.4 *Organization of Paper*

The paper is organized as follows: section 2 will provide a background to trade liberalization in Kenya with the main focus on the current WTO negotiations and the simulation scenarios to be undertaken. Section 3 will provide an overview of the methodological framework used in the analysis starting with international trade theories and the CGE model that conforms to these theories. Section 4 will provide the results and discussions while section 5 will provide conclusions and policy recommendations.

2 TRADE LIBERALIZATION IN KENYA

2.1 BACKGROUND

Trade liberalization can take different forms; it can be preferential such as regional trading agreements which are specific to countries or a region like the East African Community (EAC) customs union, or the Common Market for East and Southern Africa (COMESA). Trade liberalization can also be non-discriminatory such as the multilateral agreements under the WTO Uruguay round and the current Doha round of negotiations where once a country liberalizes, all members of the WTO should be accorded the same treatment. Trade liberalization can either be unilateral or reciprocal. Unilateral liberalization is undertaken by a country and in most cases it is non-discriminatory, since it applied to by the customs authority for all goods and services entering its territory. Most unilateral liberalization was undertaken under the structural adjustment programmes of the World Bank and the IMF. Reciprocal liberalization is a principle of the WTO under the multilateral trading framework. Reciprocity ensures that all members gain from trade liberalization, and as explained by Hoekman (2002), it limits the free rider attitude that would arise from non-discrimination principle.

Kenya has had different trade regimes since independence. From Independence in 1963 to 1979, Kenya's main economic objective was to protect small industries in order for them to be able to compete in the global market. However, the country suffered economic shocks due to the oil crisis and the breakup of the East African Community which led to macroeconomic instability. The country approached the World Bank and IMF for support in order to restore macroeconomic stability and revive economic growth, Mosley (1991). Several trade reforms were undertaken under the structural adjustment programmes of the World Bank and IMF that resulted in trade liberalization. These programmes were carried out three phases, Phase I was from 1980-84, Phase II 1985-91 and phase III 1992-95. Several authors: Mosley (1991), Swamy (1994), Ryan and O'Brien (2001) and Ongile (1998) have given details of the structural adjustment reforms that took place.

While there were other macroeconomic policy reforms, the key trade reforms that were set as conditionalities for macroeconomic stability can be summarized as follows:

- (i) Replacement of quantitative restrictions with tariffs.
- (ii) Tariff reduction and rationalization.
- (iii) Improvement of the export promotion schemes such as export compensation and insurance schemes.
- (iv) Import liberalization, where goods previously imported through quotas were liberalized and implementation of unrestricted licensing of previously restricted imports.
- (v) Reduction of import tariffs ,elimination of export taxes and improvement of the coverage of import duty compensation scheme.

Evidence of trade liberalization having taken place in Kenya was confirmed by Reinikka (1994), who used an import tariff index to identify trade liberalization episode in Kenya, he found that in the periods 1973, 1975, 1977-81, 1983, 1985, 1988-90 and in 1993, trade liberalization actually took place. It is during these times that the trade reforms outlined above took place.

2.2 THE CURRENT WTO TRADE NEGOTIATIONS AND LIBERALIZATION SCENARIOS

Kenya signed the WTO agreement in January 1995 after which the agreement came into force, it is at this time the institution World Trade Organization was also created. However, trade liberalization did not commence with the WTO, before the WTO, there was the General Agreement on Trade and Tariff (GATT) which has provided the rules for the system since 1948. The GATT also unofficially created the institution informally known as GATT, which over the years evolved through several round of negotiations. The last round of negotiations was the Uruguay Round which created the WTO. The main difference between GATT and WTO is that GATT focused on trade in goods and services only while WTO has focused on other negotiations under the Doha Development Agenda (DDA). The core focus of the DDA is to ensure that trade results in development. The WTO agreement covers goods, services and intellectual property; it also provides permitted exceptions to the rules. The focus of this study is on the liberalization under the GATT for goods and particularly agriculture and non-agricultural market access (NAMA).

2.2.1 AGRICULTURE

The main objective of the Agreement in Agriculture (AoA) is to reform trade in the sector in order to have more market oriented policies that ensure predictability and security for importing and exporting, WTO (2007). The rules on AoA apply to market access since there are various trade restrictions put on imports, domestic support which include subsidies and other programmes that raise farm gate prices and farmers' incomes and export subsidies' that make exports artificially competitive, WTO (*ibid*). In implementing this agreement, there is special and differential treatment where developing countries and developed countries implement the agreements differently and even have different time frames within which to implement the agreements. This is based on the needs and the level of development of countries. Least developed countries are exempted from implementing some provisions of these agreements. After the Uruguay Round of negotiations, quotas and non-tariff measures were replaced by tariffs that provide equivalent levels of protection.

On market access, members from developed countries further committed to cut their tariffs by 36 percent in equal steps over six years, while developing countries would reduce their tariffs by 24 percent over 10 years. WTO (2007) further notes that developing countries also used the option of ceiling their tariffs in cases where duties were not bound i.e. committed under the GATT regulations. Exports and imports are also affected by policies that support domestic prices leading to overproduction which leads to low price dumping in the world market. AoA distinguished support programmes that directly stimulated production and those that did not, these policies that do not have direct effect on production must be cut. Using the calculations of 'Total Aggregate Measurement Support' undertaken by WTO members using 1986-88 as base years, developed countries were to reduce these figures by 20 percent over a period of six years starting 1995 while developing countries were to reduce them by 13 percent over 10 years. Exports subsidies are also prohibited under the AoA, developed countries committed to reduce the value of export subsidies by 36 percent and quantities of subsidized exports by 21 percent over a period of six years

starting 1995. Developing countries on the other hand agreed to reduce the value of export subsidies by 24 percent and quantities of subsidized exports by 14 percent over 10 years.

Based on the agreements reached above, In July 2008, the chairman of the agriculture negotiations committee provided a text on the modalities of tariff reduction in agriculture using a tiered formula for reduction of bound tariffs, trade distorting domestic support and export subsidies. Table 1 provides a summary of the agricultural tariff cuts for both developed and developing countries based on the four bands agreed upon and the boundaries.

Table 1: Numerical Targets for Agriculture.

	Developed		Developing	
Band	Range	Cut	Range	Cut
A	0-20	50	0-30	33.3
B	20-50	57	30-80	38
C	50-75	64	80-130	42.7
D	>75	66-73	>130	44-48.6
Sensitive Products	5% of lines		6.7 % of lines	

Source: WTO (2008a)

Least developed countries are not required to make any tariff reductions while small and vulnerable economies and recently acceded members are required to make smaller tariff reduction. Smaller cuts are also allowed for sensitive products.

2.2.2 NAMA

Non- agricultural market access (NAMA) negotiations are aimed at reducing or as appropriate eliminating tariffs while taking into consideration the concerns of developing countries. The Hong Kong Ministerial Declaration of 2005 provided the WTO members with the modalities for reducing tariffs in the NAMA negotiations. The Chairman's text on draft modalities WTO (2008b), provided a non-linear Swiss formula, whose main objective is to reduce the highest tariffs the most. The formula has a coefficient which is determined for different groups of countries. There are a group of countries: paragraph 6 (PARA6¹) group of countries which includes Kenya are exempted from the application of the Swiss formula but are expected to increase the tariff binding coverage. The small and vulnerable economies and recently acceded members have different level of bindings and tariff cuts to be achieved. Table 2 provides a summary of the key features of the NAMA tariff cuts.

Table 2: Summary of NAMA Tariff Cuts

	Developed	Developing
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¹ PARA6 countries refer to the following group of developing countries not required to reduce tariff using the formula approach: Cameroon; Congo; Cote D'Ivoire; Cuba; Ghana; Kenya; Macao China; Mauritius; Nigeria Sri Lanka; Suriname; and Zimbabwe.

Formula- coefficient	7-9%	x=19-21%
		y=21-23%
		z=23-26%
Flexibility	NONE	x- 6-7 % of tariff unbound or 6-9 % of imports or ½ of formula cuts in 12-14 % of product lines covering no more than 12-19% of imports
		y- 5/5% of lines/imports –no cuts allowed or 10/10% of lines/imports with half formula cuts
		z- no flexibilities available

Laborde *et al* (2008) established tariff barriers levied by countries that were subject to the NAMA tariff cuts using four scenarios based on the agriculture and NAMA texts:

- 1) Baseline tariff that would apply in the absence of a DDA agreement in 2025
- 2) Tariff following implementation of DDA without flexibilities.
- 3) Tariff following implementation of tariff formulas with exception of small and vulnerable economies, least developed countries and recently acceded members.
- 4) Tariffs after tariff cuts with flexibilities for countries and products
 - (i) With flexibilities in developing countries only
 - (ii) With flexibilities in developed countries only.

Table 3 provides a summary of the applied tariffs that would be levied on agriculture and non-agricultural products based on the four scenarios above.

Table 3: Average Tariff levied on Agriculture and Non-agricultural Products (%)

	(1)	(2)	(3)	(4)	(4i)	(4ii)
Agriculture						
World Bank classification						
All Countries	14.6	9.0	9.1	11.9	10.1	11.0
High Income Countries	15.0	7.5	7.6	11.0	8.3	10.4
Developing Countries (Non LDC)	13.7	11.8	12.2	13.6	13.6	12.2
LDCs	12.5	12.2	12.5	12.5	12.5	12.5
WTO classification						
Developed WTO	15.1	6.9	6.9	10.2	6.9	10.2
Developed WTO non LDC	14.0	11.4	11.8	13.9	13.9	11.8
Normal Developing WTO	15.1	12.3	12.3	15.0	15.0	12.3
RAM WTO	10.1	6.7	7.7	9.8	9.8	7.7
SVE WTO	14.0	12.5	13.7	14.0	14.0	13.7
Non Agricultural Products						
World Bank classification						

	(1)	(2)	(3)	(4)	(4i)	(4ii)
All Countries	2.9	2.1	2.2	2.3	2.3	2.2
High Income Countries	1.7	1.1	1.1	1.1	1.1	1.1
Developing Countries (Non LDC)	6.4	4.8	5.3	5.6	5.6	5.1
LDCs	10.9	8.0	10.9	10.9	10.9	10.9
WTO classification						
Developed WTO	1.7	1.0	1.0	1.0	1.0	1.0
Developed WTO non LDC	4.8	3.7	4.0	4.3	4.3	3.9
Normal Developing WTO	3.9	3.1	3.1	3.4	3.4	3.0
RAM WTO	4.9	3.5	3.5	3.9	3.9	3.5
SVE WTO	8.9	6.7	8.9	8.9	8.9	8.9

Source: Laborde et al (2008)

The above changes in tariff levels particularly for developing countries as per the WTO classification will provide the basis for the tariff reduction scenarios to undertake. For the analysis scenario 4(i) will be the most appropriate as tariff reduction will be accompanied by flexibilities. Based on the applied tariffs estimated by Laborde *et al (ibid)*, the current applied tariffs for agriculture and NAMA products for Kenya were compared against their estimations and the amount by which applied tariffs would reduce/increased were then established to be used for the simulations. Two scenarios will be used to undertake simulations:

- 1) Trade liberalization scenario where average applied tariffs for agricultural products reduce by 0.71 percent and average applied tariff for NAMA products reduce by 10.42 percent. While considering special/sensitive products
- 2) Full liberalization where all tariffs are eliminated including sensitive products.

3 METHODOLOGICAL FRAMEWORK

3.1 INTERNATIONAL TRADE THEORY- THE NEOCLASSICAL THEORY

The methodological framework to be used for examining the impact of trade liberalization on poverty is based on the neoclassical theory of trade. The neoclassical school of economic thought was predominant in the 19th century especially in the United States and it differs from the 'classical' economic thought hence the prefix 'neo'. The foundations of the neoclassical model of international trade were laid by Eli Hecksher and his pupil Bertil Ohlin (1899-1979) a Swedish economist. Neoclassical economics has remained the dominant school of thought; it relates supply and demand to an individual's rationality and his/her ability to maximize utility or profits. The Neoclassical theory of trade consists of four theorems: the Hecksher-Ohlin (H-O) theorem, the Rybczynski theorem, the Stolper-Samuelson theorem and the factor price equalization theory.

The H-O model, argues that the pattern of international trade is determined by differences in factor endowments argues that with free trade, the aggregate welfare of a country will be raised relative to the welfare under autarky. The Rybczynski theorem provides the link between production level of final goods and the available factors of production. It demonstrates how changes in endowments affect the output of goods when full employment is maintained. It predicts that countries will export those goods that make intensive use of locally abundant factors and will import goods that make intensive use of factors that are locally scarce. It states that: *"With two final goods, two factors of production and constant prices of the final goods, an increase in the supply of the factors of production results in an increase of the output of the final good that uses this factor of production relatively intensively and a reduction in the output of the other final good, provided both goods are produced in equilibrium"*

The Stolper-Samuelson proposition was derived by Wolfgang Stolper and Paul Samuelson. This proposition provides the impact of a change in the price of the final good to the rewards of the factors of production and the factor intensity of the production process. It states that: *"With two final goods and two factors of production, an increase in the price of final good increases the reward to the factors of production used intensively in the production of that good and reduces the reward to other factors provided that both good are produced."* The Factor Price Equalization (FPE) forms the cornerstone of the neoclassical framework and also the most fragile of the theories. FPE as postulated by Bertil Ohlin state that: "Free trade in commodities will eliminate price differentials, thereby effecting equalization of factor prices; especially wages and interest rates, so that when the prices of the output goods are equalized between countries as free trade occurs, then the prices of the factors (capital and labour) will also be equalized between countries. These theorems form the foundation of the neoclassical theory of trade and are the cornerstones of arguments in favour of trade liberalization.

3.2 THE CGE MODEL

The research adopts the IFPRI computable general equilibrium model following the work of Lofgren *et al* (2002). The CGE model is Walrasian in nature since it assumes the product and factor markets clear and prices adjust in these markets in order to achieve equilibrium. The concept of economic equilibrium

was first brought to the fore by Leon Walras (1874), he highlighted the interrelationships between markets where supply and demand of different commodities are met under perfect competition, commodity prices match the cost of production hence equilibrium is achieved. Walrasian equilibrium was further applied by Arrow and Debreu (1954) and Debreu (1959) to real economies. Subsequently other authors have used these models for different economic issues, for example, Chenery and Uzawa (1958) used the CGE model to analyze economic development, Harberger (1962) examined issues of taxation, while more recent studies by Lofgren *et al* (2002), Sherman (2006) have examined the impact of trade liberalization on different aspects of the economy.

The CGE model as illustrated by Lofgren *et al* (2002) has the price and production blocks which incorporates production, distribution and demand. Equilibrium in these markets is determined by wages and prices adjusting simultaneously in all markets. Equations (1) to (10) in the appendix 1 indicate the prices derived from the model, they are in relative terms, any absolute prices required are determined exogenously. Producers maximize their profits depending on the level of technology and aggregated factor supply i.e. labour and capital. Production is assumed to take place in two stages: in the first stage, value added and intermediate consumption is combined using Leontief technology and in the second stage, different factors: capital land and labour are combined using constant elasticity of substitution (CES) technology to produce value added, while different intermediate inputs are also combined to produce intermediate consumption. Equations (11) to (18) indicate the equations of the production block of the CGE model.

Equations (19) to (27) provides the equations for the commodity block showing aggregate output produced by combining activities of different commodities. Aggregate output is then composed of aggregates exports and domestic production. Based on the work of Armington (1969), who introduced imperfect substitutability of goods which has largely been extended to the trade sector, there is imperfect substitution between imported and domestically produced goods, so that import demand is based on constant elasticity of substitution while export supply is based on constant elasticity of transformation. Domestically produced goods combined with imports produce a composite commodity which is consumed by households, government, intermediate use and investment.

The institutions incorporated in this model are households, government, enterprises and the rest of the world. These institutions provide a path through which trade liberalization affects households. Equations (28) to (32) provide incomes of institutions including intra institutional transfers. Equations (33) and (34) are the consumption of marketed and home produced commodities by households. The model closure of the IFPRI model is illustrated by Lofgren *et al* (2002) and Robinson (2003). Given the assumption of the fixed supply of primary factors of production, equilibrium in these markets is determined by wages and prices adjusting simultaneously in all markets so that supply equals demands in both factor and product markets. Supply and demand equations are also homogeneous of degree zero in prices so that doubling prices does not change demand. The trade balance i.e. foreign savings is assumed to be fixed, real exchange rate adjusts to achieve equilibrium, hence with fixed foreign savings, investment is said to be 'savings driven'. Government revenue must equal expenditure while total savings must equal total investment. This CGE model is the orthodox applied neoclassical model for welfare analysis. However, there are other strands of CGE models that do relax the Walrasian restrictions so that new elements such as nominal price rigidities, unbalanced government budgets in equilibrium and nominal exchange rates are introduced. Johansen

(1960) pioneered such works followed by macro structuralists as Lance Taylor (1990) whose works are more focused on Keynesian economics.

3.3 DATA

The social accounting matrix for Kenya 2003 was used in this analysis. The Kenyan SAM has 50 commodity/activity accounts. The activity account is valued at producers' prices, in this case Kshs. 1,886,249 million. The commodity account is valued at purchase prices i.e. Kshs. 2,440,000 million, which includes indirect commodity taxes and transaction costs. There are two factors of production in this matrix: labour (Kshs. 430,332 million) and capital (Kshs. 499,236 million). Labour has been further subdivided into skilled, semi-skilled and unskilled, while capital includes land. Trade and transportation costs are the costs associated with domestic, import, and export marketing are valued at Kshs. 97,623 million. Government income and payments are disaggregated into a core government account and different tax collection accounts are valued at Kshs. 218,359 million. The households in the SAM consist of both urban and rural and are divided into ten so that there are 20 households in total. The capital account has the saving-investment account valued at Kshs. 196,554 million and the change in stock account values at Kshs. 17,444 million. The rest of the world account which deals with imports and exports are valued at Kshs. 424,120 million.

4 SIMULATION RESULTS AND DISCUSSION

Two simulations were undertaken; Trade liberalization scenario where average tariffs for agricultural products reduce by 0.71 percent and average applied tariff for NAMA products reduce by 10.42 percent. While considering special/sensitive products and full liberalization where all tariffs are eliminated. Lastly a dynamic simulation was provided to establish the trade outlook of Kenya in 15 years' time.

4.1 PRICE AND VOLUME EFFECTS

Table 9 provides a summary of the sectoral impacts of trade liberalization. Under Simulation 1 most agricultural commodities are protected as special /sensitive products therefore a 0.02 percent increase in import prices leads to a 0.11 percent increase in quantity demanded of agricultural imports. The manufacturing sector recorded an import price decrease of 1.07 percent resulting in a 2.4 percent increase in the quantity of manufactured. Services were not part of the simulations, however, prices changes were due to exchange rates and indirect effects associated with increases in import demand of commodities with strong links to services. Domestic sales on the other hand adjust to the changes of import prices and quantities. Given the price increase in agricultural imports, the prices of domestic supply of agricultural commodities increase by 0.08 percent resulting in a 0.01 percent decrease in quantity demanded. Specific agricultural commodities are not much affected in this simulation since most of them are protected and are not subject to tariff cuts, while at the same time, considering that the tariff reduction was 0.72 percent.

For manufactured products, the domestic supply price of decrease by 0.18 percent resulting in a 0.29 percent decrease in quantity demanded. Normally when imports increase, exports prices should increase in order to maintain the same level of balance of payment and also because producers switching to export production. The increase in export prices on the other hand can also be attributed to exchange rate increases as also found by Sharma (2008) on similar studies done in India. From table 9, the price of agricultural exports has increased by 0.14 percent leading to an increase in quantity exported by 0.07 percent. This increase can be attributed to exchange rate adjustments. The changes in prices and volumes for different agricultural and non- agricultural commodities are also provided. Specific manufactured commodities that are affected by the tariff reductions include milling, beverages and bakery and confectionery (5.25, 1.97 and 1.55 percent respectively) resulting in increase in imported quantities (14.34, 3.85 and 3.24 respectively)

Table 4: Effects of Trade Liberalization on Sectoral Prices and Volumes.

Simulation1	PM	QM	PDS	QD	PE	QE	PX	QX
Agriculture*	0.02	0.11	0.08	-0.01	0.14	0.07	0.11	0.08
Maize	0.14	-0.22	0.09	-0.06	0.14	0.10	0.09	-0.06
Wheat	0.14	-0.16	0.15	-0.17	0.14	-0.18	0.15	-0.17
Rice	0.14	-0.10	0.08	-0.03			0.08	-0.03

Simulation1	PM	QM	PDS	QD	PE	QE	PX	QX
Barley			0.19	-0.01	0.14	-0.17	0.19	-0.02
Cotton			0.12	-0.15	0.14	-0.08	0.12	-0.14
Other Grains			0.17	0.00	0.14	-0.08	0.16	-0.04
Sugar	0.14	-0.17	0.13	-0.14	0.14	-0.11	0.13	-0.13
Coffee			0.07	0.21	0.15	0.40	0.13	0.38
Tea	0.14	0.02	0.14	0.02	0.14	0.02	0.14	0.02
Root			0.09	-0.06			0.09	-0.06
Oils	0.06	0.03	0.12	-0.08	0.15	-0.03	0.13	-0.06
Fruits			0.14	-0.10	0.15	-0.08	0.14	-0.09
Vegetables	0.14	-0.15	0.10	-0.06	0.14	0.04	0.12	-0.03
Cut flowers			-0.09	0.00	0.14	0.77	0.14	0.75
Other Crops	0.12	0.01	0.12	0.01	0.14	0.09	0.13	0.03
Beef			0.07	1.45			0.07	1.45
Dairy			0.10	-0.03			0.10	-0.03
Poultry			0.08	-0.01			0.08	-0.01
Other Livestock			0.08	-0.02			0.08	-0.02
Goat			0.10	0.00			0.10	0.00
Fish			0.02	-0.01			0.02	-0.01
Forestry			0.04	-0.02			0.04	-0.02
Mining	-0.84	1.70	-0.19	-1.00	0.15	0.31	0.11	0.17
Manufacturing*	-1.07	2.40	-0.18	-0.29	0.15	0.68	-0.07	0.02
Meat	-0.74	3.24	-0.01	-0.12	0.15	0.56	0.03	0.07
Milling	-5.25	14.34	-0.19	-0.24			-0.19	-0.24
Bakery & Confectionery	-1.55	2.60	-0.17	-0.27	0.14	0.36	-0.13	-0.20
Beverages	-1.97	3.85	-0.07	-0.11	0.15	0.33	-0.01	0.02
Other manuf. foods	0.02	-0.02	-0.22	0.03	0.15	0.45	0.01	0.30
Textile	-1.05	1.95	-0.34	-1.09	0.15	0.74	-0.20	-0.55
Footwear	-1.21	3.36	-0.21	-0.25	0.15	0.97	-0.14	-0.01
Wood	-1.09	1.61	-0.22	-0.48	0.15	0.28	0.06	0.10
Printing & Publishing	-0.06	0.01	-0.10	0.07			-0.10	0.07
Petroleum	-0.33	0.19	-0.20	-0.56	0.15	0.57	-0.03	0.00
Chemicals	-0.05	0.05	0.00	-0.16	0.14	0.39	0.10	0.22
Machinery	-0.44	0.22	-0.33	-0.31	0.14	1.46	-0.07	0.66
Non-Metallic Manuf.	-0.68	1.52	-0.27	-0.21	0.15	1.34	-0.22	-0.03

Simulation1	PM	QM	PDS	QD	PE	QE	PX	QX
Other manufactures	-0.63	0.70	-0.24	-0.41	0.14	0.66	-0.15	-0.17
Services*	0.14	-0.15	0.03	0.56	0.14	0.13	0.03	0.57

Simulations 2	PM	QM	PDS	QD	PE	QE	PX	QX
Agriculture	-5.87	13.23	0.44	-2.39	1.74	0.98	0.86	-1.05
Maize	-7.18	30.56	1.03	-1.36	1.74	0.95	1.03	-1.34
Wheat	-14.59	-0.26	-6.44	-26.61	1.74	-3.23	-5.10	-23.08
Rice	1.74	-1.44	0.89	-0.59			0.89	-0.59
Barley			2.13	0.01	1.74	-1.23	2.09	-0.12
Cotton			1.38	-1.40	1.74	-0.26	1.41	-1.31
Other Grains			1.88	-0.01	1.74	-0.48	1.82	-0.20
Sugar	-2.09	1.20	0.63	-3.86	1.74	-1.89	1.00	-3.20
Coffee			0.73	2.66	1.73	5.18	1.60	4.85
Tea	-5.84	23.50	0.83	-1.35	1.73	1.55	1.66	1.29
Root			0.92	-0.85			0.92	-0.85
Oils	-9.76	21.81	1.15	-1.48	1.73	-0.43	1.37	-1.09
Fruits			1.50	-1.21	1.73	-0.48	1.54	-1.08
Vegetables	-5.76	17.52	0.96	-1.23	1.73	0.67	1.20	-0.65
Cut flowers			-0.89	0.00	1.74	8.88	1.70	8.74
Other Crops	-1.59	8.71	1.12	-0.47	1.74	1.54	1.31	0.13
Beef			0.69	-6.09			0.69	-6.09
Dairy			0.93	-0.31			0.93	-0.31
Poultry			0.56	-0.11			0.56	-0.11
Other Livestock			0.69	-0.27			0.69	-0.27
Goat			1.05	-0.05			1.05	-0.05
Fish			-0.09	-0.12			-0.09	-0.12
Forestry			0.16	-0.29			0.16	-0.29
Mining	-7.77	17.51	-1.77	-9.99	1.73	2.99	1.37	1.62
Manufacturing	-10.08	45.94	-2.12	-3.09	1.73	7.46	-0.93	0.23
Meat Processing	-6.79	34.87	-0.22	-1.45	1.73	7.28	0.32	0.90
Milling	-50.79	429.75	-6.39	-3.47			-6.39	-3.47
Bakery &	-14.69	28.92	-2.31	-2.49	1.73	5.75	-1.86	-1.60

Simulations 2	PM	QM	PDS	QD	PE	QE	PX	QX
Confectionery								
Beverages	-18.82	47.81	-1.02	-1.37	1.73	4.19	-0.19	0.28
Other manufactures	0.60	-0.21	-2.56	0.61	1.72	5.70	0.18	3.86
Textile	-9.86	20.24	-3.30	-11.10	1.73	7.51	-1.74	-5.59
Footwear	-11.38	38.36	-2.17	-2.95	1.73	10.86	-1.35	-0.12
Wood	-10.23	16.92	-2.13	-5.11	1.71	2.89	0.81	0.97
Printing & Publishing	-0.21	-0.53	-0.90	0.76			-0.90	0.76
Petroleum	-2.87	1.76	-1.66	-5.59	1.73	5.59	0.08	0.03
Chemicals	-0.08	0.17	0.23	-1.64	1.74	4.02	1.28	2.28
Machinery	-3.96	2.24	-2.79	-3.21	1.74	14.80	-0.22	6.75
Non-Metallic Manuf.	-6.21	16.05	-2.31	-2.14	1.73	13.93	-1.83	-0.30
Other manufactures	-5.77	6.78	-2.14	-4.05	1.74	6.99	-1.24	-1.56
Services	1.74	-2.08	0.39	-0.96	1.74	1.81	0.42	-0.91

*average,

PM, PDS, PE and PX (import, domestic supply, export and average output price.); QM, QD, QE and QX (import, domestic, export and output quantities.)

Source: Author's Calculation

Under simulations 2 in table 9, the complete elimination of tariffs results in a 5.87 percent reduction in import prices leading to 13.23 percent increase in the quantity demanded of imports. The increase in demand for imports results in reduction in demand for domestic products, the local producers have to adjust their prices upwards to meet their production costs, as a result, domestic supply prices increase by 0.44 percent leading to a decline in the quantity demanded of domestic commodities by 2.39 percent. Exports have to increase to finance the increased import demand, these prices increase by 1.74 percent resulting in a 0.98 percent increase in export quantities, this can be explained by the fact that producers equally reorient their production to the export market since export prices are increasing. The price of output increases by 0.86 percent resulting in a decrease in a 1.05 percent decrease in quantity demanded. Under agricultural products, wheat, maize, oils and vegetables record the highest increases in import prices (14.59, 7.18, 9.76 and 5.76 respectively, resulting in increases in quantity demanded for maize (30.56 percent), oils (21.81 percent) and vegetables (17.52 percent), wheat however registered a drop in demand of 0.26 percent. This is quite interesting since it is expected that demand for wheat should increase. Nyangito *et al* (2002) in their work on wheat production in Kenya found that price of wheat is not a determinant of wheat importation, but the prevailing market conditions from the import market determine the amount of wheat to be imported.

On the manufacturing side, the average price of manufactured imports decreases by 10.08 percent resulting in a 45.94 percent increase in manufactured imports. The local producers are greatly affected as they have to adjust their prices downwards; reducing the supply price by 2.12 percent results in quantities

demand decreasing by 3.09 percent. Export prices equally adjust upwards by 1.73 percent resulting in increase in exports by 7.46 percent. These adjustments decrease overall manufacturing output by 0.23 percent. The main manufacturing products affected are milling, beverages, and bakers and confectionery which record major decreases in their import prices (50.79, 18.82 and 14.69 percent respectively) resulting in increase in quantities demanded (429.75, 47.81 and 28.92 percent respectively). Clearly, the manufacturing sector has gained more from trade liberalization; this can be attributed to the fact that our import concentration index is approximately 52 percent.

4.2 FACTOR MOVEMENT AND VALUE ADDED

The impact of trade liberalization will result in reallocation of resources and sectors are therefore affected differently. The change in sectoral price and volumes as shown on table 9 will also result in changes in factor demand and the quantity demanded of factors of production which also affects the quantity of value added. Factor demand has a direct effect on welfare since incomes will be affected. Under simulation 1, the demand for all categories of labour (skilled, semi-skilled and unskilled) has increased for agriculture while the demand for land decreases by 0.025 percent. As a result the quantity of value added has also increased by 0.011 percent. Since most agricultural commodities are protected in this simulation, changes in factor demand are quite small. In the manufacturing sector, demand for skilled labour reduces by 0.046 percent while semi-skilled and unskilled labour demand increase by 0.012 and 0.014 percent respectively. Overall demand for value added has increased by 0.023 percent. The demand for value added for milling, bakery and confectionery, textiles, footwear, non-metallic manufactures and other manufactures. The demand for value added equally decreases for the services sector due to liberalization.

Table 5: Change in Factor Demand and Value Added by Sectors (%)

Simulation 1	Skilled	Semi-Skilled	Unskilled		QVA
Agriculture*	0.005	0.040	0.056		0.011
Maize	-0.071	-0.037	-0.025		-0.062
Wheat	-0.186	-0.152			-0.166
Rice	-0.034	0.000			-0.034
Barley	-0.006	0.028			-0.023
Cotton	-0.149	-0.115	-0.104		-0.143
Other Grains	-0.030	0.004	0.016		-0.036
Sugar	-0.138	-0.104	-0.092		-0.130
Coffee	0.440	0.475	0.486		0.375
Tea	0.019	0.053	0.065		0.018
Roots & Tubers	-0.099	-0.065	-0.054		-0.063
Oils	-0.083	-0.049	-0.037		-0.078
Fruits	-0.115	-0.080	-0.069		-0.110
Vegetables	-0.073	-0.038	-0.027		-0.046

Simulation 1	Skilled	Semi-Skilled	Unskilled		QVA
Cut Flowers	0.852	0.886	0.898		0.753
Other Crops	0.043	0.077	0.088		0.034
Beef	-0.023	0.011	0.022		-0.002
Dairy	-0.108	-0.074	-0.063		-0.055
Poultry	-0.089	-0.054	-0.043		-0.038
Goat	-0.086	-0.051	-0.040		-0.043
Other Livestock	-0.114	-0.080	-0.069		-0.036
Fish	-0.059	-0.025			-0.004
Forestry	-0.094	-0.060			-0.017
Mining	0.329	0.363			0.166
Manufacturing*	-0.046	0.012	0.040		0.023
Meat	0.182	0.216	0.227		0.065
Milling	-1.121	-1.087	-1.076		-0.159
Bakery & Confectionery	-0.384	-0.350	-0.338		-0.199
Beverage		0.047	0.058		0.020
Other Manufactures	0.641	0.675	0.687		0.300
Textile	-0.829	-0.796	-0.784		-0.552
Footwear	-0.039	-0.005			-0.005
Wood	0.212	0.246	0.258		0.097
Print		0.162			0.073
Petroleum		0.096	0.108		0.002
Chemicals	0.390	0.424	0.436		0.216
Machinery	1.060	1.095	1.106		0.663
Non-metallic Manuf.	-0.339	-0.305			-0.032
Other Manufactures	-0.283	-0.249	-0.238		-0.170
Services*	-0.036	-0.016	-0.004		-0.009

Simulation 2	Skilled	Semi-Skilled	Unskilled		QVA
Agriculture*	-1.158	-0.748	0.646		-0.810
Maize	-1.505	-1.097	-0.835		-1.280
Wheat	-25.993	-25.686			-21.609
Rice	-0.705	-0.293			-0.595
Barley	0.008	0.423			-0.124
Cotton	-1.410	-1.001	-0.739		-1.312
Other Grains	-0.153	0.261	0.526		-0.204
Sugar	-3.569	-3.169	-2.913		-3.198

Simulation 2	Skilled	Semi-Skilled	Unskilled		QVA
Coffee	5.628	6.066	6.347		4.851
Tea	1.379	1.800	2.069		1.289
Roots & Tubers	-1.437	-1.029	-0.767		-0.902
Oils	-1.402	-0.993	-0.731		-1.241
Fruits	-1.532	-1.124	-0.862		-1.403
Vegetables	-1.230	-0.820	-0.557		-0.776
Cut Flowers	9.895	10.351	10.643		8.741
Other Crops	0.085	0.500	0.766		0.128
Beef	-0.428	-0.015	0.250		-0.110
Dairy	-1.310	-0.900	-0.638		-0.666
Poultry	-0.894	-0.483	-0.220		-0.349
Goat	-1.176	-0.766	-0.504		-0.618
Other Livestock	-1.517	-1.108	-0.847		-0.495
Fish	-1.119	-0.709			-0.095
Forestry	-1.449	-1.040			-0.288
Mining	3.192	3.620			1.621
Manufacturing*	-0.015	0.571	1.133		0.367
Meat	2.584	3.010	3.282		0.900
Milling	-10.097	-9.724	-9.485		-1.503
Bakery & Confectionery	-3.205	-2.804	-2.547		-1.596
Beverage		0.537	0.803		0.276
Other Manufactures	8.510	8.960	9.249		3.856
Textile	-8.249	-7.869	-7.625		-5.588
Footwear	-0.806	-0.394			-0.121
Wood	1.982	2.405	2.676		0.972
Print		1.702			0.757
Petroleum		1.358	1.626		0.026
Chemicals	4.031	4.462	4.738		2.275
Machinery	11.012	11.473	11.768		6.754
Non-metallic Manuf.	-3.250	-2.848			-0.302
Other Manufactures	-2.682	-2.278	-2.020		-1.563
Services*	-0.542	-0.279	-0.016		-0.143

Source: Author's Calculation

In simulation 2, there is a decrease in the demand for skilled labour (1.158 percent), semi-skilled labour (0.748 percent) and land (1.89 percent). Unskilled labour demand increases by 0.646 percent. Wheat and

sugar record the highest reduction in the quantity of value added while cut flowers gains the most in the increase for demand for quantity of value added. In the manufacturing sector, the demand for skilled labour decreases by 0.015 percent while semi-skilled and unskilled labour increase by 0.6 and 1.1 percent respectively. With full liberalization the demand for labour is greatly reduces in milling, bakery and confectionery and textiles, at the same time, other manufactures, and machinery record a leap in demand for all labour categories. Labour demand is negatively affected in the services sector.

4.3 CONSUMPTION EFFECTS

The changes in sectoral prices and volume due to trade liberalization equally affect the incomes which in turn affect household consumption. The changes in household consumption are shown on table 11. The households are divided into deciles hence there are twenty households in total. In simulation 1, there is minimal change in real household consumption which is 0.10 percent for most rural households In the urban households, the poorest household, urban1, 3 and 7 record a 0.10 percent increase in real consumption while rural7-10 and Urban0, 5, 6, 8 and 9 do not record any increases in real consumption. With full liberalization, most the urban households 0, 2 and 4 record approximately 2 percent increase in real consumption.

Table 6: Changes in Households Real Consumption (%)

	Simulation 1	Simulation 2		Simulation 1	Simulation 2
Rural0	0.10	1.60	Urban0		2.70
Rural1	0.10	1.40	Urban1	0.10	1.40
Rural2	0.10	1.00	Urban2	0.20	2.10
Rural3	0.10	1.00	Urban3	0.10	1.80
Rural4	0.10	0.80	Urban4	0.20	2.00
Rural5	0.10	0.70	Urban5		-0.10
Rural6	0.10	0.70	Urban6		0.60
Rural7		0.50	Urban7	0.10	0.90
Rural8		0.50	Urban8		-0.30
Rural9		0.20	Urban9		0.10

Source: Author's Calculation

4.4 WELFARE EFFECTS

The measure of welfare in this analysis is equivalent variation (EV), changes in nominal income and consumer price index (CPI). Table 12 provides the changes in welfare based on the three indicators. Under simulation 1, there is a 0.1 percent increase in equivalent variation for rural households 1-6. Rural7 to 9 do not have any increase in equivalent variations, the EV therefore shows that consumption has increased for

rural households as compared to the urban households. Column 2 provides the percentage change in nominal incomes; rural0 has the highest percentage change in nominal incomes. Comparing to urban households under simulation 1, urban4 has the highest increase in equivalent variation compared to the other urban households. Furthermore, while all urban households have increases in nominal income, urban0, which is the poorest urban decile, records a 0.006 percent decrease in income. All urban households have a decrease in the price index particularly the poor households.

Table 7: Welfare Impacts (%)

	Simulation 1			Simulation 2		
	EV	Income	CPI Change	EV	Income	CPI Change
Rural0	0.1	0.187	0.000	1.6	2.045	-0.781
Rural1	0.1	0.166	0.000	1.4	1.793	-0.773
Rural2	0.1	0.146	-0.110	1	1.554	-0.661
Rural3	0.1	0.14	-0.110	1	1.499	-0.661
Rural4	0.1	0.13	-0.110	0.8	1.36	-0.661
Rural5	0.1	0.129	0.000	0.7	1.344	-0.550
Rural6	0.1	0.126	0.000	0.7	1.301	-0.552
Rural7		0.118	-0.111	0.5	1.217	-0.556
Rural8		0.12	0.000	0.5	1.229	-0.559
Rural9		0.1	0.000	0.2	0.976	-0.452
Urban0		-0.006	-0.249	2.6	-0.318	-5.603
Urban1	0.1	0.098	-0.127	1.3	1.049	-1.906
Urban2	0.1	0.137	-0.250	2.1	1.49	-2.243
Urban3	0.1	0.165	-0.120	1.8	1.862	-1.435
Urban4	0.2	0.162	-0.125	2	1.822	-1.743
Urban5		0.054	0.000	-0.2	0.446	-0.716
Urban6		0.046	-0.249	0.5	0.356	-1.616
Urban7	0.1	0.085	-0.121	0.8	0.86	-1.573
Urban8		0.047	0.000	-0.3	0.325	-0.706
Urban9		0.087	0.000		0.806	-0.588

Source: Author's Calculation

Simulation 2 provides higher changes in equivalent variation compared to simulation 1 for all rural households, however, in the urban households Urban5 and 10 record a decrease in equivalent variation. The change in CPI for urban households is much higher than that of rural households, while comparing the changes in nominal income; Urban0 has a decrease in income. In general, rural households have registered a higher percentage change in income compared to urban households.

4.5 POVERTY

The measure of welfare in this analysis is equivalent variation (EV), changes in nominal income and consumer price index (CPI). Table 2 provides the changes in welfare based on the three indicators. Under simulation 1, nominal incomes have increased for all households, the price index has also reduced for most households and there is a 0.1 percent increase in equivalent variation for rural households except the richest decile, while in the urban households, deciles 5, 8 and 9 do not have any increases in EV implying increases in consumption. The results in simulation 2 show similar trend with higher magnitudes. These indicators are important in establishing whether welfare has improved.

Table 2: Welfare Impacts (%)

	Sim1			Sim2		
	Change in nominal income (%)	Change in CPI (%)	Equivalent Variation	Change in nominal income (%)	Change in CPI (%)	Equivalent Variation
Rural0	0.151	0.000	0.1	1.789	-0.781	1.5
Rural1	0.139	0.000	0.1	1.606	-0.773	1.3
Rural2	0.128	-0.110	0.1	1.425	-0.661	1.0
Rural3	0.125	-0.110	0.1	1.389	-0.661	1.0
Rural4	0.113	-0.110	0.1	1.234	-0.661	0.8
Rural5	0.114	0.000	0.1	1.231	-0.550	0.7
Rural6	0.113	0.000	0.1	1.198	-0.552	0.7
Rural7	0.111	-0.111	0.1	1.162	-0.556	0.6
Rural8	0.111	0.000	0.1	1.162	-0.559	0.5
Rural9	0.094	0.000	0.0	0.926	-0.452	0.2
Urban0	0.000	-0.249	0.1	-0.235	-5.603	2.0
Urban1	0.107	-0.127	0.1	1.112	-1.906	1.4
Urban2	0.125	-0.250	0.1	1.389	-2.243	2.0
Urban3	0.155	-0.120	0.1	1.711	-1.435	1.7
Urban4	0.154	-0.125	0.1	1.728	-1.743	1.9
Urban5	0.056	0.000	0.0	0.472	-0.716	-0.2
Urban6	0.052	-0.249	0.1	0.418	-1.616	0.5
Urban7	0.091	-0.121	0.1	0.905	-1.573	0.8
Urban8	0.047	0.000	0.0	0.34	-0.706	-0.3
Urban9	0.087	0.000	0.0	0.81	-0.588	0.0

Source: Author's Calculation

While the indicators in table two show that welfare has improved for most households, it would be important to establish whether these increases have led to poverty reduction, this question is answered in table 3.

The incidence of poverty using the headcount ratio has reduced by 0.07 percent under simulation 1 for the rural households while in the urban households the increase is by approximately 1 percent. The income gap (P_1), has also reduced in both simulations, however, there magnitude of change is higher in the urban areas as compared to the rural areas. In terms of poverty severity, the changes in both scenarios are not different from each other.

Table 3: Poverty Incidence (%)

	Head Count (%)	Change in % points	Poverty Gap (%)	Change in % points	Severity (%)	Change in % points
	P_0		P_1		P_2	
Rural						
Base	49.71		17.8		8.91	
Simulation1	49.64	-0.07	17.77	-0.03	8.89	-0.02
Simulation2	49.11	-0.60	17.44	-0.36	8.68	-0.23
Urban						
Base	34.43		11.65		5.57	
Simulation1	33.40	-1.03	11.64	-0.01	5.55	-0.02
Simulation2	33.38	-1.05	11.24	-0.41	5.32	-0.25

Source: Author's Calculation

5 CONCLUSION AND POLICY RECOMENDATIONS

In conclusion, the research has examined the impact of trade liberalization on Kenya using two scenarios; first, tariffs are reduced for agricultural products tariffs by 0.71 percent while non - agricultural product tariffs are reduced by 10.42 percent while considering the special/sensitive products. In the second simulation, there is full elimination of tariffs on all products. Several conclusions can be reached based on the simulations undertaken.

1. In general full liberalization has a greater impact on welfare as compared to liberalization based on the negotiations under the Doha Development Agenda, where there are minimal tariff cuts.
2. The manufacturing sector is more affected by trade liberalization as compared to the agricultural sector with particular reference to sectoral price and volume changes.
3. The main agricultural subsectors that are affected by trade liberalization in terms of price and volume effects are wheat, maize, sugar, tea, oils, vegetables and mining. In manufacturing, milling, bakery and confectionery, beverages, textiles, footwear and wood are greatly affected.
4. The wheat milling and textiles sub-sector are greatly affected when it comes to employment, the demand for labour will reduce in these sectors.
5. In terms of welfare loss due to trade liberalization, the urban poorest are the greatest casualties.

From the analysis, it is clear that the urban poorest are the most vulnerable when it comes to opening up the market to international trade, hence the government should put in extra efforts on initiative that would bring the urban poorest out of poverty and also ensure that they are less vulnerable to shock such as trade liberalization. While the manufacturing sector will gain more from international trade, there is bound to be a lot of shifts in demand for labour and hence employment. There should be initiatives geared towards ensuring that movement of labour between sectors is possible so that the active population is equipped with skills that will allow them to also adjust to the changing market demand for labour due to trade liberalization. The wheat, textile, milling and footwear sectors are particular vulnerable to decline in labour demand when the markets are opened up, special attention should be given to them. Lastly, the impact of trade liberalization on poverty and households welfare is positive though quite small. It could imply that trade liberalization alone is not sufficient to improve welfare but a combination of other policies that improve economic performance are also important component of ensuring that trade liberalization results in poverty reduction and development.

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APPENDIX

MODEL SETS, PARAMETERS, AND VARIABLES

Symbol	Explanation	Symbol	Explanation
Sets			
$a \in A$	activities	$c \in CNE$ ($\subset C$)	non exported commodities
$a \in ACES$ ($\subset A$)	set of activities with a CES function at the top of the technology nest	$c \in CND$ ($\subset C$)	commodities without domestic market sales of domestic output
$a \in ALEO$ ($\subset A$)	set of activities with a Leontief function at the top of the technology nest	$c \in CMN$ ($\subset C$)	set of non-imported commodities
$c \in C$	- set of commodities	$f \in F$	factors
$c \in CM$ ($\subset C$)	set of imported commodities	$i \in INS$	institutions
$c \in CT$ ($\subset C$)	set of domestic trade inputs (distribution commodities)	$i \in INSD$ ($\subset INS$)	domestic institutions
$c \in CE$ ($\subset C$)	set of exported commodities	$i \in INSDNG$ ($\subset INSD$)	domestic non-government institutions
$c \in CD$ ($\subset C$)	set of commodities with domestic sales of domestic output	$h \in H$ ($\subset INSDNG$)	households
$c \in CX$ ($\subset C$)	set of commodities with domestic output	$c \in SP$ ($\subset C$)	Sensitive products
Parameters			
pwm_c	import price (cost insurance and freight) in foreign currency	$\text{int } a_a$	quantity of intermediate input per unit of activity a
tm_c	import tariff rate	tva_a	value added tax for activity a
$icm_{c'c}$	quantity of commodity c. as trade input	$ica_{c,a}$	Proportion of commodity c to aggregate intermediate input in activity

Symbol	Explanation	Symbol	Explanation
	per imported unit of c.		a
pwe_c	export price free on board	$shif_{i,f}$	share of domestic institution i in income of factor f
te_c	Export tax rate	$trnsfr_{i,f}$	transfer from factor f to institution i
$ice_{c'c}$	quantity of commodity c. as trade input per exported unit of c.	$shii_{i,i}$	share of net income of domestic non government institution to domestic non government institution.
$icd_{c'c}$	quantity of commodity c. as trade input per unit of c produced and sold domestically	tf_f	direct tax rate of factor f
θ_{ac}	Yield of output c per unit of activity a	$\overline{qg}_c$	base year quantity of government demand
$ica_{c,a}$	Quantity of c per unit of aggregate intermediate input a	$qdst_c$	Stock change (qty)
ta_a	tax rate for activity	$\overline{tins}_i$	exogenous direct tax for domestic institution i
$cwts$	Weight of commodity c in the consumer price index	$tins01_i$	parameter which takes value 1 for institutions with potential for flexible interest rate
$dwts$	Weight of commodity c in the producer price index	$\overline{mps}_i$	base savings rate for domestic institution i
iva_a	quantity of value added per unit of activity a	$mps01_i$	0-1 parameter with 1 for institution with potentially flexed direct tax rates
α_a^a	Efficiency parameter in the CES activity function	δ_c^t	CET function share parameter
α_a^{va}	Efficiency parameter in the CES value-added function	δ_{fa}^{va}	CES value-added function share parameter for factor f in activity a
α_c^{ac}	Shift parameter for domestic commodity aggregation function	γ_{ch}^m	Subsistence consumption of marketed commodity c for household h

Symbol	Explanation	Symbol	Explanation
α_c^q	Armington function shift parameter	$\gamma_{a,c,h}^h$	Subsistence consumption of home commodity c from activity a by household h
α_c^t	CET function shift parameter	θ_{ac}	Yield of output c per unit of activity a
$\beta_{a,c,h}^h$	Marginal share of consumption spending on home commodity c from activity a for household h	ρ_a^a	CES production function exponent
β_{ch}^m	Marginal share of consumption spending on marketed commodity c for household h	ρ_a^{va}	CES value-added function exponent
δ_a^a	CES activity function share parameter	ρ_c^{ac}	Domestic commodity aggregation function exponent
δ_{ac}^{ac}	Share parameter for domestic commodity aggregation function	ρ_c^q	Armington function exponent
δ_c^q	Armington function share parameter	ρ_c^t	CET function exponent
Exogenous Variables			
$\overline{CPI}$	Consumer price index	$\overline{MPSADJ}$	Savings rate scaling factor (= 0 for base)
$\overline{DTINS}$	Change in domestic institution tax share (= 0 for base; exogenous variable)	$\overline{QFS}_f$	Quantity supplied of factor
$\overline{FSAV}$	Foreign savings (FCU)	$\overline{TINSADJ}$	Direct tax scaling factor (= 0 for base; exogenous variable)
$\overline{GADJ}$	Government consumption adjustment factor	$\overline{WFDIST}_{fa}$	Wage distortion factor for factor f in activity a
$\overline{IADJ}$	Investment adjustment factor		
Endogenous Variables			
$DMPS$	Change in domestic institution savings rates (= 0 for base; exogenous variable)		

Symbol	Explanation	Symbol	Explanation
DPI	Producer price index for domestically marketed output	QH_{ch}	Quantity consumed of commodity c by household h
EG	Government expenditures	QHA_{ach}	Quantity of household home consumption of commodity c from activity a for household h
EH_h	Consumption spending for household	$QINTA_a$	Quantity of aggregate intermediate input
EXR	Exchange rate (LCU per unit of FCU)	$QINT_{ca}$	Quantity of commodity c as intermediate input to activity a
$GSAV$	Government savings	$QINV_c$	Quantity of investment demand for commodity
QF_{fa}	Quantity demanded of factor f from activity a	QM_c	Quantity of imports of commodity c
MPS_i	Marginal propensity to save for domestic non-government institution (exogenous variable)	QQ_c	Quantity of goods supplied to domestic market (composite supply)
PA_a	Activity price (unit gross revenue)	QT_c	Quantity of commodity demanded as trade input
PDD_c	Demand price for commodity produced and sold domestically	QVA_a	Quantity of (aggregate) value-added
PDS_c	Supply price for commodity produced and sold domestically	QX_c	Aggregated quantity of domestic output of commodity
PE_c	Export price (domestic currency)	$QXAC_{ac}$	Quantity of output of commodity c from activity a
$PINTA_a$	Aggregate intermediate input price for activity a	$TABS$	Total nominal absorption
PM_c	Import price (domestic currency)	$TINS_i$	Direct tax rate for institution i ($i \in INSDNG$)
PQ_c	Composite commodity price	$TRII_{ii'}$	Transfers from institution i' to i (both in the set INSDNG)
PVA_a	Value-added price (factor income per unit of activity)	WF_f	Average price of factor

Symbol	Explanation	Symbol	Explanation
PX_c	Aggregate producer price for commodity	YF_f	Income of factor f
$PXAC_{ac}$	Producer price of commodity c for activity a	YG	Government revenue
QA_a	Quantity (level) of activity	YI_i	Income of domestic non-government institution
QD_c	Quantity sold domestically of domestic output	YIF_{if}	Income to domestic institution i from factor f
QE_c	Quantity of exports	$INVSHR$	investment share in nominal absorption
QG_c	Government consumption demand for commodity	$GOVSHR$	government share in nominal absorption

MODEL EQUATIONS

Price and Production Equations

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

$$PE_c = pwm_c \times (1 - te_c) \times EXR - \sum_{c' \in CT} PQ_{c'} \times ice_{c',c} \quad (2)$$

$$PDD_c = PDS_c + \sum_{c' \in CT} PQ_{c'} \times icd_{c',c} \quad (3)$$

$$PQ_c (1 - tq_c) \times QQ_c = PDD_c \times QD_c + PM_c \times QM_c \quad (4)$$

$$PX_c QX_c = PDS_c \times QD_c + PE_c \times QE_c \quad (5)$$

$$PA_a = \sum_{c \in C} PXAC_{a,c} \times \theta_{a,c} \quad (6)$$

$$PINTA_a = \sum PQ_c ica_{c,a} \quad (7)$$

$$PA_a (1 - ta_a) \times QA_a = PVA_a \times QVA_a + PINTA_a \times QINTA_a \quad (8)$$

$$\overline{CPI} = \sum PQ_c \times cwts \quad (9)$$

$$\overline{DPI} = \sum PDS_c \times dwts \quad (10)$$

$$QA_a = \alpha_a^a \times \left(\delta_a^a \times QVA_a^{-\rho_a^a} + (1 - \delta_a^a) \times QINTA_a^{-\rho_a^a} \right)^{-\frac{1}{\rho_a^a}} \quad (11)$$

$$\frac{QVA_a}{QINTA_a} = \left(\frac{PINTA_a}{PVA_a} \times \frac{\delta_a^a}{1 - \delta_a^a} \right)^{\frac{1}{1 + \rho_a^a}} \quad (12)$$

$$QVA_a = iva_a \times QA_a \quad (13)$$

$$QINTA_a = \text{int } a_a \times QA_a \quad (14)$$

$$QVA_a = \alpha_a^{va} \left(\sum_{f \in F} \delta_{f,a}^{va} \times QF_{f,a}^{-\rho_a^{va}} \right)^{-\frac{1}{\rho_a^{va}}} \quad (15)$$

$$WF_f \times \overline{WFDIST}_{f,a} = PVA_a(1 - tva_a) \times QVA_a \times \left(\sum_{f \in F} \delta_{f,a}^{va} \times QF_{f,a}^{-\rho_a^{va}} \right)^{-1} \times \delta_{f,a}^{va} \times QF_{f,a}^{-\rho_a^{va}-1} \quad (16)$$

$$QINT_{c,a} = ica_{c,a} \times QINT_a \quad (17)$$

$$QXAC_{a,c} + \sum_{h \in H} QHA_{a,c,h} = \theta_{a,c} \times QA_a \quad (18)$$

Commodities

$$QX_c = \alpha_c^{ac} \left(\sum_{a \in A} \delta_{a,c}^{ac} \times QXAC_{a,c}^{-\rho_c^{ac}} \right)^{-\frac{1}{\rho_c^{ac}-1}} \quad (19)$$

$$PXAC_{a,c} = PX_c \times QX_c \left(\sum_{a \in A'} \delta_{a,c}^{ac} \times QXAC_{a,c}^{-\rho_c^{ac}} \right)^{-1} \delta_{a,c}^{ac} \times QXAC_{a,c}^{-\rho_c^{ac}-1} \quad (20)$$

$$QX_c = \alpha_c^t \left(\delta_c^t \times QE_c^{\rho_c^t} + (1 - \delta_c^t) \times QD_c^{\rho_c^t} \right)^{\frac{1}{\rho_c^t}} \quad (21)$$

$$\frac{QE_c}{QD_c} = \left[\frac{1 - \delta_c^t}{\delta_c^t} \times \frac{PE_c}{PDS_c} \right]^{\frac{1}{\rho_c^t-1}} \quad (22)$$

$$QX_c = QD_c + QE_c \quad (23)$$

$$QQ_c = \alpha_c^q \left(\delta_c^q \times QM_c^{-\rho_c^q} + (1 - \delta_c^q) \times QD_c^{-\rho_c^q} \right)^{-\frac{1}{\rho_c^q}} \quad (24)$$

$$\frac{QM_c}{QD_c} = \left(\frac{PDD_c}{PM_c} \times \frac{\delta_c^q}{1 - \delta_c^q} \right)^{\frac{1}{1+\rho_c^q}} \quad (25)$$

$$QQ_c = QD_c + QM_c \quad (26)$$

$$QT_c = \sum_{c' \in C'} (icm_{c,c'} \times QM_{c'} + ice_{c,c'} \times QE_{c'} + icd_{c,c'} \times QD_c) \quad (27)$$

Institutions

$$YF_f = \sum_{a \in A} WF_f \times \overline{WFDIST}_{f,a} \times QF_{f,a} \quad (28)$$

$$YIF_{i,f} = shif_{i,f} \times \left[(1 - tf_f) \times YF_f - trnsfr_{row,f} \times EXR \right] \quad (29)$$

$$YI_i = \sum_{f \in F} YIF_{i,f} + \sum_{i' \in INSDNG} TRII_{i,i'} + trnsfr_{i,gov} \times \overline{CPI} + trnsfr_{i,row} \times EXR \quad (30)$$

$$TRII_{i,i'} = shii_{i,i'} \times (1 - MPS_{i'}) \times (1 - TINS_{i'}) \times YI_{i'} \quad (31)$$

$$EH_h = \left(1 - \sum_{i \in INSDNG} shii_{i,h} \right) \times (1 - MPS_h) \times (1 - TINS_h) \times YI_h \quad (32)$$

$$PQ_c \times QH_{c,h} = PQ_c \gamma_{c,h}^m + \beta_{c,h}^m \left(EH_h - \sum_{c' \in C} PQ_{c'} \gamma_{c',h}^m - \sum_{a \in A} \sum_{c \in C} PXAC_{a,c'} \gamma_{a,c',h}^h \right) \quad (33)$$

$$PXAC_{a,c} \times QHA_{a,c,h} = PXAC_{a,c} \times \gamma_{a,c,h}^h + \beta_{a,c,h}^h \left(EH_h - \sum_{c' \in C} PQ_{c'} \gamma_{c',h}^m - \sum_{a \in A} \sum_{c \in C} PXAC_{a,c'} \gamma_{a,c',h}^h \right) \quad (34)$$

$$QINV_c = \overline{IADJ} \times qinv_c \quad (35)$$

$$QG_c = \overline{GADJ} \times \overline{qg}_c \quad (36)$$

$$\begin{aligned} YG = & \sum_{i \in INSDNG} TINS_i \times YI_i + \sum_{f \in F} tf_f \times YF_f + \sum_{a \in A} tva_a \times PVA_a \div QVA_a + \sum_{a \in A} ta_a \times PA_a \times QA_a \\ & + \sum_{c \in CM} tm_c \times pwm_c \times QM_c \times EXR + \sum_{c \in CE} te_c \times pwe_c \times QE_c \times EXR + \sum_{c \in C} tq_c \times PQ_c \times QQ_c \\ & + \sum_{f \in F} YIF_{gov} + trnsfr_{gov,row} \times EXR \end{aligned} \quad (37)$$

$$EG = \sum_{c \in C} PQ_c \times QG_c + \sum_{i \in INSDNG} trnsfr_{i,gov} \times \overline{CPI} \quad (38)$$

System Constraints and Macroeconomic Closure

$$\sum_{a \in A} QF_{f,a} = \overline{QFS}_f \quad (39)$$

$$QQ_c = \sum_{a \in A} QINT_{c,a} + \sum_{h \in H} QH_{c,h} + GC_c + QINV_c + qdst_c + QT_c \quad (40)$$

$$YG = EG + GSAV \quad (41)$$

$$\sum_{c \in CM} pwm_c \times QM_c + \sum_{f \in F} trnsfr_{row,f} = \sum_{c \in CE} pwe_c \times QE_c + \sum_{i \in INSD} trnsfr_{i,row} + \overline{FSAV} \quad (42)$$

$$\sum_{i \in \text{INSDNG}} \overline{MPS}_i \times (1 - \overline{TINS}_i) \times \overline{YI}_i + \overline{GSAV} + \overline{EXR} \times \overline{FSAV} = \sum_{c \in C} \overline{PQ}_c \times \overline{QINV}_c + \sum_{c \in C} \overline{PQ}_c \times \overline{qdst}_c \quad (43)$$

$$\overline{TINS}_i = \overline{tins}_i \times \left(1 + \overline{TINSADJ} \times \overline{tins01}_i\right) + \overline{DTINS} \times t \quad (44)$$

$$\overline{MPS}_i = \overline{mps}_i \times \left(1 + \overline{MPSADJ} \times \overline{mps01}_i\right) + \overline{DPMS} \times \overline{mps01}_i \quad (45)$$

$$\begin{aligned} \overline{TABS} &= \sum_{h \in H} \sum_{c \in C} \overline{PQ}_c \times \overline{QH}_{c,h} + \sum_{a \in A} \sum_{c \in C} \sum_{h \in H} \overline{PXAC}_{a,c} \times \overline{QHA}_{a,c,h} + \sum_{c \in C} \overline{PQ}_c \overline{QG}_c \\ &+ \sum_{c \in C} \overline{PQ}_c \times \overline{QINV}_c + \sum_{c \in C} \overline{PQ}_c \overline{qdst}_c \end{aligned} \quad (46)$$

$$\overline{INVSHR} \times \overline{TABS} = \sum_{c \in C} \overline{PQ}_c \times \overline{QINV}_c + \sum_{c \in C} \overline{PQ}_c \overline{qdst}_c \quad (47)$$

$$\overline{GOVSHR} \times \overline{TAB} = \sum_{c \in C} \overline{PQ}_c \overline{QG}_c \quad (48)$$
