

# **The Impact of Multilateral Trade Liberalization on Poverty in Kenya: A Multiple Linked Top-Down Approach**

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## **1. Introduction**

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## 2. Background on the country

### 1. Macroeconomic Structure and Performance

Kenya's economic performance has continued to improve since 2003. Before this period, real GDP growth was quite depressed. For example, between 1998 and 2002, real GDP growth averaged 1.0%, while it was 5% over the period 2003- 2006. The sluggish growth before 2002 can be explained by factors such as declining level of private investment; net long-term resource outflows; low savings; unfavorable terms of trade; and excessive borrowing by the government. Other factors include: weakness in governance; poor management of public resources; poor infrastructure; deterioration in public safety and security; slow pace of economic reforms resulting in low external aid, and severe droughts experienced from time to time.

Economic recovery during the period 2003-2006 has been attributed to many factors including improvements in tourism, improved business environment, growth in the export sector, lower borrowing by Government, increases in foreign exchange reserves, and improvements in tax revenue mobilization. This has been accompanied by several governance reforms in trade licensing, public expenditure management, decentralization and local government reforms.

Better growth outcomes have also improved the level of per capita income and reduced poverty levels. Between 2003 and 2007, per capita income improved by 8.2%. Similarly, current estimates of well-being in the country reveal that overall poverty incidence declined from 52.3 per cent in 1997 to 45.9% in 2005/6 (GOK, 2007). Food poverty declined by 2.9% from 48.7% to 45.8%.

Table 1: Growth of GDP and sector contribution to growth

	2000	2001	2002	2003	2004	2005	2006
Agriculture, forestry and fishing	29.4	27.8	25.8	25.7	24.7	23.6	24
Mining and Quarrying	0.4	0.5	0.5	0.5	0.5	0.5	0.5
Manufacturing	10.3	9.8	9.8	9.7	9.9	10.3	10.2
Construction	2.9	3.1	3.1	3.3	3.7	4.1	4.3
Services	46.7	48.9	50.3	50.6	50.6	50.5	50.6
Growth of GDP	0.5	4.5	0.5	2.9	5.1	5.7	6.1

*Note: The sectoral classifications in this table follow the SNA 1993 classification. Note that the sector shares do not add up to 100% since the amount of net taxes should be added.*

*Source: GOK( 2006&2007)*

The structure of Kenya's economy has remained fairly similar in the last few years (Table 1). Services (especially private services) remain the major contributor to GDP followed by agriculture. The manufacturing sector is yet to take a major share in the economy.

However, it is important to note that the share of agriculture in GDP has been declining slowly over time while private services have been increasing over time.

The Kenyan economy is predominantly agricultural, with almost 80 per cent of the population living in rural areas and deriving their livelihoods largely from agriculture. The sector absorbs about 60% of the labor force, contributes 60% of export earnings, and accounts for 75% per cent of merchandise exports. In agriculture, small holders and subsistence farmers play a key role, they contribute 70% of the marketed agricultural production.

The contribution of the services sector to the Kenyan economy in terms of both employment creation and foreign exchange earnings is significant (KIPPRA, 2005). Transport, tourism and telecommunications services are the top three service exports in the country while insurance, transport and travel (tourism) are the top three service imports.

The share of manufacturing in Kenya's GDP has stagnated at around 10%. This is mainly because the performance of manufacturing industry has been poor. There has been stagnation in output, productivity and employment. Manufacturing employment only represents 13.1% of total wage employment, and about 25% of private sector employment. A number of factors are responsible for potential losses in industrial competitiveness. First, the unit labor cost in Kenya has been rising since the 1990s. Second, Kenya's industry has been characterized by low value addition, high import dependency, low capital productivity and the dominance of small-scale production. Thirdly, there has been a relatively slow rate of capital formation and the capital stock is largely outdated with most firms running at excess capacity.

## **2. Trade Agreements and the Kenyan Economy**

Kenya has been moving towards more liberal outward oriented regimes in pursuit for increased market access to regional and global markets and greater integration into the world economy. This is evident by the trade policy reforms undertaken since independence which range from price - oriented measures i.e. tariffs, export taxes or subsidies, retention schemes, duty exemptions and import deposits to quantity - based trade policy instruments like import quotas, import bans, import licensing and export quotas or price measures related to export targets (Onjala, 2002). In the 1960's, there was emphasis on export promotion and africanisation; import substitution in the 70's; removal of quantitative controls, expansion of export incentives and rationalization of import protection in the 80's In the mid-80's, Kenya adopted a number of policy interventions in seeking to address underlying deterioration of the terms of trade by improving incentives for exporters and adoption of a number of export promotion programmes all aimed at stimulating exports making them more competitive (GOK, 1986). Thereafter, there has been greater openness through trade liberalization reforms, elimination of price and exchange rate restrictions, lowering of tariffs and scrapping of suspended duties in the 90's (GoK 2004).

The above reforms have been pursued either unilaterally or following commitments made during bilateral, regional and multilateral trade negotiations. Kenya is thus a signatory to various trade agreements and also a beneficiary to preferential trading arrangements. At the international level, Kenya is a founder member of the World Trade Organization (WTO) and signatory to the African Caribbean Pacific and European Union (ACP-EU) Cotonou Partnership Agreement. It is also a beneficiary to preferential trade arrangements such as the Generalized System of Preferences (GSP) and the African Growth and Opportunity Act (AGOA) initiative of the USA.

At the regional level, Kenya is a member of the East Africa Community (EAC), the Common Market for Eastern and Southern Africa (COMESA), the Intergovernmental Authority on Development (IGAD), and the Cross Border Initiative (CBI). Kenya has also signed a number of bilateral trade agreements with several trading partners.

**a: The World Trade Organization**

The WTO was an outcome of the Uruguay Round of negotiations between 1986-1994 which included a major revision of the original General Agreement on Tariffs and Trade (GATT) formed in 1947. With a membership of 150 countries, it the WTO is the largest single body dealing with trade between nations at the global or near global level. Its main function is to ensure that trade between nations takes place as smoothly, predictably and freely and as far as possible. Thus, the WTO is the legal and institutional basis of the multilateral trading system.

Kenya became a member of the WTO during its inception in January 1995. Kenya's domestic and external trade policy has largely been influenced by the WTO. The Doha Development Round of the WTO negotiations has set an ambitious agenda for multilateral trade liberalization. Overall, trade preferences and the role of preference erosions are expected to play an important role in the evolving Doha Round.

The market access negotiations on non-agricultural products are aimed at further reducing or as appropriate eliminating tariffs and non-tariff barriers among WTO members. However, non-LDC countries, including Kenya, are exempted from tariff formula reductions but are expected to increase their binding coverage. For instance, they have the option to increase their binding coverage to 70% at a bound average rate of 28.5% or a 90% binding coverage at an average bound rate of 50%.

On the other hand, the main areas of concern in agriculture include, market access, export subsidies and domestic support. With regard to agriculture market access, Kenya favors the G20 tariff reduction proposals for developed and developing countries.

Currently, Kenya has an average bound tariff of 95% for all products. On the other hand, the average tariff bound for agricultural products is 100% while that for non-agricultural or industrial products is 54.8%.

**b: African Caribbean Pacific-European Union (ACP-EU) Cotonou Partnership Agreement**

The Cotonou Partnership Agreement, which was signed on 23<sup>rd</sup> 2000, aims at reduction and eventual elimination of poverty while contributing to sustainable development and to the gradual integration of ACP countries into the global economy. It replaced the Lome Convention which had been the basis for cooperation between the ACP- EU development cooperation since 1975. The Cotonou agreement envisages the signing of Economic Partnership Agreements (EPAs) by December 2007 between the EU and ACP countries. The EPAs which will be the new cooperative framework under the CPA are expected to adopt an integrated approach based on partnership and promoting cooperation, trade and political dialogue between the EU and ACP countries. The key CPA principles are reciprocity, differentiation, deeper regional integration and coordination of trade and aid. Kenya is deeply involved in the EPA negotiations under the Eastern and Southern Africa (ESA) configuration.

Kenya's participation in the ongoing EPA negotiations stems from the importance of the European Union market to Kenyan exports, following the non-reciprocal trade arrangements. The EU accounts for about 30% of Kenya's total exports (GoK, 2007). EPAs is envisaged to generate severe challenges to ACP, for instance, how to manage the expected losses of fiscal revenue, coping with increased competition under the principle of reciprocity and dealing with market access constraints for agricultural and non-agricultural products.

**c: The East Africa Community (EAC)**

The EAC was re-launched in 1999 by Kenya, Uganda and Tanzania, with the aim of widening and deepening co-operation among partner states in among others, political, economic and social fields for mutual benefit of all member states. The community launched a customs union in January 2005, with a three band tariff common external tariff regime namely:- 0% for capital goods and raw materials, 10% for semi-processed goods and 25% for finished products. Rwanda and Burundi have formally join the community in beginning July 2007, thereby bringing its size to 115 million people and a combined GDP of US\$ 40 billion.

The EAC constitutes Kenya's single largest export destination accounting for about 70% of total exports. Besides, EAC market integration will promote investment and specialization. The integration process is expected to eliminate the current state of price differentiations and lead to better efficiency and resource allocation. Besides, the launching of a Common External Tariff has taken away the flexibility of member states in so far as tariff negotiations and measures are concerned.

**d: The Common Market for Eastern and Southern Africa (COMESA)**

COMESA was established in 1994, replacing the preferential Trade Area for Eastern and Southern Africa States (PTA), which had been in existence since 1981. With a membership of 20<sup>1</sup> countries, combined population of about 400 million people and GDP of US\$ 270 billion, COMESA is the largest trading bloc in Africa. The COMESA Free Trade Area (FTA), launched in December 2000, currently has 13 member states and is scheduled to become a customs union in December 2008.

Kenya was a founder member of COMESA and the FTA. Through a steadfast implementation of COMESA integration programmes, COMESA has since become Kenya's leading export destination i.e. accounting for 36.6% total exports as compared to 25.4% to the EU Far East & Australia (12.1%) and Middle East (4.9%) during 2005. Kenya's exports to COMESA countries grew by 63.6% from US\$530.7 million in 2004 to US\$868.3 million in 2005 and accounted for 36.6% of exports. Most Kenyan exports to COMESA comprise of manufactured as opposed to primary products, thus enhancing diversification of Kenya's manufacturing base.

COMESA member states have agreed on a four - band tariff regime namely: - 0% for raw materials, 0% capital goods, 10% intermediate products and 25% for finished products.

**e: The Intergovernmental Authority on Development (IGAD)<sup>2</sup>**

The Intergovernmental Authority on Drought and Development (IGADD) was formed in 1986 with an initial mandate of issues around drought and desertification. In 1996, it was revitalized into the Intergovernmental Authority on Development (IGAD) with a broader mandate of conflict management and resolution, humanitarian affairs; infrastructure Development and Food security and environment. IGAD member states have committed to implement on COMESA trade cooperation measures.

**f: Bilateral Trade Agreements**

Kenya has signed a number of bilateral trade agreements in pursuit of market access for her products. Some of the countries with which there are trade agreements include:- Algeria, Argentina, Bangladesh, Belarus, Canada, China, Comoros, Congo D.R., Cyprus, Djibouti, Eritrea, India, Iraq, Lesotho, Liberia, Malaysia, Mauritius, Nigeria, Pakistan, Russia, Rwanda, Saudi Arabia, Somali, South Korea, Sudan, Swaziland, Tanzania, Thailand, Turkey, Ukraine, Zambia and Zimbabwe. Some of the agreements are currently being reviewed in light of regional and multilateral trade commitments.

**g: Other Preferential Trade Arrangements**

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<sup>1</sup> COMESA member states include Angola, Burundi, Comoros, Djibouti, DR Congo, Egypt, Ethiopia, Eritrea, Kenya, Libya, Madagascar, Malawi, Mauritius, Rwanda, Sudan, Seychelles, Swaziland, Uganda, Zambia, Zimbabwe

<sup>2</sup> IGAD members include Djibouti, Ethiopia, Eritrea, Kenya, Somali, Sudan and Uganda

### **(i). The African Growth and Opportunity Act (AGOA)**

The African Growth and Opportunity Act (AGOA) enacted in 2000 by the US Government, is a unilateral market access offer to Sub-Saharan countries, including Kenya. Kenya qualified for the AGOA 'wearing apparel' on January 2001, being one of the first Sub-Sahara African countries to acquire eligibility. In 2002, AGOA exports constituted over 77% of Kenya's total exports to the US, of which textiles and apparels were the dominant category (AGOA, 2007). Four subsequent amendments have been done to the original AGOA Act. The third one was signed into law in July 2004, which extended preferential access fro imports from beneficiary sub-Saharan Africa countries until September, 2015. The latest one (AGOA IV) which came into force in December 2006 extended third country fabric sourcing which was due to expire in September 2007 for a further four years until September 2012.

### **(ii). The Generalized System of Preferences (GSP)**

GSP is a programme designed to promote economic growth in developing countries by providing duty-free entry of exports from beneficiary countries. The scheme which was negotiated under the auspices of the UNCTAD grants reduced or zero tariff rates over MFN rates to beneficiary countries. The objectives are to increase the export earnings of preference-receiving countries, promote their industrialization and accelerate their rate of economic growth. Currently, there are 13 national GSP schemes notified to the UNCTAD Secretariat. Kenya is a beneficiary of the following 11 GSP schemes:- Bulgaria, Canada, Estonia, European Union, Japan, New Zealand, Norway, Russia, Switzerland, Turkey and the US.

## **3. The Technical approach:**

### **3.1 Description of the Top-Down Approach**

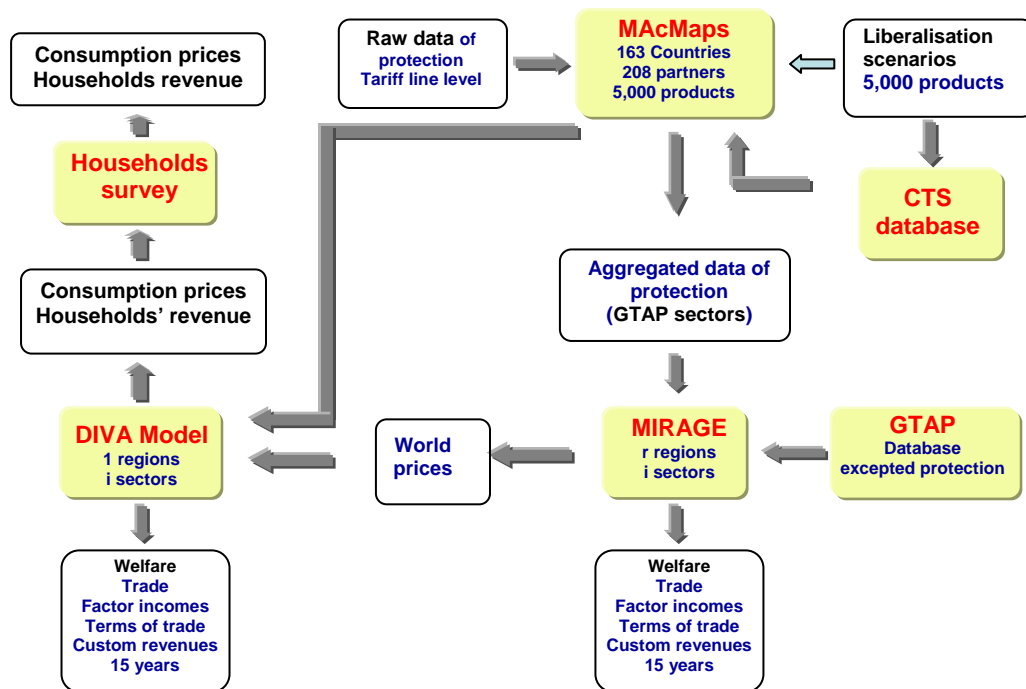
Since the study focuses only on the effects of the WTO scenarios on the Kenyan economy and given that the Kenyan<sup>3</sup> SAM is not included separately in the GTAP database, a top down approach that links a global model to a single country model has been developed (See Figure 1). This global approach is based on two main tools, the MIRAGE global CGE model and the MacMAp database for multilateral trade protection.

Figure 1: Description of the Top-Down approach adopted in this study

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<sup>3</sup> There are expectations that Kenya will be one of the new regions in Version 7 of the GTAP database, which is likely to have up to 19 African countries.





### The standard version of the MIRAGE model

The MIRAGE model has been constructed in order to assess the impact of globalization on the individual regions in the global economy. The model is a relatively standard neo-classical model of economic activity. It is based on the latest release of the GTAP data set, version 6.0. The model is designed for analyzing dynamic scenarios. The scenarios are solved as a sequence of static equilibrium, with the periods being linked by dynamic variables — population and labor growth, capital accumulation, and productivity. Policy scenarios are compared to a baseline, or business-as-usual, scenario. As far as dimensions are concerned, there are 3 essential dimensions for the MIRAGE model. Table 1 provides a complete description. Due to the existence of a flexible aggregation facility, the regional and sectoral definitions of the model are easy to modify.

**Table 1: Dimension of MIRAGE Model**

Index	Description
$i$	Sectors
$r$	Regions
$t$	Time (currently 2001-2015)

In what follows, a brief presentation of the main characteristics of the model is given, which concerns the modeling of demand, supply, capital, markets clearing and macroeconomic closure, and dynamic.

**Demand:** The demand side is modeled in each region through a representative agent, whose utility function is intra-temporal, with a fixed share of the regional income allocated to savings, the rest used to purchase final consumption.<sup>4</sup> Below this first-tier Cobb-Douglas function, consumption trade-off across sectors is represented through a LES-CES function. Each sectoral sub-utility function is a nesting of CES functions, comparable to the standard nested Armington – Dixit-Stiglitz function (see e.g. Harrison et al., 1997), with two exceptions. Firstly, domestic products are assumed to benefit from a specific status for consumers, making them less substitutable to foreign products than foreign products between each other. Secondly, products originating in developing countries and in developed countries are assumed to belong to different quality ranges<sup>5</sup>.

**Supply:** Production makes use of five factors: capital, labor (skilled and unskilled), land and natural resources. The first three are generic factors; the last two are specific factors. The production function assumes perfect complementarity between value added and intermediate consumption. The sectoral composition of the intermediate consumption aggregate stems from a CES function. For each sector of origin, the nesting is the same as for final consumption, meaning that the sector bundle has the same structure for final and intermediate consumption. The structure of value added is intended to take into account the well-documented skill-capital relative complementarity. These two factors are thus bundled separately, with a lower elasticity of substitution (0.6), while a higher substitutability (elasticity 1.1) is assumed between this bundle and other factors. Constant returns to scale and perfect competition are assumed to hold in agricultural sectors.

**Capital, markets clearing and macroeconomic closure:** The capital good is the same whatever the use sector, and capital is assumed to be perfectly mobile across sectors within each region. At the region-wide level, capital stock is assumed to be constant in the core simulations of this paper. Natural resources are also perfectly immobile and may not be accumulated. Both types of labor, as well

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<sup>4</sup> The structure of the demand function is shown in Appendix 6.

<sup>5</sup> This is motivated by the fact that, following Abd-El-Rahman (1991), several empirical works have shown that, even at the most detailed level of classification (Combined Nomenclature, 10 digits, including more than 10,000 products), unit values differences are able to reveal quality differences (see e.g. Fontagné et al., 1998; Greenaway and Torstensson, 2000).

as land, are assumed to be perfectly mobile across sectors. Production factors are assumed to be fully employed. All production factors are immobile internationally. As to macroeconomic closure, the current balance is assumed to be exogenous (and equal to its initial value in real terms), while real exchange rates are endogenous.

**Dynamics:** In a typical recursive dynamic framework, the time path of the model is solved as a sequence of static equilibrium in each year. In other words, the solution in any given year is not a function of forward looking variables, though it may be an explicit function of past variables, though known and therefore exogenous. While there are drawbacks in the recursive dynamic framework, particularly in the modeling of saving and investment behavior, its one key advantage is that it is much easier to set up and solve (van der Mensbrugghe, 1998). There are several backward linkages linking one period to another: population growth, productivity increases, and capital accumulation. Most of these linkages can be re-solved outside of the modeling framework, or in other words, in between solution periods. One of the exceptions is the capital accumulation function. Before running any policy simulations in a dynamic framework, it is often required to define some sort of reference scenario, or as it is sometimes called, a business-as-usual scenario (BaU). The BaU scenario makes some assumptions about a broad range of dynamic variables — population and labor supply growth rates, the growth rate of factor productivity, and other exogenous variables. If all productivity variables are pre-determined, as well as the population growth rates, the growth rate of real GDP is endogenous. However, the path trend in real GDP growth may be unrealistic, or at least inconsistent with the assumed trend from other studies or prospective outlooks. One way to resolve this dilemma is to make the growth of real GDP exogenous in the reference scenario, and to allow some other variable pick up the slack. In subsequent simulations, i.e. in simulations with policy shocks, the growth rate of capital and labor productivity, are exogenous, and it is the growth of real GDP and the capital-labor ratio, which are endogenous.

### **3.3. Description of the single country model**

#### **3.3.1. The SAM 2003**

The 2003 Social Accounting Matrix (SAM) was constructed by the Kenya Institute for Public Policy Research and Analysis (KIPPRA) and the International Food Policy Research Institute (IFPRI). A full description of the SAM 2003 is available in the document produced jointly by IFPRI and KIPRA (2006) titled: A 2003 Social Accounting Matrix (SAM) For Kenya. The document displays the dimension of the SAM 2005.

### 3.3.2. The DIVA Kenyan version

DIVA is a recursive, dynamic multi-sectoral single country model. A full presentation of the standard version of the model is given in Bchir et ali (2007). Meanwhile and for data limitations and in order to take into account the objectives of the present study, substantial changes were introduced to the original version of the model. This section presents these changes.

The first change introduced to the model is the elimination of the formal/informal features of production by activity. This simplification was imposed by the lack of data on formal and informal production technologies. In addition, and given that the SAM allows for some activities to produce more than one single commodity, we opted for a multi-commodity production function for some sectors.

#### \* The production block:

In each period  $t$  and for each activity  $A$  the production function  $Y(A,t)$  is supposed to be a Leontief function that combine the Value Added  $VA(A,t)$  and the total intermediate consumption  $INT(A,t)$ . The Leontief function is defined in equation (1).

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$$Y(A,t) = \text{Min} \left[ \frac{VA(A,t)}{a\_Y\_VA(A,t)}, \frac{INT(A,t)}{a\_Y\_INT(A,t)} \right] \quad (1)$$

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Where  $a\_Y\_VA(A,t)$  and  $a\_Y\_INT(A,t)$  are the Leontiel function coefficients that can vary according to the time  $t$  in order to capture the effects of the variation of the production structure and technology.

#### \*\* The Value Added

**Rural Value Added:** Agricultural sectors use land, capital unskilled and skilled<sup>6</sup> rural workers in order to achieve the Value Added  $VA(A,t)$ . The Value Added function is supposed to be a nested CES function that combines capital and land in the first stage in order to form the  $K\_Land(A,t)$  composite factor that is combined with the rural composite labor  $L\_AGG^{RUR}(A,t)$  that is also CES

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<sup>6</sup> In the standard version of the model, agricultural activities do not use skilled labor. The Kenyan SAM proves the in Kenya agriculture is using skilled labor.

function of the skilled and unskilled rural labor factors ( $L^{RUR}(UNS,A,t)$  and  $L^{RUR}(SKL,A,t)$ ). This hypothesis is chosen so as to take into account the highest level of substitutability between land and capital compared to their levels of substitution with labor. Taking into account these specificities, for every  $A \in \{1, \dots, N_{RUR}\}$ , the Value Added function for agricultural sectors is defined by equation (2).

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$$VA(A,t) = A^{RUR}(t)CES(K\_Land(A,t), L\_AGG^{RUR}(A,t)) \quad (2)$$

$$K\_Land(A,t) = CES(Land(A,t), K(A,t)) \quad (3)$$

$$L\_AGG^{RUR}(A,t) = CES(L^{RUR}(UNS,A,t), L^{RUR}(SKL,A,t)) \quad (4)$$


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$A^{RUR}(i,t)$  is a coefficient that captures the economic productivity level in agricultural sectors. This coefficient is supposed to depend on the level of public capital on agriculture and infrastructure and on the diversification index  $DI(t)$ <sup>7</sup>.

**Urban Value Added:** Urban production, uses Skilled urban labor  $L^{URB}(SKL,A,t)$ , unskilled urban labor  $L^{URB}(UNS,A,t)$  and capital  $K(A,t)$  as production factors. Using a nested two stages CES function, a distinction is made between the various substitution levels among the various labor categories and capital<sup>8</sup>. Taking into account these specificities, for every  $A \in \{N_{RUR} + 1, \dots, N\}$  the Value Added function for non-agricultural production is given by equation (5)

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$$VA(A,t) = A^{URB}(t)CES(CES(L^{URB}(UNS,A,t), L^{URB}(SKL,A,t)), K(A,t)) \quad (5)$$


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$A^{URB}(i,t)$  is a coefficient that captures the productivity level in urban areas. This coefficient is supposed to depend on the level of public capital  $K(G,t)$  and on the

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<sup>7</sup> The definition of  $A^{RUR}(i,t)$  will be given by equation (6).

<sup>8</sup> In the standard version of DIVA we have supposed a higher substitution between Capital and skilled labor. In this version we have supposed that the different labor categories are more substitutable than the capital. This changes was highly recommended by our colleagues in the Carnegie foundation

diversification index  $DI(t)$ . Relationships between productivity, diversification level and public capital will be presented in the next section<sup>9</sup>.

**Productivity, diversification and public policy :** In DIVA, public policies are not neutral. Indeed, studies such as Barro (1990) and Kelly (1997) have already proved the contribution of public expenditure as a whole in economic growth. More recent papers have refined the analysis by distinguishing the contribution of different types of public expenditure. Fan and Rao (2003) have estimated the contribution of five types of public capital in economic growth for a panel of 43 developing countries. Their results have shown that the contribution to growth of the majority of public capital components are significantly positive, confirming the hypothesis of the non neutrality of public expenditure to growth. In addition, and as shown by Ben Hammouda et al. (2006), economic diversification has a positive effect on economic productivity. DIVA also adopts the second element of externality. Finally and as intimated in equations (2) and (4) only agricultural and formal production modes could benefit from these externalities. Equations (5) and (6) describe the relationships between productivity (approximated by coefficients  $A^{RUR}(t)$  and  $A^{URB}(t)$ ), the level of economic diversification  $DI(t)$  and the different components of public capital. Agricultural production is supposed to benefit from diversification externalities as well as externalities coming from agricultural public capital  $KG^{AGRIC}(t)$  and infrastructures public capital  $KG^{INFRA}(t)$ . This relationship is described by equation (6). The formal production is also supposed to benefit from diversification externalities as well as externalities coming from education public capital  $KG^{EDUC}(t)$ , transport and telecommunication public capital  $KG^{TELEC}(t)$  and infrastructures public capital  $KG^{INFRA}(t)$ . This relationship is described by equation (7). The economic diversification level is defined by the normalized Hirschman index (Ben Hammouda et al. (2006)) (equation (7))

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$$A^{RUR}(t) = A_0^{RUR} [DI(t)]^{\alpha_{DI}} [KG^{AGRIC}(t)]^{\alpha_{KG^{AGRIC}}} [KG^{INFRA}(t)]^{\alpha_{KG^{INFRA}}} \quad (6)$$

$$A^{URB}(t) = A_0^{URB} [DI(t)]^{\alpha_{DI}} [KG^{EDUC}(t)]^{\alpha_{KG^{EDUC}}} [KG^{TELEC}(t)]^{\alpha_{KG^{TELEC}}} [KG^{INFRA}(t)]^{\alpha_{KG^{INFRA}}} \quad (7)$$


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<sup>9</sup> The definition of  $A^{URB}(A,t)$  will be given by equation (7).

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$$DI(t) = \frac{\sqrt[2]{SPE(t)} - \sqrt[2]{\frac{1}{N}}}{1 - \sqrt[2]{\frac{1}{N}}}, \text{ SPE}(t) \text{ is defined as: } SPE(t) = \sum_i \left[ \frac{\sum_R E^R(c,t)}{\sum_{j,R} E^R(c,t)} \right]^2 \quad (8)$$

$E^R(c,t)$  is the level of exports of commodity  $c$  to country  $R$ .

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**\* The Demand block**

**\*\* Households demand**

In order to take into account households self consumption or subsistence consumptions, the structure of the households utility function have been changed. Indeed, households have two types of consumption, the first one is market consumption and the second one is self consumption. To define the level of demand of each type of consumption a linear expenditure system (LES) demand function is used. The basic theoretical foundations of the demand function is presented in Nganou (2004). It is derived from a Marshallian demand function and given by equation (9) and (10).

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$$C^M(c, h, t) = C_{Min}^M(c, t) + \frac{\beta^H}{PDEM(c, t)} \left[ EXP^H(h, t) - \sum_{cc} PDEM(cc, t) C_{Min}^H(c, t) - \sum_{A, cc} PY(A, cc, t) C_{Min}^{Auto}(A, c, t) \right] \quad (9)$$

$$C^{Auto}(A, c, h, t) = C_{Min}^{Auto}(A, c, t) + \frac{\beta^H}{PY(A, c, t)} \left[ EXP^H(h, t) - \sum_{c'} PDEM(c', t) C_{Min}^M(c', t) - \sum_{A, c'} PY(A, c', t) C_{Min}^{Auto}(A, c', t) \right] \quad (10)$$


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Where  $C^H(c, h, t)$  and  $C^{Auto}(A, c, h, t)$  represent the quantity of commodities  $c$  demanded by household  $h$  respectively from the market and as auto consumption from activity  $A$ .  $EXP^H(h, t)$  is the total expenditures (or income) of household  $h$ .  $C_{Min}^H(c, t)$  and  $C_{Min}^{Auto}(c, t)$  represents subsistence quantities of consumption

respectively purchased from market and as auto consumption.  $\beta^H$  represents the relative contribution of each commodity to utility after subsistence has been achieved.  $PDEM(c,t)$  and  $PY(A,c',t)$  are respectively the market price of commodity  $c$  and the production price of commodity  $c$  produced by activity  $A$

**\*\*.** *Intermediate consumption demand*

The assumption that various modes of production follow the same shape of total intermediate consumption is adopted. As indicated by equation (11), the global demand of intermediate consumptions of activity ( $A$ ) is supposed to be a CES function of various intermediate consumptions of commodities ( $c$ )  $IC(A,c,t)$ .

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$$INT(A,t) = \left[ \sum_c a_{INT}(A,c) IC(A,c,t)^{1-\frac{1}{\sigma_{INT}(j,s)}} \right]^{\frac{1}{\sigma_{INT}(j,s)}} \quad (11)$$


---

$\sigma_{INT}(A)$  is the elasticity of substitution between the various intermediate consumptions of commodities ( $c$ ) and  $a_{INT}(A,c)$  is the share of intermediate consumption of commodity ( $c$ ) for the activity ( $A$ ).

**\*\*.** **Government final demand**

The government is supposed to have two types of spending. Current spending  $G(t)$  and investment expenditure. As indicated by equation (12), the government final demand consumption  $G(t)$  is supposed to be a CES function of various government consumptions of commodities ( $c$ )  $CG(c,t)$ .

---


$$G(t) = \left[ \sum_i a_G(c) (CG(c,t))^{1-\frac{1}{\sigma_G}} \right]^{\frac{1}{\sigma_G}} \quad (12)$$


---



$\sigma_G$  is the elasticity of substitution between the various public final consumption of commodities ( $c$ ) and  $a_G(c)$  is the share of public consumption of commodity ( $c$ ) in the total governmental final consumption.

### \*\* Capital good demand

The investment decision is going to bring the whole economy to get capital goods. The choice between various capital goods  $KG(c,t)$  will take the shape of a CES function (equation (13)).

---


$$INVTOT(t) = \left[ \sum_i a_{INV}(c) (KG(c,t))^{1-\frac{1}{\sigma_{INV}}} \right]^{\frac{1}{1-\frac{1}{\sigma_{INV}}}} \quad (13)$$


---

### \*\* The Total demand and choice between local and foreign products

The total demand of a  $DEM(c,t)$  commodity  $c$  is defined by equation (14). It is equal to the sum of households demand, intermediate consumption demand, government final demand, capital good demand stock variation  $qdst(c,t)$  and transport demand  $TR(c,t)$ . This demand is satisfied by two types of providers. The first ones are local providers and the second ones are the foreign providers. The choice between local commodity  $D(c,t)$  and imported commodities from different regions  $r$   $M(c,r,t)$  is modeled using a classic Armington hypothesis and described in equation (15).

---


$$DEM(c,t) = \sum_A IC(C,A,t) + \sum_h CH(c,h,t) + CG(c,t) + KG(c,t) + qdst(c,t) + TR(c,t) \quad (14)$$

$$DEM(c,t)^{1-\frac{1}{\sigma_{IDEM}(c)}} = \left[ \left( 1 - \sum_r a_{DEM}(c,r)^{1-\frac{1}{\sigma_{IDEM}(c)}} \right) D(c,t) + \sum_r \left( a_{DEM}(c,r) M(c,r,t)^{1-\frac{1}{\sigma_{IDEM}(c)}} \right) \right] \quad (15)$$


---

## \*\* The exports function

In most single countries CGE model, firms have the choice between internal and external market. Firms make their choice according to the relative prices and maximizing their profit constrained by a CET (*Constant Elasticity of Substitution*) function and suppose that all the exports offer is absorbed by foreign market. This last supposition seems not to be very accurate as many developing countries face a problem when selling their products abroad because they do not take into consideration the importing countries demand. To avoid this problem, DIVA is innovative. The innovation consists of linking DIVA to a global model that can generate demand and world price vectors. These vectors from the global model are then plugged into the DIVA model. Accordingly, the world prices are considered as exogenous in DIVA. While the exports is supposed to be equal to the maximum of external demand as given by the global model  $EXP\_proj(c,r,t)$  and the exports capacity as defined by the CET function. Equation (16) describes this

---

$$EXP(c,r,t) = \text{Max} \left\{ D(c,t) \frac{PEXP(c,r,t)}{PDS(c,t)} \left( 1 - \frac{\sum b\_t(c,r')}{b\_t(c,r')} \right)^{\frac{1}{\sigma_{t(c)}} - 1}, \overline{EXP}(c,r,t) \right\} \quad (16)$$

---

## \* Investment and capital accumulation

Within every sector, the model considers two types of investments: the public investment and the private investment. The first one is supposed to be exogenous and depends on government choices and priorities. The second is supposed to be endogenous and depends on the profitability of the sector, the degree of diversification of the economy and the level of public investment

### \*\* Private investment

The adopted assumption on the determinants of private investment assumes that investment is explained by the following variables: level of initial capital  $K(A,t-1)$ , net return on the capital  $RK(A,t)$ , domestic interest rate  $IR(t)$ , inflation rate  $CPI(t)$ , ratio of the public investments  $INVPUB(A,t)$  on the  $GDP$

and the indication of diversification  $DI(t)$ . Equation (17) determines the level of private investment in activity  $A$ .

---


$$\frac{INV(A,t)}{K(A,t-1)} = f(IR(t), RK(A,t), CPI(t), \frac{INVPUB(A,t)}{GDP(t)}, DI(t)) \quad (17)$$


---

### **\*\* Public investment**

The level of public investment  $INVPUB(A,t)$  in activity  $A$  is supposed to be exogenous. Its value is added up to the private investment in order to obtain the total sectoral investment  $INVTOT(A,t)$ . Equation (18) defines the total sectoral investment.

---


$$INVTOT(A,t) = INV(A,t) + INVPUB(A,t) \quad (18)$$


---

### **\*\* Capital accumulation**

The level of capital at period  $t$  is equal to its level at the precedent level minus the discount rate plus the investment. Equation (19).

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$$K(A,t) = (1 - \delta)K(A,t-1) + INVTOT(A,t) \quad (19)$$


---

### **\* Labor market structure and wages definition**

The standard version DIVA considers three distinct labor markets. The first one is the unskilled agricultural labor market, the second market is the urban unskilled labor and the third one is the urban skilled labor. In the Kenyan application, the dimension formal/informal labors is not adopted. However, we considered two alternative labor markets: urban and rural.  $Area \in \{Rur, Urb\}$ .

For each type of labor  $Lab$ , labor supply  $LS^{Lab}(t)$  is supposed to grow naturally each year by  $g^{Lab}(t)$ , the dynamics of labor supply is described by equation (20). On the other hand, the labor demand  $L^{Area}(Lab,A,t)$  addressed for each category

of labor  $Lab$ , by each activity  $A$  is deduced for the cost minimization program from equation (2) to (5). The total labor -demand  $LD^{Lab}(t)$  for each type of labor  $Lab$  is described by equation (21) and equal to the sum of all the activities and areas labor of labor demand.

To take into account the unemployment effects for each type of labor we suppose that all the labors markets are not competitive markets. Wages are supposed to be not result from the confrontation between supply and demand but to depend on other macroeconomic variables. We suppose that for every labor categories  $Lab$  wages growth rates are given by equation (22) and are defined as a cobb-Duglass function of inflation rates and the evolution of the unemployment rate  $U(lab,t)$  for the concerned labor category. The unemployment rate are defined by equation (23) and supposed to be the ratio of unemployed people (the difference between labor demand and labor supply) by the labor demand

---


$$LS^{Lab}(t) = (1 + g^{Lab}(t))LS^{Lab}(t-1) \quad (20)$$

$$LD^{Lab}(t) = \sum_{A,Area} L^{Area}(Lab,A,t) \quad (21)$$

$$\frac{W(lab,t) - W(lab,t-1)}{W(lab,t-1)} = CD \left[ \frac{CPI(t) - CPI(t-1)}{CPI(t-1)}, \frac{U(lab,t) - U(lab,t-1)}{U(lab,t-1)} \right] \quad (22)$$

$$U(lab,t) = \frac{LD^{Lab}(t) - LS^{Lab}(t)}{LD^{Lab}(t)} \quad (23)$$


---

### \*. Prices definitions

Production prices are deduced assuming perfect competition in all activities. The zero profit condition (equation (24)). The Value Added prices are determined as a function of the volume and the process of the factors used in each activity. For rural activities, this relationship is given by equations (25) (26) and (27). Equations (28) and (29) represent the relations value added prices in urban areas. The total intermediate consumption price is given by equation (30). Market prices are defined by equation (31) to (37). Fours types of indirect taxes are taken into account: Sales taxes  $\tau_q(c,t)$ , imports taxes  $\tau_m(c,r,t)$  exports taxes  $\tau_e(c,r,t)$  and production taxes  $\tau_a(A,t)$ .

---


$$PY(A,t) = \frac{PVA(A,t)VA(A,t) + PINT(A,t)INT(A,t)}{Y(A,t)} \quad (24)$$

For  $A \in \{1, \dots, N_{RUR}\}$

$$PVA(A,t) = \frac{PK\_Land(A,t)K\_Land(A,t) + W_{AGG}^{RUR}(t)L\_AGG^{RUR}(A,t)}{VA(A,t)} \quad (25)$$

$$PK\_Land(A,t) = \frac{PK(A,t)K(A,t) + PLand(A,t)Land(A,t)}{K\_Land(A,t)} \quad (26)$$

$$W_{AGG}^{RUR}(t) = \frac{W_{UNS}^{RUR}(t)L^{RUR}(UNS,A,t) + W_{SKL}^{RUR}(t)L^{RUR}(SKL,A,t)}{L\_AGG^{RUR}(A,t)} \quad (27)$$

For  $A \in \{N_{RUR} + 1, \dots, N\}$

$$PVA(A,t) = \frac{PK(A,t)K(A,t) + W_{AGG}^{URB}(t)L\_AGG^{URB}(A,t)}{VA(A,t)} \quad (28)$$

$$W_{AGG}^{URB}(t) = \frac{W_{UNS}^{URB}(t)L^{URB}(UNS,A,t) + W_{SKL}^{URB}(t)L^{URB}(SKL,A,t)}{L\_AGG^{URB}(A,t)} \quad (29)$$

For  $A \in \{1, \dots, N\}$

$$PINT(A,t) = \frac{\sum_c PDEM(c,t)IC(A,c,t)}{INT(A,t)} \quad (30)$$

$$PDEM(c,t)(1 + \tau_q(c,t)) = \frac{PD(c,t)D(c,t) + \sum_r PM(c,r,t)M(c,r,t)}{DEM(C,t)} \quad (31)$$

$$PM(c,r,t) = pwm(c,r,t)(1 + \tau_m(c,r,t))M(t) + \sum_{c'} PDEM(c',t)*icm(c',c) \quad (32)$$

---


$$PX(c,r,t) = pwe(c,r,t)(1 + \tau_e(c,r,t))X(t) + \sum_{c'} PDEM(c',t)ice(c',c) \quad (33)$$

$$PD(c,t) = PDS(c,t) + \sum_{c'} PDEM(c',t)icd(c',c) \quad (34)$$

$$PYC(c,t)YC(c,t) = PDS(c,t)D(c,t) + \sum_r PX(c,r,t)X(c,r,t) \quad (35)$$

$$PYA(A,t) = \sum_c PYAC(A,c,t)\theta(A,c) \quad (36)$$

$$PVA(A,t)VA(A,t) = PYA(A,t)(1-\tau_a(A,t))YA(A,t) - PINTA(A,t)INT(A,t) \quad (37)$$


---

### \*. Household's revenues

Each factor  $F$  (labors, capital and land) generates revenue  $REV^F(t)$  defined as the sum of factor remuneration (wages, capital rate of return and land rate of return) multiplied by factor use. Equations (38) to (39) define the revenue of each local factor (labors, capital and land). This revenue are dispatched between households and firms. Each households is supposed to receive  $\Psi(h,F)$  portion of each factor while the firms are supposed to receive  $\Psi'(F)$  portion of each factor. The before revenue taxes households  $REVH(h,t)$  is defined in equation (41). This revenue has three sources:

**Factor revenue:** Each type  $h$  of household receives a part  $\Psi(h,F)$  of the local factor revenue and factors transfers from abroad  $E(t)TRF(F,t)$ , where  $E(t)$  is the nominal exchange rate. The taxation rate on factor revenue is defined as  $\tau_f(f,t)$ .

**The firm's dividend:** Each type  $h$  of households is supposed to receive a constant  $\Phi(h,t)$  from firms' revenues as dividend  $DIV(h,t)$  that is the after saving revenue and taxes of firms. Firms are supposed to save a fixed part  $\tau_{sav}^{Firms}(t)$  of their revenue as saving and to pay a part  $\tau_{DIR}^{Firms}(t)$  as direct taxes. The definition of the dividend received by each household  $h$  is given by equation (42).

**Transfers:** Households receive two types of transfers one from the government and one from abroad  $TR_G(h,t)$  and  $E(t)TR_{ROW}(t)$ .

House holds are supposed to pay a part  $\tau_{DIR}^H(h,t)$  of their revenue as direct tax. A fixed part  $\tau_{SAV}^H(h,t)$  of the net revenue  $REVH^{Net}(h,t)$  is saved. Equation (43) describes the net revenue of households. Equation (44) and (45) define respectively the revenue allocated by households to final consumption  $BUGC(h,t)$  and to saving  $SAV(h,t)$ .

---


$$REV^{Lab}(t) = \sum_A W(Lab,t)L(Lab,A,t) \quad (38)$$

$$REV^{Lab}(t) = \sum_A PK(A,t)K(A,t) \quad (39)$$

$$REV^{Land}(t) = \sum_A PLand(A,t)Land(A,t) \quad (40)$$

$$REVH(h,t) = \sum_F [\Psi(h,F)((1-\tau_f(f,t))REV^F(t) - TRF(F,t)E(t))] \\ + DIV(h,t) + TR_G(h,t) + E(t)TR_{ROW}(h,t) \quad (41)$$

$$DIV(h,t) = \Phi(h)(1 - \tau_{sav}^{Firms}(t))(1 - \tau_{DIR}^{Firms}(t)) \sum_F [\Psi'(F)((1-\tau_f(F,t))REV^F(t) - TRF(F,t)E(t))] \quad (42)$$

$$REVH^{Net}(h,t) = (1 - \tau_{DIR}^H(h,t))REVH(h,t) \quad (43)$$

$$BUGC(h,t) = (1 - \tau_{SAV}^H(h,t))REVH^{Net}(h,t) \quad (44)$$

$$SAV(h,t) = \tau_{SAV}^H(h,t)REVH^{Net}(h,t) \quad (45)$$


---

**\*. Public sectors:**

The model treats the public deficit question by modeling separately the public spending and the government incomes. The government is supposed to have three types of expenditure. The first type is the public investment  $INVPUB(t)$  and the second type is the current expenditure  $G(t)$ . The third is the current transfers. Three types of transfers are taken into account, the transfers to households

$TR_G(h,t)$ , the transfers to firms  $TR_G^{Firms}(t)$  and the transfers to the rest of the world  $+TR_G^{Row}(t)$ . The total expenditure  $EXPG(t)$  is then given by equation (46). The Government revenue is defined as the sum of indirect taxes (tariffs and consumption taxes) and direct taxes (taxes on firm's profit  $REV^{Firms}(t)$  and household's income  $REVG(h,t)$ ) and the transfers from the rest of the world  $TR_{Row}^G(t)$ . The Government revenue  $REVG(t)$  is then given by equation (46). The public deficit  $DEF(t)$  is then defined as the difference between government revenue and the government expenditure (equation (48)).

---


$$EXPG(t) = E = \sum_c PDEM(C,t) \left[ G(c,t) + KG(c) \frac{\sum_A INVPUB(a,t)}{\sum_A INVTot(A,t)} \right] \quad (46)$$

$$+ \sum_h TR_G(h,t) + TR_G^{Firms}(t) + TR_G^{Row}(t)$$

$$REVG(t) = \sum_h \tau_{DIR}^H(h,t) REVG(h,t) + \tau_{DIR}^{Firms}(t) REV^{Firms}(t) \sum_f \tau_f(f,t) REV^F(t)$$

$$+ \sum_A \tau_{va}(A,t) PVA(A,t) VA(A,t) + \sum_A \tau_a(A,t) PYA(A,t) YA(A,t) \quad (47)$$

$$+ \sum_{c,r} \tau_e(c,r,t) pwm(c,r,t) M(CE,R,t) E(t) + \sum_{c,r} \tau_e(c,r,t) pwe(c,r,t) X(c,r,t) E(t)$$

$$+ \sum_c \tau_q(c,t) PDEM(c,t) DEM(c,t) + TR_{Row}^G(t) E(t)$$

$$DEF(t) = EXPG(t) - REVG(t) \quad (48)$$


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Dynamic variables and projections

Description of the BaU scenario

#### 4. The global analysis

##### 4.1. Sectoral and regional aggregation for the global analysis.

The global approach is only used to estimate the effects of WTO scenarios based on proposed modalities in the current Doha Round, on world prices and external demand. For this reason, a limited regional disaggregation is adopted that takes into account the major international trade actors and allows a more important sectoral disaggregation. The Regional disaggregation takes into account 11 countries or regions. Three distinct categories of countries can be discerned from the regional disaggregation: developed countries or regions that contains the EU27, the USA, Japan and the Rest of Developed countries. Then there is the African countries or regions that contains the North African region, the South African Customs Union, the Southern African Development Community and the Rest of Sub-Saharan Africa. The third category is that of developing non-African countries or regions that contains China, India and the rest of developing countries. The sectoral disaggregation is more important (Table 4.1). It has tried to isolate the major sectors for Kenyan economy. The idea behind is to map the global model sectors to the single country model sectors. The sectoral disaggregation takes into account 13 agricultural sectors, 13 manufacture sectors and 2 service sectors.

**Table 4.1:** the sectoral disaggregation of the study

Agricultural sectors (13)	Manufacturing sectors (13)	Service (2)
Rice	mining	Transport services
Wheat	meat	Other services
Cereal grains nec	Other food manufactures	
Vegetables. fruit. Nuts	Bakery and confectionary	
Oil seeds	Beverages and tobacco	
Sugar	Textiles	
Plant-based fibers	Footwear	
Crops nec	Wood and papers products	
Cattle. sheep. goats. horses	Petroleum	
Animal products nec	Chemicals	

Dairy Products	Non-mettalic manufactures	
Forestry	Machinery	
Fishing	Other Manufactures	

## 4.2. Scenarios definition

**Agricultural sectors:** For agricultural sectors liberalization the three pillars of agricultural protection (i.e.: exports subsidies, domestic support, and market access) are taken into account. A liberalization scenario or formula for each one of these pillars has been defined based on the 2007 negotiation situation and consensus. The **export subsidies** are supposed to be abolished by 2013 as agreed in the Hong Kong WTO Ministerial Conference of December 2005. This shock is implemented as a one shot shock.

For the **domestic support** pillar the simulation are based on the proposals of the tiered formula. There has been consensus on the use of such formula and the issue under negotiation has just been about the magnitudes. The proposed scenario for the domestic support is given in Table 4.2 and Table 4.3. It represents the average of different propositions that were on the table during the negotiations in 2007.

In the **market access pillar**, a consensus on the use of tiered formula has also been obtained and is the basis of the negotiations on the modalities. Table 4.4. presents the scenarios implemented on the tired formula. With regards to the **special and sensitive products**, the scenarios assume that the definition of the number of lines to be considered as sensitive or sensitive depends on the level of development of the WTO member countries. Thus, for developed countries, it is assumed that if the percentage of lines with tariffs lower than 75% is lower than 30% then 5% of tariff lines can be designed as sensitive products and thus not cut. Otherwise, if the percentage of lines with tariffs lower than 75% is higher than 30% then 7% of tariff lines can be designed as sensitive products and thus not cut. For developing countries it is supposed that these have the right to profit from 1/3 more lines. This means that they can consider as sensitive lines 6.67% of their agricultural products in the first case and 9.93% in the second case. Having defined the special products the level of reduction is given in Table 4.5.

**Table 4.2.** The proposed liberalization scenario for the overall domestic support

Bands	Thresholds (US\$ billion)	Cuts Interval	The proposed cuts
3	> 60 (EU)	75% or 85%	80%
2	10 – 60 (US + Japan)	66% or 73%	69.5%
1	0 – 10 (All DC)	50% or 60 %	55%

**Table 4.3.** The proposed liberalization scenario for the Amber box

Bands	Thresholds (US\$ billion)	Cuts
3	> 20 (EU)	70%
2	12 – 20 (US + Japan)	60%
1	0 – 12 (All DC)	45 %

**Table 4.4.** The proposed scenario for market access liberalization.

Developed countries		Developing countries		LDC
Tiers	Cuts	Tiers	Cuts	No Liberalization
0-20%	45%	0-30%	25%	
20-50%	55%	30-80%	30%	
50-75%	65%	80-130%	35%	
>75%	70%	>130%	40%	
Cap: 100%		Cap: 150%		

**Table 4.5:** The rate of reduction for Special lines

Bands	Cuts
50% of SPs	0% tariff reduction
25% of SPs	5% tariff reduction
25% of SPs	10% tariff reduction

**NAMA sectors:** A Swiss formula is adopted with a coefficient of 25% for developing countries and 5% for developed countries. The LDCs are supposed to apply no cuts on their tariffs for unbound tariffs. The simulation also considers that countries have to bind their tariffs with a mark-up of 5%. In addition countries with low binding coverage < 35% are expected to increase binding coverage to 70% with an overall average applied tariff of 28.5%. For **the S&D** component, paragraph 8B of the Hong Kong Decision is used: 5% of NAMA tariff lines excluded from the formula cuts.

### 4.3. Implementation of the Global Scenarios

The **market access** liberalization scenarios are defined at the HS6 digit level using the MACMap database. This methodology allows one to take into account the binding overhang and the status of binding (see Bchir et al. 2006a). Market access was therefore implemented taking into account the binding overhang and

the status of binding. The **sensitivity criteria** of the products are supposed to be the level of the binding tariffs. **Export subsidies** are already modeled in MIRAGE. These are supposed to be equal to 0 in 2013. **Domestic support mechanisms** are more complicated to model, as they are non-linear mechanisms. **Decreux et al. ()** have developed a dedicated version of MIRAGE that takes into account the real complexity of the domestic support mechanism; meanwhile the strong non-linearity of the model does not allow them to run it in a dynamic way. For this reason and in order to take into accounts the dynamic effects, the methodology presented in Bchir et al (2007) is used in this study. This methodology consists on linking the different fiscal instruments contained in the MIRAGE model to the different boxes of domestic supports that are discussed in the WTO scenarios. This linkage is based on the work done by **Walsh et al ()**. Table 4.6 gives the mapping between the different fiscal instruments contained in MIRAGE and the different boxes of the domestic support. Table 4.7 gives then the level of applied domestic support by boxes after the implementation of the scenario presented in Table 4.2 and 4.3. This methodology allows us to take into account the binding overhang effects in domestic support.

**Table 4.6.** Mapping between boxes and MIRAGE instruments

	EU	USA	Canada	Japan	Brazil
<b>Amber Box</b>					
Output Subsidies	3,653	8,859	249	667	481
Intermediate Subsidies	1,101	1,051	67	223	0
Land-based Subsidies	103	486	403	907	0
Capital-based Subsidies	905	392	84	989	0
<b>Blue Box</b>					
Output Subsidies	0	0	0	750	0
Intermediate Subsidies	22	0	0	0	0
Land-based Subsidies	16,715	0	0	0	0
Capital-based Subsidies	7,144	0	0	0	0
<b>Green Box</b>					
Output Subsidies	147	678	14	798	15
Intermediate Subsidies	104	110	13	77	0
Land-based Subsidies	4,137	15,102	1,460	67	0
Capital-based Subsidies	5,950	36	6	180	0

Source: **Walsh et al ()**.



#### 4.4. Simulations results

The global effects of the implementation of the above scenarios are reported and discussed in this section.

**Table 4.7:** GDP variation

Region	2008	2010	2015
<b>African countries</b>			
North Africa	0.00	0.00	-0.07
SACU	0.01	-0.03	-0.23
SADC	0.02	0.06	-0.14
Rest of Sub-Saharan Africa	0.04	0.25	0.09
<b>Other developing countries</b>			
China	-0.03	-0.15	-0.15
India	-0.1	-0.04	-0.21
Rest of developing countries	0.02	0.02	-0.1
<b>Developed countries</b>			
EU27	-0.01	0.04	0.22
USA	-0.02	0.04	-1
Japan	-0.01	0.33	1.05
Rest of developed countries	0.00	0.28	0.62

**Source:** Authors computation using the MIRAGE model.

As Table 4.7 shows, given the limited ambition likely to be realized in the Doha Round, the increase in income for African countries is not likely to be significant. In deed, except for sub-Sahara Africa where a positive result is still realized, for North Africa, SACU and SADC regions, by 2015, the small positive change in GDP will have petered out.

With regards to welfare, the picture on the GDP changes is replicated, albeit in this case, by 2015 even the sub-Saharan Africa region's gain will have died out. This is the same result in North Africa and SADC regions.

It is noteworthy that with reduced ambition in the agriculture liberalisation, the developed countries incomes and welfare will experience much better outcomes that is the case with African countries. The EU, Japan and the rest of developed countries have both positive changes in the GDP and welfare. These results contrast with earlier studies that assumed more ambitious market access and domestic support reductions and which showed that the developed countries stood to experience much lower positive variations in incomes and welfare.

For the purposes of this study, the focus is not the evolution of the incomes and welfare in the different regions. Rather, the global trade reforms are taken as given. The question is how does this global trade reform play in the Kenyan economy, all the way to the household level. But given that the version of the GTAP database does not disaggregate Kenya as a stand-alone region, the study's interest is in the evolution of the world prices. These world prices are exogenous to the Kenyan exporters and importers, given the small country assumption.

**Table 4.8:** Welfare variation

Region	2008	2010	2015
<b>African countries</b>			
North Africa	-0.03	-0.03	-0.26
SACU	0.01	-0.03	0.04
SADC	0.01	0.02	-0.11
Rest of Sub-Sahara Africa	0.01	0.04	-0.18
<b>Other developing countries</b>			
China	-0.04	-0.12	-0.22
India	0.00	-0.01	-0.05
Rest of developing countries	0.00	-0.02	-0.19
<b>Developed countries</b>			
EU27	-0.01	0	0.07
USA	0	0.01	0.16
Japan	-0.01	0.11	0.33
Rest of developed countries	-0.01	0.09	0.12

**Source:** Authors computation using the MIRAGE model.

Table 4.9 shows the changes in the world prices that are as a result of the agricultural trade liberalisation based on the Doha scenarios for the different pillars in the agriculture negotiations. As the results in Table 4.9 shows, for many of the agriculture sectors, as expected, the Doha Round will lead to an improvement in the global prices. However, the price changes are still small, given that the most realistic outcome in the Doha Round is one in which tariff cuts will not be as high as originally expected. At the same time, these cuts will be implemented over time, as they are not one-time shocks. Nevertheless, at the country level, and in this case Kenya, the crucial issue is how much benefit is derived from the new global market environment. To understand this, the changes in the world prices as given in Table 4.9 will now need to be given as exogenous shocks in Kenya's country CGE-model. This will allow the tracing of the transmission mechanism of the global price changes to the different economic sectors in Kenya, given the current structure. It will also enable the understanding

of how the global agricultural and industrial goods trade reforms impact on the labour market in Kenya.

**Table 4.9:** World prices variation

Products	2008	2010	2015
Rice	-0.08	-0.43	-0.83
Wheat	0.41	1.3	2.51
Cereal grains nec	0.33	1.03	3.37
Vegetables. fruit. nuts	0.24	0.5	0.94
Oil seeds	-0.47	-0.31	0.03
Sugar	0.09	0.06	1.42
Plant-based fibers	0.24	0.38	0.8
Crops nec	0.26	0.46	0.7
Cattle.sheep.goats.horses	0.89	1.99	3.94
Animal products nec	0.45	0.86	1.24
Dairy products	0.36	0.66	2.61
Forestry	0	-0.04	-0.08
Fishing	-0.07	-0.12	-0.16
Mining	-0.01	-0.08	-0.1
Meat & dairy	0.26	0.6	3.23
Other manufactured food	0.17	0.2	0.59
Sugar	0.2	0.23	0.3
Beverages and tobacco products	0.05	0.08	0.24
Textiles and Wearing apparel	0.02	-0.08	-0.19
Leather products	0.02	-0.06	-0.09
wood and printing	-0.01	-0.03	-0.18
Petroleum. coal products	-0.01	-0.08	1.27
Chimical industry	-0.01	-0.06	-0.25
Non metallic products	-0.02	-0.06	-0.17
Other manufactures	-0.01	-0.08	-0.16
Metals and machines	-0.02	-0.07	0.77
Service	-0.02	-0.04	-0.29
Transport	-0.01	-0.01	-0.14

**Source:** Authors computation using the MIRAGE model.



5. The country-analysis: to be finalized
  - 5.1.The Baseline scenario
  - 5.2. Economic Trend
  - 5.3. Poverty Trend
  - 5.4.Alternative simulations
    - Economic impact
    - Poverty Impact
5. Conclusion: to be written

## References

Bchir, M.H, Ben Hammouda, Chemingui M.A and Karingi, S (2007) « Multilateral Agriculture Liberalization: What's in it Africa», Journal of Agricultural and Food Economics, Vol2. No 1 June (2007). pp 33-43.

Bchir, M.H, Jean, S. and Laborde, D. (2006a) « Binding Overhang and Tariff-Cutting Formulas », the Review of World Economics (2006), Vol. 142 (2).

AGOA ( 2007). 2007 Comprehensive Report on US Trade and Investment Policy Towards Sub-Saharan Africa and Implementation of AGOA. Website. <http://www.agoa.info/>

COMESA: Various Reports.

EAC: Various Reports.

EU (2000). ACP-EU Partnership Agreement. Published by Directorate General for Development 12, rue de Geneva 1140 Brussels, Belgium.

GOK (1986): Sessional paper No. 1 on Economic Management for Renewed Growth of 1986. Government printers, Nairobi

GOK (1994): Sessional Paper No. 1 of 1994 on Recovery and Sustainable Development to the Year 2010. Government Printer, Nairobi.

GOK(2004): Investment Programme for the Economic Recovery Strategy for Wealth and Employment Creation. Revised Edition. Government Printer, Nairobi.

GOK(2006/7): Economic Surveys, Government Printer, Nairobi.

KIPPRA (2005) “Assessment of the Potential Impact of Economic Partnership Agreements on the Kenyan Economy, Report for Ministry of Trade and Industry, Nairobi.

Onjala J.O. ( 2002). Total Factor Productivity in Kenya: The Links with Trade Policy. AERC Research Paper 118.

UNCTAD (2005). Generalized System of Preferences; List of Beneficiaries.

WTO. Various Reports.

Decreux et al (XXX)

**Table A1:** The evolution of the world prices for the Buisness as usual scenario

	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020
Rice	0.95	0.97	0.94	0.96	0.93	0.95	0.93	0.95	0.92	0.94	0.91	0.93	0.90	0.92	0.90	0.92
Wheat	0.96	0.97	0.95	0.96	0.94	0.95	0.94	0.95	0.93	0.94	0.92	0.93	0.92	0.93	0.91	0.92
Cereal grains nec	0.93	0.97	0.92	0.96	0.91	0.95	0.90	0.95	0.90	0.94	0.89	0.93	0.88	0.92	0.88	0.92
Vegetables, fruit, nuts	0.98	0.97	0.97	0.96	0.96	0.95	0.95	0.94	0.95	0.93	0.94	0.93	0.93	0.92	0.92	0.91
Oil seeds	0.86	0.99	0.86	0.98	0.85	0.97	0.84	0.96	0.83	0.95	0.82	0.94	0.82	0.93	0.81	0.93
Sugar	0.98	0.97	0.98	0.96	0.97	0.95	0.96	0.94	0.95	0.94	0.94	0.93	0.93	0.92	0.92	0.91
Plant-based fibers	0.95	0.96	0.94	0.95	0.93	0.94	0.93	0.93	0.92	0.93	0.91	0.92	0.90	0.91	0.90	0.91
Crops nec	0.97	0.96	0.96	0.95	0.95	0.94	0.94	0.93	0.93	0.93	0.93	0.92	0.92	0.91	0.91	0.90
Cattle,sheep,goats,horses	0.98	0.97	0.97	0.96	0.96	0.95	0.95	0.94	0.94	0.93	0.93	0.93	0.93	0.92	0.92	0.91
Animal products nec	0.99	0.97	0.98	0.97	0.97	0.96	0.97	0.95	0.96	0.94	0.95	0.94	0.95	0.93	0.94	0.93
Dairy products	0.97	0.97	0.96	0.96	0.96	0.95	0.95	0.94	0.94	0.94	0.93	0.93	0.92	0.92	0.92	0.91
Forestry	1.03	0.95	1.02	0.94	1.01	0.93	0.99	0.91	0.98	0.90	0.96	0.89	0.95	0.88	0.94	0.86
Fishing	0.98	0.97	0.97	0.97	0.97	0.96	0.96	0.95	0.95	0.94	0.94	0.94	0.94	0.93	0.93	0.92
Mining	1.03	0.96	1.02	0.95	1.01	0.94	0.99	0.93	0.98	0.92	0.97	0.91	0.96	0.89	0.94	0.88
Meat & dairy	0.95	0.97	0.94	0.96	0.93	0.96	0.92	0.95	0.92	0.94	0.91	0.93	0.90	0.93	0.90	0.92
Other manufactured food	1.00	0.97	0.99	0.96	0.98	0.95	0.97	0.94	0.96	0.93	0.95	0.93	0.95	0.92	0.94	0.91
Sugar	0.97	0.97	0.96	0.96	0.95	0.95	0.94	0.94	0.93	0.93	0.92	0.92	0.91	0.92	0.91	0.91
Beverages and tobacco products	1.05	0.96	1.04	0.95	1.03	0.94	1.02	0.93	1.01	0.92	1.00	0.91	0.99	0.90	0.98	0.89
Textiles and Wearing apparel	1.02	0.94	1.01	0.93	1.00	0.92	0.99	0.92	0.99	0.91	0.98	0.90	0.97	0.89	0.96	0.88
Leather products	1.00	0.98	1.00	0.97	0.99	0.97	0.98	0.96	0.98	0.95	0.97	0.95	0.96	0.94	0.96	0.93
wood and printing	0.99	0.98	0.98	0.97	0.97	0.96	0.97	0.95	0.96	0.95	0.95	0.94	0.95	0.93	0.94	0.93
Petroleum, coal products	1.04	0.97	1.03	0.96	1.02	0.95	1.00	0.93	0.99	0.92	0.98	0.91	0.97	0.90	0.96	0.89
Chimical industry	1.01	0.98	1.00	0.97	0.99	0.96	0.99	0.95	0.98	0.95	0.97	0.94	0.96	0.93	0.96	0.92
Non metallic products	1.01	0.98	1.01	0.97	1.00	0.96	0.99	0.95	0.98	0.94	0.97	0.94	0.96	0.93	0.96	0.92
Other manufactures	1.00	0.98	1.00	0.97	0.99	0.96	0.98	0.95	0.97	0.95	0.96	0.94	0.96	0.93	0.95	0.92
Metals and machines	0.99	0.98	0.98	0.97	0.97	0.97	0.97	0.96	0.96	0.95	0.95	0.95	0.95	0.94	0.94	0.93
Service	1.04	1.01	1.04	1.02	1.05	1.02	1.05	1.02	1.05	1.03	1.06	1.03	1.06	1.03	1.07	1.04
Transport	1.02	1.01	1.02	1.01	1.02	1.01	1.02	1.02	1.03	1.02	1.03	1.02	1.03	1.02	1.03	1.02

Source: Autors computation using the Mirage model.

**Table A2:** The evolution of the world prices for the simulation scenario

	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020
Rice	0.95	0.97	0.94	0.97	0.93	0.96	0.92	0.94	0.89	0.89	0.94	0.89	0.94	0.88	0.93	0.88
Wheat	0.96	0.97	0.95	0.97	0.95	0.96	0.94	0.96	0.94	0.95	0.93	0.95	0.92	0.94	0.92	0.93
Cereal grains nec	0.93	0.97	0.92	0.97	0.91	0.96	0.91	0.96	0.92	0.95	0.91	0.94	0.90	0.93	0.90	0.93
Vegetables, fruit, nuts	0.98	0.97	0.97	0.96	0.96	0.95	0.96	0.95	0.95	0.94	0.94	0.93	0.94	0.93	0.93	0.92
Oil seeds	0.86	0.99	0.86	0.99	0.85	0.98	0.85	0.98	0.84	0.97	0.83	0.96	0.83	0.96	0.82	0.95
Sugar	0.98	0.97	0.98	0.97	0.97	0.96	0.96	0.95	0.95	0.94	0.94	0.93	0.93	0.92	0.93	0.91
Plant-based fibers	0.95	0.96	0.94	0.96	0.94	0.95	0.93	0.94	0.92	0.93	0.91	0.93	0.91	0.92	0.90	0.91
Crops nec	0.97	0.96	0.96	0.96	0.95	0.95	0.95	0.94	0.93	0.93	0.93	0.92	0.92	0.91	0.91	0.90
Cattle,sheep,goats,horses	0.98	0.97	0.97	0.97	0.96	0.96	0.96	0.96	0.95	0.96	0.95	0.95	0.94	0.95	0.94	0.94
Animal products nec	0.99	0.97	0.98	0.97	0.97	0.96	0.97	0.96	0.96	0.95	0.96	0.95	0.95	0.94	0.94	0.94
Dairy products	0.97	0.97	0.96	0.96	0.96	0.96	0.95	0.95	0.96	0.94	0.95	0.93	0.94	0.93	0.94	0.92
Forestry	1.03	0.95	1.02	0.94	1.01	0.93	0.99	0.91	0.98	0.90	0.97	0.89	0.95	0.88	0.94	0.86
Fishing	0.98	0.97	0.97	0.97	0.97	0.96	0.96	0.95	0.95	0.94	0.95	0.93	0.94	0.93	0.93	0.92
Mining	1.03	0.96	1.02	0.95	1.01	0.94	0.99	0.93	0.98	0.92	0.97	0.90	0.96	0.89	0.94	0.88
Meat & dairy	0.95	0.97	0.94	0.97	0.93	0.96	0.93	0.95	0.95	0.95	0.95	0.94	0.94	0.93	0.93	0.93
Other manufactured food	1.00	0.97	0.99	0.96	0.98	0.95	0.97	0.94	0.97	0.94	0.96	0.93	0.95	0.92	0.94	0.91
Sugar	0.97	0.97	0.96	0.96	0.95	0.95	0.94	0.94	0.96	0.93	0.95	0.92	0.94	0.91	0.93	0.91
Beverages and tobacco products	1.05	0.96	1.04	0.95	1.03	0.94	1.02	0.93	1.01	0.92	1.00	0.91	0.99	0.90	0.98	0.89
Textiles and Wearing apparel	1.02	0.94	1.01	0.93	1.00	0.92	0.99	0.91	0.99	0.91	0.98	0.90	0.97	0.89	0.96	0.88
Leather products	1.00	0.98	1.00	0.97	0.99	0.97	0.98	0.96	0.98	0.95	0.97	0.94	0.96	0.94	0.96	0.93
wood and printing	0.99	0.98	0.98	0.97	0.97	0.96	0.97	0.95	0.96	0.95	0.95	0.94	0.94	0.93	0.94	0.92
Petroleum, coal products	1.04	0.97	1.03	0.96	1.02	0.94	1.00	0.93	1.02	0.92	1.00	0.91	0.99	0.90	0.98	0.89
Chimical industry	1.01	0.98	1.00	0.97	0.99	0.96	0.99	0.95	0.98	0.95	0.97	0.94	0.96	0.93	0.96	0.92
Non metallic products	1.01	0.98	1.01	0.97	1.00	0.96	0.99	0.95	0.98	0.94	0.97	0.93	0.96	0.93	0.96	0.92
Other manufactures	1.00	0.98	1.00	0.97	0.99	0.96	0.98	0.95	0.97	0.95	0.96	0.94	0.96	0.93	0.95	0.92
Metals and machines	0.99	0.98	0.98	0.97	0.97	0.97	0.97	0.96	0.97	0.95	0.96	0.94	0.96	0.94	0.95	0.93
Service	1.04	1.01	1.04	1.02	1.05	1.02	1.05	1.02	1.05	1.03	1.06	1.03	1.06	1.03	1.06	1.04
Transport	1.02	1.01	1.02	1.01	1.02	1.01	1.02	1.02	1.02	1.02	1.03	1.02	1.03	1.02	1.03	1.02

