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Impacts of Tariff Reduction and Mixed Fiscal Policy on the Kenyan Agricultural and Food Industry: Using the Macro CGE Model

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The objective of this study is to evaluate the impacts of tariff reduction and mixed fiscal policy on the Kenyan economy. The study assumes a close relationship between fiscal policy and economic welfare. In this regard, the 2009 Social Accounting Matrix and the Kenyan Macro Computable General Equilibrium model are used to evaluate the economic welfare and subsequent changes in both domestic production of various sectors and imports from outside economies. As a result, we found that when the target industries are food manufacturing and food processing industries, like coffee and tea, the welfare measure for households improves greatly.

Key words: tariff reduction, mixed fiscal policy, household welfare, macro CGE model

1. Introduction

The Republic of Kenya is trying to position itself as a gateway to the rest of Africa. This is important because almost 45% of its exports are destined for other African countries. Most of Kenya's goods go to neighboring East African Community (EAC) countries, notwithstanding concerns about the potential influx of, and trade in, Chinese products across these countries. However, positive results looming with new trade blocks, such as the eastern and southern Africa trade block of which Kenya is a member, are emerging. These moves indicate a willingness towards the formation of new trade partnerships.

The fiscal situation in Kenya has been under scrutiny recently with a significant focus on both the increasing government spending and government debt. Most of this spending pumps into industrial policy ambitions and has been directed to transport and infrastructure projects that are being undertaken by the government. In this industrial policy context, the labor absorbing rate in Kenya is very low compared to its supply and Kenyan government should try and find an alternative policy, which will generate a greater benefit to the economy.

This paper is related to extant empirical studies on trade liberalization in developing countries which using a computable general equilibrium (CGE) model, evaluate the effects of trade liberalization on industry and households in particular. Adi and Tokunaga (2006) evaluated the impacts of tariff reduction in the East Asia Free Trade Area (FTA) using the Global Trade Analysis Project (GTAP) model. Cororaton *et al.* (2006) conducted research on the impacts of tariff reduction on Philippines' households focusing on economic variables. Though a reduction in tariffs caused consumers to access cheap imports for domestic use, income disparities increased and this clearly indicates that poor households did not benefit in the long run. Lucke (2001) analyzed the impact of trade liberalization on the Syrian economy and suggested that domestic industries suffer from increased competition with imported goods as private household demand increases. Aredo *et al.* (2012) and Yimer (2012) analyzed trade liberalization and poverty in Ethiopia. Aredo *et al.*(2012) revealed that further trade liberalization has little effect on the overall economy, but textile and leather industries are likely to be strongly affected by further tariff reductions. Furthermore, Yimer (2012) indicated that the welfare and real consumption of households are decreasing in the short run with trade liberalization performing well in its capacity to increase real GDP, welfare, real output and real exports in the long run. Tokunaga *et al.* (2003) evaluated the impacts of tariff reduction and fiscal decentralization on regional economies as well as on the wider Indonesian economy using a three-region interregional CGE model and suggested that export sectors such as the textile sector benefit in industry activity, while import competing sectors are more likely to suffer damage from increased competition with imported goods. Konan and Maskus (2006) studied the impact of

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services liberalization on Tunisia's economy; in that context, liberalization eased adjustment costs, measured in terms of the sectoral movement of workers, which could thus be reasonably expected to diffuse political resistance to services liberalization. On a different theme from liberalization, Sahoo *et al.* (2016) evaluated the long-run economy-wide impacts of productivity changes in maize and wheat and the lowering of trade and transport margins for all crops in Kenya using a recursive CGE model.

Regarding government budgets, Konan and Maskus (2006) and Aredo *et al.* (2012) used direct tax as a compensation mechanism for the loss in government revenue after liberalization, but herein we impose an indirect tax on all industries for the purpose of recouping the revenues and incorporating a subsidy scheme for the development of industry in which Kenya has a comparative advantage.

The purpose of this paper is to quantify the impact of trade liberalization on the Kenyan economy using a CGE model and identify the extent to which a tariff abolition policy and fiscal policy have enhanced economic welfare of households in Kenya and reduced the hitherto high levels of unemployment.

2. Kenya CGE Model Structure

The database used for this analysis is the 2009 Kenya Supply and Use Table (SUT) that has been used to construct the Input-Output Table (IO Table). This data is further combined with data from the National Bureau of Statistics Accounts, the Labor Force Survey and the Integrated Household Survey of 2005–2006, to construct the 2009 Social Accounting Matrix (SAM 2009). The Kenya SAM will comprise 19 aggregated industries and four institutions, thus including both urban and rural households, enterprises, and governments. The factors of production will be divided among urban and rural labor, rural and urban household capital (self-employed people including independent farmer and landowner) and enterprise capital. Other sectors will include savings, direct tax, net indirect tax less subsidies, and the rest of the world

1) Kenya CGE model framework

The Kenya CGE model is based on Hosoe *et al.* (2010) and Tokunaga *et al.* (2014) and it is a basic system that uses a static single country open economy model with the household divided into two regions thus rural and urban region. The Kenya CGE is constructed to analyze the impact of tariff elimination on the named economic agents[1]. With this regard rural and urban labor and household capital endowment are exogenously fixed and cannot be transferred between rural and urban households, although labour and capital can be moved between industries. However, rural and urban labor market is not at full employment condition more over there is no migration of both rural and urban unemployed and therefore the share the labor market that is employed and unemployed are subject to change if the share of unemployed reduces the share of employed will increase. This paper hence forth suggests model improvement in situation whereby the labor market is open such that there is free movement of the labor force between rural and urban labor when faced with changes in wage rates.

The basis of construction of the model framework is the existence of 6 principle sectors. The major sectors here are the production sector that seek to minimize their cost, the household sector that seek to maximize their utility and the trade sector that seek to maximize profits and the following explanation shows the details of these major sectors and how they interact in the economy to meet their economic obligations as detailed below.

All the production sectors shown in Figure 1 have a nested four-level structure and are assumed to produce XD_a amount of commodity. At the first level of the production sector (A1) is the Leontief technology, capital and labor bundle (KLT_a), and intermediate inputs (XC_c: composite commodity c as intermediate input to activity a) as factors of production. At the second level (A3), the household labor demand bundle (HL_a) and household-enterprise capital demand bundle (HEK_a) by firms have a constant elasticity of substitution (CES σ = 0.5~1.8) and form factors of production at this level. At the third level (A4 and A5), the household-enterprise capital demand bundle has a Cobb-Douglas constant return to scale household capital (HK_a) and enterprise capital (EK_a) as the demanded factors of production by firms; in addition, household labor demand bundle (HL_a) has a Cobb-Douglas constant return to scale between urban and rural labor (L_a) as a factor demanded by firms for production. At the fourth level (A6) household capital bundle (HK_a) has a Cobb-Douglas constant return to

1) If we were analyzing the impact of tariff reduction in Kenya on regional economic dynamics between Kenya and neighboring countries, we would use the GTAP multi-country database and multi-country GTAP-based models. However, instead, we constructed the Kenya CGE model to quantify the impacts of trade liberalization on Equivalent Variation of rural and urban households and regional unemployment conditions.

scale between rural and urban household capital (K_a) as factors of production demanded by firms.

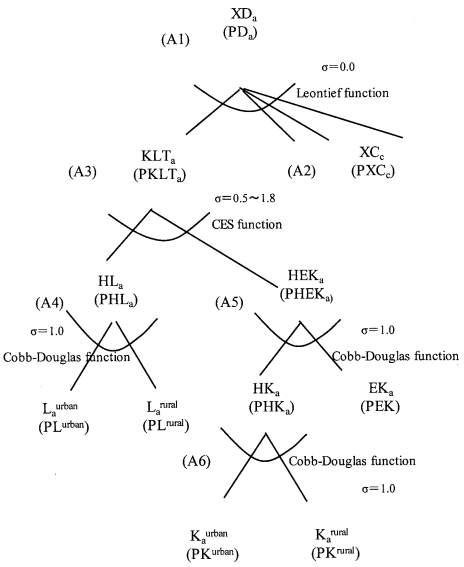

Figure 1. The structure of production sector

The household sector has a maximizing utility function UH in urban and rural regions defined by a Cobb-Douglas utility function shown in Figure 2. Households maximize the linear-homogeneous Cobb–Douglas utility function for the composite commodity (HC_c) under the budgetary constraints. Zero profit condition is adhered to have a price PHC_c. Savings and investment sectors has the same structure as the household sector and the Kenya CGE is closed prior to savings and an agent called "a Bank" allots savings to investment demand from the 19 goods with a linear homogeneous Cobb-Douglas function.

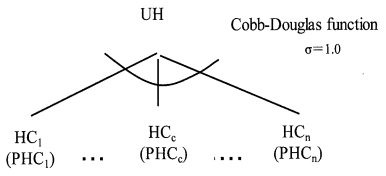

Figure 2. The structure of household sector

The trade sector is concerned with imports and exports of goods from and into the domestic market shown in Figure 3. The structure allocates products produced for the domestic market (XDD_c) and for export (E_c) which is derived by solving the problem of sales maximization under the constraint of Constant Elasticity of Transformation function (CET function). In addition, for the composite commodity according to the Armington assumption, which is the composite commodity for domestic supply (X_c) comprising producer goods for the domestic market and imported goods (M_c), is derived by solving the constrained optimization problem by minimizing its total costs subject to the CES function constraint. The prices for the domestic market (PDD_c) and the composite commodity (P_c) according to the Armington assumptionare both derived from the "zero profit condition." The export price (PE_c) and the import price (PM_c) are calculated by multiplying the international price by exchange rate, but the import price includes customs duty and commodity tax on imported goods. Finally trade sector deals with not only the trade balance that is the difference between imports and imports, but also the non-trade balance. For example, receipt and payment of interest to domestic and foreign capital by the production factor agents, remittance from overseas migrant workers in the household sector and payment and receipt of interests in the government sector, etc. These are treated as exogenous variables. Therefore, in the Kenya CGE model, as a balance of payment constraint on transactions with the rest of world, foreign savings and exchange rates are added.

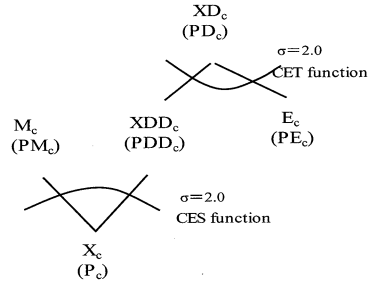

Figure 3. The structure of trade sector

We explain the government sector. The government has budget that contain the difference between the revenues generated from tax receipts and the subsidies disbursed to each production sector. These budgets are then multiplied by a fixed ratio to create savings, and expenditures comprise social security benefits to the household sector and transfers to the rest of world.

We incorporated the factor market-clearing conditions (1)-(2), the equation (3) of a Phillips curve-type formula and the income equations (4)-(5) into the Kenya CGE model. Particularly, the household income (Y^o) in equation (4) is composed of revenues from labor and capital, transfer from government ($\overline{TEGH^o}$)and the rest of the world ($\overline{TEWH^o}$), etc. $CBUD^o$ in equation (5) represents the household's budget devoted to the consumption of commodities. And we calculate EV based on the amount of $CBUD^o$[2].

$$\sum_{a\in A} PL^o \cdot L_a^o + \overline{LW^o} \cdot ER = PL^o \cdot (\overline{LS^o} - UNEMP^o) \quad (1)$$

$$\sum_{a\in A} PK^o \cdot K_a^o + \overline{KW^o} \cdot ER = PK^o \cdot \overline{KS^o} \quad (2)$$

$$\left(\frac{PL^o \cdot PCINDEX^o}{PLZ^o \cdot PCINDEXZ^o} - 1\right) = phillips^o \left(\frac{UNEMP^o / \overline{LS^o}}{UNEMPZ^o / \overline{LS^o}} - 1\right) \quad (3)$$

$$Y^o = PK^o \cdot \overline{KS^o} + PL^o \cdot (\overline{LS^o} - UNEMP^o) + \overline{TEGH^o} + \left(\overline{TEWH^o} - \overline{LWS^o} - \overline{KWS^o}\right) \cdot ER \quad (4)$$

$$CBUD^o = Y^o - TRDH^o - SH^o - \overline{TEHW^o} \cdot ER \quad (5)$$

Where $UNEMP^o\left(UNEMPZ^o\right)$ represents unemployment (initial unemployment); $PCINDEX^o\left(PCINDEXZ^o\right)$ represents the Lasperyres consumer commodity price index (initial consumer price index). Superscript means urban and rural, respectively. Phillips represents a Phillips curve parameter[3] (urban= −0.1, rural= −0.2) and PL^o (PLZ^o) and PK^o represent the wage rate (initial wage rate) and returns to household capital respectively. $\overline{LS}$, $\overline{KS}$, $\overline{LW}$, $\overline{KW}$, $\overline{LWS}$, $\overline{KWS}$ and ER represent the labor and household capital endowment, labor demand and household capital demand from the rest of the world, labor endowment and household capital endowment from the rest of the world and the exchange rate, respectively[4]. $TRDH^o$, SH^o and $\overline{TEHW^o}$ represent direct tax revenues from household, household savings and transfer to rest of the world, respectively. Still more the bar above the variable means an exogenous variable. For the external balance, the default closure is that the exchange rate is flexible while foreign savings (the current account deficit) are fixed.

2) Setting tariff rate and elasticity of substitution

The elasticity of the CES function is assumed to be 0.5–1.8 based on the results that we estimated using time-series data for South Africa and Table 4-3 of Tokunaga and Okiyama (2014). The elasticity of the Armington and CET functions is assumed to be 2.0 for all industries (Hosoe *et al.* 2010) because the previous studies done for Kenya could not provide the above information[5]. Therefore we must give careful consideration to our simulation results, though we carried out the sensitivity analysis to check the robustness of our model. These parameters and tariff rates per sector are summarized in Table 1[6].

Table 1. Elasticity parameter and tariff rate

Production sector	Variable	Tariff rate	Elasticity of CES function
Growing of crops	Agrr	20.3	0.5
Animal production	Livs	22.0	0.5
Support act to agriculture	Asev	0.0	0.5
Forstry and Fishery	Fish	22.2	0.5
Mining and Quarry	Mine	2.9	1.2
Processing of agricuture products	Prfd	18.8	1.2
Manufacture of agriculture products	Mafd	10.1	1.2
Manufacture of textile, wood and paper products	Malp	10.2	1.8
Manufature of chemical machinery and equipment	Mahp	1.6	1.8
Construction and Tertiary industry	–	0.0	0.8

Source : Author construction.

3. Simulation Procedure and Results

1) Setting the simulation

Seven different simulations (S1~S5,Ref.S2 and Ref.S3), as shown in Table 2 below, have been carried out to

2) We define the equivalent variation(EV)as follows: the equivalent variation is the difference between the household's budget of the "proposed change", deflated by the price index of composite commodities, and the household's budget of the "benchmark equilibrium".

3) A Phillips curve parameter is assumed to be smaller than the 0.5 estimated in the South African context because of the relatively high unemployment rate in Kenya.

4) Labor movement between domestic market and foreign market was incorporated in 2011 SAM. But the simulations in this paper included assumption that labor movement does not occur. Because this paper is assured that a domestic laborer does not notice the difference between domestic wage rate and foreign wage rate arising from the changes in domestic wage rate and exchange rate by the simulation (initial wage rate and return to capital in foreign countries set up 1 in the same as domestic wage rate and return to capital and are fixed).

5) Sahoo *et al.* (2016) assumed the elasticity of the CES function, Armington function, and CET function to be 2.0, 3.0, and 3.0, respectively.

6) As industry-specific tariff is not clearly outlined in SUT, we must estimate the tariff rate using the total amount of tax on imported goods and then MFN applied duties found in the World Tariff Profile report by the co-publication of WTO, ITC and UNCTAD of the products groups.

determine the best policy scenario. The first simulation (S1) targets complete abolition of tariffs to evaluate the impact on key economic sectors for the purpose of trade liberalization. The second simulation (S2) reflects a mixed policy, in which the government is poised to raise more revenue by an increase of 0.01% in indirect tax (VAT) while, at the same time, completely abolishing tariffs. On the other hand, the reference simulation (Ref., S2), compared with S2, is executed according to 0.01% increase in only the indirect taxes. The third simulation (S3) targets two sectors—the manufacturing sector and the processing of agricultural products such as tea and coffee—to try and eradicate extreme poverty through job creation in these sectors and improve people's standard of living. To accomplish this, the government provides an increase of 0.055% in the subsidy rates[7] for these two sectors, since Kenya is assumed to have competitive advantage in these sectors. Similarly to Ref., S2, the reference simulation (Ref., S3) compared with S3 is only conducted about an increase of 0.055% in subsidy rates for the same sectors. The fourth simulation (S4) provides for an increase of 0.022% in the subsidy rates for three sectors: agriculture, processing of agriculture products, and manufacture of food industry products. The rationale behind this simulation is that Kenya's population is believed to rely on these sectors and this change will narrow the income gap between households. The fifth simulation (S5) targets the manufacturing in textiles and chemical sectors. In this situation, the government provides an increase of 0.043% in the subsidy rates to achieve higher growth in GDP. Table 2 illustrates the simulation procedure.

Table 2. Simulations scenario

Simulation Scenario	Tariff rate of all industries (%)	Indirect Tax (changes in base value %)	Subsidy rate (changes in base value %)				
			Agrr	Prfd	Mafd	Malp	Mahp
S1	0.00	0.00	0.00	0.00	0.00	0.00	0.00
S2	0.00	0.01	0.00	0.00	0.00	0.00	0.00
Ref.,S2	Table 1.	0.01	0.00	0.00	0.00	0.00	0.00
S3	0.00	0.01	0.00	0.055	0.055	0.00	0.00
Ref.,S3	Table 1.	0.00	0.00	0.055	0.055	0.00	0.00
S4	0.00	0.01	0.022	0.022	0.022	0.00	0.00
S5	0.00	0.01	0.00	0.00	0.00	0.043	0.043

7) Each subsidy rate in S3, S4, and S5 and is calculated from the amount equivalent to the increase in government revenue through experimental iteration. In other words, even if each subsidy rate is implemented, the government budget will not change substantially.

2) Simulation results

Seven simulation results are shown in Tables 3 and 4. In this study, simulation is performed using numerical analysis software GAMS (General Algebraic Modeling System), and numerical values excluding of Equivalent Variations in relating to the simulation results are the rate of change in Base Value (= the 2009 Kenya SAM) , and these rates are in percentage. Based on the first simulation (S1), we can observe that the perfect abolition of tariffs, that is, trade liberalization, results in a positive equivalent variation (EV) of Ksh 13.359 billion for urban households and Ksh 13.044 billion for rural households. This is a fair welfare distribution. However, with this scenario, government budget is reduced, changing by −3.764%. Looking at S2, when the government tries to introduce an increase of 0.01% in indirect tax and also abolish tariffs, household welfare (EV) of rural households becomes worse with a Ksh −5.156 billion but that of the urban households becomes positive with a Ksh 5.216 billion. The simulation, S3, targets the food manufacturing and food processing industries. The welfare measure for households greatly improves in this scenario, with an accumulative welfare of a Ksh 28.616 billion. In addition, the government budget does not decrease very much, ensuring that the provision of public goods and services by the government does not drop in a way that deprives the beneficiaries of their utility for these goods. The other simulations (S4 and S5) testify to policy interventions as their impact on economic welfare is lower than S3. With the Kenyan economy facing high unemployment, tariff abolition shows a decline in unemployment levels both in rural and urban areas.

Table 3. Impact on principle economic indicators

Simulation Scenario (Changes in base value %)	GDP	Govern-ment Budget	Equivalent Variation (unit:KSh Billion)		Volume of Unemployment		Factor price		
							Wage rate	Return to household capital	
			Urban	Rural	Urban	Rural	Urban	Urban	Rural
S1	0.598	-3.764	13.359	13.044	-1.480	-0.692	0.340	2.198	1.254
S2	0.402	3.675	5.216	-5.156	-0.842	-0.916	0.334	0.186	-1.110
Ref., S2	-0.200	7.258	-7.931	-18.083	-0.663	-1.618	0.005	-1.949	-2.343
S3	0.705	-0.070	10.889	17.727	-1.222	-0.855	0.130	1.392	1.703
Ref., S3	0.290	-3.686	5.630	22.703	-0.396	0.057	-0.212	1.199	2.806
S4	0.402	0.006	3.369	19.830	0.160	-0.496	0.255	1.046	2.168
S5	0.801	-0.056	13.331	-3.788	-2.211	-1.437	0.612	1.438	-1.194

Note:1) Rural wage rate is fixed of the numeraire.

Table 4. Impact on production volumes

Simulation Scenario	Total Output (% change)	Production Volumes by main industries (changes in base value %)						
		Agrr	Prfd	Mafd	Malp	Mahp	Publ	Educ
S1	0.769	-0.320	7.652	1.162	-0.374	4.196	-3.306	-2.108
S2	0.404	-0.468	6.003	-0.645	-1.036	1.090	2.093	0.702
Ref., S2	-0.349	-0.176	-1.392	-1.762	-0.671	-2.908	5.258	2.703
S3	1.040	-0.366	20.872	7.698	-1.638	-0.686	-0.569	-0.999
Ref., S3	0.574	0.191	12.540	8.299	-0.508	-1.553	-2.739	-1.687
S4	0.474	1.188	10.974	3.046	-1.410	-0.009	-1.017	-1.111
S5	1.297	-1.118	2.758	-0.781	4.706	14.828	-0.876	-1.189

Simulation S1 in Table 4 shows that agriculture and manufacturing sectors record a reduced domestic production, and the public administration (Publ) and education (Educ) sectors decreased more than other sectors because of the reduced government budget. In Simulation S3 with a tax increase and production subsidy, the public administration and education sectors became slightly a 0.569% and 0.999% decrease.

4. Concluding Remarks

Our simulations show economic welfare when setting the tax rate and subsidy ratio without reducing the government budget in the case of tariff elimination. Given the results of previous study that Konan and Maskus (2006) pointed out that free trade is not the optimal policy when maintaining government expenditures simply and arrived at the conclusions by finding out the household lump-sum tax rates to maximize economic welfare under government budget constraints, we must notice in mind that the following advisable policy is not an optimal policy.

We found that, if a mixed fiscal policy under total tariff elimination is instituted in the form of a 1% indirect tax with a 5.5% subsidy rate on the food manufacturing and food processing industries, then simulation results suggest improved economic welfare due to high consumption in the economy and this is as a result of improved income due to the demand of factor endowments; public administration and education sectors are highly dependent on government expenditure and can be limited to minimize the negative impacts.

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