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**GTAP 2008 Conference**

**Does theory matters in Global CGE models**

**<< Very preliminary version >>**

**Mohamed Hedi Bchir  
Hakim Ben Hammouda**

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**Abstract:**

## **Introduction:**

Since the launch of the Doha Round many studies were launched to assess the impact of this round of trade liberalisation on the global economy. The global CGE models such as GTAP, MIRAGE and the Linkage Model were used to provide some figures at the global level and especially to give an idea about the potential winners and losers from the trade reforms. These results received in the past a lot of criticism about the level of the gains for the global economy from the trade reforms (Polasky, 2006, Taylor and von Armin, 2006, Roberta...). The criticism is focusing on the theoretical background of the CGE models and more particularly the nature of the macroeconomic closure and the market structure. Many papers highlight the fact that the standard views behind the majority of the CGE models explains their limitations and their unrealistic predictions.

There have some recent studies that tried to address these issues and to implement different features in the Models. D. van der Mensbrugghe looked at the role of the labour markets in measuring the impact of trade reforms (Mensbrugghe 2007). P. Conforti and A. Sarris used different closures when dealing with the impact of trade reforms on Tanzania including some structural closures for the labour market, the fiscal deficit, the investment and saving balance and the current account (Conforti and Sarris, 2007). Taylor and Von Armin also used different macroeconomic closures (Taylor and von Armin, 2006). All these studies have showed that the results and the potential impact of the trade liberalisation are strongly influenced by the theoretical features and the macroeconomic closures of the model.

This paper will continue the research efforts on the link between the theoretical background of the models and their results. We will go a step further and we will measure the impact of different market closures on the potential impact of global trade reforms. We will implement these different closures in the MIRAGE Model. The paper will compare the results of a global trade reform of a standard version of the model with four different closures dealing with macroeconomic level, the labour market, the current account and...

The paper will be articulated around three sections. After this introduction, the first section will go back to the theoretical debate in the CGE models especially the different closures. Section 2 presents the Mirage Models with the alternatives closures. Sections 3 discusses results.

## **Section 1: Which theory behind the CGE models?**

The CGE models are following standardized closures since their development at the macroeconomic level, especially in the three main accounts namely the government fiscal account, the balance of payments account and the investment saving balance. The global macroeconomic closure of the economy represents the way in which the equilibrium is reached in the different markets then translated into a global equilibrium in the economy. This issue is at the centre of an important controversy in the economic literature mainly between two major traditions, the Keynesian one and the classical. For the neoclassical tradition the market the price are flexible and the market forces are able to balance the total demand and supply of a factor of production or a product. In this standard vision of market functioning the adjustment of the price will clear the demand and supply side of the model. This vision was criticized and numbers of studies in the Keynesian tradition higlited the rigidity of some prices and the difficulties to clear the markets. In this new perception where prices have a high level of rigidity, the goods and the products factors are going to adjust to clear the market.

Today economists have more pragmatic views to the issue of closures and there is an agreement that both prices and quantities are playing a role in clearing the different markets. The role of each of them will more depend on the time horizon and the structure of the economy. In this context some studies have tried in the recent years to open up the debate of market closures in the CGE models and to test other market closures. The idea behind this work is to measure the relative weight of the theories behind the modelling exercise. The debate is concentrated around four main assumptions behind different markets.

The first is the savings government account which measures the gap between the government revenue and its expenditure. Here the standard models consider that the government's expenditures and savings are fixed. Hence the tax system is very flexible and could help reducing any budget gap. For example a reduction of tariffs in trade liberalisation scenario will not be translated into a greater public deficit because of the decrease of the fiscal revenues of the government but into a tax increase to clear the deficit. This closure is a neutral and has no distributive impact since it is applied a representative household. The assumption of an endogenous tax assumes that we have an active fiscal policy with limited costs. But, we could imagine different closures especially in a situation of limited room of manoeuvre of the tax policies. One possibility is to assume that the flexibility of the tax is very limited and the results of an increase of the government expenditures are a deeper budget deficit. Another scenario for

this closure is to assume an important reduction of government expenditures to face a decrease in government revenues.

The second major assumption is linked to the balance of payments the important question is the nature of the exchange rate and whether it adjusts to take into account a given current account balance or they are fixed and the current account is to adjust by borrowing more external resources. The standard models assume a fixed balance for the capital account and the trade balance. In this version the trade liberalisation will lead to an increase of imports and the need to increase the exports to clear the gap which will conduct to an exchange rate depreciation. The alternative to this closure is to assume the exchange rate are fixed and to relax the capital account and hence the international capital flows will be adjust. This second scenario explains the situation of a lot of developing countries and the debt crisis as a result of a structural deficit in the trade account.

The third important assumption is linked to the balance of savings and investments. In the standard models investment is mainly determined by savings. Different model closure is to assume that the level of investment is determined by the government and the level of savings needs to adjust. The fourth assumption is linked to the labour market and the capacity of the wages to adjust the demand and the supply and to clear the market. Many studies have tried to introduce more segmentation in the market by taking into account including the differences between skilled and unskilled labour which are translated into some rigidities in the wage.

In this paper we will more concentrate on the first three closures namely the fiscal, the external and the investment saving closures. Our objective is to measure the impact of alternatives closures to the standardized one on the economy.

## **Section 2: The model, Closures rules and scenarios**

### **The Mirage Model:**

This study uses the MIRAGE package<sup>1</sup>. It uses a modified version of MIRAGE that takes into account the government account in order to distinguish between the private and the public final demand.

### **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 labour growth, capital accumulation, and productivity. Policy scenarios are compared to a baseline, or business-as-usual, scenario. In what follows, we present briefly the main characteristics of the model, which concern the modelling 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. 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>2</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

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<sup>1</sup> Composed by the MacMAP data base and the MIRAGE model.

<sup>2</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).



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 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 Mensbrugge, 1998). There are several backward linkages linking one period to another: population growth, productivity increases, and capital accumulation. Most of these linkages can be resolved 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.

### **Separation of government and households accounts in the MIRAGE model.**

Government has two main roles: 1) Collecting taxes: 4 types of taxation are taken into account in our modeling framework: direct taxes, indirect taxes, tariffs and a lump sum taxes that governments punctuate from household revenue. 2) Expending these revenues: The collected revenues are used to purchase final public consumption<sup>3</sup>. The choice between goods is defined by a classic program of objective maximization constrained by government revenue. We have supposed that the objective function is a Cobb-Duglass function. This implies that the share in value of public consumption of each good remains constant.

The difference between public revenue and public consumption is supposed to be fixed and supposed to increase over the time at the same rate of the world GDP. This hypothesis implies that the government has to adjust its revenue or his consumption each year in order to reach this exogenous public deficit or surplus. In our modeling framework we have supposed that governments are adjusting their taxation policies.

**The sectoral and regional desegregation.** The mapping from the GTAP regional and sector definitions to the corresponding aggregations defined for the MIRAGE model used in this study is provided in tables (1) and (2)

<< table 1 >>

<< table 2 >>

### **The Different Closures**

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<sup>3</sup> At this stage, we do not take into account public investment

The multilateral trade simulation is implemented using the MacMAP database. This method consists on implementing the formulas at the HS6 digit level when taking into account the binding overhang effects. For agricultural products, we have implemented the G20 proposal with EU reduction coefficients. To take into account the special and differentiated treatment we suppose that the reduction coefficients are 1/3 less for Middle-Income Countries. The *Ad valorem* equivalents of specific tariffs are calculated on the basis of the 2005 WTO formula. For the implementation of the tariff caps, we suppose that high-Income Countries cap their tariffs at 150% and that the Middle-Income Countries cap their tariffs at 300%. We suppose also that 5% of agricultural tariff lines exempted as sensitive/special products. Sensitive/special products face 50% less in tariff reduction and no caps, but tariff-rate quotas (TRQs) increased according to the European formula. Sensitive and special products<sup>4</sup> are defined using the Jean, Laborde and Martin (2005) method. For the Non Agricultural products, we have implemented a Swiss formula. To take into account the special and differentiated treatment, we suppose that High-Income Countries apply a coefficient of 10% and that the Middle-Income Countries apply a coefficient of 25%. We have supposed also that Least Developed Countries do not cut their own agricultural or manufacturing tariffs they are also benefiting from a free access to OECD countries market in 2008 excepting 3% of tariff lines. The implementation of these Tariff reforms is supposed to be implemented in 5 years for High-Income Countries and in 10 years for Middle-Income Countries. Finally we suppose that export subsidies are eliminated in 2013 and we do not include services liberalization or domestic support cuts.

In this paper we will follow different closure for the Mirage Model. The first closure will be the tax system, exchange rate and an investment determined by saving. The second closure will assume that the government budget is endogenous and the government is not able to manipulate the tax rate to reduce the fiscal deficit. The third closure will depart from the standard views on the balance of payments and will assume the exchange rate are fixed. This closure will assume that the capital account will adjust to absorb a deficit on trade account. The third closure will side the classical views on the behaviour of investment and assume that the level of investment is determined by the government and the level of saving will adjust.

**The “fiscal” hypothesis:** We have modelled three alternative closures:

- Closure 1: the government adjusts its tax revenue using the lump sum taxation. This closure is a neutral one.

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<sup>4</sup> And also products exempted from Duty free Quota Free Access (3% rule)

- Closure 2: the government adjusts its tax revenue using the direct taxation.
- Closure 3: the government adjusts its tax revenue using the indirect taxation. This closure could affect households' consumptions.

Once the government module is included separately in the model, the rest of the original account can be considered as the account reflecting household.

### **The Simulations**

The objective of this paper is to study the role of the macroeconomic closure in assessing the impact of trade policy reforms. In this paper we will not focus on focus on the outcome of the DDA. We will use the different closures in assessing one scenario where tariffs on all merchandise are reduced to zero. Also, we will remove agriculture export subsidies and all other production support.

We will have four simulations. The first one is done with the standard version of Mirage. The second simulation is using the second closure with a fixed tax rate. The third simulation is using the third closure with a rigid exchange rate. Finally the last simulation will assess the impact of a different closure on investment.

**For the “fiscal” closure”** Table (3) and (4) gives an overall idea about the macroeconomic impacts of the proposed scenario when supposing a lump sump closure in each region defined in our study. The trade liberalization scenario will affect positively African economy as a whole. The total GDP gain will reach 1.44% and the welfare gain will reach 1.29%. Africa seems to be one pf greatest winner of this scenario, its gain is even higher than USA gain (0.02% of welfare gain), The European Union gain (0.19% of welfare gain) and China and India (respectively. 0.13% and 0.02% of welfare gain). Meanwhile, this global positive impact is unfairly distributed across African countries and regions.

North African region presents the highest welfare and GDP gain (3.07% for welfare and 3.11% for GDP) this positive results is essentially driven by the significant performance of Egypt. Indeed this North African country profit from the improvement of its market access in order to increase its exports by 40% with a limited evolution impact of its imports (an increase of 20%). The improvement of the trade balance affects positively the whole economy and the country register more than 6% of GDP gain and 5.6% of welfare gain. The global effects for the three others North African economies is week compared to Egypt. Tunisia presents a GDP gain of 0.8% Morocco 0.7% and the rest of North African countries 0%.

The South Africa Customs Union presents limited but positive impacts. The total GDP gain reaches 0.27% while the welfare gain reaches 0.24%. The three countries and regions contained in this sub-region present almost the same range of gain. South Africa, the leading economy in the region, presents a 0.24% GDP gain and 0.2% of welfare gain. The trade liberalization scenario has not significant impact on the South African terms of trade and the trade effects remains weak as the global exports increases by 4.2% and the global imports increases by 8%. Botswana and the rest of SACU present also positive by not significant gains. Botswana registers 0.5% welfare gain and the rest of SACU presents a welfare gain of 0.1%.

The situation in the Southern African development Community is quite different. The Global region presents global positive effects. The total GDP gain reaches 0.35% while the total welfare gain attains 0.20%. The situation within the SADAC regions is heterogeneous. Malawi, Mauritius, Tanzania and Zimbabwe are positively affected by the liberalization scenario with respectively 2.65%, 0.53%, 0.09% and 0.78% of welfare gain. On the other hand, Mozambique, Zambia and the rest of SADeC are negatively affected by the scenario with respectively -0.22%, -0.09 and -0.36% of welfare loss.

The rest of Sub-Saharan African region is the unique sub region in Africa that will be negatively affected by the proposed liberalization scenario with a total welfare loss of -0.38% but with a total GDP increase of 0.13%. This global result is essentially driven by the bad performance of Nigeria. Indeed this country is the main economy in this region and its performance affects significantly the sub region results. According to our simulation the Nigerian economy will face important effective real exchange rate depreciation (-1.9%). This depreciation is also coupled to net imports increase as the total imports increases by 4.2% while the total exports increases by 3.8%. The depreciation is then realized through an important decrease of all the factors remuneration. Indeed Skilled real wages decreases by -1.6%, Unskilled real wages decreases by -2.6%, Real return to capital decreases by 1.1% , Real return to land decreases by -2.4% and Real return to natural resources decreases by -1.3%. These negative evolutions are at the origin of the welfare loss in the country. The other countries in the region will be positively affected by the global scenario. Senegal will register a 0.24% welfare gain and 0.44% GDP gain. Madagascar will register a 0.12% welfare gain and 0.01% GDP gain and finally Uganda will register 0.03% GDP gain but the level of welfare remains constant.

The macroeconomic effects of alternative closure are presented in table 5. While the specific effects on African countries are described in tables 6 and 7. Regarding the specific effects on welfare, and compared with the central trade simulation,

the direct tax closure improves the African welfare while the indirect tax closure reduces it. However, once again, these effects are not uniform across sub-regions and countries in the continent. For North Africa, the impact on welfare for the alternative government closures follows the impact for Africa as a whole. The effects are uniform across countries of this region. For SACU region, the aggregate effect is also the same as for North Africa but with differences across the countries. Only South Africa will gain from closure 1 and lose from closure 2 while Botswana will win with closure 2 and Rest of SACU region will not observe any change. The importance of the economy of South Africa in the region explains the aggregate directions of the effects of both closures on the region's welfare. For SADC, the overall impact follows also the one for whole Africa with a much higher disparity across countries compared with the two previous sub-regions. Accordingly, Malawi is the only country where welfare is not affected by alternative government closure rules while all Mauritius will see its welfare improved in closure 1. However, for the remaining countries, the use of option 1 by the government will induce either lower improvement in welfare compared to the central scenario or an intensification of the decline in welfare compared with the central scenario. Finally, and as the rest of Sub-Saharan countries are concerned, Nigeria will be a winner in closure 1 compared with a situation of losers in the central scenario while with the closure 2 the welfare loss is even intensified. For Senegal, the situation does not change much and the country seems to be non-sensitive to the nature of government closure. As for the other countries of the region, they will be impacted following the same ways as for whole Africa.

**Table 3: Global macroeconomic effects of the scenarios<sup>5</sup>**

	Welfare			GDP (vol)		
	Lump sum Tax	Direct Tax	Indirect Tax	Lump sum Tax	Direct Tax	Indirect Tax
<b>African countries</b>	1.29	1.45	0.91	1.44	1.62	3.27
<b>North African countries</b>	3.07	3.26	2.58	3.11	3.29	5.53
Egypt	5.58	5.79	5.02	6.17	6.40	9.80
Tunisia	0.21	0.23	0.02	0.77	0.80	1.08
Morocco	-0.36	0.08	-1.37	0.65	1.09	4.72
Rest of North Africa	-0.33	-0.33	-0.34	-0.04	-0.04	-0.04
<b>South African Customs Union</b>	0.24	0.32	0.16	0.27	0.34	0.93
South Africa	0.24	0.32	0.15	0.28	0.35	0.99
Botswana	0.49	0.48	0.80	0.17	0.15	-0.01
Rest of South African Customs Union	0.13	0.13	0.13	0.16	0.17	0.16
<b>Southern African Development Community</b>	0.20	0.19	0.03	0.35	0.34	0.57
Malawi	2.65	2.56	2.65	0.88	0.80	-0.01
Mauritius	0.53	1.27	-1.53	2.45	2.91	10.38
Mozambique	-0.22	-0.23	-0.18	-0.02	-0.02	-0.12
Tanzania	0.09	0.08	0.09	0.07	0.06	-0.22
Zambia	-0.09	-0.07	-0.11	0.02	0.04	0.32
Zimbabwe	0.78	0.32	0.84	0.67	0.24	-3.54
Rest of Southern African Development Community	-0.36	-0.37	-0.37	-0.14	-0.14	-0.14
<b>Other Sub-Saharan African countries</b>	-0.38	-0.14	-0.88	0.13	0.46	2.62
Nigeria	-0.83	0.03	-2.64	0.37	1.26	6.92
Senegal	0.24	0.22	0.25	0.44	0.42	0.23
Madagascar	0.12	0.16	0.09	0.01	0.07	1.09
Uganda	0.03	0.14	-0.08	0.00	0.11	1.73
Rest of Sub-Saharan Africa	-0.30	-0.30	-0.30	-0.04	-0.04	-0.04
<b>High income countries</b>	0.11	0.11	0.11	0.08	0.08	0.08
European Union	0.19	0.19	0.19	0.12	0.12	0.12
United States of America	0.02	0.02	0.02	0.01	0.01	0.01
Japan	0.27	0.27	0.27	0.18	0.18	0.18
<b>Middle income countries</b>	0.12	0.12	0.12	0.16	0.16	0.16
China	0.13	0.13	0.13	0.12	0.12	0.12
India	0.02	0.02	0.02	0.68	0.68	0.68
Thailand	1.08	1.09	1.07	0.96	0.97	0.96
Rest of Asia	0.35	0.36	0.35	0.20	0.20	0.20
Rest of Northern and central America	-0.06	-0.06	-0.06	0.02	0.02	0.02
Rest of Oceania and Free Trade Area of the Americas	-0.03	-0.03	-0.03	0.05	0.05	0.05
South America	0.06	0.06	0.05	0.08	0.08	0.08
Rest of the World	0.04	0.03	0.03	0.06	0.06	0.06

Source: Author's computation

**Table 5: Global macroeconomic effects on African countries of the lamp sum tax scenario**

	North African countries				South African Customs Union			Southern African Development Community							Other Sub-Saharan African countries				
	Egypt	Tunisia	Morocco	Rest of North Africa	South Africa	Botswana	Rest of SACU	Malawi	Mauritius	Mozambique	Tanzania	Zambia	Zimbabwe	Rest of SADC	Nigeria	Senegal	Madagascar	Uganda	Rest of SSA
<b>Macroeconomic effects</b>																			
GDP (vol)	6.2	0.8	0.7	0.0	0.3	0.2	0.2	0.9	2.4	0.0	0.1	0.0	0.7	-0.1	0.4	0.4	0.0	0.0	0.0
Welfare	5.6	0.2	-0.4	-0.3	0.2	0.5	0.1	2.7	0.5	-0.2	0.1	-0.1	0.8	-0.4	-0.8	0.2	0.1	0.0	-0.3
Real effective exchange rate	-4.1	-0.5	-1.5	0.2	0.0	0.5	0.1	4.1	-0.5	-0.3	0.3	0.0	-0.1	0.0	-1.9	2.1	1.2	0.4	-0.2
Terms of trade	-6.3	-1.2	-2.6	-0.7	0.0	0.4	0.0	3.9	-2.1	-0.4	0.2	-0.2	0.5	-0.4	-1.0	1.0	0.9	0.2	-0.7
Tariff revenue (points of GDP)	-0.4	-0.1	-0.2	0.0	0.0	0.0	0.0	0.0	-0.5	0.0	0.0	0.0	0.0	0.0	-0.2	0.0	0.0	0.0	-0.1
Employment in agricultural sectors	0.4	0.4	0.8	1.4	1.8	5.9	4.7	1.8	5.5	0.6	0.1	0.5	2.4	0.7	-0.2	2.0	2.3	0.0	0.3
Employment in non agricultural sectors	-0.2	-0.1	-0.3	-0.5	-0.2	-1.1	-0.7	-1.5	-1.1	-0.3	-0.2	-0.3	-1.0	-0.3	0.5	-2.5	-2.7	-0.1	-0.3
<b>Trade effects</b>																			
Exports (val)	31.6	3.9	10.9	-0.7	4.2	0.2	0.9	8.1	13.5	-0.9	0.8	-0.5	4.8	-0.6	3.8	6.2	-1.2	-0.1	0.7
Exports (vol)	40.0	4.9	13.3	-0.8	4.1	-0.2	0.9	4.1	15.9	-0.6	0.7	-0.3	4.2	-0.6	4.4	4.4	-1.9	-0.2	1.0
Imports (val)	19.9	3.5	10.0	-1.2	5.6	0.2	0.9	8.3	14.8	-0.8	0.7	-0.3	5.4	-0.6	4.2	3.5	-0.9	0.1	0.6
Imports (vol)	19.8	3.5	9.7	-1.8	5.6	0.3	1.0	8.6	14.8	-0.8	0.8	-0.3	5.5	-0.9	3.8	2.8	-0.7	0.3	0.3
<b>Effects on labor</b>																			
Skilled real wages	9.8	0.2	-0.8	-0.4	0.0	-0.6	-0.3	2.4	-2.3	-0.8	0.0	-0.1	1.0	-0.6	-1.6	0.0	-1.4	0.1	-0.4
Unskilled real wages	6.4	0.2	-0.4	0.0	0.1	0.1	0.1	3.5	1.6	-0.1	0.2	0.2	1.1	-0.2	-2.6	3.2	1.2	0.1	-0.3
Unskilled real wages in agriculture	6.6	0.4	0.0	0.7	1.0	3.0	2.4	4.4	4.3	0.1	0.3	0.4	2.2	0.1	-2.7	4.2	2.4	0.1	-0.2
Unskilled real wages in non agricultural sectors	6.3	0.1	-0.5	-0.2	0.0	-0.5	-0.3	2.7	1.0	-0.3	0.1	0.0	0.5	-0.4	-2.3	1.9	-0.2	0.1	-0.4
<b>Other factors remuneration</b>																			
Real return to capital	3.4	0.0	-0.6	-0.5	0.1	0.3	0.1	0.4	-0.9	-0.2	-0.1	-0.4	0.1	-0.4	-1.1	-1.0	-1.5	-0.2	-0.5
Real return to land	6.3	0.3	0.5	1.1	1.5	9.8	7.4	5.3	8.2	0.7	0.3	0.7	4.0	0.9	-2.4	5.7	4.2	0.1	-0.1
Real return to natural resources	0.4	-1.6	-2.8	-0.5	3.2	-1.3	-0.8	-3.2	-3.1	-0.1	0.2	0.7	0.3	-0.5	-1.3	-1.3	-0.3	-0.3	-0.6

Source: Author's computation



**Table 5: Global macroeconomic effects on African countries of the indirect tax scenario**

	North African countries				South African Customs Union			Southern African Development Community							Other Sub-Saharan African countries				
	Egypt	Tunisia	Morocco	Rest of North Africa	South Africa	Botswana	Rest of SACU	Malawi	Mauritius	Mozambique	Tanzania	Zambia	Zimbabwe	Rest of SADC	Nigeria	Senegal	Madagascar	Uganda	Rest of SSA
<b>Macroeconomic effects</b>																			
GDP (vol)	6.4	0.8	1.1	0.0	0.4	0.1	0.2	0.8	2.9	0.0	0.1	0.0	0.2	-0.1	1.3	0.4	0.1	0.1	0.0
Welfare	5.8	0.2	0.1	-0.3	0.3	0.5	0.1	2.6	1.3	-0.2	0.1	-0.1	0.3	-0.4	0.0	0.2	0.2	0.1	-0.3
Real effective exchange rate	-5.1	-0.6	-2.4	0.2	-0.1	0.6	0.2	4.4	-3.0	-0.2	0.5	-0.1	1.1	0.0	-3.2	2.2	1.1	-0.1	-0.2
Terms of trade	-7.3	-1.2	-3.4	-0.7	-0.2	0.4	0.0	4.2	-4.2	-0.4	0.2	-0.3	1.5	-0.4	-2.6	1.0	0.6	-0.3	-0.7
Tariff revenue (points of GDP)	-0.4	-0.1	-0.2	0.0	0.0	0.0	0.0	0.0	-0.5	0.0	0.0	0.0	0.0	0.0	-0.2	0.0	0.0	0.0	-0.1
Employment in agricultural sectors	0.6	0.4	1.4	1.4	1.8	5.9	4.7	1.8	5.4	0.6	0.1	0.5	2.4	0.7	0.1	2.0	2.4	0.1	0.3
Employment in non agricultural sectors	-0.3	-0.1	-0.6	-0.5	-0.2	-1.1	-0.7	-1.5	-1.1	-0.3	-0.2	-0.3	-1.0	-0.3	-0.3	-2.5	-2.9	-0.4	-0.3
<b>Trade effects</b>																			
Exports (val)	30.4	3.8	9.7	-0.7	4.1	0.3	1.0	8.5	10.0	-0.8	0.9	-0.6	5.9	-0.6	2.9	6.3	-1.5	-0.6	0.7
Exports (vol)	40.3	4.9	13.1	-0.8	4.2	-0.2	1.0	4.2	14.8	-0.6	0.7	-0.4	4.3	-0.6	5.1	4.4	-2.0	-0.2	1.0
Imports (val)	20.0	3.5	9.8	-1.2	5.7	0.3	0.9	8.4	13.7	-0.8	0.7	-0.3	5.5	-0.6	4.8	3.5	-0.9	0.1	0.6
Imports (vol)	19.9	3.5	9.5	-1.8	5.6	0.3	1.0	8.6	13.8	-0.8	0.8	-0.4	5.5	-0.9	4.4	2.8	-0.8	0.3	0.3
<b>Effects on labor</b>																			
Skilled real wages	9.7	0.2	-0.8	-0.4	0.2	-0.7	-0.2	2.3	-0.6	-0.9	0.0	-0.1	0.4	-0.6	-1.1	0.0	-1.6	-0.2	-0.4
Unskilled real wages	6.5	0.2	0.1	0.0	0.2	0.0	0.1	3.4	2.6	-0.2	0.2	0.2	0.5	-0.2	-1.0	3.2	1.2	0.3	-0.3
Unskilled real wages in agriculture	6.8	0.4	0.8	0.7	1.1	2.9	2.4	4.2	5.3	0.1	0.2	0.5	1.6	0.1	-0.9	4.2	2.4	0.3	-0.2
Unskilled real wages in non agricultural sectors	6.3	0.1	-0.2	-0.2	0.1	-0.5	-0.3	2.6	2.0	-0.3	0.1	0.1	-0.1	-0.4	-1.2	1.9	-0.3	0.1	-0.4
<b>Other factors remuneration</b>																			
Real return to capital	3.3	0.0	-0.3	-0.5	0.2	0.2	0.2	0.3	0.3	-0.2	-0.1	-0.4	-0.5	-0.4	-0.7	-1.0	-1.5	-0.3	-0.5
Real return to land	7.2	0.3	2.2	1.1	1.7	9.7	7.5	5.0	10.0	0.7	0.2	0.8	2.9	0.9	-0.2	5.7	4.4	0.5	-0.1
Real return to natural resources	2.8	-1.3	1.8	-0.5	3.9	-1.6	-0.8	-4.1	5.5	-0.2	0.0	0.9	-2.9	-0.5	3.4	-1.4	0.5	0.6	-0.6

Source: Author's computation

**Table6: Global macroeconomic effects on African countries of the direct tax scenario**

	North African countries				South African Customs Union			Southern African Development Community							Other Sub-Saharan African countries				
	Egypt	Tunisia	Morocco	Rest of North Africa	South Africa	Botswana	Rest of SACU	Malawi	Mauritius	Mozambique	Tanzania	Zambia	Zimbabwe	Rest of SADC	Nigeria	Senegal	Madagascar	Uganda	Rest of SSA
<b>Macroeconomic effects</b>	9.8	1.1	4.7	0.0	1.0	0.0	0.2	0.0	10.4	-0.1	-0.2	0.3	-3.5	-0.1	6.9	0.2	1.1	1.7	0.0
GDP (vol)	5.0	0.0	-1.4	-0.3	0.1	0.8	0.1	2.7	-1.5	-0.2	0.1	-0.1	0.8	-0.4	-2.6	0.3	0.1	-0.1	-0.3
Welfare	-4.1	-0.5	-1.6	0.2	0.0	0.5	0.1	4.1	-0.6	-0.3	0.4	0.0	0.0	0.0	-2.1	2.1	1.2	0.3	-0.2
Real effective exchange rate	-6.2	-1.2	-2.7	-0.7	-0.1	0.4	0.0	4.0	-2.3	-0.4	0.2	-0.2	0.5	-0.4	-1.2	1.0	0.8	0.1	-0.7
Terms of trade	-0.4	-0.1	-0.2	0.0	0.0	0.0	0.0	0.0	-0.5	0.0	0.0	0.0	0.0	0.0	-0.2	0.0	0.0	0.0	-0.1
Tariff revenue (points of GDP)	0.1	0.4	0.3	1.4	1.8	5.9	4.7	1.8	5.0	0.6	0.1	0.4	2.4	0.7	-0.8	2.0	2.3	0.0	0.3
Employment in agricultural sectors	0.0	-0.1	-0.1	-0.5	-0.2	-1.1	-0.7	-1.5	-1.0	-0.3	-0.2	-0.2	-1.0	-0.3	2.1	-2.5	-2.7	0.1	-0.2
Employment in non agricultural sectors																			
<b>Trade effects</b>	31.5	3.9	11.4	-0.7	4.3	0.2	0.9	8.0	14.5	-0.9	0.8	-0.4	4.4	-0.6	5.3	6.2	-1.0	0.4	0.7
Exports (val)	39.9	4.9	14.0	-0.7	4.3	-0.1	1.0	4.0	17.1	-0.6	0.6	-0.2	3.9	-0.6	6.0	4.3	-1.7	0.4	1.0
Exports (vol)	19.9	3.5	10.5	-1.2	5.8	0.3	0.9	8.2	15.9	-0.8	0.6	-0.2	5.1	-0.6	5.7	3.5	-0.7	0.4	0.6
Imports (val)	19.7	3.5	10.2	-1.8	5.7	0.4	1.0	8.5	15.9	-0.8	0.7	-0.2	5.1	-0.9	5.3	2.8	-0.5	0.6	0.3
Imports (vol)																			
<b>Effects on labor</b>	9.7	0.1	-0.7	-0.4	0.1	-0.3	-0.2	2.2	-2.4	-0.8	-0.1	0.0	-0.1	-0.6	-1.5	0.0	-1.2	0.6	-0.4
Skilled real wages	5.9	0.0	-1.2	0.0	0.0	0.4	0.1	3.4	0.5	-0.1	0.2	0.2	0.6	-0.2	-5.5	3.2	1.2	-0.1	-0.3
Unskilled real wages	6.0	0.2	-1.0	0.7	0.9	3.3	2.4	4.3	3.0	0.2	0.3	0.4	1.8	0.1	-5.9	4.2	2.3	-0.1	-0.2
Unskilled real wages in agriculture	5.9	-0.1	-1.2	-0.2	-0.1	-0.2	-0.3	2.6	0.0	-0.3	0.1	0.1	0.1	-0.4	-4.5	1.9	-0.2	0.0	-0.4
Unskilled real wages in non agricultural sectors																			
<b>Other factors remuneration</b>	2.7	-0.1	-2.6	-0.5	-0.2	0.4	0.1	0.7	-3.9	-0.1	0.0	-0.5	0.6	-0.4	-4.3	-1.0	-1.9	-0.9	-0.5
Real return to capital	5.4	0.0	-1.0	1.1	1.3	10.2	7.4	5.2	6.4	0.8	0.3	0.6	3.5	0.9	-5.9	5.7	4.0	-0.2	-0.1
Real return to land	2.9	-1.4	0.4	-0.5	3.9	-1.3	-0.8	-4.0	3.6	-0.2	-0.1	0.9	-4.7	-0.5	3.6	-1.5	0.6	1.0	-0.6
Real return to natural resources	9.8	1.1	4.7	0.0	1.0	0.0	0.2	0.0	10.4	-0.1	-0.2	0.3	-3.5	-0.1	6.9	0.2	1.1	1.7	0.0

Source: Author's computation



### **3. Results and conclusions:**