COLORADOSCHOOLOFMINES
EARTH • ENERGY • ENVIRONMENT

Division of Economics and Business
Working Paper Series

Poverty and Shared Prosperity Implications of Reducing Trade Costs Through Deep Integration in Eastern and Southern Africa

Edward J. Balistreri
Maryla Maliszewska
Israel Osorio-Rodarte
David G. Tarr
Hidemichi Yonezawa

Working Paper 2016-07
http://econbus.mines.edu/working-papers/wp201607.pdf

Colorado School of Mines
Division of Economics and Business
1500 Illinois Street
Golden, CO 80401

September 2016

Colorado School of Mines
Division of Economics and Business
Working Paper No. **2016-07**
September 2016

Title:

Poverty and Shared Prosperity Implications of Reducing Trade Costs Through Deep Integration in Eastern and Southern Africa*

Author(s):

Edward J. Balistreri
Colorado School of Mines
ebalistr@mines.edu

Maryla Maliszewska
The World Bank
mmaliszewska@worldbank.org

Israel Osorio-Rodarte
Consultant, The World Bank
iosoriorodarte@worldbank.org

David G. Tarr
Corresponding author:
Consultant, The World Bank
dgtarr@gmail.com

Hidemichi Yonezawa
ETH-Zürich
hyonezaw@ethz.ch

ABSTRACT

Evidence indicates that trade costs are a much more substantial barrier to trade than tariffs, especially in sub-Saharan Africa. We decompose trade costs into: (i) trade facilitation; (ii) non-tariff barriers; and (iii) the costs of business services. Our paper is the first CGE-microsimulation model to assess the poverty and shared prosperity impacts of the reduction of trade costs. We examine policies to reduce trade costs in: (i) the "Tripartite" FTA among COMESA, SADC and the East African Customs Union (EACU); (ii) within the EACU alone; and (iii) unilaterally by the EACU. Our CGE model contains imperfect competition and foreign direct investment, which allows us to assess the poverty effects of services liberalization. We find that there are significant reductions in the poverty headcount, the percentage of the population living in poverty and increases in the incomes of the bottom forty percent of the population for all six of our African regions from deep integration in the Tripartite FTA or comparable unilateral reforms by the EACU. Despite the uniform increases in income for the poorest 40 percent, we find that trade facilitation tends to increase the *share* of income captured by the poorest 40 percent of the population, while services reform decreases the share. We find that the estimated gains vary considerably across countries and reforms. Thus, countries would have an interest in negotiating for different reforms in different agreements.

JEL **classifications: F14, F15, F17, O55, F55**

Keywords: poverty head count; shared prosperity; microsimulation; CGE; trade facilitation; trade costs; services liberalization; non-tariff barriers; regional integration; Tripartite Free Trade; foreign direct investment

*This research was partially funded by the PSIA Trust Fund of the World Bank for the project TF018287 entitled "Africa's trade potential and interactions with the global economy and China: opportunities for growth and poverty reduction" and the Government of the Netherlands under the Bank-Netherlands Partnership Program, project TF012466. The authors gratefully acknowledge the financial support. The views expressed are those of the authors and do not necessarily represent those of the World Bank, its Executive Directors or those acknowledged.

Poverty and Shared Prosperity Implications of Reducing Trade Costs Through Deep Integration in Eastern and Southern Africa

by

Edward J. Balistreri
Maryla Maliszewska
Israel Osorio-Rodarte
David G. Tarr
and
Hidemichi Yonezawa

1. Introduction

Trade costs are a much more important barrier to trade integration than tariffs in most sub-Saharan African countries.[1] Further, unlike tariffs, which generate revenue for the importing country, trade costs often impose real resource costs on both importing and exporting countries. Thus, the expected gains from reducing trade costs are greater than for the "equivalent" tariff, which partly motivates the conclusion of Schiff and Winters (2003) that the real gains from regional trade initiatives come from deep integration.

As part of their efforts to raise incomes and reduce poverty, countries in Eastern and Southern Africa are attempting to address their high trade costs through deep integration in their regional initiatives. Notably, the proposed 26 country Tripartite Free Trade Area (Tripartite FTA)[2] has programs in place for trade and transport facilitation and the reduction of non-tariff barriers, and has the objective in "Phase II" to liberalize trade in services.[3] In addition, the members of the East African Customs Union (EACU) also have initiatives within the EACU to reduce trade costs.[4] In order to assess the relative gains of narrowing or widening the reforms, we assess the impacts on poverty and shared prosperity of comparable reforms by the members of the EACU applied only within the EACU, more widely in the Tripartite FTA and unilaterally by the EACU to all countries in the world, where feasible.

[1] World Economic Forum (2012) found that it is still considerably more expensive to trade with Africa than with other regions, and, in many cases, the cost of trading is a more important obstacle to trade development than trade policies. Brenton and Isik (2012) have also documented the high costs of trading in sub-Saharan Africa. See also, the estimates of Hummels *et al*., (2007) and Minor (2013) that show the costs of trade are greater than tariffs as an obstacle to trade for most countries.

[2]The Tripartite FTA is the union of three regional trade groups: the East African Customs Union (EACU); the Common Market of East and Southern Africa (COMESA); and South African Development Community (SADC).

[3] See http://www.comesa-eac-sadc-tripartite.org/intervention/focal_areas/trade_facilitation, Pearson (2013) and the East African Business Council progress report at: http://www.eabc.info/uploads/progress_report.pdf.

[4]See East African Community (2012), East African Community Secretariat (2011), World Bank (2012) and Dihel et al. (2010).

We decompose trade costs into three categories: time in trade costs that can be lowered by **trade facilitation; non-tariff barriers;** and the costs of **business services.** In order to analyze the impacts of the change in these trade costs on poverty and shared prosperity, we combine two models: a global computable general equilibrium (CGE) model with imperfect competition and foreign direct investment in services and a microsimulation model. The microsimulation model uses estimates from our global CGE model as inputs into the microsimulation analysis. Although it is a "top down" or sequential approach to poverty and shared prosperity analysis of macro shocks, we assure consistency between the two models in the aggregate results and in key aspects of the construction of the datasets.

Despite the expected larger impacts of the reduction in trade costs compared with tariffs, our paper is the first CGE-microsimulation model to examine the impacts of the reduction in trade costs on poverty from either unilateral, multilateral or regional liberalization;[5] and it is one of the few to examine any aspect of the poverty impacts of regional integration. Of the almost 60 studies surveyed by Teichman (2016) that combine a CGE model with a microsimulation model for poverty analysis, none examine the consequences of the reduction in trade costs; and only two examine the poverty impacts of regional trade agreements. These two studies, Bussolo et al. (2008) for four Latin American countries and Boysen and Matthews (2016) for Uganda, examine tariff reductions only and employ CGE models with perfect competition and no foreign direct investment. They find small or no gains from the preferential trade agreement so little poverty impact.[6] Although they do not contain microsimulation models to assess poverty impacts, Karingi and Fekadu (2009), Jensen and Sandry (2011) and Willenbocket (2013) have executed general equilibrium assessments of the impacts of the Tripartite FTA. They focus either exclusively or primarily on preferential tariff reductions at the aggregate level.[7] They find small welfare changes from preferential tariff reduction

[5] Some CGE studies have examined the impact of trade costs, or some of aspects of trade costs, without a poverty or distribution assessment, including Balistreri et al. (2015), Maliszewska et al. (2009) and Jensen and Tarr (2012).

[6] Boysen and Matthews find loses for Uganda of .03 percent, while Bussolo et al. (2008) find that the gains for their four countries range from .09 to .39 percent of consumption. An additional CGE-microsimulation study of tariff reductions in regional trade agreements with a model of perfect competition is Bussolo and Niimi (2009). They examine preferential tariff reductions in Nicaragua and estimate gains between 0.5 and 1.1 percent in real GDP.

[7] Jensen and Sandry add a 2 percent uniform reduction in non-tariff barriers on goods and cross-border services to preferential tariff reduction. Willenbockel (2013) also executes a scenario with a five percent reduction in border crossing costs for all goods based on unpublished TradeMark South Africa estimates of border crossing costs; then the estimated gains increase to 0.4 percent of GDP for the Tripartite FTA in aggregate.

Although they do not focus on Eastern or Southern Africa, two other interesting general equilibrium assessments of trade policy changes in Africa are the following. Anderson, Martin and van der Mensbrugghe (2006) find that global free merchandise trade would boost real incomes in sub-Saharan Africa more than proportionately than in other developing countries; but partial liberalization proposals would capture only a small share of the gains. Mevel and Karangi (2012) analyze the removal of all tariffs on goods within the African continent as a whole. They find this would increase intra-African trade by 52 percent, but if trade facilitation measures are also implemented that reduce the time costs of trade by 50 percent, intra-African trade would more than double.

in the Tripartite FTA, with many countries losing and net gains of only about 0.1 to 0.2 percent of GDP. Our estimates of the impact of tariff changes are consistent with these earlier studies, little gains with some countries losing. Depending on the country or region, however, our estimates of the gains from reductions of trade costs within the Tripartite area are about 10 to 30 times larger than their estimated gains of preferential tariff reduction, with significant reductions in poverty--suggesting very different stakes.

The CGE model contains 19 sectors and Kenya, Tanzania, Uganda, Rwanda,[8] COMESA, SADC, the US, EU, China and Rest of the World as regions. Balistreri, Tarr and Yonezawa (2014; 2015), hereafter BTY (2014; 2015) assessed the near-term impacts of reducing trade costs in Eastern and Southern Africa with a comparative static CGE model, but did not assess poverty or distributional impacts. In this paper, we extend the comparative static model of BTY to a comparative steady-state model to derive estimated impacts for 2030 and link the CGE model to a microsimulation model.

An important database for our poverty and shared prosperity results is the time in trade costs (or trade facilitation) database of Hummels et al. (2007), Hummels and Schaur (2013) and Minor (2013). A central finding of the studies is that the ad valorem equivalents (AVEs) of time in trade costs vary across products. Our more accurate database has relatively higher time in trade costs for agriculture. As agriculture is unskilled labor intensive in our African countries, our results show that the poor tend to benefit more than proportionately from trade facilitation.

Our model contains foreign direct investment as well as cross-border trade in services, which allow us to assess the poverty impacts of liberalization of barriers against foreign services suppliers. We show that services liberalization contributes significantly to the reduction of poverty in our African regions. Due to the relatively intensive use of skilled labor in business services, however, we find that the share of income going to the poorest forty percent of the population declines.

Our decomposition analysis reveals that the estimated aggregate gains and poverty impacts vary considerably across countries and depend on the reform. Thus, the regions and countries have very different stakes in the various reforms and would have an interest in negotiating for different reforms in different agreements. Notable examples are the following. In the regional agreements, trade facilitation tends to dominate in relative importance, but is especially important for Uganda as a share of its gains. In the Tripartite FTA, Kenya gains the most from the reduction of non-tariff barriers on its exports to partner countries in goods as well as from improved market access for its insurance companies in COMESA. Global services liberalization leads to very large estimated gains for Kenya, Uganda and especially Rwanda from better access to services. Tanzania gains the most from liberalization of its own high non-tariff barriers

[8] Due to lack of data, Burundi, the fifth member of the EAC, is not represented as a separate region of our model.

when liberalized widely. COMESA, in the Tripartite FTA, gains the most from liberalization of its own high services barriers.

The paper is conceptually innovative in several ways. As mentioned, it is the first to examine the poverty and shared prosperity impacts of the reduction in trade costs. It employs a model that includes imperfect competition and foreign direct investment that is necessary for the effective assessment of the poverty effects of services liberalization. It is the first microsimulation exercise to employ the time in trade costs database differentiated by product, which we show has important poverty implications. In addition, we adapt the comparative steady-state model employed by several authors to eliminate its well-known upward bias in its welfare estimate. We provide the first clear mathematical description of the Global Income Distribution Dynamics (GIDD) microsimulation model. Finally, our decomposition analysis of the various policy choices and their components allows us to infer their relative importance on poverty and shared prosperity for our different African regions.

We organize the paper as follows. In section 2, we provide an overview of the CGE and the microsimulation models. In section 3, we explain the data. The CGE model results are presented in section 4 and the microsimulation results for poverty and shared prosperity are presented in section 5. In section 6, we conclude with a summary of the key results and the stakes of the regions of our model based on the reform.

2. Overview of the Computable General Equilibrium (CGE) and Global Income Distribution Dynamics (GIDD) Models

2.1 Introduction

In this paper, we obtain results for poverty and shared prosperity in several African countries of deep integration in East and Southern Africa. We do this by first assessing the impacts on the variables that impact poverty and shared prosperity in a multi-region comparative steady-state CGE trade model focusing on Eastern and Southern Africa, and linking it to a micro-simulation household model. The key variables on which we obtain CGE estimates are the change in the value of real consumption, the change in real wages of skilled and unskilled labor in agriculture and non-agricultural sectors and the change in prices of food and non-food items. We then use those estimates as inputs in the Global Income Distribution Dynamics (GIDD) microsimulation model to obtain assessments of the changes in the poverty headcount and on shared prosperity.

Our paper employs an innovative version of a comparative steady-state model to assess impacts in the year 2030. We extend the comparative static version of the CGE model in BTY (2015).[9] For the comparative steady-state model, we employ exogenous labor force projections and endogenously determine the capital stock for 2030, as explained in section 2.2 below. Innovatively, we also endogenously adjust investment to eliminate the well-known bias in the welfare assessment of the comparative steady-state model. Otherwise, the comparative steady-state model is the same as the comparative static model. For a detailed description of the comparative static version of our model, we refer the reader to BTY (2014; 2015). Here we provide a brief overview.

There are 18 sectors in the model shown in table 1. There are three categories of sectors: (1) four perfectly competitive goods and services sectors: (2) seven imperfectly competitive goods sectors; and (3) seven services sectors in which there is imperfect competition and foreign direct investment. Imperfectly competitive firms have a fixed cost and constant marginal costs with respect to output. Regardless of sector, all firms minimize the cost of production.

Primary factors are skilled labor, unskilled labor, capital (including land)[10] and natural resources. Regarding capital, there is mobile capital and sector-specific capital in imperfectly competitive goods sectors and services sectors with FDI; and primary inputs imported by multinational service providers, reflecting specialized management expertise or technology of the firm. There is some sector specific capital for each imperfectly competitive firm (and for firms in services sectors with FDI) for each region of the model. In the sectors where there is sector specific capital, there are decreasing returns to scale in the use of the mobile factors and supply curves in these sectors slope up. One extension of BTY is that we allow sector specific labor. In our benchmark equilibrium, we assume that fifty percent of labor is sector specific (both skilled labor and unskilled labor). Value-added is an aggregate of our primary factors with elasticity of substitution σ. Skilled (and unskilled) labor is an aggregate of sector specific and mobile labor with elasticity of substitution 2σ. Thus, the share of sector specific labor may change in a counterfactual scenario, including a comparative steady-state scenario.

2.2 Comparative Steady-state Formulation for the 2030 Solution of the Model.

2.2.1 Basic Theory of the Endogenous Capital Stock in the Comparative Steady-state Model. In the comparative static model, we assume that the capital stock is fixed and the rental rate on capital is endogenously determined. In the comparative steady-state model, the logic is reversed: the real return on capital is fixed, but we allow the capital stock to adjust to its steady-state equilibrium along with all of the

[9] That model builds on the algebraic structure of the small open economy models of Balistreri, Rutherford and Tarr (2009), Jensen and Tarr (2010), Jensen, Rutherford and Tarr (2010) and Balistreri, Jensen and Tarr (2009; 2015).

[10] Given the nature of the shocks we consider (which are economy-wide), we do not believe the aggregation of capital and land has a significant impact on the results.

model features we employ in our comparative static model. The comparative steady-state model is based on the assumption that investors demand a given real rate of return on capital in order to invest in a given country. We assume that the rate of return demanded by investors for each country or region is initially in long run equilibrium. If a trade policy or other type of shock happens to induce and increase in the rate of return on capital so that it exceeds the initial rate of return, investors will invest and expand the capital stock. Expansion of the capital stock drives down the marginal product of capital, i.e., it drives down the rental rate on capital. A new equilibrium in the comparative steady-state model is determined when the capital stock rises sufficiently that the real rate of return on capital falls back to the initial level.[11]

To analyze trade policy, this comparative steady-state approach has been employed by many authors, including Harrison, Rutherford and Tarr (1996, 1997, 1997a), Baldwin et al. (1999) and Francois et al. (1996). The approach, however, dates back to the 1970s, when both Hansen and Koopmans (1972) and Dantzig and Manne (1974) developed it.

2.2.2 Adjustment to Eliminate the Bias in the Welfare Calculation in the Comparative Steady-State Model. The approach employed in the above studies ignores the foregone consumption necessary to achieve the higher level of investment, and, thus, is biased upward regarding the estimated welfare gains within the framework of the model assumptions. We have made an important extension in the modeling approach of the above studies to adjust for the upward bias in the estimated welfare gains.[12] In a discrete time intertemporal model, the capital stock in period t is:

$$\mathbf{K(t) = K(t-1)d + I(t-1)} \qquad (1)$$

where **K(t)** and **I(t)** are the capital stock and investment in period t, respectively, and **d** is one minus the depreciation rate. If we assume that investment in each period is constant equal to **I**, then the capital stock in period t is the cumulative undepreciated value of investments over time:

$$\mathbf{K(t) = I*[(1-d^t)/(1-d)]} \qquad (2)$$

It follows that for a fixed time period and depreciation rate, the percentage change in the constant value of investment in each period is equal to the percentage change in the capital stock, i.e.,

$$\Delta K/K = \Delta I/I. \qquad (3)$$

Following equation 3, in our comparative steady-state model, we assume that investment increases in proportion to the increase in the capital stock. We measure welfare change from Hicksian equivalent variation, which is based on consumption only. Thus, when the capital stock increases in our model, investment will also increase, thereby reducing the reported welfare gains. This adjustment removes the

[11] The rate of return on investment in our model is the rental rate on capital divided by the cost of a unit of the capital good. We allow both mobile and sector specific capital to be endogenously determined in the comparative steady-state model.

[12] This approach was first suggested in an unpublished paper by Francois *et al*. (2013).

well-known upward bias in comparative steady-state models from ignoring the investment costs of increasing the capital stock.

If the shock favors labor-intensive sectors and the relative return to capital falls sufficiently, it could induce a decline in the capital stock. We have imposed a lower bound of zero, however, on the change in the capital stock in any of our scenarios, assuming that over a fifteen-year period it is not reasonable to allow a decline in the capital stock in our regions. If the lower bound constraint is binding, the real return on capital will decline in the new steady-state equilibrium.

2.2.3 Labor Force Projections for 2030. In section 3.5, we discuss data for projections of the labor force (both skilled and unskilled labor) as well as the total population for 2030. Based on these data, in all of our scenarios for 2030, we shock the initial labor force data such that the labor force for the 2030 scenarios in the African regions of the model satisfies two properties. First, the percentage increase in the total labor force of our model increases by the percentage increase in the total labor force from the projected labor force data. Second, the percentage point change in the skilled labor force versus unskilled labor force in our model is the same as in the projected labor force data. The labor force increase has the impact of increasing the marginal product of capital, so the capital stock. If the population increases, however, we would expect an approximately proportional decrease in per capita real consumption. To avoid a biased overestimate of the welfare gain in our comparative steady-state model with labor force growth, we reduce the welfare gain estimate (Hicksian equivalent variation of the representative agent) by the percentage increase in the population.[13] That is, suppose the population in 2030 is z times the population in our initial equilibrium. If EV is our solution for Hicksian equivalent variation in our steady-state model, then our measure of the change in welfare in our steady-state model is ΔW, where ΔW is defined by

$$\Delta W = EV/z \qquad (4)$$

2.3 Microsimulation Methodology for Poverty and Shared Prosperity Results

To estimate distributional effects, we use the microsimulation model known as the GIDD. Bussolo, de Hoyos, and Medvedev (2010) originally developed the GIDD, building on the work of Bourguignon et al. (2008) and Davies (2009). The GIDD has been applied in several examples including Devarajan et al., (2015) and others that are discussed in Bourguignon and Bussolo (2013). Here we contribute to the literature by providing a clear mathematical explanation of the GIDD, but first we provide an intuitive explanation.

2.3.1 What is the Global Income Distribution Dynamics (GIDD) model.

[13] In many of our African countries the percentage increase in the labor force exceeds the percentage increase in the population. A greater share of the population in the labor force should increase welfare, so we reduce the estimated welfare by the percentage increase in the population, not the percentage increase in the labor force.

For inputs, the GIDD uses CGE model estimates of the changes in four differentiated wages: for skilled, unskilled, agricultural and non-agricultural labor and changes in the prices of agricultural and non-agricultural goods. We impose consistency between the GIDD and the CGE models in two ways. First, as explained in section 2.2.3, in both models we use the same projections in aggregate population and education (skill) structures for 2030.[14] Second, all household incomes are adjusted proportionally so that the percentage change in weighted average aggregate of household incomes in the GIDD is consistent with the CGE model's estimate of the percentage change in real income.

The first step in the microsimulation exercise is to implement a set of changes in the household surveys' demographic structure, as explained in section 3.5. The second step is to adjust factor returns by skill and sector in accordance with the results of the CGE model. The GIDD imposes a new vector of earnings on each worker, conditional on that worker being in sector s and having educational attainment e. In the third step, we proportionally adjust the per capital income of each household to guarantee that the weighted average of household incomes changes exactly in line with the CGE results. Lastly, GIDD constructs a household-specific deflator to adjust for changes in relative prices. We construct the price using initial and final prices indices of food versus non-food from the CGE model and household-specific budget consumption shares for food and non-food observed in micro data.

2.3.2 Mathematical Description of our Household Model. We adopt the following conventions: denote a variable from the CGE model by x if it is the initial or benchmark value from the data, and by $\hat{x}$ if it is a counterfactual or estimated value from the CGE model. Similarly, denote a variable from the GIDD model by x' if it is the initial data and by $\widehat{x'}$ if it is a counterfactual or estimated value from the GIDD model.

We start with a distribution of earnings from labor by sector and skill $[y_{s,e}]$ in the CGE initial data. Define a set of wage gaps as follows:

$$g_{s,e} = \frac{y_{s,e}}{y_{1,1}} - 1 \quad (5)$$

and a similar set of wage gaps from the CGE counterfactual scenario:

$$\hat{g}_{s,e} = \frac{\hat{y}_{s,e}}{\hat{y}_{1,1}} - 1 \quad (6)$$

[14] The aggregate returns to capital and labor in the CGE model, however, are not aligned with the household data. See Rutherford and Tarr (2008) for a discussion of the impact of reconciliation of the factor returns in the household data with the input-output table.

where $y_{1,1}$ is the average earnings from labor of unskilled workers in agriculture. All right hand side values in equation 5 are known data in the CGE model benchmark dataset, and all right hand side values in equation and 6 are known values in the CGE model counterfactual simulations.

The household data will have also have a set of wage gaps that, in general, will differ from the CGE data. Analogous to equations 5 and 6, define:

$$g'_{s,e} = \frac{y'_{s,e}}{y'_{1,1}} - 1 \quad (7)$$

$$\hat{g}'_{s,e} = \frac{\hat{y}'_{s,e}}{\hat{y}'_{1,1}} - 1 \quad (8)$$

where $g'_{s,e}$ are the wage gaps or premia based on averages by skill group and sector in the household data; $y'_{s,e}$ are the average earnings of labor in sector s and skill group e based on the household data; $y'_{1,1}$ are the average earnings of unskilled labor in agriculture based on the household data; and the $\widehat{g'}$ are the predicted values at the household level as a result of the policy change. All right hand side values of equation 7 are known from the initial household data. In order to calculate $\hat{g}'_{s,e}$, we assume that:

$$\hat{g}'_{s,e} = g'_{s,e} \frac{\hat{g}_{s,e}}{g_{s,e}} \quad (9).$$

Since the three values on the right hand side are known from equations 5, 6 and 7, we may calculate $\hat{g}'_{s,e}$. Equation 9 implies that the percentage change in the wage gaps will be consistent across the CGE and GIDD models. Within each group of workers, distributional changes occur; but, on average, for any group of workers, the relative wages for each type of worker is constrained to be consistent with the corresponding growth rates from the CGE model.

Given the known values in equations 5-9, and defining average wages for unskilled labor in agriculture as numeraire in the GIDD, so that $y'_{1,1} = \hat{y}'_{1,1}$, it is possible to calculate the percentage changes in average wage income of households in sector s and skill level e that are consistent with wage gaps expressed in Equation 9:

$$\hat{y}'_{s,e}/y'_{s,e} \quad (10)$$

Note that Equation 10 only operates on labor income. In order to adjust the micro data such that the weighted average percentage change in the per capita income/consumption across all households matches the change in real consumption per capita in the CGE model, we execute a subsequent adjustment. Define Y as real per capita income calculated from the CGE model in the benchmark and $\hat{Y}$ as its predicted value in the CGE model simulation.

Define $y_h = \sum_{i \in h} y_{i,h} / n_h$ as the per capita income of household h in the benchmark equilibrium, where $y_{i,h}$ is the income of the ith member of household h, and n_h is equal to the size of household h. (Note that for income at the individual household level of the micro data, we use the index h, and drop the apostrophe that we use for aggregates in the GIDD as defined above.) Similarly, define $\lambda \hat{y}_h = \sum_{i \in h} \lambda \hat{y}_{i,h} / n_h$ where $\hat{y}_{i,h}$ and $\lambda \hat{y}_{i,h}$ are the unadjusted and adjusted values, respectively, of the income of the ith member of household h in the counterfactual of the household-model; the role of λ is explained by equation 14 below. Then define Y' as the weighted average value of real per capita income across all households, i.e.,

$$\sum_h v_h y_h = Y' \quad (11)$$

where v_h is the weight of household h in aggregate income in the benchmark. Correspondingly

$$\sum_h \omega_h \lambda \hat{y}_h = \hat{Y}' \quad (12)$$

is the weighted average per capita income value in the policy simulation. Note that $\sum_h v_h = 1$, $\sum_h \omega_h = 1$ and λ is a scalar. Equations 11 and 12 allow for different household weights since the weights of the households will typically change over time. So that the percentage change in the aggregate value of household income is consistent with the CGE model, we constrain $\hat{Y}'$ by equation 13:

$$\hat{Y}' = Y' \frac{\hat{Y}}{Y} \quad (13)$$

We implement this constraint in a distribution neutral way. That is, we adjust all household income in the counterfactual by a scalar λ such that per capita household income equals $\lambda \hat{y}'_h$: as a result, λ can be defined by:

$$\lambda \sum_h \omega_h \hat{y}_h = Y' \frac{\hat{Y}}{Y} \quad (14)$$

Despite the fact that the GIDD ignores other forms of income, such as capital income, this transformation guarantees consistency between the weighted average household income assessment and the CGE model assessment. For poor households, which is the focus of our work, the assumption should be reasonably accurate, since poor households have little capital income. There is more of a margin of error for wealthier households. For these households, however, it is skilled labor rather than unskilled labor that tends to be more important and Bussolo, de Hoyos, Medvedev (2010) have noted a tendency for the skilled wage and returns to capital to be correlated.

Finally, CGE estimates of changes in agricultural and non-agricultural prices are distributed across heterogeneous households using the following method. Let us define the initial per capita monetary income of household h, y_h , and the real income of household h, y_h^r, as the ratio of its monetary income divided by a household-specific price index capturing the household's consumption patterns in terms of food and non-food expenditure:

$$y_h^r = \frac{y_h}{P_h} = \frac{y_h}{\alpha_h P_f + (1-\alpha_h) P_{nf}} \qquad (15)$$

where P_f and P_{nf} are food and non-food price indices and α_h is the proportion of household's h budget spent on food.

The α_h parameter in the denominator of the right hand side of Equation 15 can be estimated with household data using the following specification:

$$\alpha_h = \beta_0 + \beta_1 \ln(y_h) + \varepsilon_h \qquad (16)$$

where ε_h represents household-specific errors that are assumed to be distributed with $E(\varepsilon_h) = 0$ and variance $= \sigma^2$. Assuming that estimated parameters $\hat{\beta}_0$ and $\hat{\beta}_1$ remain constant, the new budget share spent on food for household h, α_h , at the counterfactual per capita income, $\lambda\hat{y}_h'$, can obtained from:

$$\hat{a}_h = \hat{\beta}_0 + \hat{\beta}_1 \ln(\lambda\hat{y}_h) \qquad (17)$$

The changes in real per capita incomes brought about by a change in relative prices of food versus non-food can be approximated by the following expression:

$$\hat{y}_h^r = \frac{\lambda\hat{y}_h}{\hat{a}_h P_f' + (1-\hat{a}_h) P_{nf}'} \qquad (18)$$

where $\hat{y}_h^r$ in Equation 18 is the real per capita income adjusted for changes in relative prices of food versus non-food. $\hat{y}_h^r$ is the counterfactual measure of real per capita income of household h for the analysis of poverty and shared prosperity.

Finally, in order to assure that the percentage increase in the weighted average per capita real income increases by the same percentage as given by the CGE model after the adjustments for price changes, analogous to equation 14, we do an equiproportionate rescaling of all estimated household per capita real incomes in 2030. That is, all real household per capita incomes are scaled by a common parameter such that $\hat{Y}^r = Y^r \frac{\hat{Y}}{Y}$, where Y^r is the weighted average real household per capita income across all households in the initial data and $\hat{Y}^r$ is its predicted value in 2030.

3. Key Data: Estimates of the AVEs of Trade Costs, Population Projections and FDI Shares

The core dataset for the CGE analysis is the set of input-output tables from version 8.1 of GTAP.[15] We use the International Income Distribution Dataset (I2D2) for the household datasets of our microsimulation model. The I2D2 is a global harmonized household survey database of 120 countries that are comparable across countries and time. It contains data on household income and consumption and individual data on education, demographics and labor force participation. (See Montenegro and Hirn (2009) for documentation.)

Given the primary importance of the ad valorem equivalents of the barriers against foreign suppliers of services, the time in trade costs and the non-tariff barriers, we discuss those estimates here. Since it involves a new dataset, we also discuss the estimates of the shares of domestic services markets captured by foreign direct investors. Full documentation of the dataset is available in Balistreri et al. (2016). Finally, given their importance for our 2030 CGE model and the microsimulation work, we also discuss the population and skill mix projections.

3.1 Ad Valorem Equivalents (AVEs) of the Barriers Against Foreign Suppliers of Business Services.

We employ the estimates of Jafari and Tarr (2015) of the ad valorem equivalents of discriminatory barriers against foreign providers of services. These estimates are based on the World Bank database of discriminatory regulatory barriers in 11 services sectors in 103 countries described in Borchert, Gootiiz and Mattoo (2014).[16] Independent studies based on more detailed data were performed in the cases of Kenya and Tanzania, as discussed in BTY (2014).

3.2 Estimates of the Ad Valorem Equivalents of the Costs of Time in Exporting and Importing.

Our costs of time in trade are from Minor (2013), who builds in the work of Hummels and Schaur (2013) and Hummels et al. (2007). As documented in BTY (2014), we aggregate the estimates of Minor (2013) to the sectors and regions of our model, yielding the cost of time costs of trade by product and country on a bilateral trade basis.

3.3 Estimates of the Ad Valorem Equivalents (AVEs) for Non-Tariff Measures (NTMs)

Our estimates of the AVEs of NTMs are based on the estimates of Kee *et al*., (2009). The measure we use from Kee *et al*. is the uniform tariff equivalent that generates the same level of import value for the country in a given year, based on applied tariffs, which take into account bilateral trade preferences. To avoid wide margins of error at the sector level, we have chosen to use the aggregated estimates of Kee *et*

[15] See https://www.gtap.agecon.purdue.edu/.

[16] In the cases of Kenya and Tanzania, we commissioned new surveys by local law firms of the regulatory regimes in services as a basis of estimating both the non-discriminatory barriers that impact both domestic and foreign suppliers of services as well as the discriminatory regulatory barriers against foreign suppliers of services.

al. i.e., for each country, we have two AVEs: one AVE of the NTMs in manufacturing and one AVE of the NTMs in agriculture. We then further aggregate these values for 93 countries to the regions of our model. Details are available in appendix B of BTY (2014). Where the non-tariff measure has a legitimate regulatory function, we assume that the estimate of Kee *et al.* is the discriminatory component of the regulation.

The report of the East African Community (2012) shows that non-tariff barriers remain a very significant problem. Consequently, we assume the ad valorem equivalents of the non-tariff barriers apply to all countries.

3.4 Share of Market Captured by Foreign Direct Investors in Services and by Cross-Border Sales of Services

For cross-border sales of services, we use the trade data from the GTAP 8.1 dataset. Our primary data source for foreign affiliate sales is the database developed by Fukui and Lakatos (2012). Fukui and Lakatos combine Eurostat data for 41 countries with an econometric model to estimate the missing values and thus produce estimates for all regions and sectors in the GTAP dataset. For the share of sales in the sector by the host country, we use the GTAP dataset for total sales in the sector and subtract the total of foreign affiliate sales from total sales to obtain the host country share of sales. In the insurance, banking, telecommunications and professional services sectors for our African regions, we used supplementary sources discussed in appendices D and E of BTY (2014).

3.5 Population and Skill Mix of the Labor Force

Starting with our household survey, the country specific demographic profiles are constructed by partitioning each country's total population into: (1) 16 age-groups (0-4, 5-9, 10-14, …, 65-69, 70-74, 75 and above); (2) two gender groups; and (3) three different levels of educational attainment: (i) no-education or primary only; (ii) secondary education; and (iii) tertiary education. For 2030, our age and gender projections are taken from the medium variant population projections of United Nations Department of Economic and Social Affairs (2015). In terms of education, we assume that as the population ages, the average educational attainment in a country increases through a pure pipeline effect, as younger and more educated cohorts replace older cohorts. For example, if at time *t* half of the population in the cohort formed by individuals between 25 and 30 years of age have post-secondary education, then after ten years (at *t*+10), half of the population between 35 and 40 will have post-secondary education. Furthermore, for younger cohorts we imposed the assumption that there is no improvement in enrollment and graduation rates from those observed at time *t*. In other words, the average educational attainment of these young cohorts in the future is equal to the average educational levels of the 20 to 24 cohort of time *t*. This is a conservative

assumption given that the 20 to 24 cohort observed at time t may not have the maximum educational level attainable.[17]

4. CGE Results: Deep Integration in Eastern and Southern Africa

In order to assess the importance of wider integration, we evaluate the impacts of deep integration to reduce trade costs at three levels of integration: (i) deep integration within the EACU alone; (ii) unilateral liberalization of the same policies by the EACU countries toward the whole world; and (iii) deep integration within the Tripartite FTA. We also decompose each of the three broad deep integration policies into their three components: trade facilitation; reduction of non-tariff barriers; and services liberalization. The decomposition allows us to infer the relative importance of the various reforms to the different countries within each broad policy scenario. In all scenarios, we assume that the barriers impose real resource costs, so liberalization generates both "rectangles" of gains from additional capital and labor that are available, as well as "Harberger triangles" of efficiency gains. In Balistreri et al. (2015), we conduct sensitivity analysis on this assumption.

4.1 Scenario Definition and Rationale

Table 3 presents the results from our 12 scenarios for the variables important in the micro-simulation analysis; it also contains a chart that defines the components of the scenario. We label the results of our 12 scenarios as **S.1** to **S.12** in table 3. These scenarios and their rationale are defined as follows.

Scenario 1 (S.1). Business as Usual. Exogenous increase in the labor force and endogenous increase in the capital stock, with investment adjustment.

In order to isolate the impacts of the trade policies, we create a "Business as Usual" (BAU) scenario for 2030. The BAU scenario includes an exogenous increase in the labor force categories and an endogenous determination of the capital stock, as discussed in section 2.2. BAU excludes trade policy changes. The scenarios for trade policy impacts for 2030 are presented as differences from the BAU scenario, and thereby are the trade policy impacts alone, excluding the impact of the labor market expansion and the endogenous change in the capital stock due to the labor force expansion. There is an endogenous capital stock change in the trade policy scenarios for 2030, but it is attributable to the impact on the real return to capital from the trade policy change alone, not the increase in the labor force.[18]

[17] The micro-simulation model recalibrates each household sample weight to match the age, gender, and education projected totals such that the new sets of age, gender and education deviate as little as possible from the initial distributions. See Wittenberg (2010) for a technical description and implementation of this method.

[18] We obtain the values for the trade policy changes in table 3 as follows. For each trade policy scenario, we exogenously impose the 2030 labor force and the trade policy changes and then execute a simulation in our comparative steady-state model. From the estimates of these simulations, we subtract the estimated change of the

Scenario 2 (S.2). EACU Central. This constitutes:

(i) Trade Facilitation, 20 percent cut in AVE of the time in trade costs within the EACU and a five percent cut in these costs for trade with countries outside the EACU;
(ii) Services liberalization, 50 percent cut in the AVEs of services barriers within the EACU; and
(iii) Non-tariff barriers reduction, 20 percent cut in the AVEs of the NTBs within the EACU, with zero cut for countries outside the EACU.

As members of a customs union, we assume that the EACU members act collectively on all actions in our scenarios. We assume that tariff free trade prevails within each of the three regional groups of the Tripartite FTA, but the barriers that lead to high trade costs apply to all countries and regions. In table 2, we show the benchmark ad valorem rates of distortion for all barriers we apply for Tanzania. See Balistreri et al. (2016) for the comparable tables for all six African regions of our model.

Regarding **trade facilitation, w**e take modest cuts for multiple reasons. One is that the most efficient countries in the world have positive time costs of trade. Second, part of the costs are due to infrastructure deficiencies that cannot be addressed through policy alone. There are, however, some collaborative projects and plans among members of the EACU (see East African Community Secretariat, 2011), such as common customs posts, designed to cut the time costs of trade. Since there is likely a spillover benefit of these measures within the EACU that will cut the time costs of trade outside of the EACU, we assume cuts in external trade costs as well.

With respect to **non-tariff barriers**, under the auspices of the East African Community, the member countries are undertaking collaborative efforts to reduce non-tariff barriers (see, for example, East African Community, 2012). Non-tariff measures, however, have become much more subtle in the post-Uruguay Round world. Most measures have a legitimate regulatory function and distinguishing the legitimate regulations from protective or inefficient regulations is complicated. Consequently, we take a more modest 20 percent reduction in the ad valorem equivalent of these barriers, with no spillover to countries excluded from the agreement.

For **barriers on foreign providers of services**, on July 1, 2010, the East African Community adopted a Common Market protocol that called for the free movement of services within the five member states, along with the free movement of goods, capital and labor.[19]

BAU scenario to obtain the values in table 3. This isolates the trade policy impacts since the BAU scenario contains the same exogenous labor force expansion.

[19] For the text of the protocol, see: http://www.eac.int/commonmarket/index.php. See also Dihel et al. (2010) for a discussion of liberalization of professional services in East Africa.

Scenarios 3, 4 and 5 (S.3, S.4, S.5). The components of EACU Central, Scenario 2. **Only Trade Facilitation, Only Services Liberalization and only reduction of Non-Tariff Barriers, respectively**.

Scenario 6 (S.6). EACU Liberal. This constitutes unilateral liberalization by the EACU countries as follows:

(i) Trade Facilitation, 20 percent cut in AVE of the time in trade costs within the EACU and a five percent cut in these costs for trade with countries outside the EACU;
(ii) Services liberalization, 50 percent cut in the AVEs of services barriers for all countries; and
(iii) Non-tariff barriers reduction, 20 percent cut in the AVEs of the NTBs for all countries.

With a combined nominal GDP in 2013 of only about US$121 billion (or US$297 on a purchasing power parity basis),[20] the EACU is not a large market, and economic theory indicates that there should be substantially greater gains from integrating into the world trading environment. In "EACU Liberal," we assess how much more could be gained extending the liberalizations of non-tariff barrier and services barriers implemented in "EACU Central" to all trading partners in the world. In the case of the time in trade costs, however, we do not extend these outside of the EACU since the improvements are primarily regional and reciprocal and we already convey a five percent cut in these barriers for countries outside of the EACU.

Scenarios 7 and 8 (S.7, S.8). EACU Countries Implement Only Services Liberalization or Only Reduction of Non-Tariff Barriers, respectively, for all Countries.

Scenario 9. Tripartite Central. This constitutes:

(i) Trade Facilitation, 20 percent cut in AVE of the time in trade costs within the Tripartite FTA and a five percent cut in these costs for trade with countries outside the Tripartite FTA;
(ii) Services liberalization, 50 percent cut in the AVEs of services barriers within the Tripartite FTA; and
(iii) Non-tariff barriers reduction, 20 percent cut in the AVEs of the NTBs within the Tripartite FTA, with zero cut for countries outside the region.

The Second Tripartite Summit in June 2011 envisioned liberalization of trade in goods and movement of business persons in Phase I and, in Phase II, liberalization of trade in services and related trade areas. Programs of trade and transport facilitation and NTB removal have been launched.[21] In our Tripartite Central scenario, we assume all six of our Tripartite-African regions (Kenya, Tanzania, Rwanda, Uganda, COMESA and SADC) execute identical preferential liberalization of the time costs of trade, non-tariff barriers and services liberalization as we implemented in the EACU Central scenario, except that the preferences apply throughout the Tripartite FTA.

[20] In 2013, the International Monetary Fund estimated the nominal GDP of the EACU members as follows (in billions of US dollars): Kenya, 55; Tanzania, 33.3; Uganda, 22.9; Rwanda, 7.4; and Burundi, 2.7. The purchasing power parity GDP, however, was estimated by the IMF at: Kenya, 125.8; Tanzania, 84.9; Uganda, 61.9; Rwanda, 17.4; and Burundi, 7.9.

[21] See Pearson (2012) and Willenbockel (2013) for details.

Scenarios 10, 11 and 12 (S.10, S.11, S.12). The three components of Scenario 9, respectively, each in isolation.

4.2 Aggregate Welfare Effects

Real income gains in the BAU scenario are substantial, ranging from 17 percent for Rwanda to 45 percent for Kenya and SADC. The large gains are due to two factors: the labor force is projected to grow faster than the population and the capital stock increases.

Comparing welfare results in scenarios 2, 6 and 9, we see that, for Tanzania, Uganda and Rwanda, we have the expected result that the wider the integration, the greater the gains. Integrating with the larger Tripartite FTA yields larger gains than limiting deep integration to within the EACU only, and unilateral liberalization dominates Tripartite liberalization. In the case of Kenya, however, the gains from deep integration in the Tripartite FTA are 90 percent of the gains from wider liberalization with the whole world; and in our comparative static model, the gains to Kenya are larger in the Tripartite scenario (S.9) compared with EACU Liberal (S.6). Our decomposition analysis provides intuition into the reasons for these results.

4.3 Reduction of Time in Trade Costs (Trade Facilitation)

4.3.1 Relative Importance of Trade Facilitation. Trade facilitation is the largest component of the gains in both the EACU Central and the Tripartite scenarios for all countries with the exception of COMESA in the Tripartite scenario. For equivalent AVES, trade facilitation is more important than non-tariff barriers to the welfare results since it reduces the time costs of trade on both imports and exports, whereas the reduction on non-tariff barriers only reduces costs of imports. Services liberalization is less important in our dataset since, with limited exceptions discussed below, the six regions have limited penetration into the services markets of each other.

For the COMESA and SADC regions, the gains from the reduction in the time costs of trade are considerably less than for the four EACU countries. The reason is that the COMESA and SADC regions trade much more intensively with countries outside of the Tripartite FTA, where we assume there are fewer opportunities for reductions in time in trade costs. The trade-weighted import intensities of goods trade with regions outside of the Tripartite FTA are as follows: Kenya, 86.7%; Tanzania, 84.7%; Uganda, 70.7%; Rwanda, 63.1%; COMESA, 97.6%; and SADC, 99.3%.

Second, despite wider liberalization in the EACU Liberal scenario, the trade facilitation gains for the EACU countries are larger in the Tripartite scenario than they are in the EACU Liberal scenario. This is because of our assumption that the trade facilitation reforms, such as road and border crossing improvements, disproportionately reduce the costs of the local countries implementing the reforms. Our Tripartite scenario widens the regions to which the larger 20 percent cuts apply, but the EACU Liberal scenario applies a five percent cut in these costs on trade outside of the EACU.

4.3.2 Larger Gains for Agricultural Exporters

Previous efforts at simulating sector output and export changes from trade facilitation used uniform ad valorem equivalents across sectors, which tended to result in more uniform impacts across sectors. Our dataset has the time costs of trade varying by both product and by country of origin and destination.[22] Since the time costs of trade tend to be highest in agricultural products, trade facilitation tends favor agriculture and to favor disproportionately countries that intensively export agricultural products. This is especially important in explaining results for Uganda (and to a lesser extent for Rwanda). Agriculture is a Ugandan sector with one of our highest estimated AVE of the time costs of exporting (importing); the Ugandan AVE in agriculture is about 40 (30) percent, depending on the destination (origin) country.[23] Consequently, from trade facilitation, we estimate an expansion of agricultural output and exports in Uganda relative to other sectors; and 85 percent of the gains from the Tripartite FTA are due to trade facilitation gains.

4.4 Reduction of Non-Tariff Barriers

The results are very striking for both Tanzania and Kenya. We estimate a big increase in welfare for Tanzania from the reduction of non-tariff barriers toward the whole world in the EACU Liberal scenario (S.8). The wider liberalization of non-tariff barriers results in a welfare gain of more than 5.7 percent of consumption, whereas the welfare gains are only 0.99 percent of consumption in the Tripartite scenario (S.12). This large gain in EACU Liberal for Tanzania is explained by two factors: (i) the ad valorem equivalents of the non-tariff barriers in Tanzania are 47.4 percent in manufacturing and 22.2 percent in agriculture. This is substantially higher than the estimates for the other African countries or regions in our model; and (ii) on a trade-weighted basis, 84.7 percent of Tanzania's trade is with countries outside of the Tripartite FTA. Thus, the reduction of NTB barriers impacts a much larger share of trade, generating more recaptured rents and greater efficiency gains.

For Kenya, perhaps surprisingly, Kenya gains more from preferential NTB liberalization in the Tripartite FTA (S.12) than from equivalent unilateral liberalization of EACU Liberal scenario (S.8). This is due to preferential market access in goods. The theory paper of Wonnacott and Wonnacott (1981) emphasized that improved market access in export markets of goods could lead to preferential trade agreements dominating unilateral trade liberalization; and an example of this with real data was first shown by Harrison, Rutherford and Tarr (2002). Our result for Kenya provides another example in which preferential agreements can yield larger gains than unilateral liberalization due to market access gains.

[22] The AVEs differ across countries, due to the product mix differences across countries of the aggregated sectors of our model.

[23] The partner country AVE is also relevant in assessing impacts.

For COMESA and SADC, the gains are negligible from a cut in the AVEs of the NTBs in the Tripartite FTA. This is because the share of their trade within the Tripartite region is so small: only 2.4 percent for COMESA and 0.7 percent for SADC.

4.5 Reduction of Barriers against Foreign Service Providers

Uganda, Kenya and especially Rwanda reap very large gains from reducing barriers against all suppliers of services in the world (S.7). For Rwanda, the AVEs of barriers against foreign providers of services are substantial, with four sectors in Rwanda having AVEs of between 25 and 62 percent. Further, except for Kenyan insurance firms, the market share of EACU firms in Rwanda is very small in services. But the main foreign service suppliers in Rwanda (see table 6d of BTY, 2014) are European Union suppliers followed by the United States and the Rest of the World. COMESA's share in Rwanda's service markets is zero and SADC is represented in Rwanda only in telecommunications (36 percent) and insurance (4 percent). Therefore, liberalization of services markets by Rwanda in the Tripartite FTA yields additional services suppliers and gains from COMESA and SADC only in telecommunications and insurance.

Two regions gain substantially from services liberalization within the Tripartite FTA. One is Kenya, which, gains 2.31 percent of consumption in the Tripartite "only services liberalization" scenario. The reason is that Kenya has a significant share of the insurance markets in COMESA, where we estimate a very high ad valorem equivalent of the barriers to services providers. The improved market access for Kenyan insurance suppliers under the protected umbrella of very high barriers creates substantial gains for insurance services suppliers from Kenya in COMESA markets. We verified this explanation by executing a scenario in which we preferentially liberalize services barriers within the Tripartite area, but exclude preferential reduction in insurance services barriers. In this scenario, the estimated gains to Kenya from "only services liberalization" within Tripartite fall dramatically from 2.31 to 0.7 percent of consumption.

The other region that reaps substantial gains from services reform in the Tripartite area is COMESA. This is explained by the high services barriers in COMESA, especially in insurance where Kenya has a presence in the markets of COMESA. Reduction of services barriers in COMESA generates gains in part since it frees up capital and labor required to comply with the protective or inefficient regulation as well as efficiency gains from better access to relatively efficient services suppliers.

5. Poverty and Shared Prosperity Results of Deep Integration in East and Southern Africa.

5.1 Poverty Headcount and Percentage of the Population Living in Poverty

Results for the percentage of the population below the poverty line and the poverty headcount are in the top two sections of table 4. We define the poverty line as $1.25 per day on a purchasing power parity

(PPP) basis. In the Tripartite scenario, the results indicate a net reduction in the poverty headcount for all six of our African regions, varying between 0.48 million people in Rwanda to 1.63 million in SADC, with a reduction in the poverty headcount in the EACU of 4.19 million. We estimate that the largest percentage point reduction of poverty is in Rwanda (2.70), but the largest reduction in the percentage of people living in poverty is in Uganda (14 percent). Unilateral liberalization by the EACU members would lift even more out of poverty-- an estimated 5.14 million people in the EACU region would be lifted out of poverty.

5.2 Shared Prosperity Results

5.2.1 Impact on the incomes of the poorest 40 percent. Regarding shared prosperity, both deep integration in the Tripartite FTA and unilateral liberalization would significantly increase the incomes of the poorest 40 percent of the population. We estimate that as a result reduction of trade costs in the Tripartite FTA, incomes of the poorest 40 percent of the populations in the EACU would increase by between 4.1 percent for Tanzania to 7.7 percent for Kenya. For COMESA and SADC, the poorest 40 percent of the population would see a significantly smaller increase in their incomes of 2.2 percent and 1.5 percent, respectively. The smaller gains for the bottom forty percent follow from the aggregate results: COMESA and SADC goods trade is primarily conducted (more than 97 percent) with countries outside the Tripartite FTA. So COMESA and SADC gain much less from NTB reduction and trade facilitation. The bottom forty percent in SADC and especially COMESA, however, have a lot to gain from services liberalization in the Tripartite area.

With unilateral liberalization, incomes of the poorest 40 percent of the EACU populations would increase by a larger amount than from our Tripartite scenario: from 7.5 percent for Uganda to 9.8 percent for Rwanda.

5.2.2. Inequality effects—decreased inequality with trade facilitation and increased inequality with services liberalization. For three of the four EACU countries we model in the Tripartite scenario (Tanzania excepted), the poorest 40 percent realize a larger increase in their incomes than the average of the entire population. The primary reason for these results is that the poor depend disproportionately on the earnings of unskilled labor. In the Tripartite scenario, trade facilitation is the reform responsible for the largest gains. Given our sector specific dataset on trade facilitation, the trade facilitation scenario tends to favor agriculture, which is typically one of the most intensive users of unskilled labor. In the cases of Rwanda and Uganda, unskilled labor constitutes 70 and 74 percent of value added in our dataset and are among the most unskilled labor-intensive sectors. So the expansion of agriculture drives up the relative wage of unskilled labor, yielding a reduction in inequality.

Although unilateral liberalization by the EACU raises incomes of the bottom 40% more than in the Tripartite scenario, the Tripartite scenario would promote more equitable growth in the EACU than unilateral liberalization, especially for Rwanda and Uganda. The reason is that, with unilateral

liberalization, services expansion is the most important reform. The services sectors are the most intensive users of skilled labor, so their expansion drives up the relative wage of skilled labor, which tends to reduce the share of income of the bottom 40 percent. We emphasize that services liberalization has an important impact on poverty reduction and increasing incomes of the poorest forty percent of the population; so services liberalization is an important tool in the fight to eliminate poverty. However, these results tend to suggest it has an adverse impact on the share of income going to the poorest forty percent.

6. Conclusions

Our poverty results suggest that the effects of the trade reforms to reduce trade costs are pro-poor. For example, we estimate that reduction of trade costs within the Tripartite agreement would reduce the number of poor in the whole region by 7.43 million; and the incomes of the poorest 40 percent of the population would increase by from 1.5 percent in the case of SADC to 7.7 percent in the case of Kenya. Focusing on poverty reduction in Kenya, Tanzania, Uganda, and Rwanda, unilateral expansion of the reforms to lower trade costs to the whole world would lift an additional 1.1 million out of poverty, compared with deep integration within the Tripartite FTA alone. This indicates that while deep regional integration is an important step in helping to reduce poverty, the region should not ignore the additional gains available from broader trade liberalization.

We find that the different reforms affect countries differently, which could lead to countries lobbying for different reforms as part of a strategy that maximizes poverty reduction. This is typical in trade negotiations, as a country will often have to make "concessions" in areas it is not highly motivated to reform, in order to obtain agreement from other countries on what is most important to it. For example, in the Tripartite scenario, the country that has the most to gain from services liberalization is Kenya: in terms of percentage points of poverty reduction (-0.62 percent) or incomes of the poorest 40 percent (increase of 2.31 percent), Kenya has the most to gain from Tripartite services liberalization. However, based on the percent living in poverty or the results for shared prosperity, Rwanda and Uganda have the most to gain from trade facilitation. Since all these reforms benefit all the countries, the "exchange of concessions" would lead to a more desirable trade agreement.

We find that trade facilitation tends to both increase incomes of the poor as well as reduce inequality. The latter is due to the disproportional gains in agriculture that tends to benefit unskilled labor. Services liberalization is also strongly pro-poor as it reduces poverty and raises incomes of the poorest forty percent of the population. Nonetheless, it tends to increase wages of skilled workers more than unskilled workers, and thereby increase inequality. Finally, BTY (2015) estimate that adjustment costs are only a small percentage of the gains from trade liberalization in Eastern and Southern Africa. Nonetheless, the

poor are often very badly equipped to handle adjustment costs. This highlights the value of effective safety net programs that may assist the poor through the transition.

8. References

Anderson, Kym, Will Martin and Dominique van der Mensbrugghe (2006), "Would Multilateral Trade Reform Benefit Sub-Saharan Africans?" *Journal of African Economies*, Vol. 15(4), 626-670.

Baldwin, Richard.E., Rikard Forslid and Jan Haaland (1999), "Investment Creation and Investment Diversion: Simulation Analysis of the Single Market Programme," in R. Baldwin and J. Francois (eds.), *Dynamic Issues in Applied Commercial Policy Analysis*, Cambridge: Cambridge University Press

Balistreri, Edward J., Jesper Jensen and David G. Tarr (2015), "What Determines Whether Preferential Liberalization of Barriers against Foreign Investors in Services are Beneficial or Immizerising: Application to the case of Kenya," *Economics: The Open-Access, Open-Assessment E-Journal, Vol.* 9 (2015-42): 1—134. http://dx.doi.org/10.5018/economics-ejournal.ja.2015-42

Balistreri, Edward J., Maryla Maliszewska, Israel Osorio-Rodarte, David G. Tarr and Hidemichi Yonezawa (2016), "Poverty and Shared Prosperity Implications of Deep Integration in Eastern and Southern Africa," World Bank Policy and Research Working Paper No. 7660, May. Available at: http://documents.worldbank.org/curated/en/905551468180262500/Poverty-and-shared-prosperity-implications-of-deep-integration-in-Eastern-and-Southern-Africa

Balistreri, Edward J., Thomas F. Rutherford and David G. Tarr (2009), "Modeling Services Liberalization: The Case of Kenya," *Economic Modeling*, Vol. 26 (3), May, 668-679.

Balistreri, Edward J., David G. Tarr and Hidemichi Yonezawa (2015), "Deep Integration in East and Southern Africa: Poverty: What are the Stakes? *Journal of African Economies,"* Vol. 24(5), 677-706.

Balistreri, Edward J., David G. Tarr and Hidemichi Yonezawa (2014), "Reducing Trade Costs in East Africa: deep regional integration and multilateral action," World Bank Policy and Research Working Paper No. 7049, September. Available at: http://papers.ssrn.com/sol3/papers.cfm?abstract_id=2503724

Borchert, Ingo, Batshur Gootiiz and Aaditya Mattoo (2014), "Policy Barriers to International Trade in Services: Evidence from a New Database," *World Bank Economic Review*, vol. 28, 162-188.

Boysen, Ole and Alan Matthews (2016), "Will Economic Partnership Agreements increase poverty? The case of Uganda," *Review of Development Economics*, DOI: 10.1111/rode.12272.

Bourguignon F., F. Ferreira, and P. Leite (2008), "Beyond Oaxaca-Blinder: Accounting for Differences in Household Income Distributions Across Countries," *Journal of Economic Inequality*," Vol. 6 (2), 117-148.

Bourguignon, F. and M. Bussolo (2013), "Income Distribution in Computable General Equilibrium Modeling," in *Handbook of Computable General Equilibrium Modeling*, Vol. 1, Peter B. Dixon and Dale Jorgenson (eds.), Elsevier, 1383–1437.

Brenton, Paul and Gozde Isik (2012), *De-fragmenting Africa: Deepening Regional Trade Integration in Goods and Services*, Washington DC: The World Bank.

Bussolo, Maurizio, Rafael E. De Hoyos and Denis Medvedev (2010), "Economic Growth and Income Distribution: Linking Macroeconomic Models with Household Survey Data at the Global Level," *International Journal of Microsimulation*, Vol. 3(1), 92-103.

Bussolo, Maurizio, Jann Lay, Denis Medvedev and Dominique van der Mensbrugghe (2008), "Trade Options for Latin America: A Poverty Assessment Using a Top-Down Macro-Micro Modeling Framework," in Bourguignon, Bussolo and Pereira da Siva (eds.), *The Impact of Macroeconomic Policies on Poverty and Income Distribution*, Palgrave MacMillan and the World Bank, 61-92.

Bussolo, Maurizio and Yolo Niimi (2009), "Do Regional Trade Agreements Benefit the Poor? An Illustration from Dominican Republic—Central American Free Trade Agreement in Nicaragua," *World Development*, Vol. 17(1), 146-160.

Davies, J. (2009), "Combining Microsimulation with CGE and Macro Modelling for Distributional Analysis in Developing and Transition Countries," *The International Journal of Microsimulation* 2 (1): 49-65.

Dantzig, George and Alan Manne (1974), "A Complementary Algorithm for an Optimal Capital Path with Invariant Proportions," *Journal of Economic Theory*, 9, 312-323.

Devarajan S, D. S. Go, M. Maliszewska, I. Osorio-Rodarte, and H. Timmer (2015), "Stress-Testing Africa's Recent Growth and Poverty Performance," *Journal of Policy Modeling*, 37 (4): 521–547.

Dihel, Nora, Ana Margarida Fernandes, Aaditya Mattoo and Nicholas Strychacz (2010), "Reform and Regional Integration of Professional Services in East Africa," Economic Premise No. 32, September, The World Bank. Available at: www.worldbank.org/economicpremise.

East African Community Secretariat (2011), "East African Transport Strategy and Regional Road Sector Development Program and East African Trade and Transport Facilitation Project," September.

East African Community (2012), "Status of Elimination of Non-Tariff Barriers in the East African Community," Vol. 5, December.

Francois, Joseph, Bradley McDonald and Hakan Nordstom (1996), "Assessing the Uruguay Round," in Will Martin and L. Alan Winters (eds.), *The Uruguay Round and the Developing Countries*, Cambridge: Cambridge University Press.

Francois, Joseph, Miriam Manchin, Hanna Norberg, Olga Pindyuk and Patrick Tomberger (2013), "Reducing Transatlantic Barriers to Trade and Investment: An Economic Assessment," Prepared under European Commission implementing Framework Contract TRADE10/A2/A16. Available at: http://trade.ec.europa.eu/doclib/docs/2013/march/tradoc_150737.pdf. Accessed August 7, 2015.

Fukui, Tani and Csilla Lakatos (2012), "A Global Database of Foreign Affiliate Sales," GTAP Research Memorandum No. 24, July.

Hansen, Terje and Tjalling Koopmans (1972), "On the Definition and the Computation of a Capital Stock Invariant Under Optimization," J*ournal of Economic Theory*, 5, 487-523

Harrison, Glenn H., Thomas F. Rutherford and David G. Tarr. (1996), "Increased Competition and Completion of the Market in the European Community: Static and Steady-State Effects," *Journal of Economic Integration*, 11(3), September 1996, 332-365.

Harrison, Glenn H., Thomas F. Rutherford and David G. Tarr (1997), "Economic Implications for Turkey of a Customs Union with the European Union," *European Economic Review*, Vol. 41(3-5), 861-870.

Harrison, Glenn, Thomas Rutherford and David Tarr (1997a), "Quantifying the Uruguay Round," *Economic Journal*.

Harrison, Glenn H., Thomas F. Rutherford and David G. Tarr (2002), "Trade Policy Options for Chile: The Importance of Market Access," *World Bank Economic Review*, Vol. 16, Number 1.

Hummels, David L. and G. Schaur (2013), "Time as a Trade Barrier," *American Economic Review*, Vol. 103, 1-27.

Hummels, David L., Peter Minor, Matthew Reisman and Erin Endean (2007), "Calculating Tariff Equivalents for Time in Trade," Arlington, VA: Nathan Associates Inc. for the United States Agency for International Development (USAID).

Jafari, Yaghoob and David G. Tarr (2015), "Estimates of the Ad Valorem Equivalents of Foreign Discriminatory Regulatory Barriers in 11 Services Sectors for 103 countries," *The World Economy*. Article first published online October 12, 2015, DOI: 10.1111/twec.12329.

Jensen, H. G. and R. Sandrey (2011), "The Tripartite Free Trade Agreement: A computer analysis of the impacts," Tralac Working Paper No. N11WP06/2011, March.

Jensen, Jesper, Thomas Rutherford and David Tarr (2010), "Modeling Services Liberalization: the Case of Tanzania," *Journal of Economic Integration*, Vol. 25 (4), December, 644-675.

Jensen, Jesper and David G. Tarr (2012), "Deep Trade Policy Options for Armenia: The Importance of Trade Facilitation, Services and Standards Liberalization," *Economics: The Open Access-Open Assessment E-Journal*, Vol. 6, 2012-1. http://dx.doi.org/10.5018/economics-ejournal.ja.2012-1.

Karingi S. and B. Fekadu (2009), "Beyond Political Rhetoric – the Meaning of the Grand Eastern and Southern Africa FTA," UN Economic Commission for Africa, April.

Kee, Hiau Looi, Alessandro Nicita and Marcelo Olarreaga (2009), "Estimating trade restrictiveness indices," *Economic Journal*, Vol. 119, 172--199.

Maliszewska, Maryla, Iryna Orlova and Svitlana Taran (2009), "Deep Integration with the EU and its Likely Impact on Selected ENP Countries and Russia," Case Network Report No. 88/2009. Available at: http://papers.ssrn.com/sol3/papers.cfm?abstract_id=1518342.

Mevel S. and S. Karingi (2012), "Deepening Regional Integration in Africa: A Computable General Equilibrium Assessment of the Establishment of a Continental Free Trade Area followed by a Continental Customs Union," Paper presented at the 7th African Economic Conference, Kigali, Rwanda, 30 October - 2 November.

Minor, Peter (2013), "Time as a Barrier to Trade: A GTAP Database of ad valorem Trade Time Costs," ImpactEcon, Second Edition, October. Available at: http://mygtap.org/resources/.

Montenegro, Claudio E. and Maximilian L. Hirn (2009), "A New Disaggregated Set of Labor Market Indicators Using Standardized Household Surveys from Around the World," World Development Report Background Paper. Available at: https://openknowledge.worldbank.org/bitstream/handle/10986/9033/WDR2009_0015.pdf

Pearson, Mark (2012), "Trade Facilitation in the COMESA-EAC-SADC Tripartite Free Trade Area," in *The Tripartite Free Trade Area: Towards a New African Integration Paradigm*, in T. Hartzenberg and others (eds.), Trade Law Centre for Southern Africa.

Rutherford, Thomas F. and David Tarr (2008), "Poverty Effects of Russian WTO accession: modeling "real" households with endogenous productivity effects," *Journal of International Economics*, Vol. 75 (1), 131-150.

Schiff, Maurice and L. Alan Winters (2003), *Regional Integration and Development*, Oxford: Oxford University Press and the World Bank.

Teichman, Isabel (2016), "CGE-Based Methods to Measure the Impact of Trade Liberalization on Poverty," DIW Roundup, July 28, 1-12. http://www.diw.de/sixcms/detail.php?id=diw_01.c.540414.de

United Nations Department of Economic and Social Affairs Population Division. (2015), *World Population Prospects: the 2015 Revision.* Retrieved from http://esa.un.org/unpd/wpp/DVD/

Willenbockel, D. (2013), "General Equilibrium Analysis of the COMESA-EAC-SADC Tripartite FTA, Draft Final Report to TradeMark Southern Africa," August 2013.

Wittenberg, M. (2010). An introduction to maximum entropy and minimum cross-entropy estimation using Sta. *The Stata Journal*, *10*(3), 315–330.

Wonnacott, Paul and Ronald Wonnacott (1981), "Is Unilateral Tariff Reduction Preferable to a Customs Union? The Curious Case of the Missing Foreign Tariffs," *American Economic Review*, Vol. 71 (4), 704-714.

World Bank (2012), *East African Community: Reshaping Economic Geography of East Africa: From Regional to Global Integration*, Report No. 6599-AFR, Poverty Reduction and Economic Management Unit, Africa Region, June.

World Economic Forum (2012), *The Global Enabling Trade Report, 2012: Reducing Supply Chain Barriers*, edited by Robert Lawrence, Margareta Drzeniek Hanouz and Sean Doherty. Available at www.weforum.org.

Table 1: List of Sectors, Regions and Factors of Production in the Eastern and Southern Africa Model

Business Services with FDI	**Dixit-Stigliz Goods**
Air Transport	Chemicals Mineral and Metal Products
Communication	Energy and Minerals
Insurance	Food Products
Business Services nec	Petroleum and Coal Products
Financial Services nec	Other Manufacturing
Transport nec	Textile, Apparel and Leather Products
Water Transport	Wood and Paper Products
CRTS Goods and Services	**Regions**
Agriculture and Forestry	Kenya
Other Services	Tanzania
Trade	Uganda
Utilities	Rwanda
	COMESA
Factors of Production	SADC
Skilled labor	USA
Unskilled labor	European Union (EUR)
Capital	China
Natural Resources	Rest of the World (ROW)

Table 2: Benchmark Distortions in Tanzania; Ad valorem values in percentage.

	Barriers Against Service Providers									
	Discriminatory									Non-Discriminatory
	Kenya	Uganda	Rwanda	COMESA	SADC	USA	EUR	China	ROW	
Business Services										
Air Transport	40.0	40.0	40.0	40.0	40.0	40.0	40.0	40.0	40.0	0.0
Communication	8.0	8.0	8.0	8.0	8.0	8.0	8.0	8.0	8.0	3.1
Insurance	37.0	37.0	37.0	37.0	37.0	37.0	37.0	37.0	37.0	17.9
Business Services nec	22.0	22.0	22.0	22.0	22.0	22.0	22.0	22.0	22.0	22.0
Financial Services nec	34.0	34.0	34.0	34.0	34.0	34.0	34.0	34.0	34.0	14.7
Transport nec	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Water Transport	51.0	51.0	51.0	51.0	51.0	51.0	51.0	51.0	51.0	0.0
	Tariff Rates on Goods									Non-Tariff Measures
	Kenya	Uganda	Rwanda	COMESA	SADC	USA	EUR	China	ROW	
Goods										
Chemicals Mineral and Metal Products	0.0	0.0	0.0	4.4	0.0	4.4	4.4	4.4	4.4	47.4
Energy and Minerals	0.0	0.0	0.0	3.2	0.0	3.2	3.2	3.2	3.2	47.4
Food Products	0.0	0.0	0.0	13.4	0.0	13.4	13.4	13.4	13.4	47.4
Petroleum and Coal Products	0.0	0.0	0.0	3.2	0.0	3.2	3.2	3.2	3.2	47.4
Other Manufacturing	0.0	0.0	0.0	6.3	0.0	6.3	6.3	6.3	6.3	47.4
Textile and Apparel	0.0	0.0	0.0	29.7	0.0	29.7	29.7	29.7	29.7	47.4
Wood and Paper Products	0.0	0.0	0.0	11.6	0.0	11.6	11.6	11.6	11.6	47.4
Agriculture and Forestry	0.0	0.0	0.0	11.9	0.0	11.9	11.9	11.9	11.9	22.2
	Barriers to Efficient Trade Facilitation on Exports									
Chemicals Mineral and Metal Products	16.2	16.1	14.2	14.0	16.1	12.9	13.7	15.9	16.2	
Energy and Minerals	9.0	7.6	9.0	9.0	5.4	5.4	8.6	9.0	8.4	
Food Products	12.6	15.3	16.4	12.1	13.8	7.6	14.7	9.8	13.9	
Petroleum and Coal Products	19.9	19.9	19.9	19.9	19.9	19.9	19.9	19.9	19.9	
Other Manufacturing	7.8	6.4	13.1	10.2	10.2	9.4	9.3	9.8	9.6	
Textile and Apparel	5.9	5.7	5.8	5.6	6.3	6.8	7.2	6.6	7.5	
Wood and Paper Products	8.3	15.1	11.2	10.8	9.5	5.8	6.3	4.3	15.2	
Agriculture and Forestry	14.3	18.2	28.7	12.5	17.6	17.9	15.2	13.1	18.0	
	Barriers to Efficient Trade Facilitation on Imports									
Chemicals Mineral and Metal Products	19.9	38.6	58.8	9.2	29.3	4.8	5.9	14.8	13.5	
Energy and Minerals	11.7	18.9	19.8	4.5	17.3	2.6	3.9	8.2	9.2	
Food Products	20.7	30.7	27.9	41.9	19.7	4.8	4.8	11.3	10.8	
Petroleum and Coal Products	25.9	41.9	43.9	38.1	36.0	6.0	14.1	18.0	17.8	
Other Manufacturing	15.1	26.9	42.6	3.4	16.3	2.0	4.1	8.6	8.2	
Textile and Apparel	6.5	12.8	13.8	5.3	15.0	2.1	3.9	5.9	7.2	
Wood and Paper Products	14.7	17.6	49.9	10.8	33.9	2.6	7.9	9.6	9.7	
Agriculture and Forestry	19.8	34.7	54.2	20.4	30.3	8.7	9.0	17.9	15.6	

Table 3: Deep Integration within the Tripartite FTA and the East Africa Customs Union (EAC) and Unilateral Reforms by the EACU Results for 2030 -- (Trade Policy Results are percentage change from BAU for 2030)

		EACU Central				EACU Liberal			Tripartite FTA (Deep Integration)			
Scenario definition	**Benchmark (only labor and capital expansion)**	**EACU Central: Trade Facilitation plus services and NTB liberalization**	**EACU: only Trade Facilita-tion****	**EACU: only services liberaliza-tion**	**EACU: only NTB liberaliza-tion**	**EACU Liberal: Trade Facilitation plus Unilateral services and NTM refrom by EACU**	**EACU Liberal: only services liberaliza-tion**	**EACU Liberal: only NTB liberaliza-tion**	**Tripartite central : Trade Facilitation plus services and NTB liberalization**	**Tripartite: only Trade Facilitation**	**Tripartite: only services liberaliza-tion**	**Tripartite : only NTB liberaliza-tion**
Time in Trade Costs: 20% reduction within EACU (Tripartite) countries*	No	Yes	Yes	No	No	Yes	No	No	Yes	Yes	No	No
Time in Trade Costs: 5% reduction with non-EACU (Tripartite) countries*	No	Yes	Yes	No	No	Yes	No	No	Yes	Yes	No	No
Services Liberalization: 50% reduction of discriminatory barriers within EACU (Tripartite)*	No	Yes	No	Yes	No	Yes	Yes	No	Yes	No	Yes	No
Services Liberalization: 50% multilateral reduction of discriminatory barriers by EACU	No	No	No	No	No	Yes	Yes	No	No	No	No	No
Non-Tariff Barriers: 20% reduction of costs within EACU (Tripartite) countries*	No	Yes	No	No	Yes	Yes	No	Yes	Yes	No	No	Yes
Non-Tariff Barriers: 20% multiltateral reduction of NTB costs by EACU countries	No	No	No	No	No	Yes	No	Yes	No	No	No	No
Scenario number	**S.1**	**S.2**	**S.3**	**S.4**	**S.5**	**S.6**	**S.7**	**S.8**	**S.9**	**S.10**	**S.11**	**S.12**
Aggregate welfare change												
Hicksian Equivalent Variation divided by population increase and initial consumption												
Kenya	45.4	3.78	2.23	0.23	0.90	8.30	5.38	0.47	7.46	3.72	2.31	1.02
Tanzania	20.7	1.76	1.08	0.03	0.37	9.68	2.35	5.69	4.47	2.33	0.30	0.99
Uganda	37.1	1.01	0.85	0.16	0.05	6.46	5.39	0.13	3.80	3.22	0.39	0.11
Rwanda	17.4	2.15	1.62	0.32	0.07	11.11	8.40	0.22	3.37	2.28	0.48	0.17
COMESA	20.9	0.00	0.00	0.00	0.00	0.00	0.00	0.00	2.39	0.32	1.90	0.04
SADC	45.4	0.00	0.01	0.00	0.00	0.04	0.01	0.02	1.55	1.01	0.52	0.08
Unskilled Wage												
Agriculture												
Kenya	32.11	3.81	2.36	0.21	0.89	8.25	5.33	0.34	7.04	3.86	1.56	1.34
Tanzania	9.86	2.37	1.35	0.02	0.72	8.17	1.72	4.65	5.05	2.51	0.21	1.46
Uganda	16.39	5.44	4.64	0.10	0.31	8.61	3.64	0.10	8.38	6.47	0.29	0.78
Rwanda	9.78	3.11	2.38	0.24	0.11	8.91	6.46	0.16	11.34	7.97	0.35	0.33
COMESA	16.96	0.00	0.00	0.00	0.00	0.01	0.00	0.00	2.29	0.36	1.86	0.02
SADC	25.78	0.00	0.01	0.00	0.00	0.04	0.01	0.02	2.14	1.06	0.38	0.12
Non-Agriculture												
Kenya	35.07	4.16	2.51	0.22	1.02	8.71	5.52	0.42	6.90	3.80	1.50	1.25
Tanzania	10.00	1.92	1.08	0.02	0.52	8.09	1.96	4.57	4.61	2.32	0.26	1.18
Uganda	18.30	3.41	2.87	0.11	0.21	6.95	3.79	0.12	6.01	4.70	0.31	0.51
Rwanda	9.86	2.40	1.83	0.27	0.08	9.37	6.94	0.13	5.75	4.05	0.39	0.22
COMESA	18.11	0.00	0.00	0.00	0.00	0.01	0.00	0.00	2.33	0.25	1.94	0.02
SADC	25.59	0.00	0.01	0.00	0.00	0.03	0.00	0.01	1.17	0.72	0.38	0.08

Table 3 (continued): Deep Integration within the Tripartite FTA and the East Africa Customs Union (EACU) and Unilateral Reforms by the EACU Results for 2030 -- (Trade Policy Results are percentage change from BAU for 2030)

		EACU Central				EACU Liberal			Tripartite FTA (Deep Integration)			
	Benchmark (only labor and capital expansion)	EACU Central: Trade Facilitation plus services and NTB liberalization	EACU: only Trade Facilita-tion**	EACU: only services liberaliza-tion	EACU: only NTB liberaliza-tion	EACU Liberal: Trade Facilitation plus Unilateral services and NTM liberalization by the EACU	EACU Liberal: only services liberaliza-tion	EACU Liberal: only NTB liberaliza-tion	Tripartite central : Trade Facilitation plus services and NTB liberalization	Tripartite: only Trade Facilitation	Tripartite: only services liberaliza-tion	Tripartite : only NTB liberaliza-tion
Scenario number	**S.1**	**S.2**	**S.3**	**S.4**	**S.5**	**S.6**	**S.7**	**S.8**	**S.9**	**S.10**	**S.11**	**S.12**
Skilled Wage												
Agriculture												
Kenya	16.20	2.48	1.49	0.18	0.50	5.91	3.93	0.30	4.30	2.24	1.19	0.41
Tanzania	6.15	1.71	0.83	0.03	0.47	8.54	2.00	5.17	4.29	2.05	0.23	1.15
Uganda	10.97	0.43	0.40	0.11	0.00	4.01	3.47	0.09	2.08	1.85	0.30	-0.03
Rwanda	3.16	2.30	2.02	0.31	0.13	10.01	6.19	0.34	-4.52	-2.79	0.47	0.05
COMESA	-2.06	0.01	0.01	0.00	0.00	0.02	0.01	0.00	2.28	0.31	1.79	0.05
SADC	13.94	0.00	0.01	0.00	0.00	0.03	0.01	0.01	1.61	0.86	0.35	0.09
Non-Agriculture												
Kenya	17.12	2.49	1.46	0.18	0.52	5.87	3.87	0.35	3.86	1.99	1.12	0.22
Tanzania	5.63	1.35	0.60	0.03	0.31	8.55	2.19	5.20	3.92	1.87	0.26	0.94
Uganda	11.96	-1.41	-1.20	0.12	-0.11	2.43	3.54	0.09	-0.10	0.19	0.31	-0.32
Rwanda	2.88	1.91	1.76	0.33	0.13	10.49	6.41	0.36	-8.35	-5.62	0.50	-0.03
COMESA	-1.81	0.00	0.01	0.00	0.00	0.02	0.01	0.00	2.36	0.24	1.88	0.05
SADC	12.77	0.01	0.01	0.00	0.00	0.03	0.00	0.01	0.79	0.56	0.34	0.05
Price												
Food												
Kenya	-1.29	0.21	0.17	-0.02	0.03	-0.08	-0.31	0.07	0.09	0.21	-0.18	0.01
Tanzania	4.95	0.79	0.44	0.01	0.21	2.76	0.47	1.75	1.51	0.77	0.05	0.43
Uganda	4.17	0.94	0.83	0.00	0.06	1.46	0.56	0.03	1.50	1.20	0.07	0.13
Rwanda	2.92	0.07	0.06	0.01	0.01	0.07	-0.15	0.02	-0.38	-0.27	0.01	0.02
COMESA	3.20	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.91	0.03	0.91	0.00
SADC	5.04	0.00	0.00	0.00	0.00	0.01	0.00	0.00	0.19	0.09	0.07	0.01
Non-Food												
Kenya	5.37	0.45	0.29	0.01	0.09	0.69	0.31	0.09	0.59	0.37	0.09	0.08
Tanzania	5.50	0.69	0.36	0.01	0.17	2.17	-0.05	1.71	1.36	0.74	-0.01	0.34
Uganda	5.35	0.04	0.04	-0.01	0.00	0.48	0.40	0.03	0.31	0.23	0.05	0.00
Rwanda	4.13	0.84	0.80	0.01	0.02	1.38	0.55	0.06	0.51	0.44	0.03	0.02
COMESA	3.57	0.00	0.00	0.00	0.00	0.00	0.00	0.00	1.00	0.08	0.84	0.01
SADC	5.52	0.00	0.00	0.00	0.00	0.01	0.00	0.00	0.15	0.10	0.06	0.01

***Reductions apply to the EACU or the Tripartite countries depending on the scenario.**
****Trade facilitation within the "EACU Liberal" scenario is the same as Scenario 3, Trade Facilitation within the EACU.**
Source: Authors' estimates.

Table 4. Poverty Percentage, Headcount and Shared Prosperity Results for Deep Integration within the Tripartite FTA and the East Africa Customs Union (EACU) and Unilateral Reforms by the EACU

Scenario definition	Business as Usual: only labor and capital expansion	EACU Central: Trade Facilitation plus services and NTB liberaliza-tion	EACU: only Trade Facilita-tion**	EACU: only services liberaliza-tion	EACU: only NTB liberaliza-tion	EACU Liberal: Trade Facilitation plus Unilateral services and NTM refrom within EACU	EACU Liberal: only services liberaliza-tion	EACU Liberal: only NTB liberaliza-tion	Tripartite central: Trade Facilitation plus services and NTB liberalization	Tripartite: only Trade Facilitation	Tripartite: only services liberaliza-tion	Tripartite: only NTB liberaliza-tion
Time in Trade Costs: 20% reduction within EACU (Tripartite) countries*	No	Yes	Yes	No	No	Yes	No	No	Yes	Yes	No	No
Time in Trade Costs: 5% reduction with non-EACU (Tripartite) countries*	No	Yes	Yes	No	No	Yes	No	No	Yes	Yes	No	No
Services Liberalization: 50% reduction of discriminatory barriers within EACU (Tripartite)*	No	Yes	No	Yes	No	Yes	Yes	No	Yes	No	Yes	No
Services Liberalization: 50% multilateral reduction of discriminatory barriers by EACU	No	No	No	No	No	Yes	Yes	No	No	No	No	No
Non-Tariff Barriers: 20% reduction of costs within EACU (Tripartite) countries*	No	Yes	No	No	Yes	Yes	No	Yes	Yes	No	No	Yes
Non-Tariff Barriers: 20% multiltateral reduction of NTB costs by EACU countries	No	No	No	No	No	Yes	No	Yes	No	No	No	No
Tariff: 100% removal within the Tripartite regions	No	No	No	No	No	No	No	No	No	No	No	No
Scenario number	**S.1**	**S.2**	**S.3**	**S.4**	**S.5**	**S.6**	**S.7**	**S.8**	**S.9**	**S.10**	**S.11**	**S.12**
Headcount, (in S.1, % of the populaiton living in poverty in 2030; all other scenarios, percentage point deviations from the S.1 scenario)												
Kenya	**16.63**	-0.90	-0.54	-0.01	-0.20	-1.90	-1.22	-0.10	-1.71	-0.98	-0.62	-0.32
Tanzania	**20.79**	-0.76	-0.15	0.00	-0.04	-2.16	-0.70	-1.76	-1.58	-1.00	-0.02	-0.12
Uganda	**14.73**	-1.28	-1.10	-0.03	-0.04	-2.64	-1.79	-0.03	-2.12	-1.76	-0.13	-0.17
Rwanda	**51.66**	-1.11	-0.84	-0.13	-0.03	-3.93	-3.10	-0.09	-2.70	-1.98	-0.23	-0.09
COMESA	**8.48**	0.00	0.00	0.00	0.00	0.00	0.00	0.00	-0.63	-0.09	-0.47	0.00
SADC	**40.92**	0.00	0.00	0.00	0.00	0.00	0.00	0.00	-0.50	-0.31	-0.15	-0.02
Poverty, millions of people in poverty in 2030 in scenario S.1; all other scenariios, deviations from Business as Usual (S.1) scenario, in millions of people)												
Kenya	**10.98**	-0.60	-0.36	-0.01	-0.13	-1.26	-0.81	-0.06	-1.13	-0.64	-0.41	-0.21
Tanzania	**16.41**	-0.60	-0.12	0.00	-0.03	-1.70	-0.55	-1.39	-1.25	-0.79	-0.02	-0.10
Uganda	**9.28**	-0.80	-0.69	-0.02	-0.02	-1.66	-1.13	-0.02	-1.34	-1.11	-0.08	-0.11
Rwanda	**9.14**	-0.20	-0.15	-0.02	0.00	-0.69	-0.55	-0.02	-0.48	-0.35	-0.04	-0.02
COMESA	**21.58**	0.00	0.00	0.00	0.00	0.00	0.00	0.00	-1.60	-0.23	-1.18	-0.01
SADC	**134.41**	0.00	-0.01	0.00	0.00	-0.02	0.00	-0.01	-1.63	-1.00	-0.49	-0.06
Percentage Change in Weighted Average Real Value of Per Capita Household Income												
Kenya	**45.40**	3.78	2.23	0.23	0.90	8.30	5.38	0.47	7.46	3.72	2.31	1.02
Tanzania	**20.75**	1.76	1.08	0.03	0.37	9.68	2.35	5.69	4.47	2.33	0.30	0.99
Uganda	**37.10**	1.01	0.85	0.16	0.05	6.46	5.39	0.13	3.80	3.22	0.39	0.11
Rwanda	**17.39**	2.15	1.62	0.32	0.07	11.11	8.40	0.22	3.37	2.28	0.48	0.17
COMESA	**20.87**	0.00	0.00	0.00	0.00	0.00	0.00	0.00	2.39	0.32	1.90	0.04
SADC	**45.42**	0.00	0.01	0.00	0.00	0.04	0.01	0.02	1.55	1.01	0.52	0.08
Percentage Change in Weighted Average Real Value of Per Capita Household Income of Poorest 40% of Households												
S.1 is the percentage change compared to the initial data. All other scenarios are the percentage change from the S.1 (BAU) scenario.												
Kenya	**40.00**	3.79	2.25	0.23	0.91	8.22	5.36	0.42	7.70	3.87	2.33	1.22
Tanzania	**16.53**	1.80	1.07	0.03	0.35	8.95	1.72	5.10	4.08	2.35	0.30	0.98
Uganda	**25.01**	2.79	2.38	0.15	0.17	7.54	4.80	0.13	5.67	4.56	0.34	0.41
Rwanda	**8.41**	2.32	1.73	0.28	0.07	9.82	7.60	0.18	7.15	4.93	0.41	0.23
COMESA	**15.95**	0.00	-0.01	0.00	0.00	0.00	0.00	0.00	2.21	0.35	1.79	0.03
SADC	**44.06**	-0.01	0.00	-0.07	-0.01	0.03	-0.01	0.01	1.51	0.89	0.42	0.06

*Reductions apply to the EACU countries or the Tripartite countries depending on whether the scenario is EACU or Tripartite.

** Trade facilitation within EACU is part of the "EACU liberal" scenario also.

Source: Authors' estimates