Tripartite FTA: Economic and poverty implications

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1. Introduction

African leaders are seeking to redouble the efforts to achieve regional integration first agreed in the 1991 Abuja Treaty. The treaty, which aimed for the creation of a competitive single market African Economic Community (AEC) and a single currency, entered into force in 1994. A summit of AU leaders in January 2012 endorsed a new action plan to boost trade between the continent's countries on the basis of the closer links being built between East African Community (EAC), the Common Market for East and Southern Africa (COMESA) and the Southern African Development Community (SADC), henceforth referred to as Tripartite FTA (TFTA). The summit noted the slow progress of implementing the Abuja Treaty and set a target of 2017 to establish a Continental Free Trade Area (CFTA) to bring together Africa's small and fragmented economies into a single market. Main objectives of the CFTA are to create a single market for goods and services with free movement of business people and investment, paving the way for a continental customs union. In the years up to the creation of the CFTA the goal is to enhance business and industrial competitiveness and expand trade.

The timeline for the CFTA assumes that the liberalization will proceed in a two stages. The 2014-2017 period is to be marked by a phased liberalization of trade in goods including tariffs, rules of origin, customs procedures and simplifying customs documentation, transit procedures, non-tariff barriers, trade remedies, technical barriers to trade and sanitary and phyto-sanitary measures. The sensitive products would be included in that phase, while countries boost their efforts to improve production capacity and competitiveness. The second phase would include preparations for the Continental Customs Union in 2019 in line with the Abuja Treaty. During the second phase countries would also undertake liberalization of trade in services such as tourism, financial services, transport and communications as well as free movement of persons. Finally, the last stage would cover trade-related areas of intellectual property rights (IPRs), competition policy and others. This will entail a number of domestic reforms as in the report on "De-fragmenting Africa", World Bank (2012).

The TFTA aims to cover the countries in East and Southern Africa, from Cape Town to Cairo. During the second Tripartite summit in June 2011, the parties created a Roadmap to the negotiation process that would liberalize the trade in goods and movement of business people by the end of 2014. It is agreed to also cover: rules of origin; customs, non-tariff barriers (NTBs); sanitary and phytosanitary (SPS) measures; technical barriers to trade (TBTs); and trade remedies along with the dispute settlement.

Similarly to the CFTA process, the second Phase of negotiations will cover trade in services and trade related areas such as IPRs, competition policy and trade development and competitiveness.

At the same time some countries have decided to speed up their integration without having the burden of waiting for all countries to agree on the liberalization measures and schedules. Five like-minded countries: Malawi, Mauritius, Mozambique, Seychelles and Zambia have launched the initiative to form the Accelerated Program of Economic Integration (APEI) in late 2011. The initiative is based on four pillars: removing barriers to trade in goods, promoting trade in services, enhancing trade facilitation and improving business environment. The APEI involves a complex and ambitious set of reforms focusing on eliminating NTBs, facilitating movement of persons, improving efficiency of customs border and management and a number of trade-related reforms to improve the business environment. It could become a model for a faster integration for other African countries.

The aim of this study is to shed light on the likely economic and poverty implications of broad regional integration in Africa with encompassing number of countries and measures. We intend to cover measures beyond the liberalization of tariffs including quantification of the impact of non-tariff measures related to trade facilitation, SPS, and TBTs that would be tackled in the first phase of integration and some key elements from the second phase such as trade in services. The methodology integrates a computable general equilibrium model and a micro simulation tool. By combining macro and micro modules into a single framework, the study aims to evaluate the impact of various scenarios of liberalization not only on international trade, economic growth and structural change, but also on poverty and income inequality through changes in wages, sectoral employment, and relative sectoral prices.

2. Previous studies

To date, there have been few empirical studies based on a CGE model applied to the estimation of the impact of a creation of the tripartite FTA or Customs Union. Most of them have focused only on tariff changes. There is therefore a need for new analysis that covers in a more comprehensive way trade liberalization, trade facilitation and trade in services. In addition, the implications of a TFTA for poverty and income distribution have so far not been investigated.

Among recent studies, Jensen and Sandrey (2011) employ the GTAP model and GTAP 8 database1 to study the impact of the removal of all tariffs between the three trading blocks and a reduction in non-tariff barriers to trade in goods and services of 2%. Their scenario also incorporates the conclusion of the Economic Partnership Agreements (EPAs) between the EU and African countries except South Africa. The authors find small, but significant welfare gains from the Tripartite FTA for Mozambique. Although not covered in the agreements, South Africa also benefits. However, other SACU partners and Botswana

[1] GTAP refers to the Global Trade Analysis at Purdue University, a multi-country database that has become standard in multilateral trade analysis. It also provides a multi-country general equilibrium model using the GEMPACK software for such analysis.

register a welfare loss either due to shift of capital to less productive uses or through the terms of trade loss (respectively).

The study by Karingi and Fekadu's (2009) uses also the GTAP model along with GTAP Africa database benchmarked to 2001. The scenarios include elimination of tariffs on all products among EAC-COMESA and SADC, as well as the elimination of tariffs between TFTA members and the EU. The results of this analysis indicate that the TFTA has negative impact on the GDP of COMESA, but positive impact on SADC and the EAC. The authors explain that low export intensity and high import penetration lead to a contraction of GDP in the COMESA and the EAC.

Using the MIRAGE model developed initially at the Centre d'Etudes Prospectives et d'Informations Internationales (CEPII) in Paris, Mevel and Karingi (2012) estimate the impact of a continental Free Trade Area (FTA) followed by the formation of a Continental Customs Union. It is a broader experiment than the creation of a TFTA. The authors analyze two experiments with CET of COMESA with 3 tariff bands between 0% and 25% and the ECOWAS CET with 5 bands between 0% and 35%. Trade facilitation measures are also included. These have been calculated based on Minor and Tsigas (2008), who estimated trade lost due to delay of one day in customs processing or port handling. The simulations include halving of these ad valorem trade costs. The authors find that although the Continental FTA contributes to increasing trade and its sophistication within Africa, it is not sufficient to double the share of intra-African trade. Customs Union on the other hand, including trade facilitation, would lead to a significant expansion of trade with the rest of the world.

Finally, a recent study of Willenbockel (2013) provides a very comprehensive analysis of several scenarios of tariff changes, along with a five percentage point reduction of ad valorem tariff equivalent of trade facilitation costs. Employing the latest GTAP 8.1 data base and bringing the model forward to 2014, the study provides a comparative static simulation of trade policy changes. The author finds that all scenarios (with various coverage of sectors and countries, with and without trade facilitation measures) lead to income gains for the tripartite FTA area as a whole, although the gains as a share of aggregate income are very small. Despite the more comprehensive set of trade and trade facilitation scenarios, these remain restrictive given that non-tariff barriers changes and services trade reforms have not been taken into account, while the trade facilitation scenario has been rather conservative.

3. Research methodology

We propose to design the forward-looking scenarios by employing the World Bank's global computable general equilibrium (CGE) model called LINKAGE and the global microsimulation framework called Global Income Distribution Dynamics (GIDD) model. We briefly describe the models and the modifications to be employed in this study.

LINKAGE is a global general-equilibrium model with an adjustable number of countries, regions and production sectors, linked by global trade flows and finance (van der Mensbrugghe 2011). Its current database is the Global Trade Analysis Project (GTAP) 8 with 2007 as the base year.2 At its core, LINKAGE

[2] See www.gtap.org for details.

is essentially a neo-classical growth model, with aggregate growth predicated on assumptions regarding the growth of the labor force, savings/investment decisions (and therefore capital accumulation) and total factor productivity. Unlike more simple growth models, LINKAGE has considerably more structure and the full dimension of its data covers a total of 226 countries aggregated into 134 regions or country groupings, and 57 sectors or commodities. This multi-sector and multi-regional configuration permits the analysis of global development and structural transformation, incorporating the complex interactions of productivity differences at the country, sector or factor level, shifts in demand as income rises, demographic and skill dynamics in the factor markets, as well changes in comparative advantage and trade flows from globalization or trade liberalization. In practice, aggregation is employed to emphasize the countries or sectors underscored in the analysis.

For this study, we will extend the approach developed in our recent Africa study, Devarajan et al. (2013), to cover the necessary trade related features for a regional integration analysis and to likely include all individual African countries members of the TFTA (see Annex 1). In addition, the rest of the world would cover several large countries (such as United States, China, India, Brazil, and Russia), plus various regional subgroups (such as the rest of SSA, OPEC, other less developed countries, EU countries, and other high income countries). The number of sectors will be determined in consultation with the team, but sectors common to all regions or countries in the model would include agriculture, natural resources (excl. oil), oil, food, several manufacturing, infrastructure, and services sectors (about 30 in total).

The LINKAGE model will use the GTAP 8.1 database to calibrate initial parameters. Like most computable general equilibrium models, a scenario is developed by solving for a new equilibrium in each subsequent year through 2030. The long term projections rely on assumptions regarding developments in population, factors of production (capital and labor) and productivity.3 The first set of simulations in the baseline would cover any trade policy changes that took place by 2014.

The assumptions on productivity growth are more complex and different approaches are adopted to three broad sectors: agriculture, manufacturing and services. Agricultural productivity is assumed to be factor-neutral and exogenous and is set to estimates from empirical studies (e.g., Martin and Mitra, 1999). Productivity in manufacturing and services is labor-augmenting (Harrod-neutral technical change); it is skill-neutral but sector-biased. In the case of agriculture productivity growth averages 2 per cent per annum. The productivity growth assumptions in manufacturing and services are country-specific and based on the past trends in productivity growth as calibrated using the Linkage model. Following the broad findings of Bosworth and Collins (2007) we assume that productivity growth in manufacturing is about 2 percentage points faster than in services. Up to 2014, we track the short- to medium-term GDP projections in World Bank (2013a); from 2015 onwards, the productivity growth is exogenous and GDP growth becomes endogenous in the Linkage simulations.

[3] See World Bank (2013) for more discussion of the population and labor force trends and their global implications for savings, investment and growth.

While the national savings are determined by the growth in per capita income and demographic factors, foreign savings are exogenous in the baseline. We assume that current account (CA) imbalances decline to more sustainable levels by 2030. In line with World Bank (2011a) assumption, we assume a linear glide where by 2030 non-energy exporting countries adopt a +/-7.5, 5 or 3 percent surplus/deficit target if there 2015 CA exceeds these bounds. Energy-exporting countries maintain their 2014 CA balances as projected in the World Bank (2013a).

To measure the effects of external shocks (or economic policies) on poverty and on the distribution of welfare among individuals and households, the microeconomic simulation in the GIDD (Global Income Distribution Dynamics) framework would project how households would be affected by the changes in relative commodity and factor prices generated from LINKAGE, incorporating into the analysis demographic and occupational characteristics of each household (Bourguignon and Bussolo, 2013). Based on the International Income Distribution Database of the World Bank, the GIDD currently includes harmonized household survey data for 121 countries, covering approximately 90 percent of the world's population. It also allows for the analysis of impacts on global income distribution from global growth scenarios. It also includes the ability to distinguish changes due to shifts in average income between countries from changes attributable to widening disparities within countries. The GIDD includes recent household surveys for 18 out of the total of 32 countries and more aggregate information on household income distribution for the remaining countries allowing for the analysis of poverty for all SSA countries. By generating a new distribution of household income following the various regional integration scenarios we can generate a number of poverty and inequality indicators.

The links between the Linkage and GIDD empirical framework is depicted in **Error! Reference source not found.**. Future income distribution is simulated or obtained by applying three main exogenous changes to the initial distribution: (a) demographic changes, including aging and shifts in the skill composition of the population; (b) shifts in the sectoral composition of employment; and (c) economic growth, including changes in relative wages across skills and sectors. In the GIDD's simplified framework, these changes are accommodated in a sequential fashion. In the first step, total population in each country is projected to 2030, including any shifts in the structure such as older age cohorts becoming larger in many countries. To accommodate these changes in the survey data, larger weights are assigned to older people than those assigned to younger individuals.4 In the next step, workers move from traditional agricultural sectors to more dynamic industrial and service sectors, and new incomes are estimated for these movers. Finally, consistent with an overall growth rate of real income per capita, changes in labor remuneration by skill level and sector are applied to each worker in the sample depending on their education and sector of employment. The number of workers changing sector of occupation and the growth differential in labor remuneration which are used to "shock" the micro-data are consistent with the results of the global computable general equilibrium (LINKAGE) model.

[4] Actually weights are not changed for each single individual but for whole households. Therefore, in the example in the text, households whose heads are older are assigned larger weights than households with younger heads. For a complete technical description of this re-weighting procedure, which in addition to the age structure also involves education attainments, see Bussolo, De Hoyos and Medvedev (2010).

Measuring income distribution and accounting for the general equilibrium effects of growth patterns and policy changes are not easy. The sequential steps of the framework reshape national income distribution under a set of strong assumptions. In particular, income inequality within population subgroups formed by age, skills, and sector of employment is assumed to be time invariant. Data limitations also affect estimates and projections. Although consumption expenditure is a more reliable welfare measure than income, consumption data are not available for all countries' surveys. To get a global or regional picture, the GIDD dataset includes also countries for which only income data were available. Moreover, measurement errors implicit in purchasing power parity exchange rates, which have been used to convert local currency units, also affect comparability across countries. Like most simulation models, the results should be understood as what-if scenarios, not forecasts. That is, the main advantage of a model-based analysis is having a framework which is consistent with economic theory and that can be used to test and explain the ceteris paribus effects of these and many different factors. For this study, we will in effect investigate under what circumstances or assumptions regional integration in Africa will have significant economic gains and poverty reduction.

4. Policy scenarios

We will develop a set of scenarios to analyze the likely policy changes related to the various stages of regional integration. The policy simulations will include the following elements: tariff changes, non-tariff measures, transport costs and restrictions of trade in services. We discuss the data sources to be employed in the policy simulations below.

One of the issues which might be beyond the scope of this project, but which should be reflected upon at all aspects of the analysis is the prevalence of unofficial trade flows. The informal trade flows between Cameron and Nigeria have been estimated to be around 230 million compared to the recorded non-oil trade flows of between USD 10 to 40 million (World Bank, 2013b). The streamlining of border formalities, reduction of hurdles to formal trade and progress on curbing corruption are likely to accompany regional integration. Hence large part of the informal trade is likely to move to the official channels greatly affecting currently under-recorded bilateral trade flows. This issue deserves a thorough investigation.

4.1. Tariff changes

In order to aggregate the 6-digit trade protection data to use with the CGE model, we will adapt the methodology of Laborde, Martin and van der Mensbrugghe (2011). Their work builds on the theoretically consistent approach to the aggregation problem of Anderson and Neary (1994). The authors proposed a uniform tariff that yields the same welfare as the original differentiated tariff structure. Subsequently Anderson and Neary (2003) develop a set of uniform tariff measures that are optional for measuring effects on trade volumes. The unifying feature of their methodology is that it provides aggregators that are optimal in the sense of yielding the same value of a specific function as the non-uniform tariff distortions. Anderson (2009) showed that an optimal approach to aggregation dramatically increases the welfare gains of trade liberalization using a two sector model of India.

Laborde, Martin and van der Mensbrugghe (2009) use the optimally aggregated tariffs with a modified version of the Linkage model to show that this aggregation procedure almost doubles the welfare gains from complete liberalization of global trade barriers as compared to standard trade weighted tariffs.

Following the guidance from the team we will analyze a subset of tariff reduction scenarios in line with the simulations done by Willenbockel (2013). However, in our study the welfare implications of tariff reductions are likely to be more significant due to the use of optimally aggregated tariffs. In line with previous studies the gains from the regional integration are expected to be a lot higher once we incorporate the reductions of NTMs, trade costs and services liberalization.

4.2.NTMs

International experience indicates that as tariffs have come down, non-tariff measures (NTMs) have become prevalent. NTMs are regulatory measures issued by various government agencies and affecting import and export. From the import perspective, the central policy question for governments is how to trade off the need to protect the population against health, environmental or other hazards brought by imported products against the need to contain business costs and to maintain market access for the country's trading partners.

When analyzing the impact of various NTMs we will take advantage of the recent data collection effort by the World Bank, UNCTAD and the African Development Bank on NTMs. Currently the data covers 30 developing countries from Africa, Latin America and South Asia, but data on additional 17 countries is under collection or revision. This data base has led to new estimations of ad valorem equivalents of NTMs using price or quantity based approaches. For example Cadot and Gourdon (2012) using price comparisons estimated price increasing impact of NTMs on foodstuffs to reach about 13 percent in Sub-Saharan Africa (SSA).

In their ongoing work, Cadot and Gourdon (2013) follow the price-based strand of the literature and estimate the effect of NTMs on unit value of products to approximate trade prices. The authors estimate the price-raising effect of NTMs on unit value of import (CIF price) by combining the CEPII's Unit Value database with the new NTM database. Combining the two datasets, the authors construct a (destination country × origin country × product) panel of over 2 million of observations and run within-product regressions with destination country effects and product effects. This allows for the differentiation of the NTMs impact among SPS, TBT or quantity regulation measures (such as non-automatic import licensing). Their findings will become part of the scenarios on streamlining the NTMs as part of the regional integration initiatives.

A prominent example of the quantity based approach is provided by Kee et. al. (2009). The authors run import equations at the product level on factor endowments, tariffs and NTMs. The algebraic manipulation of the coefficient yields ad valorem equivalents (AVEs) at the product level for an aggregate of countries and NTMs. In a more recent research using the NTMs data base mentioned above, Kee (2012) estimates AVEs of various NTMs in South Asian countries. The median AVE turns out to amount to 17% for South Asian countries, which is almost three times as much as the median tariff. In

the ongoing research Kee estimates the AVEs of SPS, TBTs and other NTMs for Kenya, Madagascar, Mozambique, Namibia, Senegal, Tanzania and Uganda. As new data becomes available through the joint WB-UNCTAC-ADB data collection effort, we are planning to commission a new research to cover any additional countries for which the data becomes available. The simulations will include a range of scenarios comprising of a gradual reduction of ad valorem equivalents of NTMs.

4.3.Transport/border costs

Hummels (2001) and Hummels et. al. (2007) provide econometric estimates of the willingness of importers to pay for one more day of time savings when shipping goods. The tariff equivalent of this has been estimated on a HS4-digit product basis separately for air and ocean freight. Minor and Tsigas (2008) and Minor (2013) offer a database of tariff equivalents for the time in trade that are specific to each product and country in the GTAP data base. These data have been updated by Olekseyuk and David Tarr (for details see Appendix 2). We will use this database for the initial estimates of the costs of trade between the African trading partners and their external trade partners. Informed by these initial levels of the trade costs that will be sector and country specific, we will study the implications of their gradual reduction as part of the regional integration efforts on trade facilitation. In the scenario analysis we will study the implications of a gradual reduction of transport costs to provide the policy makers with a range of plausible scenarios.

4.4.Services liberalization

Jafari (2013b) in cooperation with David Tarr has conducted a preliminary estimation of foreign discriminatory barriers to services in 103 countries and 11 services sectors (for details see Annex 3). The World Bank has conducted a survey of the regulatory barriers in selected services (World Bank, STRI data base). The SSA countries covered by the data base include: Botswana, Cameroon, Burundi, Congo, Cote d'Ivoire, Ethopia, Ghana, Kenya, Leshotho, Madagascar, Malawi, Mali, Mauritius, Mozambique, Namibia, Nigeria, Rwanda, Senegal, South Africa, Tanzania, Uganda, Zambia and Zimbabwe. The sectors include four transportation modes, fixed line telecommunications, mobile telecommunications, banking, insurance, accounting and auditing, legal services and retail trade. Jafari (2013a) has mapped DECTI scoring of the questionnaires to the scoring according to the matrices defined by Findlay and Warren (2000). Then the translated scores are multiplied by weights from various empirical studies from the volume of Findlay and Warren (2000) along with several recent studies to calculate the trade restrictiveness indices for each sector in all countries. We intend to contribute to the development of this database both financially and intellectually by reviewing/discussing their results and to employ this newly created data base in the scenarios of the implications of the regional SSA integration. Gradual reduction of these barriers will form the basis for scenarios of the second phase of the integration.

5. Baseline results and policy simulations

To be completed

6. Poverty and shared prosperity estimates

Informed by these initial levels of sector and country specific NTBs, trade costs and regulatory barriers in services, we will study the implications of their gradual reduction as part of the Africa's efforts on trade integration. In line with previous studies on regional integration in other regions (Andriamananjara et al. (2004), Harrison et al. (1994), Francois et al. (2005)) the gains from trade integration are expected to be a lot higher once we incorporate measures beyond tariff reductions. Finally, we will derive the poverty and income distribution implications of each of the scenarios. The GIDD includes recent household surveys for 32 SSA countries (covering nearly 90% of the population). By generating a new distribution of household income consistent with the scenarios of trade liberalization we can generate a number of associated poverty and shared prosperity indicators. The study will conclude with a discussion on the most beneficial scenarios for economic growth, poverty reduction and shared prosperity outcomes.

To be completed

7. Conclusions

To be completed

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Appendix 1 Regional and Sectoral Aggregation

Model Country/Region		Number of GTAP 8.1 countries/regions
usa	United States	1
eur	High income EU & EFTA	28
jpn	Japan	1
kor	Korea	1
xhy	Rest of high income countries	17
chn	China	1
ind	India	1
egy	Egypt	1
xna	Rest of North Africa	3
xwf	Rest of Western Africa	10
xcf	Central Africa	1
xac	South-Central Africa	1
eth	Ethiopia	1
ken	Kenya	1
mdg	Madagascar	1
mwi	Malawi	1
mus	Mauritius	1
moz	Mozambique	1
rwa	Rwanda	1
tza	Tanzania	1
uga	Uganda	1
zmb	Zambia	1
xec	Rest of Eastern Africa	1
zwe	Zimbabwe	1
bwa	Botswana	1
zaf	South Africa	1
xsc	Rest of South African Customs Union	2
row	Rest of the World	52
	Total	134

Model Sectors		Number of GTAP 8.1 sectors
CRO	Crops	6
GRO	Grains	1
V_F	Vegetable and fruits	1
LVS	Livestock and products	4
NTR	Fossil fuels and forestry	4
OMN	Other minerals	1
FOD	Food, fish, beverages and tobacco	10
TEX	Textiles, leather, wearing apparel	3
WPP	Wood, paper prodcuts	3
CRP	Chemicals	1
MET	Metals & products	3
NMM	Mineral products	1
VEH	Motor vehicles and transport	2
ELE	Electronics and machinery	2
UTL	Utilities	3
CNS	Construction	1
TRD	Trade	1
TRN	Transport, Communications	4
FIN	Financial, Insurance	2
OBS	Other business services	1
SRV	Other services	3
	Total	57

Appendix 2 Estimates of the Ad Valorem Equivalents of Poor Trade Facilitation

Zoryana Olekseyuk and David Tarr

Our estimates of the ad valorem equivalents (AVEs) of poor trade facilitation are based on the path-breaking work of David Hummels and his co-authors (Hummels, 2007; Hummels and Schaur, 2013; Hummels et al., 2007). Using the estimates of Hummels and his co-authors, Peter Minor (2013) provided estimates for the regions and products in the GTAP database. We use estimates from Peter Minor, which we aggregate to the sectors and regions of our model.5 Documentation of the steps we have taken and a brief explanation of the methodology are explained below. (See Minor (2013) for a fuller explanation of the methodology.)

Although a central finding of the above studies is that the AVE of time in trade varies across products, most computable general equilibrium modeling of trade facilitation issues have used a single AVE across all products. By basing our estimates on the work of Hummels and Minor, we improve on the sector accuracy of the benefits of trade facilitation. We summarize the steps in the estimation of Minor and our aggregation below.

1. Estimation of the value of one day saved in transit for over 600 HS4 products ("the per-day value of time savings" by product)

The crucial first step is the estimation of the value of one day saved in transit for each product ("the per-day value of time savings" by product). The key to the estimation is the premium in shipping costs that firms are willing to pay for air shipping to avoid an additional day of ocean shipping. The premium that firms are willing to pay for air shipping varies considerably across products. At one extreme, we have products like crude oil, coal and fertilizers with an AVE of zero for one day saved in transit. Evidently no significant amounts of these products are shipped by air, which reflects no willingness to pay to save time. On the other hand, a significant share of fruits and vegetables are shipped by air, reflecting a willingness to pay to save time in shipping. Hummels et al., (2007, p. 8) estimate that for an aggregate of all fruits and vegetables the AVE of one day saved in 0.9 percent; that is, one additional day in transit cost almost one percent of the value of the fruits and vegetables. Hummels has statistically significant estimates of the AVE of one day saved in transit for slightly more than 600 HS4 products. The AVE of one day of time saved in shipping is independent of the country.

[5] We thank Peter Minor for his cooperation with us in this process.

The data for Hummels estimates come from the U.S. Merchandise Imports database 1991-2005, and a database on shipping times between ports. Hummels calculates average shipping times between ports around the world and U.S. ports. As such, the AVE estimates of one day saved in shipping are based solely on U.S. data and assumed to apply to all countries.

2. Estimation of the value of one day saved in transit for the GTAP database ("the per day value of time savings" by GTAP product category)

To obtain estimates of the AVE of one day saved in transit for the GTAP product categories, Peter Minor (2013) aggregated from the HS4 categories for which Hummels has provided estimates, to the 57 product categories of the GTAP database. The 600 plus HS4 product categories for which Hummels has statistically significant estimates, however, is less than the number of HS4 categories underlying the GTAP database. The missing HS4 categories account for about 38 percent of the value of trade, based on the MacMap 2007 database.6 Minor proposes three methodologies to address the lack of estimates for the missing HS4 categories and provides estimates using all three methodologies. We believe the first two methodologies are biased down and Minor shows evidence of this. We believe the third of his three methodologies is theoretically unbiased (although Minor shows it may be empirically biased up), and we chose the third -- he calls it "tau-3." In tau-3, where there is a missing estimate at the HS4 level, Minor replaces the missing value with the average for the same GTAP product category based on values that exist from Hummels. Minor then aggregates from HS4 to the GTAP product categories using trade weights from the MacMap 2007 dataset for GTAP. The trade weights in the MacMap dataset vary by country; so, despite the fact that there is a unique AVE for the value of one day saved in trade at the HS4 level for each of the 600 plus product categories from Hummels, due to differing trade weights across countries, the value of one day saved in transit varies across countries at the GTAP 57 product level. Minor's full dataset of results is available at: http://mygtap.org/resources/.

3. Calculating the AVE of Time in Importing and Exporting for the GTAP sectors and countries.

Following Hummels et al. (2007), Minor combines the above data set with the World Bank's Doing Business data set for 2012. The Doing Business dataset shows the number of days in transit in each country for importing and for exporting goods. The Doing Business dataset is not distinguished by product, so it is assumed the same number of days applies to all products. Combining the Doing Business dataset with the Minor dataset mentioned in step 2 above, yields the AVE equivalents of the

[6] See Minor (2013, table 1).

cost of time to export or import by product and country in the GTAP dataset for imports and exports, where the AVEs are bilateral depending on the partner country.

4. Aggregating the AVE of the time in trade to the products and regions of our model.

We start with the estimates of Minor (2013) described in step 3 of the bilateral ad valorem equivalents (AVEs) of the time in trade for exports and imports. We then aggregate these estimates to the products and regions of our model. The mapping of the GTAP sectors and regions to the sectors and regions of our model is described in Appendix A. The weights we use for the aggregation are bilateral trade weights, taken from the GTAP 8.1 dataset, which is based on 2007 trade weights. There are four steps in the aggregation, which we describe in both words and mathematics. We specify the mathematics for exporting; the importing aggregation is fully symmetric and is omitted.

(i) **Total time costs of exporting product k from region r to region s**. We calculate the value of the total time costs of exporting product k from region r to region s by multiplying the AVEs of time costs of exporting product k from region r to region s by the bilateral exports if product k from region r to region s. The trade flow data are taken from GTAP 8.1 with the base year 2007.

Let X_{rs}^{k} = the value of exports of product k from region r to region s from the GTAP dataset.

Let $etau_{rs}^{k}$ = the bilateral trade weighted ad valorem equivalent of the time in trade in exporting product k from region r to region s (from step 3 above).

Define $CTIT_{rs}^{k} = X_{rs}^{k} * etau_{rs}^{k}$ = the total costs of time in exporting product k exported from GTAP region r to GTAP region s.

(ii) **Total time cost of exporting products within one of the model's sectors and regions.** Then for any sector and region of our model, we aggregate these total costs for all subsectors and subregions –simply summing up the values for GTAP sectors which belong to the one sector of our model and the same for the regions) – according to the mapping given in Appendix A.

Let R be the set of all 129 regions in the GTAP dataset. Our model contains ten regions, R_v, v= 1,…29. The GTAP regions that belong to R_v are defined Appendix 1. The regions are non-overlapping subsets of R, the union of which is all the GTAP regions. That is, we have R = $(R_1 \cup R_2 \cup, \dots, \cup R_{29})$, with $R_v \cap R_{v'} = \emptyset \ \forall \ v, v'$, where v' is an alternate index for the elements of R_v. Let the elements of R be indexed by both R_v and S_v.

Similarly, let K be the set of all 57 GTAP goods and services. Our model contains 28 sectors, K_w, w= 1,…28. The GTAP sectors that belong to K_w are defined in appendix A. Our sectors are non-overlapping subsets of K, the union of which is all the GTAP products. That is, we have K = $(K_1 \cup K_2 \cup, \dots, \cup K_{28})$,

with $K_w \cap K_{w'} = \emptyset \quad \forall w, w'$, where $w \neq w'$ and $w'$is an alternate index for the elements of K_w.

For any product group K_w and any pair of regions R_v , $R_{v'}$ of our model, we aggregate the total cost of exporting across the sub-products of K_w from the sub-regions of R_v to the sub-regions of $R_{v'}$. That is, the aggregate or total time cost of exporting products within product group K_w from region R_v to region S_v is:

$$ACTIT^{K_w}_{R_v S_{v'}} = \sum_{k \in K_w} \sum_{s \in S_{v'}} \sum_{r \in R_v} CTIT^k_{rs} \quad \forall w, v, v' \quad v \neq v'.$$

(iii) **Total value of exports within one of the model's sectors from one of the model's regions to another.** In the same way we aggregate the value of all exports X^k_{rs}. The total value of all exports within product group K_w from one sub-region of R_v to another sub-region of region R_v is:

$$AX^{K_w}_{R_v S_{v'}} = \sum_{k \in K_w} \sum_{s \in S_{v'}} \sum_{r \in R_v} X^k_{rs} \quad \forall w, v, v' \quad v \neq v'.$$

(iv) **Model specific AVEs of the cost of time in exporting one of the model's sectors from one of the model's regions to another.** At the end we calculate the new AVEs for our model. In particular, we divide the value of total costs of time to export (import) by the value of exports (imports) for each sector and country pair of our model (we use here already aggregated values from (ii) and (iii).

In the last step we calculate the model-specific AVEs of time in trade $etf_{R_v S_{v'}}^{K_w}$ to export the commodities within product group K_w from one region to another region of our model:

$$etf_{R_v S_{v'}}^{K_w} = ACTIT_{R_v S_{v'}}^{K_w} \Big/ AX_{R_v S_{v'}}^{K_w} \qquad \forall w, v, v' \quad v \neq v'.$$

5. Interpretation and Caveats

If using these estimates in a simulation exercise of policy changes to facilitate trade, we believe that it is prudent to simulate modest percentage cuts, rather than cuts of 50 to 100 percent. In our policy scenarios, the maximum cuts in the time in trade costs that we implement are 20 percent. The reasons are as follows.

(i) The time in trade can't be cut to zero. The world average for shipping a container for exporting or importing is about 23 days, down about two days compared with 2009.[7] However, the most efficient country in the world in the Doing Business data is Singapore. Based in the 2014 *Doing Business* data, it takes six days to export a shipment on average and four days to import a shipment in Singapore. This is likely a lower bound for most countries to achieve.

(ii) Policies can't change infrastructure. Many of the changes responsible for the global decline in the time in trade to ship a container in the past few years are policies such as: improved customs administration; introduction or improvement in electronic submission and processing; introduction of the electronic single window; introduction or improvement in risk management procedures. But poor roads, ports, rail facilities, airports and pipelines also significantly contribute to delays. If polices are being simulated, they can't be expected to improve infrastructure.

(iii) Potential double counting. In a Small Open Economy model, we clearly need to impose the distortion on both imports and exports. But there may be components of double counting if we follow the tradition in this field and impose trade facilitation distortions on both imports and exports for both countries in a bilateral relationship in a multi-country model. Take the example of exports of food products from Kenya to Tanzania. We have an export distortion that we impose in Kenya that reflects the AVE of the time of exporting from Kenya to Tanzania. In addition, we impose an import distortion in Tanzania on food products from Kenya. For there to be no double counting, the distortions should be independent. One

[7] In 2009 the world average to export a standard containerized cargo by sea transport was 23.5 days, and 25.9 days to import. Today it takes 21.8 days on average to export and 24.2 days to import (World Bank, 2014, p.107).

could argue the distortions are independent. That is, the exporting time lost for Kenyan food to Tanzania comes from factors under the control of Kenya (like Kenyan roads, ports, customs procedures); and the Tanzanian time lost on importing food from Kenya is due to Tanzanian roads, ports and customs procedures that are under the control of Tanzania. Then the distortions would be independent and should both be included. We have chosen to include the distortions on both imports and exports, but take modest cuts in both recognizing that there is a potential for double counting.

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Appendix 3

Calculation of the Weighted Average AVEs of the Discriminatory Services Barriers against Foreign Services Providers in 29 Regions [8]

Yaghoob Jafari

1. Introduction

This report provides the estimation of the weighted average Ad Valorem Equivalents (AVEs) of the regulatory barriers in the 8 services sectors in aggregate for the 29 regions of a Multi-Region Trade Model, using two different sets of estimates. The 8 services sectors are: trade, transport n.e.s. (an aggregation of road and rail transport), sea transport, air transport, communication (an aggregation of mobile and fixed line services), financial services n.e.s., insurance, and business services n.e.s. (an aggregation of legal services and accounting and auditing services). The 29 regions and the details on regional aggregation are shown in Appendix A.

For the first set of estimate which is our primary focus, this paper builds on Jafari (2013a, 2013b). Jafari (2013a) mapped the data on the regulatory regimes for foreign services providers in 103 countries available on the World Bank website[9]into Trade Restrictiveness Indices (TRIs) according to the Australian methodology described in the Findlay and Warrant (2000) volume. The eleven services sectors are: four in transportation (water, air, land and maritime), fixed line telecommunications, mobile telecommunications, banking, insurance, accounting and auditing, legal services and retail trade. In this paper we calculate AVEs using the regressions estimated by the Australian authors, primarily in the Findlay and Warren volume. The results in this paper are estimated AVEs for 11 services sectors in 103 countries. For the second set of estimates, this paper also builds on Jafari (2013a, 2013b). For the second set of AVEs estimates, we simply take the DECTI scoring of the TRIs, and calculate AVEs using the Australian regressions. We begin with our bottom line table of results in Section 2. We then discuss the estimating methodology.

[8]I would like to thank Prof. Dr. David Tarr for his valuable comments. I would also like to thank the World Bank for support for this work. However, the estimations here are my own and do not necessary reflect the views of the World Bank or any individuals being acknowledged.

[9]http://iresearch.worldbank.org/servicestrade

2. Results: Estimation of Weighted Average Ad Valorem Equivalents (AVEs)

Table 1: Estimation of Weighted Average AVEs based Trade Restrictiveness Indices from the mapping from the World Bank database to the Australian methodology, from Jafari (2013)

Sector	Botswana (bwa)	China (chn)	Egypt (egy)	Ethiopia (eth)	High income EU & EFTA (eur)	India(ind)	Japan(jpn)	Kenya (ken)	Korea (kor)	Madagascar (mdg)	Mozambique (moz)	Mauritius (mus)
Business services n.e.s.	26	47	62	39	37	52	22	36	43	31	20	30
Air transport	46	39	40	61	38	61	41	38	40	0	0	0
Transport n.e.s.	30	20	24	38	36	39	21	0	20	28	25	28
Financial services n.e.s.	18	22	44	106	2	14	1	8	2	18	1	3
Insurance	23	21	35	105	13	38	12	32	37	23	2	17
Communication	17	12	14	0	4	52	4	10	10	20	2	5
Trade	2	6	7	14	2	8	0	1.6	3	1	1	0
Sea transport	n/a	30	58	63	23	40	33	42	39	0	0	0

Table 1 continued: Estimation of Weighted Average AVEs based Trade Restrictiveness Indices from the mapping from the World Bank database to the Australian methodology, from Jafari (2013)

Sector	Malawi (mwi)	Namibia (nam(	Rest of the World (row)	Rwanda (rwa)	Tanzania (tza)	Uganda (uga)	United States (usa)	Congo, the Democratic of the (xac)	Burundi (xec)	income countries (xhy))	Rest of North Africa (xna)
Business services n.e.s.	39	46	37	62	22	43	42	32	43	31	51
Air transport	29	0	33	0	40	0	42	0	0	16	19
Transport n.e.s.	25	26	25	26	0	24	24	30	29	21	24
Financial services n.e.s.	18	18	15	44	34	2	2	3	21	6	11
Insurance	21	27	26	35	37	16	12	104	29	19	27
Communication	39	23	9	14	8	n\a	4	n\a	n\a	8	10
Trade	2	1	3	7	0.8	1	2	2	0	3	4
Sea transport	n/a	0	32	n/a	51	n/a	41	35	0	34	45

Table 1 continued: Estimation of Weighted Average AVEs based Trade Restrictiveness Indices from the mapping from the World Bank database to the Australian methodology, from Jafari (2013)

Sector	Rest of South African Customs Union (xsc)	Rest of Western Africa (xwf)	South Africa (zaf)	Zambia (zmb)	Zimbabwe (zwe)	Central Africa (xcf)
Business services n.e.s.	15	49	47	26	42	n/a
Air transport	0	12	40	0	39	n/a
Transport n.e.s.	25	24	26	27	34	n/a
Financial services n.e.s.	1	7	6	5	23	n/a
Insurance	16	31	29	24	31	n/a
Communication	30	16	12	18	63	n/a
Trade	2	2	1	1	11	n/a
Sea transport	n/a	10	0	n/a	n/a	n/a

Note: The "n/a" cells are referred to "Not Applicable" cells.

Table 2: Estimation of Estimation of Weighted Average AVEs based on the World Bank (DECTI) scoring of the TRIs

Sector	Botswana (bwa)	China (chn)	Egypt (egy)	Ethiopia (eth)	High income EU & EFTA (eur)	India (ind)	Japan (jpn)	Kenya (ken)	Korea (kor)	Madagascar (mdg)	Mozambique (moz)	Mauritius (mus)
Business services n.e.s.	37	46	58	59	39	70	45	54	45	31	23	28
Air transport	65	65	58	56	23	64	0	40	40	44	44	59
Transport n.e.s.	29	0	14	36	16	39	13	14	13	0	0	n/a
Financial services n.e.s.	18	27	36	108	0	44	0	17	0	30	20	0
Insurance	36	32	37	71	3	39	4	22	4	19	4	19
Communication	17	17	13	0	1	77	1	10	2	16	3	6
Trade	4	4	8	16	1	12	4	0	0	0	0	0
Sea transport	n/a	0	0	50	0	38	27	0	0	0	0	0

Table 2 continued: Estimation of AVEs based on the World Bank (DECTI) scoring of the TRIs

Sector	Malawi (mwi)	Namibia (nam)	Rest of the World (row)	Rwanda (rwa)	Tanzania (tza)	Uganda (uga)	United States (usa)	Congo, Democratic of the (xac)	Burundi (xec)	[illegible] income countries (xhy)	Rest of North Africa (xna)
Business services n.e.s.	28	46	34	22	38	28	42	20	32	27	44
Air transport	58	33	38	61	62	59	11	58	59	30	44
Transport n.e.s.	58	33	38	61	62	59	11	58	59	30	44
Financial services n.e.s.	25	22	24	17	17	18	17	17	60	26	25
Insurance	36	23	23	13	20	29	17	65	0	20	26
Communication	88	13	7	12	13	25	6	17	0	8	10
Trade	4	4	1	0	4	8	0	12	0	0	1
Sea transport	n/a	0	7	n/a	0	n/a	13	27	0	20	25

Table 2 continued: Estimation of AVEs based on the World Bank (DECTI) scoring of the TRIs

Sector	Rest of South African Customs Union (xsc)	Rest of Western Africa (xwf)	South Africa (zaf)	Zambia (zmb)	Zimbabwe (zwe)	Central Africa (xcf)
Business services n.e.s.	24	50	43	34	46	n/a
Air transport	62	42	46	44	58	n/a
Transport n.e.s.	n/a	10	14	0	35	n/a
Financial services n.e.s.	0	17	17	0	48	n/a
Insurance	0	19	13	17	53	n/a
Communication	29	14	6	12	26	n/a
Trade	8	3	4	0	12	n/a
Sea transport	n/a	3	0	n/a	n/a	n/a

Note: The "n/a" cells are referred to "Not Applicable" cells.

2. Data and Methodology

The estimates of the Ad Valorem Equivalents (AVEs) of the regulatory barriers in the 11 services sectors for individual 103 countries are taken from Jafari (2013b). For the purposes of weighting the Ad Valorem Equivalents (AVEs), we used the value added of relevant services sectors including insurance (isr), other financial services (ofs), air transport (atp), water transport (wtp), other transport services (otp), communication (cmn), trade (trd) and other business services (obs) fom GTAP 8 database as the basis of our calculation for weights. The GTAP 8 database was released in March 2012 and is the most recent release of the GTAP dataset at the time of this project. It is documented in Badri Narayanan et al. (2012).10 GTAP 8 contains 57 sectors and 129 regions.

We provided a regional mapping from Jafari (2013a, 2013b) to 29 aggregated regions that is most relevant for application in a CGE model in which we will need estimates of the ad valorem equivalents (AVEs) of the discriminatory services barriers against foreign services providers (See. Appendix1). Since there is not a one to one mapping between the countries for which we have estimated AVE, and the regions of this study, we adjusted the weights appropriately based on GTAP 8 database. Appendix A shows concordance of countries for which we have estimates of AVEs with GTAP classification, and our regional aggregation. As it can be seen from Appendix A, some countries for which we have the estimated AVEs are a part of a region covering many other countries. Thus, the sectoral value added of these regions should be disaggregated in order to exclude the countries for which we do not have the estimated AVEs. For example, Jordan, Lebanan, and Yeman for which we have AVEs are a part "Rest of Western Asia" in GTAP 8 classification. However, "Rest of Western Asia" covers some other countries such as Iraq, Palestinian Territory occupied, and Syrian Arab Republic. In this case, Jordan, Lebanan, and Yeman for which we have AVEs will be mapped into the "Rest of the World" in our multi region model. The other countries of the Rest of western Asia (e.g., Iraq) will be excluded from the AVE calculation for the Rest of the Word. For example, we disaggregated Rest of Western Asia (XWS) region of GTAP database. To do this, we used GDP at constant USD prices from WDI indicators to disaggregate the regions of GTAP where necessary (See. Appendix B). As indicated in the Appendix B, Jordan, Lebanan, and Yeman for which we have AVEs stand for 13, 24, and 12 percent of XWS region. Therefore, we included Jordan, Lebanan, and Yemen in the relevant region of our model- ROW-, while excluded the other parts of the region such as Iraq, Palestinian Territory occupied, and Syrian Arab Republic.

[10]See Badri Narayanan, G., Angel Aguiar and Robert McDougall, Eds. (2012), *Global Trade, Assistance, and Production: The GTAP 8 Data Base*, Center for Global Trade Analysis: Purdue University. Available at: https://www.gtap.agecon.purdue.edu/databases/v8/default.asp.

Consequently, in order to calculate the weighted average AVEs for each region, the estimated AVEs for each country and sector are multiplied by its associated weight. It should be noted that the estimated AVES for some of countries is missing in Jafari (2009b) as estimation of those values were "not applicable". In such cases, weighted average AVEs are calculated based on the available AVES. In other words, if we had an AVE estimate for x countries in a region with y countries, where y > x, we based the aggregation on the x countries. This meant the weights summed to less than one. So, we scaled all remaining category weights up so the sum of the category weights equals one. Further, it should be noted that

Next, we mapped each of services sectors in Jafari (2013b) to the services sector for which we wish to estimate AVEs. The mapping may be found in Table 3.

Table 3. Mapping from GTAP to the Mapping survey's Classification of Services

	Classification Of Services In Jafari (2013a, 2013b)	*Classification of Services in Present Study*
1	Insurance	Insurance (isr)
2	Banking	Other financial services (ofs)
3	Air transport	Air transport (atp)
4	Maritime transport	Water transport (wtp)
5	Rail transport	Other transport services (ots)
6	Road transport	Other transport services (ots)
7	Mobile- line services	Communication (cmn)
8	Fixed-line services	Communication (cmn)
9	Retail trade services	Trade (wtd)
10	Accounting services	Other business services (obs)
11	Legal services	Other business services (obs)

For the purpose of aggregating the sectors we used the weights taken from Jafari (2013b) as shown in tables 4 through 6.

Table 4. The weights (in percent) for the rail and road transport of total rail and road transport

Region	Kenya	Tanzania	Other regions
Rail	10	5	14
Road	90	95	86

Source: from Jafari (2013b)

Table 5. The weights (in percent) the legal and accounting services of the total legal and accounting services

Region	Kenya	Tanzania	Other regions
Accounting	42	0.8	63
Legal	58	02	37

Source: from Jafari (2013b)

Table8. The weights (in percent) the fixed line and mobile line services of the total telecom services

Region	Kenya	Tanzania	Other Regions
Fixed line	1.5	1	18
Mobile	98.5	99	82

Source: from Jafari (2013b)

Lastly, Table 1 and 2 presents the aggregated weighted average AVEs based on the two different sets of estimates.

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Appendix B: Concordance of countries for which we have estimates of AVEs with GTAP, and our regional aggregation

Countries for which we have AVEs	GTAP Classification	**The Regions of our Model**	**Description of the regions**
Botswana	BWA	bwa	Botswana
China	CHN	chn	China
Egypt	EGY	egy	Egypt
Ethiopia	ETH	eth	Ethiopia
Austria	AUT	eur	High income EU & EFTA
Belgium	BEL	eur	High income EU & EFTA
Czech Republic	CZE	eur	High income EU & EFTA
Denmark	DNK	eur	High income EU & EFTA
Finland	FIN	eur	High income EU & EFTA
France	FRA	eur	High income EU & EFTA
Germany	DEU	eur	High income EU & EFTA
Greece	GRC	eur	High income EU & EFTA
Hungary	HUN	eur	High income EU & EFTA
Ireland	IRL	eur	High income EU & EFTA
Italy	ITA	eur	High income EU & EFTA
Lithuania	LTU	eur	High income EU & EFTA
Netherlands	NLD	eur	High income EU & EFTA
Poland	POL	eur	High income EU & EFTA
Portugal	PRT	eur	High income EU & EFTA
Spain	ESP	eur	High income EU & EFTA
Sweden	SWE	eur	High income EU & EFTA
United Kingdom	GBR	eur	High income EU & EFTA
India	IND	ind	India
Japan	JPN	jpn	Japan
Kenya	KEN	ken	Kenya
Korea, Republic of	KOR	kor	Korea
Madagascar	MDG	mdg	Madagascar
Mozambique	MOZ	moz	Mozambique
Mauritius	MUS	mus	Mauritius
Malawi	MWI	mwi	Malawi
Namibia	NAM	nam	Namibia
Albania	ALB	row	Rest of the World
Argentina	ARG	row	Rest of the World

Armenia	ARM	row	Rest of the World
Bangladesh	BGD	row	Rest of the World
Belarus	BLR	row	Rest of the World
Bolivia	BOL	row	Rest of the World
Brazil	BRA	row	Rest of the World
Bulgaria	BGR	row	Rest of the World
Cambodia	KHM	row	Rest of the World
Colombia	COL	row	Rest of the World
Costa Rica	CRI	row	Rest of the World
Dominican Republic	XCB	row	Rest of the World
Ecuador	ECU	row	Rest of the World
Georgia	GEO	row	Rest of the World
Guatemala	GTM	row	Rest of the World

Appendix B Continued: Concordance of countries for which we have estimates of AVEs with GTAP, and our regional aggregation

Countries for which we have AVEs	GTAP Classification	**The Regions of our Model**	**Description of the regions**
Honduras	HND	row	Rest of the World
Indonesia	IDN	row	Rest of the World
Iran (Islamic Republic of)	IRN	row	Rest of the World
Jordan	XWS	row	Rest of the World
Kazakhstan	KAZ	row	Rest of the World
Kyrgyzstan	KGZ	row	Rest of the World
Lebanon	XWS	row	Rest of the World
Malaysia	MYS	row	Rest of the World
Mexico	MEX	row	Rest of the World
Mongolia	MNG	row	Rest of the World
Nepal	NPL	row	Rest of the World
Nicaragua	NIC	row	Rest of the World
Pakistan	PAK	row	Rest of the World
Panama	PAN	row	Rest of the World
Paraguay	PRY	row	Rest of the World
Peru	PER	row	Rest of the World
Philippines	PHL	row	Rest of the World
Romania	ROU	row	Rest of the World
Russian Federation	RUS	row	Rest of the World
Sri Lanka	LKA	row	Rest of the World
Thailand	THA	row	Rest of the World
Trinidad and Tobago	XCB	row	Rest of the World
Turkey	TUR	row	Rest of the World
Ukraine	UKR	row	Rest of the World
Uzbekistan	XSU	row	Rest of the World
Venezuela	VEN	row	Rest of the World
Viet Nam	VNM	row	Rest of the World
Yemen	XWS	row	Rest of the World
Rwanda	XEC	rwa	Rwanda
Tanzania, United Republic of	TZA	tza	Tanzania
Uganda	UGA	uga	Uganda
United States of America	USA	usa	United States
Congo, the Democratic of the	XAC	xac	South-Central Africa
Burundi	XEC	xec	Rest of Eastern Africa

Appendix B Continued: Concordance of countries for which we have estimates of AVEs with GTAP, and our regional aggregation

Countries for which we have AVEs	GTAP Classification	The Regions of our Model	Description of the regions
Australia	AUS	xhy	Rest of high income countries
Bahrain	BHR	xhy	Rest of high income countries
Canada	CAN	xhy	Rest of high income countries
Chile	CHL	xhy	Rest of high income countries
Kuwait	KWT	xhy	Rest of high income countries
New Zealand	NZL	xhy	Rest of high income countries
Oman	omn	xhy	Rest of high income countries
Qatar	QAT	xhy	Rest of high income countries
Saudi Arabia	SAU	xhy	Rest of high income countries
Uruguay	URY	xhy	Rest of high income countries
Algeria	XNF	xna	Rest of North Africa
Morocco	MAR	xna	Rest of North Africa
Tunisia	TUN	xna	Rest of North Africa
Lesotho	XSC	xsc	Rest of South African Customs Union
Cote d'Ivoire	CIV	xwf	Rest of Western Africa
Cameroon	CMR	xwf	Rest of Western Africa
Ghana	GHA	xwf	Rest of Western Africa
Mali	XWF	xwf	Rest of Western Africa
Nigeria	NGA	xwf	Rest of Western Africa
Senegal	SEN	xwf	Rest of Western Africa
South Africa	ZAF	zaf	South Africa
Zambia	ZMB	zmb	Zambia
Zimbabwe	ZWE	zwe	Zimbabwe
-	-	xcf	Central Africa

Appendix B: Countries' GDP Share In Each Region

Country Name	Region	Share of GDP
Congo, Dem. Rep.	XAC	0.2015
Dominican Republic	XCB	0.3402
Trinidad and Tobago	XCB	0.8939
Burundi	XEC	0.0326
Rwanda	XEC	0.1172
Algeria	XNF	0.6074
Lesotho	XSC	0.3568
Uzbekistan	XSU	0.6922
Jordan	XWS	0.1376
Lebanon	XWS	0.2468
Yemen, Rep.	XWS	0.1233
Mali	XWF	0.0782

Source: WDI indicators

Note: Disaggregation is based on GDP as of 2009 except for XCB which is disaggregated based on GDP as of 2008