

POLICY RESEARCH WORKING PAPER

5481

Regional Trade Policy Options for Tanzania

The Importance of Services Commitments

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November 2010



Abstract

Despite the growing importance of commitments to foreign investors in services in regional trade agreements, there are no applied general equilibrium models in the literature that assess these regional impacts. This paper develops a 52 sector applied general equilibrium model of Tanzania with foreign direct investment, and uses that model to assess Tanzania's regional and multilateral trade options. The model incorporates the features of the modern theory of international trade that has shown empirically that trade and foreign direct investment can increase productivity, and trade and foreign direct investment with technologically advanced countries is especially valuable for that purpose. To assess the

sensitivity of the results to parameter values, the model is executed 30,000 times, and the results are reported as confidence intervals of the sample distributions.

The analysis finds that a 50 percent preferential reduction in the ad valorem equivalents of barriers in all business services by Tanzania with respect to its African regional partners would be slightly beneficial for Tanzania. But wider liberalization, with larger partners or multilaterally, it will yield much larger gains due to providing access to a much wider set of service providers. Finally, the results show that the largest gains in services would be derived from reduction of regulatory barriers that are geographically non-discriminatory.

This paper—a product of the Trade and Integration Team, Development Research Group—is part of a larger effort in the department to assess the impacts of liberalization of barriers in services on growth and poverty reduction in developing countries. Policy Research Working Papers are also posted on the Web at <http://econ.worldbank.org>. The author may be contacted at dtarr@worldbank.org.

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I. Introduction

Both economic theory and empirical literature have shown that wide availability of business services results in productivity gains to the manufacturing sector and contributes to its international competitiveness.¹ International commitments to national treatment and market access for foreign investors in key business services sectors may help developing countries obtain better access to these services that contribute to productivity gains. Some developing countries, however, are hesitant to make substantial multilateral commitments, but may be more inclined to proceed in regional arrangements with other neighboring developing countries, rather

¹ Arnold et al. (2007), Fernandes (2007) and Fernandes and Paunov (2008) have provided econometric estimates of the gains from services liberalization. Marshall (1988) shows that in three regions in the United Kingdom (Birmingham, Leeds and Manchester) almost 80 percent of the services purchased by manufacturers were bought from suppliers within the same region. He cites studies which show that firm performance is enhanced by the local availability of producer services. In developing countries, McKee (1988) argues that the local availability of producer services is very important for the development of leading industrial sectors.

Both the urban economics literature (Vernon, 1960; Chinitz, 1961) and the modern economic geography literature (e.g., Krugman, 1991; Fujita, Krugman and Venables, 1999) have focused on the fact that related economic activity is economically concentrated due to agglomeration externalities (e.g., computer businesses in Silicon Valley, ceramic tiles in Sassuolo, Italy). Evidence comes from a variety of sources. Ciccone and Hall (1996) show that firms operating in economically dense areas are more productive than firms operating in relative isolation. Caballero and Lyons (1992) show that productivity increases in industries when output of its input supplying industries increases. Hummels (1995) shows that most of the richest countries in the world are clustered in relatively small regions of Europe, North America and East Asia, while the poor countries are spread around the rest of the world. He argues this is partly explained by transportation costs for inputs since it is more expensive to buy specialized inputs in countries that are far away for the countries where a large variety of such inputs are located.

than with a major Northern partner. Commitments in services, however, are often limited in South-South arrangements.

Since the early 1990s, regional trade agreements have surged; 283 are in force and have been notified to the WTO as of February 2010.² Given the inclusion of services in modern FTA agreements negotiated with the EU, the US and in some other agreements, economists need to be able to assess the impact of services commitments as part of their advice to governments regarding preferential trade agreements. Services commitments in regional agreements could lead to substantial productivity improvements. But is there an analogy to trade diversion in goods whereby preferential commitments in services could be immiserating? Are developing countries likely to obtain substantially larger gains from an agreement with a developed country, rather than a developing country? How do the gains of preferential versus global liberalization compare?

Policy-makers have expressed considerable demand for analysis of their actual or potential regional agreements. Applied modelers have responded with applied general equilibrium models that focus on goods. So the literature now contains a substantial number of good studies (summarized below) that examine regional agreements in goods. But the literature does not contain any numerical studies of regional arrangements that involve commitments to multinational firms who will undertake foreign direct investment in services.

Given substantial demand by governments for advice on their prospective trade policies in the regional and multilateral arenas, it is unfortunate that the profession does not have a framework for assessing the ex ante welfare impact of preferential reduction of barriers against foreign direct investment in business services. We attempt to fill that gap in this paper. Crucial to

² http://www.wto.org/english/tratop_e/region_e/region_e.htm. This does not include a significant number that are in force but which have not been notified to the WTO.

the analysis, we incorporate the Dixit-Stiglitz-Ethier mechanism of endogenous productivity gains from additional varieties of imperfectly produced goods and services.

Tanzania is an example of a country facing most of these policy choices mentioned above. In many of its business services sectors (including maritime and road transportation, banking, insurance and professional services) the regulatory regime imposes significant burdens on the cost of providing services, both by Tanzanian service providers and by multinationals. In 2010 it is involved in negotiations of commitments in services in various regional arrangements, including the European Partnership Agreements, SADC³ and the East African Customs Union.⁴ And in the context of its international negotiations under the Doha Development Agenda, Tanzania may be called upon to make further commitments in the business services area. Tanzania is proceeding cautiously regarding services commitments in all these areas, but is taking steps to adopt a mutual recognition agreement in professional services within the East African Customs Union.

In this paper we develop a 52-sector small open economy comparative static computable general equilibrium model of Tanzania that we believe is appropriate to evaluate the impact of Tanzanian liberalization of services barriers. We build on the model of Jensen, Rutherford and Tarr (2008), but we decompose the rest of the world into three regions: the European Union; our Africa region; and the Rest of the World. All foreign regions are sources of foreign direct investment in some of the business services sectors.

We find that a 50 percent preferential reduction in the ad valorem equivalents of barriers in all business services with respect to its African regional partners would be slightly beneficial

³SADC (Southern African Development Community) is comprised of Angola, Botswana, Congo, Lesotho, Madagascar, Malawi, Mauritius, Mozambique, Namibia, Seychelles, South Africa, Swaziland, Zambia and Zimbabwe.

⁴ The East African Customs Union is a customs union among Tanzania, Uganda, Kenya, Rwanda and Burundi.

for Tanzania in our central elasticity case. But if preferential liberalization with the Africa region is extended to an agreement with the EU, the gains would triple. If the liberalization of business services commitments is extended to all foreign partners (called “Unilateral” in the tables), the gains would increase by seventeen times. Thus, these results suggest that preferential liberalization in the region is a valuable first step, but wider liberalization, with larger partners or multilaterally will yield much larger gains due to providing access to a much wider set of services providers.

Finally, we estimate that a serious effort to reduce non-discriminatory regulatory barriers (that is, barriers that raise the costs of Tanzanians as well as foreign services providers in Tanzania) would roughly quadruple the benefits of multilateral liberalization in Tanzania.

Multilateral liberalization yields larger gains than preferential liberalization since with preferential liberalization Tanzania will not obtain additional service sector suppliers from excluded countries, and, in fact, will suffer losses of service sector suppliers in excluded countries. Moreover, we summarize research below that shows that small countries gain more technological spillovers from trade with technologically advanced countries (at least in research and development intensive products). Our model allows for differentiated rates of technological spillover by region and product, and this is the main explanation for why the estimated gains from a preferential agreement with the EU will yield larger gains for Tanzania than a preferential agreement with the African region.

Combining African regional liberalization with regional liberalization with the EU would capture the gains from agreements with both regions. Tanzania could combine an agreement with

the EU and the Africa region with liberal rules of origin, and the results would then come closer to the gains from unilateral liberalization with the whole world.

We devote considerable attention to the sensitivity of our results to uncertainty in the parameters. First, to understand the model better, we conduct piecemeal sensitivity of the results, where we isolate the impact of each of the parameters to ascertain which parameters most strongly impact the results. Second, to assess the robustness of the results to parameter uncertainty, we conduct systematic sensitivity analysis, where we execute the model 30,000 times. Each simulation is based on a random draw of all the parameter values; we then present sample distributions and sample confidence intervals of the key variables. Finally, we conduct sensitivity on a range of values of key parameters that determine the productivity impacts in imperfect competition.

With the notable exception of Mattoo and Fink (2003) and Mattoo and Sauve (2008), there has been surprisingly little theoretical research on the welfare economics of services liberalization in preferential agreements, either in perfect or imperfect competition. When granting preferential market access to foreign investors in services, there is no tariff loss. Since it is the tariff loss that is the source of the possible welfare loss in goods, one might infer that preferential reduction of services barriers is unambiguously beneficial. If domestic firms capture rents from the barriers, however, then these rents are analogous to tariff losses in goods. We show graphically, in a perfectly competitive partial equilibrium model, that losses may occur from preferential liberalization of services with initial rent capture. With imperfect competition, preferential liberalization will lead to a gain of varieties from the partner countries, but a loss of varieties from excluded countries; the lost varieties can lead to a net loss of welfare. We show that, with initial rent capture, there is plausible range of elasticities where there is a loss of

welfare due to the loss of varieties and show why agreements with large, technologically advanced partner countries are more likely to lead to gains.

The paper is organized as follows. We begin in section II with a brief review of the applied general equilibrium literature of regional arrangements. In section III we discuss the welfare economics of preferential trade liberalization in services. In section IV, we provide an overview of the Tanzanian services sectors. We discuss how we estimated the tariff equivalents of the barriers in services in section V. We provide an overview of the model in section VI and a discussion of the data in section VII. The central results are presented in section VIII and sensitivity results are presented in section IX. Given the initiative of the East African Customs Union to begin to include services in their agreements by negotiating mutual recognition agreements in professional services, we focus on a range of possible policy options in professional services. These are presented in section X. Conclusions are presented in section XI. In appendix A, we discuss the trade and tariff data in some detail. We document the calculation of ownership shares by sector and region in appendix B. How we obtained estimates of the Dixit-Stiglitz elasticities in goods is described in appendix C. Our estimation of the ad valorem equivalents of barriers in professional services is explained in appendix D and our calculations of the research and development intensity by sector are in appendix E.

II. Review of the Applied General Equilibrium Literature on Regional Agreements

The formation of the Canada-US free trade agreement led to the path-breaking work of Harris (1984) and of Cox and Harris (1986) in incorporating imperfect competition into a small open economy applied general equilibrium model. They showed that if the agreement leads to a more competitive pricing strategy by Canadian firms, there would be substantial welfare gains

from rationalization. The creation of the single market in the European Union led to innovative analysis that required the use of multi-region models with imperfect competition or dynamic effects in order to capture the impacts of the key features of the single market (Harrison, Rutherford and Tarr, 1996; Smith and Venables, 1988; Baldwin, Forslid and Haarland, 2000). The North American Free Trade Agreement (NAFTA) led to a large number of CGE studies summarized in the Francois and Shiells (1994) volume. Among these, Levy and van Wijnbergen (1995) use their dynamic CGE model to argue that dynamic incentive problems in adjustment policies for Mexican agriculture imply that adjustment policies should focus on increasing the value of the assets of poor farmers, not their incomes. Preferential arrangements of the European Union with its Mediterranean neighbors led to policy-maker requests for CGE analysis. Using small open economy models of the developing country under perfect competition (Harrison, Rutherford and Tarr (1997a) for Turkey; Rutherford, Rutstrom and Tarr (1993) for Morocco; and Rutherford, Rutstrom and Tarr (1995) for Tunisia), these North-South arrangements were estimated to be beneficial to the developing country due to the introduction of competition into the Southern markets. Finally, Chile has adopted a strategy of negotiating preferential arrangements with all potential partners (called “additive regionalism” or “competitive regionalism”). This strategy has been controversial within Chile regarding preferential arrangements with its Southern neighbors. Using a multi-region perfect competition model, Harrison, Rutherford and Tarr (2002) estimated that Chile would lose from individual preferential arrangements with Southern neighbors unless it lowered its then 11 percent uniform tariff. But these authors show that the agreements with Southern partners are beneficial to Chile in the context of Chile’s additive regionalism strategy due to substantial estimated terms of trade gains to Chile in partner markets and the reduction of trade diversion costs if the Northern partners are included in the

network of agreements.⁵ Rutherford and Tarr (2003) showed that simply making the Chilean model fully dynamic will not increase the estimated gains from these agreements if there are no endogenous productivity effects.

III. Welfare Economics of Preferential Trade Liberalization in Services

Although our model is a general equilibrium model with imperfect competition in all business services sectors, to provide intuition, we begin with a graphical description in partial equilibrium and perfect competition. We subsequently discuss how imperfect competition and general equilibrium affect the results. In our model there are four regions. In the case of the Tanzania model the regions are: Tanzania, the EU, Africa (SADC plus the EAC) and the Rest of the World. Although in our model we have firm level product differentiation, for simplicity, we begin the discussion by assuming product differentiation at the level of the country. The demand curve for any region, takes the prices of services from the other three regions as shift parameters.

Consider the case of preferential liberalization in services by Tanzania with respect to the European Union. For the purpose of the welfare economics, we may ignore the Tanzanian market for Tanzanian services since we assume no distortions in this market. Thus, we confine the graphical analysis to the markets for services from the EU, Africa and Rest of the World in Tanzania.

⁵ Harrison, Rutherford, Tarr and Gurgel (2004) found similar results for Brazil.

Welfare Economics in the Tanzanian Market of EU Services

We begin, in figure 1, by examining the welfare impacts in the market for EU services in Tanzania. We consider two cases in figure 1: Case I, where EU supply is assumed to be infinitely elastic and Case II, where EU supply of services in Tanzania is less than perfectly elastic. We denote by P^* the vector of prices of substitute services from Africa, ROW and Tanzania.

The demand curve for EU services takes the vector of prices of substitutes from Africa, ROW and Tanzania as shift parameters; this vector is labeled P^* in figure 1. The preferential reduction in barriers against EU firms lowers the cost of production of EU firms and shifts the supply curve down. The increase in supply from EU firms drives down the price of EU services and decreases the demand curves for substitute services from the ROW, Africa and Tanzania. The decline in demand for services from ROW, Africa and Tanzania results in a lower price for these services. There is then a feedback effect on EU services, resulting in a decline in demand for EU services. In both cases I and II, the equilibrium before (after) preferential reduction of the barriers against the EU is labeled A (B).

The case of perfectly elastic partner supply. Consider first Case I. The reduction in the price of EU services in Tanzania, leads to an increase in consumers surplus that is the sum of the rectangle EACF and a triangle ABC of efficiency gains. If Tanzanians initially captured the rents from the barriers, then the rectangle EACF equals the loss of Tanzanian rents. Then the welfare gains are limited to the efficiency triangle ABC. But if Tanzanians do not capture rents from barriers initially, the welfare gains are significantly larger and equal EABF, the sum of the rectangle and triangle.

The case of less than perfectly elastic partner supply. In Case II, we assume that EU services suppliers require higher prices to supply additional services. Then, the increase in the

demand for EU services results in an increase in the price of EU services relative to Case I.⁶ That is, there is a greater fall in the price of EU services in Case I than in Case II. There is an adverse terms of trade loss for Tanzania in Case II equal to FCDG, as EU producers will capture infra-marginal rents equal to the area FBDG.

There is an increase in consumers' surplus equal to the area EABF and a triangle of efficiency gains equal to ABC.⁷ Rents are still the key to the story. If rents are not captured initially, the welfare gain in the EU market is positive and equal to the consumer's surplus change of EABF. If Tanzanians do capture rents initially, then the sign of the welfare change in the EU market is ambiguous. There is a triangle ABC of efficiency gains, but a rectangle of terms of trade loss equal to FCDG. The net welfare change is $ABC - FCDG$.

Welfare Economics in the Tanzanian Market of African and Rest of World Services

In figure 2, we depict the welfare impacts in the markets for African and Rest of the World services suppliers in Tanzania of preferential liberalization of barriers against EU services suppliers in Tanzania. We depict the cases where supply of services from the Rest of the World is perfectly elastic, but upward sloping from African suppliers. In the figures, P^{**} is the vector of prices of substitutes for African services and P^{***} is the vector of prices of substitutes for Rest of the World services in Tanzania. As a result of preferential liberalization with respect to the EU, the prices of substitutes decline in the new equilibria, and this shifts the demand curves in for Rest of World and African services in the new equilibria.

⁶ By construction, the height AD in Case II, is equal to the height AC in Case I. The price falls by the full length of AC in Case I; but since the EU is not infinitely large in Case II, the increase in demand for EU services drives up the price of EU services in Tanzania. Thus, the height of AC in Case II is less than the height of AC in Case I.

⁷ We adopt the procedure of Burns (1974) and connect the equilibria with a straight line for the purpose of calculating the welfare change.

Market for rest of the world services in Tanzania. In the Rest of the World market, if Tanzania captures the rents initially from the services barriers, it would lose the rectangle of rents ABCD, and this would be the welfare change. If there is no rent capture initially, then there is no welfare impact in the Rest of the World market from preferential liberalization of barriers against the EU services suppliers.

Market for African services in Tanzania. The demand for African services declines due to the decline in the prices of substitutes for African services in Tanzania, so the equilibrium moves from point A to point B. Initially rents are equal to the area HACD. In the new equilibrium, rents are equal to GBFE. We decompose this initial rent area HACD into three areas: the sum of $\alpha + \beta + \delta$, where $\alpha = \text{HJBG}$, $\beta = \text{GBID}$ and $\delta = \text{JACI}$. We decompose the subsequent rent area GBFE into $\beta + \gamma$, where $\gamma = \text{DIFE}$. Rents in the new equilibrium minus rents initially are equal to $\beta + \gamma - (\alpha + \beta + \delta) = \gamma - \alpha - \delta$. For illustration, assume linear supply curves where the shift parameter induces a parallel shift in the supply curve.⁸ Then $\alpha = \gamma$ and the change in rents equals $-\delta$. That is, the reduction in rents is equal to the rectangle δ . If rents are captured initially, the loss of rents is a welfare loss to the home country. If there is no domestic rent capture initially, this area does not enter into the welfare calculation.

In addition, there is a terms of trade gain for the home country. That is, in the new equilibrium Tanzanians consume Q_1 of African services at price P_1^{AF} . In the initial equilibrium it had been necessary for Tanzanians to pay P_0^{AF} . Thus, the area $\alpha = \text{HJBG}$ is a welfare gain to Tanzanians due to the lower prices they pay on African services. Thus, with no initial rent capture by Tanzanians, the net welfare change for Tanzanians in the Africa market is positive

⁸ More generally, the change in rents is equal to: $t [P_1^{AF} Q_1 - P_0^{AF} Q_0] < 0$.

and equal to the terms of trade gain α . If, however, there is initial rent capture by Tanzanians, the net welfare change in the Africa market is ambiguous and equal to $\alpha - \delta$.

Elasticity Considerations—Why North-South Agreements Are More Likely to Yield Gains

Market for partner country services. We illustrate the impacts with the aid of Figure 3. Case I is the market for the partner country. It builds on figure 1, case II, where we have drawn two sets of supply curves—a more elastic pair and less elastic pair. Both the less elastic (S_{0TI}) and more elastic tax ridden supply curves (S_{0Te}) must pass through to point A; and to be consistent with the estimated ad valorem barrier, the undistorted less elastic (S_{1I}) and undistorted more elastic supply curve (S_{1e}) must both pass through the point D. After liberalization, with larger elasticities, the new equilibrium shifts to B' , and shifts to B with lower supply elasticities. With initial rent capture, the welfare change is equal to $ABC - FCDG$ (less elastic case) or $AB'C' - F'C'DG$ in the more elastic case. The difference in the welfare between the high elastic and low elasticity cases is $[\Delta W_e - \Delta W_I] = [AB'C' - F'C'DG] - [ABC - FCDG] = [AB'C' - ABC] + [FCDG - F'C'DG]$. Clearly, $FCDG > F'C'DG$ and the second term is positive, but it would vanish in the welfare calculation with no initial rent capture. Since the price falls to F' , the height of the triangle $AB'C'$ exceeds the height of triangle ABC . What is the impact of elasticities on the new equilibrium quantity? With larger elasticities, the price of EU services falls more, inducing a larger increase in the quantity demanded of EU services. On the other hand, the larger fall in the price of EU services, induces a larger fall in the equilibrium price of competitor services and thus a larger shift down in the demand curve for EU services. Since the former is the first order effect and the latter a second order effect, we expect $Q_{1e} > Q_{1I}$ and have

drawn the figure accordingly. Then $AB'C' > ABC$ and $[\Delta W_e - \Delta W_I] > 0$. That is, we have greater welfare gains in the partner country market with larger supply elasticities in the partner country.

Market for excluded country services. We illustrate the impacts with the aid of figure 3, right hand side. It builds on figure 2, right hand side, where we have drawn two sets of supply curves—a more elastic pair and less elastic pair. To be consistent with the initial equilibrium data point, both the less elastic (S_{0I}) and more elastic tax ridden supply curves (S_{0Te}) must pass through to point A; and to be consistent with the estimated ad valorem barrier, the undistorted less elastic (S_{0I}) and undistorted more elastic supply curve (S_{0e}) must both pass through the point C. Preferential liberalization with another country results in a downward shift in demand for the excluded countries services. Equilibrium in the market for excluded country services shifts to to B' with higher elasticities, and shifts to B with lower supply elasticities. What is the impact of elasticities on the new equilibrium price and quantity? With a higher supply elasticity, in response to the initial shift down in demand, there is a smaller reduction in price and larger reduction in quantity. On the other hand, there is an offsetting second order effect. Since the price of excluded market services initially falls less with high elasticities, there is a smaller second order cross-elasticity effect on the reduction in demand, so the demand curve shifts in less in the high elasticity case. We assume the second order effect is smaller so that we have drawn $G' > G$ and $Q_{1e} < Q_{1I}$.

With initial rent capture, the welfare change is equal to $HJ'B'G' - J'I'CA$ in the high elasticity case and equal to $HJBG - JICA$ in the lesser elasticity case; the second terms vanish with no initial rent capture. The difference in the welfare between the high elasticity and low elasticity cases is $[\Delta W_e - \Delta W_I] = [HJ'B'G' - J'I'CA] - [HJBG - JICA] = [HJ'B'G' - HJBG] +$

[JICA - JICA]. The first term is the difference in the terms of trade gains and is negative. The second term, is the lost rents and is also negative in the case of initial rent capture and is zero otherwise. Thus, the welfare losses in the excluded country markets are larger with higher elasticities of supply of the partner.

Summary of Results in Partial Equilibrium with Perfect Competition

Welfare gains with no initial rent capture. With no initial rent capture, there is an unambiguous welfare gain deriving from an increase in welfare in the EU and African markets and no welfare change in the Rest of the World market. In the market for EU services, the welfare gain is equal to the increase in consumer's surplus, from a triangle ABC of efficiency gains and a rectangle EACF of gains in rents. In the market for African services, the welfare gain is equal to the area of terms of trade gain.

Ambiguous welfare impacts with initial rent capture. With initial capture of the rents by the home country, a significant potential for losses by the home country arises. In the market for EU services, there is no rectangle of rents that are gained and the gains from a triangle of efficiency gains will be reduced or exceeded by the terms of trade loss when the EU has an upward sloping supply curve. In the market for Rest of the World services, there is a rectangle of lost rents that weighs negatively on the overall welfare calculation. And in the Africa market, there is a rectangle of terms of trade gain that will be weighed against a rectangle of rent losses.

Gains from preferential liberalization are more likely with high elasticities of the partner and low elasticities of excluded countries. This contributes to a rule of thumb that agreements with large countries that are likely to have higher supply elasticities are more likely to lead to benefits.

Imperfect Competition and General Equilibrium Impacts—Why There Are Productivity and Welfare Losses Analogous to Trade Diversion

In business services such as telecommunications, banking, insurance, maritime and air transportation and in selected goods sectors firms operate under increasing returns to scale. In these sectors we assume firms price according to a monopolistic competition model with zero profits in equilibrium. Users of these goods and services obtain a productivity increase from additional varieties through the Dixit-Stiglitz mechanism. Our model contains foreign direct investment in business services from each region in the model. Preferential liberalization in services entails the reduction in the discriminatory tax on multinationals service providers in a particular region, say the EU. This increases profitability for provision of services by EU multinational service providers, thereby inducing new entry by EU multinational service providers until zero profits are restored for them. The additional varieties of services from the EU service providers induce a productivity gain for users of EU services through the Dixit-Stiglitz effect. Preferential liberalization with respect to the EU, however, will imply a downward shift in demand and a reduction in profitability for producers from all other regions, including the home country. This will induce exit of services providers in the excluded regions and the home country until zero profits are restored. The loss of varieties, from service providers from all excluded regions and the home country, results in a loss of productivity for sectors using these services. The lost productivity from lost varieties from the regions excluded and the home country from the preferential liberalization in services is analogous to the trade diversion losses in perfect competition.⁹ Moreover, we find in the sensitivity section that higher elasticities of foreign firm supply in the partner country increase the likelihood of welfare gains from preferential liberalization (due to greater varieties), while higher elasticities of firm supply in

⁹ Although we may exclude the home country from the welfare analysis in the perfect competition case, due to the Dixit-Stiglitz externality, in imperfect competition and general equilibrium, the home country enters into the welfare analysis.

excluded regions makes losses more likely (due to greater loss of varieties from excluded regions).

IV. Overview of the Tanzanian Service Sectors

In this section, we summarize the key institutional and policy issues in telecommunications, banking, insurance and transportation. This discussion builds on and updates several papers written in 2008 on the Tanzanian business services sectors, namely Telecommunications Management Group (2007), Carruthers (2008), Thorburn (2008), Costain (2008) and Jensen and Tarr (2008). Details on the regulatory environment in these sectors are available in Mircheva (2008). A listing of the barriers in engineering services is provided in Appendix D.

Telecommunications

The government has implemented significant reforms in the sector since the reform program began in 1993. But even as late as the year 2000, there were only 284,000 telephone subscribers in the country, of which 174,000 were fixed line subscribers. . By 2009, fixed line subscription had not changed significantly as there were only 157,000 fixed line subscribers in Tanzania for a population of almost 38 million. But, mobile telephony has dramatically changed things--there were about 17.5 million telephone subscribers in Tanzania who were receiving service at very competitive prices from seven mobile telephone service providers. 10

¹⁰ For the data see the website of the Tanzania Communications Regulatory Authority at <http://www.tera.go.tz/publications/telecom.htm>.

The Tanzanian telecommunications regulatory environment is based on the modern “converged” licensing framework, and is not restrictive regarding entry requirements. The non-restrictive regulatory environment has introduced competition in the telecommunications sector, and should be credited with much of the success of the mobile telephone build-out. Nonetheless significant problems remain in the telecommunications sector. Notably: (i) the contract for the construction of the national Information and Communication Technology (ICT) backbone network was awarded without a transparent tender to an apparently high cost company; (ii) internet and data transmission services are very costly; (iii) electronic commerce is seriously constrained by the need to develop credit reference bureaus, the lack of a national payments system, and a legislative framework appropriate for e-business; and (iv) there is a need to make progress in achieving universal service. We now discuss the second problem in more detail.

Internet service provision and data transmission. Internet service provision and data transmission has been very expensive in Tanzania. The Telecommunications Management Group (2007) report notes that in 2004 a monthly basket of internet access services costs US \$117, whereas the same basket costs an average of US\$ 54.8 in sub-Saharan Africa and an average of US\$45.5 in low income countries. The primary explanation for the high cost of these services is that until recently East Africa was the only major coastline in the world without access to a fiber-optic cable network. In early 2008, these services were provided by satellite services, which are more expensive than fiber optic seabed cable. However, the completion of the SEACOM fiber optic cable system in 2009 and the expected operation of the EASSy system in mid-2010 should lower the costs of internet and data transmission services. A reduction in the costs of internet transmission services will likely result in more internet service users. More internet users will likely allow achievement of economies of scale in production that would further reduce costs.

We do not, however, see a regulatory problem in this area that would increase our assessment of the ad valorem equivalents of non-tariff barriers in telecommunications.

Transportation

The port of Dar es Salaam. As of early 2008, there were widespread complaints about the container terminal at Dar es Salaam. Congestion in the container terminal of the port is the greatest transport impediment to an increase in exports. The container terminal was concessioned to TICTS in 2000, when the throughput was less than 100,000 tons of equivalent units (TEU). By offering a high quality service, the terminal was able to attract much of the traffic of the land-locked countries for which it is convenient transit port as well as for the rapidly growing Tanzanian economy.

As the throughput approached and passed the nominal capacity of 250,000 TEU and is approaching 350,000 in 2008, the number of containers loaded or offloaded per hour fell to less than half of what was achieved in 2004 and 2005, at the peak of the port's efficiency. The average waiting time for ships to access a container berth is twelve days, while the average total time for a ship in the port ("dwell time") is approaching 30 days. This congestion is raising costs for both importers and exporters and undermining firms that rely on speed and reliability to market. As a result, some shipping lines are reducing the frequency of calls to the port, and one major line has stopped service until the situation improves. Long-term solutions to this problem require investment and are not the subject of this analysis. There are, however, several regulatory problems that have caused problems. These are: (1) the structure of tariffs for the container terminal operator does not provide an incentive to move containers out of the port. Container terminal operators expect to make most of their revenue from the throughput of containers, and this is what happened in the early years of the concession. However, between 2005 and 2008, more than half of the revenue (and in 2008 more than three-quarters) came from storage charges, and this is possible because of the long dwell times. (2) Present practices require that all containers from a ship must arrive at an inland container terminal (ICD) before any containers can be released. This increases congestion at the ICDs and extends delays for available containers. (3) Shippers have weak incentives to undertake pre-clearance of containers. (4) The

container tracking system is not well developed; it sometimes takes days to inform container owners that their containers have cleared customs, when it should be done in minutes. And (5) container management is inhibited due to multiple measures, such as bureaucratic delays in allowing the use of available space; the requirement that containers from a ship must go to a single inland container terminal; the limited use of rail freight services to move containers out of the port; and the lack of space in the port that is aggravated by the parking of unnecessary equipment in the port (like cars and minibuses).

In addition to the above primarily non-discriminatory cost increasing regulatory barriers, there are discriminatory barriers against foreign firms. A commercial presence in Tanzania is required in order to offer shipping services and foreigners are prohibited from operating in Tanzania, but must operate through a Tanzanian agent. Moreover, formally, although not in practice, the maximum ownership share allowed in a local shipping firm is 1 percent.

Roads and border crossings. Although many roads are of poor quality, the government has received adequate donor support for maintenance and upgrading of the road network. There is, however, considerable scope for improvement in trade facilitation, especially at the borders. Border crossings within the East African Customs Union (EAC) are characterized by poor infrastructure and facilities, which typically results in long transit delays, poor traffic management, traffic jams and congestion at crossing points and parking yards. Delays of several days are reported when the ferry from Tanzania arrives in the Democratic Republic of Congo (DRC) and in Tanzania for the reverse journey. Similar delays occur at the border with Zambia. Anecdotal evidence from newspaper reports suggests that truck delays at the border between Tanzania and Kenya often lead to damage to flowers being transported for onward air freight from Nairobi. Clearly there are opportunities for improvements to transit arrangements.

To address these problems, the East Africa Customs Union has agreed to move towards the implementation of One-Stop Border Posts, which are expected to halve transit time at the borders. Moreover, under the World Bank “East Africa Trade and Transport Facilitation

Project,” nine joint border posts with revenue and transport authorities in the region have been selected. Of these, four are between Tanzania and Kenya and one each between Tanzania and Rwanda and Uganda. These joint border posts are expected to further facilitate trade.

Railroads. Due to a lack of investment, Tanzania’s railways have significantly declined and are considered rather poor providers of freight transportation services since the 1980s. The Tanzania Railways Corporation,¹¹ in the hope of improved performance, gave RITES, an Indian company, a concession to exclusively operate its routes and invest in the railroads. As of the end of 2007, the RITES concession had only been in operation for several months, and was still in the process of rebuilding its track infrastructure and acquiring refurbished and rebuilt locomotives and wagons from India.

Airlines. There is a lack of capacity to handle significant freight shipping. Due to lack of capacity in air freight facilities in Dar es Salaam, many Tanzanian cut flower producers choose to ship flowers by land to Nairobi, despite the high costs of border delays.

Banking

Banking sector reform in Tanzania started in the early 1990s and has continued to the present. A new regulatory framework has been introduced and new banks have entered the market so that there were 25 banks operating in Tanzania in 2007, including Tanzanian, banks from within the region (notably South Africa but also Kenya, Botswana and Uganda), from OECD countries and from Asia (India, Pakistan and Malaysia). Banking supervision in Tanzania complies with many of the “Basel Core Principles.”

The overall market environment appears to have benefited from increased competition and private sector credit has increased significantly while interest rate spreads are estimated to have declined from 11% at December 2005 to about 8.6% as at end of December 2006. The

¹¹ The Tanzania Railways Corporation offers service within Tanzania and on to the Democratic Republic of Congo, Burundi and Rwanda. TANZARA offers service between Tanzania and Zambia.

move to sell off a controlling stake in National Microfinance Bank (NMB) to a foreign strategic investor with strong experience in rural credit appears to have paid off through an introduction of innovative new products and approaches to agricultural finance and microfinance. Besides crop finance, banks and microfinance institutions have made limited headway in finding secure and cost-effective ways of lending for agricultural finance.

The banking sector, however, performs only a very limited role in the economy, even by Sub-Saharan African standards. Private sector credit remains limited, short-term interest rate spreads are high, banks continue to invest approximately half their deposits in government securities (although loan to deposit ratios have improved in recent years), and banks maintain significant offshore foreign currency deposits (about 39% of total deposits as of October 2007). Housing finance is negligible as residential mortgages represent less than 1% of all bank loans.

In order to develop new business models and lending technologies, the key task for government will be to ensure the legal and information infrastructures for banks and other financial institutions are in place. The general credit culture and institutional framework for contract enforcement remains underdeveloped and this has inhibited the growth of financial markets. The almost total absence of a mortgage market is a reflection of both the uncertainty concerning land title and the inability to enforce a contract.

Foreign banks, particularly the new entrants, have been challenged in mobilizing local currency for lending to match both their capital and institutional capacity. A better-developed interbank market would serve to extend the provision of credit within the domestic financial system. In 2008, shilling deposits were held largely by the three large domestic banks.

The efficient operation of the financial markets can be much assisted through the effective use of registries such as a land registry, company registry and a movable collateral registry. In addition, banks in particular are supported in their lending activities through the use of credit information bureaus. While these registries exist in Tanzania, their usefulness has been impeded by relatively weak implementation (and, in the case of the credit bureau, limited cooperation from the larger banks).

Although the Bank of Tanzania has substantial operating independence on banking supervision matters, some features of the legislation have the potential to compromise its

independence. At the same time, despite substantial progress, it would be useful to further increase transparency and accountability in the banking supervision procedures of the Bank of Tanzania, as well as the development of a risk based approach to banking supervision.

Insurance

Although the structure of the non-life insurance market is competitive (but not the life insurance market), the insurance sector is not well developed. Current regulations impede the growth of the sector. These rules include restricting foreign ownership to two-thirds of capital, requiring insurers to be locally incorporated entities, not allowing foreign branches or wholly owned subsidiaries of foreign insurers, not allowing cooperative and mutual insurance companies and limits that make it less attractive for banks to participate in the distribution of insurance.

There are no foreign reinsurance companies operating in Tanzania. This is partly due to the fact that reinsurance arrangements have, at their core, compulsory reinsurance requirements to TanRe, a company indirectly owned by the government. Moreover, reinsurance companies are prohibited to operate as either branches or as wholly owned subsidiaries of foreign domiciled reinsurers. Reinsuring externally, and insuring for that matter, also requires approval.

V. Estimation of the Tariff Equivalence of the Regulatory Barriers

Estimates of the ad valorem equivalents of the regulatory barriers in services are key to the results. In order to make these estimates, we first need to assess the regulatory environment in the services sectors in our model. We commissioned a 54 page survey of the regulatory regimes in key Tanzanian business services sectors, namely, insurance, banking, fixed line and

mobile telecommunications services and maritime transportation services.¹² We supplemented this information based on the policy notes discussed in section II. The Telecommunications Management Group (2007) provided extensive details in telecoms. These questionnaires and papers provided us with data and descriptions and assessments of the regulatory environment in these sectors. In the case of professional services, a World Bank team commissioned separate surveys of the regulatory environment in several East African countries, including Tanzania. These surveys were conducted by local consultants, who interviewed the professional associations in the in 2009. For reasons discussed below, we used engineering services as our proxy for all professional services.

Mircheva (2008) then estimated the ad valorem equivalents of barriers to foreign direct investment in fixed line and mobile telecommunications, banking, insurance and maritime transportation services. The process involved converting the answers and data of the questionnaires into an index of restrictiveness in each industry. Mircheva followed the methodology of Kimura, Ando and Fujii (2004a, 2004b, 2004c) to generate these estimates. The methodology involves classification of the possible restrictions into separate categories with unique weights summing to one, where the weights are determined based on the significance of each category. Next, Mircheva assigned a score to each potential restriction, where the score reflects the level of restriction imposed by the economy. Mircheva estimated two indices: an index of “regulatory barriers” (RB index) where the regulatory barriers impose costs on both domestic and multinational firms in a non-discriminatory manner; and an index of discriminatory barriers against multinational service providers, which we call the foreign discriminatory index (FDR index).¹³

This methodology further involves building on the estimates and methodology explained in the volume by C. Findlay and T. Warren (2000), notably papers by Warren (2000), McGuire and Schulele (2000) and Kang (2000). For each of these service sectors, the authors evaluated the regulatory environment across many countries. The price of services is then regressed against the regulatory barriers to determine the impact of any of the regulatory barriers on the price of

¹² We thank Mr. Cyril Pesha and his law firm associates in Dar es Salaam for leading this research effort.

¹³ In order to obtain the estimated score for each restriction, the assigned score is multiplied by the corresponding weight. Finally, the estimated scores for all categories are summed to obtain the restrictiveness indices.

services. Mircheva (and Kweka in the case of engineering services) then assumed that the international regression applies to Tanzania in the case that the above mentioned restrictiveness indexes are used. Applying that regression and their assessments of the regulatory environment in Tanzania from the questionnaires and other information sources, she estimated the ad valorem impact of a reduction in barriers¹⁴ both for discriminatory and non-discriminatory barriers. Mircheva then weighted her fixed line and mobile telecommunications estimates by their market shares to obtain her estimate for communications. The results of the estimates of the ad valorem equivalents of the barriers are listed in table 4.

In the case of professional services, we used engineering services as a proxy for all professional services. In engineering services, we have the regression results from the paper by Ngyuen-Hong (2000). Based on an international data set, he estimates the ad valorem equivalents of barriers on trade in engineering services. No such estimates are available for other professional services. Since the methodology we employ requires the existence of a cross-country regression estimate of the impact of barriers to foreign direct investment, we must use engineering services as our proxy. The scoring was done by Josaphat Kweka, senior economist in the World Bank office in Tanzania. The details of the regulatory regime and the scoring are listed as appendix D.

VI. Overview of the Model

This paper builds on the algebraic structure of the model of Jensen, Rutherford and Tarr (2007). Here we provide a general description of the structure described there and provide more details where we depart from that structure. There are 52 sectors in the model shown in table 1. These include eight imperfectly competitive business services sectors, eleven imperfectly competitive manufacturing sectors, nineteen competitive agricultural sectors and fourteen competitive manufacturing or services sectors. Primary factors include 8 types of labor grouped both according to gender and to one of four levels of education; child labor; agricultural land;

¹⁴ Warren estimated quantity impacts and then using elasticity estimates was able to obtain price impacts. The estimates by Mircheva that we employ are for “discriminatory” barriers against foreign direct investment.

mobile capital; sector-specific capital in imperfectly competitive sectors; and primary inputs imported by multinational service providers, reflecting specialized management expertise or technology of the firm. The existence of sector specific capital in the imperfectly competitive sectors implies that there are decreasing returns to scale in the use of the mobile factors and supply curves in these sectors slope up. In our central model, we assume that 50 percent of the capital in each of the imperfectly competitive sectors is sector specific. We conduct sensitivity analysis with respect to this share by allowing 25 percent and 75 percent of the capital in each sector to be sector specific.

We build on the model and data set for Tanzania in Jensen, Rutherford and Tarr (2009). As in their model, there are three categories of firms in the model: (1) perfectly competitive goods and services sectors; (2) imperfectly competitive goods sectors; and (3) imperfectly competitive services sectors with foreign direct investment. The cost, production and pricing structures in the three categories differ widely. The principal extension is that we disaggregate the rest of the world region of JRT into three regions: (1) the European Union; (2) the union of the East African Customs Union and SADC, which we call our African region; and (3) the Rest of the World. In the imperfectly competitive sectors, this requires introducing different firm types with distinct cost structures for each region. We retain the small open economy model framework, so only Tanzania is modeled fully.

Perfectly Competitive Goods and Services Sectors

Regardless of sector, all firms minimize the cost of production. In the competitive goods and services sectors, goods or services are produced under constant returns to scale and where price equals marginal costs with zero profits. This includes all 19 of the agriculture sectors, some food processing sectors such as meat and dairy products and grain milling, and services such as construction, hotels and restaurants, postal communication, real estate, public administration, health and education. In these sectors, products are differentiated by country of origin, i.e., we employ the Armington assumption. All goods producing firms (including imperfectly competitive firms) can sell on the domestic market or export. Firms optimize their output decision between exports and domestic sales based on relative prices and their constant elasticity of transformation production function. Having chosen how much to allocate between exports and

domestic sales, firms also optimize their output decision between exports to the three possible export regions, based on relative prices the three regions and their constant elasticity of transformation production function for shifting output between the regions.

Tourism is one of the sectors in this category, and given its importance in the Tanzanian economy, it deserves its own discussion. All sales to tourists are considered exports, i.e., the sector does not produce for the domestic market. Based on a survey (discussed below), we have that the inputs of the sector are domestic transportation services, hotel and restaurant services, clothing, gold items, and certain food products, as well as foreign inputs such as international travel expenditures. Given that we have data only on tourist expenditure by sector and on tourism imports and exports, we assume that the output of this sector is produced without value added. But the tourism sector demands domestically produced services and goods that lead to value-added in the Tanzanian economy. Moreover, the sector is intensive in services and this way we capture the impacts on services liberalization on services exports. We discuss the special data issues related to this sector in the data section below.

Goods Produced Subject to Increasing Returns to Scale

These goods are differentiated at the firm level. We assume that manufactured goods may be produced domestically or imported for firms in any region in the model. Firms in these industries set prices such that marginal cost (which is constant) equals marginal revenue; and there is free entry, which drives profits to zero. For domestic firms, costs are defined by observed primary factor and intermediate inputs to that sector in the base year data. Foreigners produce the goods abroad at constant marginal cost but incur a fixed cost of operating in Tanzania. The cif import price of foreign goods is simply defined by the import price, and, by the zero profits assumption, in equilibrium the import price must cover fixed and marginal costs of foreign firms. Domestic firms set prices using the Chamberlinian large group monopolistic competition assumption within a Dixit-Stiglitz framework, which results in constant markups over marginal cost for both foreign firms and domestic firms.

We have made one significant modeling extension in the imperfectly competitive sectors compared to the Jensen, Rutherford and Tarr (2007) model. In the Jensen, Rutherford and Tarr model, domestic firms faced a perfectly elastic demand curve on export markets and they

exported at marginal costs. In this model, all imperfectly competitive domestic firms (both goods and services producers) face a downward sloping demand curve in each of their three export markets. Consistent with firm level product differentiation, we assume that the elasticity of demand in each of the export markets is the Dixit-Stiglitz elasticity of demand. Firms then set marginal revenue equal to marginal costs in each of the three export markets; then the export market contribute to the quasi-rents of the firm and affect the entry and exit decisions of firms.

Introducing downward sloping demand curves into the model means that there are possible terms of trade affects to consider in this model that were not present in the Jensen, Rutherford and Tarr model. Balistreri and Markusen (2009) have shown, however, that there should be virtually no role for optimal tariffs to exploit terms of trade effects. The reason is that, unlike perfectly competitive firms, imperfectly competitive firms are pricing such that marginal revenue equals marginal costs on export markets, which is the objective of optimal tariffs.

For simplicity we assume that the composition of fixed and marginal cost is identical in all firms producing under increasing returns to scale (in both goods and services). This assumption in a our Dixit-Stiglitz based Chamberlinian large-group model assures that output per firm for all firm types remains constant, i.e., the model does not produce rationalization gains or losses.

The number of varieties affects the productivity of the use of imperfectly competitive goods based on the standard Dixit-Stiglitz formulation. The effective cost function for users of goods produced subject to increasing returns to scale declines in the total number of firms in the industry.

Service Sectors That Are Produced under Increasing Returns to Scale and Imperfect Competition

These sectors are telecommunications, financial services, transportation services and professional business services. In these services sectors, we observe that some services are provided by foreign service providers on a cross border basis analogous to goods providers from abroad. But a large share of business services are provided by service providers with a domestic

presence, both multinational and Tanzanian.¹⁵ Our model allows for both types of foreign service provision in these sectors. There are cross border services allowed in this sector and they are provided from abroad at constant costs—this is analogous to competitive provision of goods from abroad. Cross border services, however, are not good substitutes for service providers who have a domestic presence.¹⁶

Crucial to the results, we allow multinational service firm providers that choose to establish a presence in Tanzania in order to compete with Tanzanian firms directly. As in the goods sectors, services that are produced subject to increasing returns to scale are differentiated at the firm level. Firms in these industries set prices such that marginal cost (which is constant) equals marginal revenue; and there is free entry, which drives profits to zero. We assume firm level product differentiation and employ the Chamberlinian large group monopolistic competition assumption within a Dixit-Stiglitz framework. Given our assumption on the composition of fixed and variable costs, we have constant markups over marginal cost for both foreign firms and domestic firms, i.e., no rationalization impacts.

For domestic firms, costs are defined by observed primary factors and intermediate inputs to that sector in the base year data. When multinationals service providers decide to establish a domestic presence in Tanzania, they will import some of their technology or management expertise. That is, foreign direct investment generally entails importing specialized foreign inputs. Thus, the cost structure of multinationals differs from national only service providers. Multinationals incur costs related to both imported primary inputs and Tanzanian primary factors, in addition to intermediate factor inputs. Foreign provision of services differs from foreign provision of goods, since the service providers use Tanzanian primary inputs. Domestic service providers do not import the specialized primary factors available to the multinationals. Hence, domestic service firms incur primary factor costs related to Tanzanian labor and capital only. These services are characterized by firm-level product differentiation. For multinational firms, the barriers to foreign direct investment affect their profitability and

¹⁵ One estimate puts the world-wide cross-border share of trade in services at 41% and the share of trade in services provided by multinational affiliates at 38%. Travel expenditures 20% and compensation to employees working abroad 1% make up the difference. See Brown and Stern (2001, table 1).

¹⁶ Daniels (1985) found that service providers charge higher prices when the service is provided at a distance.

entry. Reduction in the constraints on foreign direct investment will induce foreign entry that will typically lead to productivity gains because when more varieties of service providers are available, buyers can obtain varieties that more closely fit their demands and needs (the Dixit-Stiglitz variety effect).

VII. Data of the Model and Evidence for Key Elasticities

Social Accounting Matrix

The core of the model data is the Social Accounting Matrix (SAM) for 2001 developed by Thurlow and Wobst (2003). The SAM contains 43 sectors, most of which are agricultural and food-producing sectors and only a few are service sectors.

Two sectors in the SAM, "Transport and communication" and "Business and other service activities", account for most business services in Tanzania. Given our focus on services, these sectors are disaggregated into 10 sectors using unpublished national accounts data for the year 2006 from the National Bureau of Statistics of Tanzania.

Data for gross domestic product for the sectors "Transport", "Communications", "Financial intermediation", and "Real estate and business services" is officially published (National Bureau of Statistics (2007)). Upon specific request, we received a breakdown of these data for the main types of services within each sector. Specifically, the data allows us to disaggregate "Transport and communication" into road transport, railway transport, water transport, air transport, postal services and telecommunication. "Business and other service activities" is disaggregated into insurance, banking, business services and other services.

Within each of the two aggregate sectors, the share of gross domestic product by disaggregate sector is used to decompose the corresponding aggregate sector. It is furthermore assumed that the input output structure for all the disaggregate sectors is identical to the input output structure of the corresponding aggregate sector. Along with the addition of the tourism sector, the resulting table has 52 sectors as shown in table 1.

The Thurlow and Wobst SAM allocate international travel expenditure (mainly international tourism) to the "Transport and communication" sector. According to a survey

conducted by the Bank of Tanzania (2007), this is grossly contradicted by the facts. Given our focus on services and the importance of tourism to the Tanzanian economy, we had to correct this problem.

In our first step, we reduced imports and exports in the "Transport and communication" sector by the value of tourism imports and tourism exports, respectively. This yields levels of traditional exports and imports for this sector which are roughly in line with balance of payments data from the Bank of Tanzania for these sectors.

In the second step, we had to reallocate the tourist expenditures subtracted from Transportation and Communication to other sectors. Since most of the tourism imports are re-exported, e.g., international air travel, we chose to calculate net tourism expenditures. We allocated the net expenditures to the various sectors of our model based on the Bank of Tanzania survey results.

The survey revealed that around 28% of total expenditure of non-package tourists is transport, 29% is accommodation, 12% is shopping and 31% is other expenditure. We therefore allocated the cost share of tourism input expenditures to the following sectors: 29% to "Hotels & restaurants," 28% to road transport, railway transport and air transport in proportion to the three sectors' contribution to GDP. The remaining 43% is on goods. We allocate these expenditures to the goods producing sectors in proportion to their share in total exports of goods. Major examples of tourist expenditure on goods include clothing, gold items, and food products such as cashew nuts and coffee.

This allocation of tourist expenditures implies that our SAM gets additional accounts representing "Tourism". An activity account (the tourism sector) contains the tourism expenditure and produces an aggregate tourism commodity. The tourism sector in our SAM does not generate value-added itself, but demands domestically produced services and goods (as detailed above). Additional exports of tourism therefore indirectly increases value-added in the Tanzanian economy.

An additional commodity account contains the aggregate tourism commodity (the output of the domestic tourism activity) and tourism imports. The sum of the two is exported as gross tourism exports.

The reallocation of tourism expenditure corresponds to a relocation of demands for output between sectors. To maintain a balanced SAM a final correction was needed to ensure that the value of output equals total demand in each sector. Capital earnings are increased in sectors where demand is increased, and decreased in sectors where demand is decreased.

The SAM includes 12 household accounts. 6 accounts represent rural households and 6 accounts represent urban households. 2 accounts in each group represent households below the food poverty line and between the food and basic needs poverty lines. The other accounts are grouped according to the education of the head of the household.¹⁷

The SAM contains nine types of labor: Adults are grouped both according to gender and to one of four levels of education. All child labor (age 10 to 14) is the 9th and final category. Capital and agricultural land and a factor called a subsistence factor are the three remaining primary factors of production.

The subsistence factor is a composite of land, labor and capital used in the production for home (own) consumption by households.¹⁸ The subsistence factor is used in the agricultural and food-producing sectors. In each sector the SAM shows the value of output allocated for home consumption and of output allocated to the market, both of which are coming from the same activity.

Trade Data by Regional Partner and Sector

To obtain the shares of imports and exports from the different regions of our model, we used trade data for 2007 obtained from WITS access to the COMTRADE database. The regions of our model are Tanzania, the European Union, the East African Customs Union plus SADC and the Rest of the World. For the European Union, we took the 27 member countries as of 2007. In appendix A, we calculate and report data for the East African Customs Union and

¹⁷ Average per capita income in the SAM is calculated as USD 2.2 per day. This calculation is based on income data in the SAM, the number of heads in each of the household accounts as reported by Thurlow and Wobst (2003), and a purchasing power parity conversion between Tanzanian Schillings and USD of 274.16 (see Heston et al. (2006)). The market exchange rate for 2001 reported by the Bank of Tanzania is 876.4 Tanzanian Schillings per USD.

¹⁸ Data do not allow a breakdown of the subsistence factor on its shares of the other primary factors.

SADC separately. For the East African Customs Union, we took Kenya, Uganda, Rwanda and Burundi. For SADC we took Angola, Botswana, Democratic Republic of Congo, Lesotho, Madagascar, Malawi, Mauritius, Mozambique, Namibia, South Africa, Swaziland, Zambia and Zimbabwe. Trade shares for the “Africa” region in our model are the sum of East Africa Customs Union plus SADC. Rest of the World is the residual.

We mapped two digit sectors from the COMTRADE database into the sectors of our model. The exact mapping is defined in appendix A. We used Tanzania as the reporter country for both exports and imports. Results for both exports and imports are reported in tables A2 and A3 of appendix A.

Tariff Data—Collected Rates at the Tariff Line Level

We were fortunate to receive unusually detailed collected tariff data from the Tanzania Revenue Authority. That is, we received data on collected import duties (tariffs) and import values at the eight digit tariff line level. The collected tariff rates for the sectors in our model are obtained by first aggregating the eight digit tariff line level tariff collections and import values to the sectors of our model. The ratio of tariff collections to import values for each sector of our model is then calculated to give estimates of the collected tariff rates, which in turn are incorporated into our SAM. The tariff rates are shown in Table 4. Applying these tariff rates across all sectors implies that tariff revenue in the revised database is about 1.3% of GDP, which is consistent with collected revenues in Tanzania.¹⁹ The SAM has some detail on taxes, which include direct taxes on households and enterprises, import tariffs, producer taxes, indirect (sales) taxes and factor taxes. The data for import tariffs are replaced with collected tariff rate data for the year 2006.

Given that Tanzania participates in preferential trade areas with the East Africa Customs Union and the South African Development Community, it was necessary to make further adjustments. That is, since, in principle, tariff rates should be zero within these preferential trade areas, we set tariff collections on imports from SADC and EACU (our Africa region) at zero. We

¹⁹ For the year 2006, aggregate data from Tanzania show that tariff collections are 1.47 percent of GDP.

then increased the tariff rates for the other regions in our model so that the overall weighted average collected tariff rate is unchanged. We used the trade flow data, disaggregated by regions and sectors of our model to weight the tariff rates. This adjustment has the impact of raising the collected tariff rates for the regions in our model where positive tariff rates apply. The resulting adjusted tariff rates are reported in Table 4.

Share of Market Captured by Multinational Service Providers

It was necessary to calculate the market share of multinational firms in the services sectors by region of the model. Take the banking sector as an example. We need to know the share of the market captured by Tanzanian, EU, African and Rest of the World firms, where the countries in the regions are defined in table 1. This entailed acquiring a list of all banks operating in Tanzania along with their market share, and, when the bank is owned by multiple parties, allocating the ownership across the regions of our model. The database Bankscope was sufficient for this task in most cases, but websites of the banks had to be consulted to allocate ownership shares in several cases. The results, by region and sector, are presented in table 6. Documentation of the results, with listing by firm, sector and region, and the data sources are presented in appendix B.

Share of Expatriate Labor Employed by Multinational Service Providers

The impact of liberalization of barriers to foreign direct investment in business services sectors on the demand for labor in these sectors will depend importantly on the share of expatriate labor used by multinational firms. We explain in the results section that despite the fact that multinationals use Tanzanian labor less intensively than their Tanzanian competitors, if multinationals use mostly Tanzanian labor, their expansion is likely to increase the demand for Tanzanian labor in these sectors.²⁰ We obtained estimates of the share of expatriate labor or specialized technology not available to Tanzanian firms that is used by multinational service providers in Tanzania from the survey mentioned above. We found that multinational service providers use mostly local primary factor inputs and only small amounts of expatriate labor or

²⁰ See Markusen, Rutherford and Tarr (2005) for a detailed explanation on why FDI may be a partial equilibrium substitute for domestic labor but a general equilibrium complement.

specialized technology. Our estimated share of foreign inputs used by multinationals in Tanzania is presented in the table on sensitivity analysis.

Estimates of the Dixit-Stiglitz Elasticities of Substitution for Goods

It was necessary for us to obtain estimates of the Dixit-Stiglitz product variety elasticities of substitution for the imperfectly competitive sectors in our model. Christian Broda, Joshua Greenfield and David Weinstein (2006) estimated Dixit-Stiglitz product variety elasticities of substitution at the 3 digit level in 73 countries. Among the 73 countries, there were four in sub-Saharan Africa: the Central African Republic, Madagascar, Malawi and Mauritius. We judged that Madagascar was the country closest in characteristics to Tanzania, so we took the values of the elasticities estimated for Madagascar as a proxy for the elasticities for Tanzania. We explain in appendix C, how we mapped the 3 digit elasticities for 130 goods sectors estimated by Broda et al. into the sectors of our model. The mapping and resulting elasticities by relevant sector in our model are shown in table C1.

Elasticities of varieties with respect to price--evidence on the role of trade and FDI in increasing total factor productivity through technology transfer as a function of research and development intensity of the trading partner

Grossman and Helpman (1991) have developed models of economic growth that have highlighted the role of trade in a greater variety of intermediate goods as a vehicle for technological spillovers that allow less developed countries to close the technological gap with industrialized countries. Similarly, Romer (1994) has argued that product variety is a crucial and often overlooked source of gains to the economy from trade liberalization. In our model, it is the greater availability of varieties that is the engine of productivity growth, but we believe there are other mechanisms as well through which trade may increase productivity.²¹ Consequently, we take variety as a metaphor for the various ways increased trade can increase productivity. Winters et al. (2004) summarize the empirical literature by concluding that “the recent empirical evidence seems to suggest that openness and trade liberalization have a strong influence on

²¹ Trade or services liberalization may increase growth indirectly through its positive impact on the development of institutions (see Rodrik, Subramanian and Trebbi, 2004). It may also induce firms to move down their average cost curves, or import higher quality products or shift production to more efficient firms within an industry. Tybout and Westbrook (1995) find evidence of this latter type of rationalization for Mexican manufacturing firms.

productivity and its rate of change.” Some of the key articles regarding product variety are the following. Broda and Weinstein (2004) find that increased product variety contributes to a fall of 1.2 percent per year in the “true” import price index. Hummels and Klenow (2005) and Schott (2004) have shown that product variety and quality are important in explaining trade between nations. Feenstra et al. (1999) show that increased variety of exports in a sector increases total factor productivity in most manufacturing sectors in Taiwan (China) and Korea, and they have some evidence that increased input variety also increases total factor productivity. In business services, because of the high cost of using distant suppliers, the close availability of a diverse set of business services may be even more important for growth than in goods. The evidence for this was cited in the introduction section.

Beginning with the path-breaking work of Coe and Helpman (1995), a rich literature now exists that has empirically investigated the transmission of knowledge through the purchase of imported intermediate goods and through foreign direct investment. Coe and Helpman found that OECD countries benefit from foreign research and development (R&D), that they benefit more from trading with countries that have a larger stock of research and development, and that the benefits are greater the more open the country is to foreign trade. Moreover, while in large countries the elasticity of total factor productivity (TFP) with respect to domestic R&D capital stocks is larger than that with respect to foreign R&D capital stocks, the opposite holds in small countries; that is, foreign R&D is more important for small countries. Coe, Helpman, and Hoffmaister (1997) extend these results based on a sample of 77 developing countries. They find developing countries that do little R&D on their own, have benefited substantially from industrialized country R&D through trade in intermediate products and capital equipment with industrialized countries. They find that R&D spillovers through trade with the U.S. are the largest, since the U.S. stock of R&D is the highest and it is the most important trading partner for many developing countries. A 1 percent increase in the R&D stock of the U.S. raises total factor productivity for all 77 developing countries in their sample by 0.03 percent. By comparison, a 1 percent increase in the R&D stock of Japan, Germany, France or the U.K. raises total factor productivity only between 0.004 percent and 0.008 percent. Crucially, they find that countries that trade more with the U.S., such as the Latin American countries, get more productivity spillover increases from the U.S. R&D stocks. And the relatively more open East Asian countries have benefited the most from foreign R&D through trade. Keller (2000) also finds that trade is

an important conveyor of R&D and is especially important for small countries. Several other studies, including Lumenga-Neso et al. (2005), Schiff et al., (2002) and Falvey et al., (2002), confirm these results. Lumenga-Neso et al. (2005) show that technological spillovers can occur from indirect trade with technologically advanced countries. i.e., imports from the U.K. embody some U.S. technology due to U.K. imports from the U.S.. Since the data show that OECD countries have the vast majority of R&D stocks,²² it implies that it is important for small developing countries to trade with large technologically rich countries, such as the U.S. and the EU, at least indirectly.

Regarding the impact of FDI on the productivity of firms, the results depend on intra-industry versus inter-industry impacts. Since FDI in the same industry may bring spillovers, but has an adverse competitive or market share impact, the literature has found mixed results on the productivity of firms in the same industry that receives the FDI. But several papers have found significant productivity spillovers from FDI in both upstream (supplying) industries (e.g., Javorcik, 2004; Blalock and Gertler, 2008; and Javorcik and Spatareanu, 2008) and downstream (using) industries (e.g., Wang, forthcoming; Jabbour and Mucchielli, 2007; and Harris and Robinson, 2004). Saggi (2006) summarizes the theory and additional empirical papers that show the spillovers of FDI on supplying industries. Regarding FDI in services, Arnold, Mattoo and Javorcik (2007) show that in the Czech Republic, services sector liberalization led to increased productivity of downstream industries, and the key channel through which reform led to increased productivity was allowing foreign entry. Fernandes and Paunov (2008) found a positive and significant effect of foreign direct investment in services on productivity growth in Chile. Fernandes (2007) finds a positive and significant effect of services liberalization in both finance and infrastructure on the productivity of downstream manufacturing in the fifteen Eastern European countries.

Schiff and Wang (2006) estimate the relative importance for technology diffusion to developing countries of trade with industrialized versus developing countries. They note that technology from the industrialized countries may indirectly diffuse to a developing country through trade with another developing country, if the other developing country has traded with industrialized countries. They conclude that trade with industrialized countries has a stronger

²² Coe, Helpman and Hoffmaister (1997) calculate that 96 percent of the world's R&D expenditures took place in industrial countries in 1990 and this number stood at 94.5 percent in 1995.

impact on productivity in developing countries and that spillovers from developing country trade occurs with more of a lag. They find that the elasticity of productivity (TFP) with respect to current trade with all industrialized countries is 0.16, but only 0.01 for current trade with all developing countries. That is, trade with the industrialized countries is 16 times better for productivity spillovers. In addition, since trade may be expected to have an impact on productivity with a lag, Schiff and Wang estimate the impact of lagged trade with developing countries. They find that the productivity spillovers from **current** trade with industrialized countries are only about 1.5 times greater than the productivity spillovers from **lagged** trade with developing countries.²³ Moreover, Schiff et al. (2002) show that developing country trade with technologically advanced countries is very important in technology intensive sectors, but trade with developing countries can be important for productivity spillovers in less technologically complex products in which developing countries have comparative advantage. So on low R&D products like footwear and textiles and apparel, trade with China and Indonesia could be as important for technology diffusion as trade with the EU and the US.

In summary, this literature shows that the purchase of intermediate inputs and FDI from industrialized countries is an important mechanism for the transmission of R&D and productivity growth in developing countries. For small developing countries, trading with large technologically advanced countries is crucial for TFP growth. But for products in which developing countries have a comparative advantage, developing country trade may be important for spillovers.

In our model, the parameter that reflects the ability of a region to increase total factor productivity through the transmission of new technologies is the elasticity of varieties with respect to the price. Schiff *et al.*, (2002, table 1) have shown that for R&D intensive sectors, trade with industrialized countries contributes significantly to total factor productivity in developing countries, but trade with developing countries does not. Averaging over the industries in Schiff *et al.*, (2002, table 3) yields that trade with industrialized countries in R&D intensive products is about eight times more valuable for developing country TFP increases. On the other

²³ Schiff and Wang do not compare lagged industrialized trade to lagged developing country trade, which may bias the results against the relative benefits of industrialized trade.

hand, for sectors that are low in R&D intensity, their results suggest that for technology diffusion trade with developing countries can be as important as trade with industrialized countries.

Based on these considerations, we first classify the increasing returns to scale sectors of our model into low, medium and high technology sectors. The classification is defined by the share of R&D expenditures in total sales, based on U.S. data. For low R&D intensive sectors, we assume that the elasticity of firms with respect to price is the same for the Africa region as for the EU, but the elasticity is only one-third of Rest of the World elasticity (trade with the Africa or EU regions misses out on trade with China or the U.S.). For medium and high R&D intensive sectors, we assume that trade and FDI with the Africa region is only one-eighth as valuable as trade with the Rest of the World (as discussed above), while trade with the EU is two-thirds as valuable as trade with the Rest of the World. Finally, we allow the elasticity of the Rest of the World to vary depending on the R&D intensity of the sector, where we allow for more technology diffusion in more R&D intensive sectors. The results of these assumptions are in table 6b.

To determine the impact of this parameter on the results, we conduct three types of sensitivity analysis on these parameters: systematic sensitivity analysis, piecemeal sensitivity analysis and a third where we simulate the model 100 times. When we conduct sensitivity analysis, we scale all the elasticities from 0.5 times their central values to 1.5 times their central values.

VIII. Results for Preferential Reduction of All Services Barriers—Central Elasticity Case

We execute several scenarios to assess the impacts of Tanzania entering into a bilateral free trade agreement that includes services with the European Union, and similarly with the Africa region. In these scenarios we assume that Tanzanian ad valorem equivalents of the barriers against foreign investors in services are reduced by 50 percent with respect to the region with which Tanzania has an agreement. We assume that Tanzania already offers tariff free access to goods originating from its African trade partners, so in the scenario where we evaluate the agreement with the Africa region we include only liberalization of discriminatory barriers against foreign investors in services. Insofar as combining preferential trade agreements could

potentially reduce trade diversion inherent in separate agreements (see, e.g., Harrison, Rutherford and Tarr, 2002, 2004), we examine the impacts of the combination of free trade agreements with both the Africa region and the European Union. We compare these impacts with unilateral non-discriminatory liberalization. Finally, given our earlier result on the importance of reducing non-discriminatory barriers against investors in service, we examine the impact of a 50 percent reduction of non-discriminatory barriers against service providers combined with unilateral liberalization of discriminatory barriers.

As discussed above, who captures the rents from the barriers is important for the welfare results. Consequently, for each policy scenario, we execute two versions of the model with our central elasticities. In one case, we assume that Tanzanians do not capture any rents from the barriers. In the second scenario, we assume that the discriminatory barriers generate rents that are captured by Tanzanians. In our systematic sensitivity analysis, in each of the 30,000 scenarios, we allow the share of rents captured by Tanzanians to vary stochastically between zero and one. In a section below, we focus on the impacts in professional services by considering the same set of policy experiments where we allow reduction in services barriers only in professional services.

Aggregate Effects

We first discuss (and present results in tables 7 and 8) our estimates of the full reform scenario in our central elasticities case. In these tables we present results on the impacts on aggregate variables including welfare, the real exchange rate, aggregate exports and imports, the return to capital, skilled labor and unskilled labor and the percentage change in tariff revenue. In order to obtain an estimate of the adjustment costs, we estimate the percentage of each of our factors of production that have to change industries.

Gains with the EU—deriving primarily from services liberalization. We estimate that the preferential arrangement with the EU that includes both goods and services would generate gains for Tanzania of 0.35 percent of consumption with no initial rent capture and 0.27 percent of consumption if there is initial rent capture by Tanzanians. The gains come primarily from the preferential liberalization of services, although the relative contribution is much larger with no initial rent capture. That is, the gains to Tanzania from preferential liberalization of tariffs with

the EU are invariant to the rent capture assumption at 0.05 percent of consumption. But, if there is initial rent capture, the gains to Tanzania of preferential liberalization of services fall from 0.30 percent of consumption to 0.22 percent of consumption.

Small gains from preferential liberalization with the Africa region. In the case of preferential liberalization with the Africa region, the gains are smaller—0.10 percent of consumption in the case of no initial rent capture and 0.03 percent of consumption in the case of rent capture initially by Tanzania. The agreement with the EU includes tariff reduction, while tariff free access in the Africa region is considered part of the status quo; so the appropriate scenario for comparison of the relative gains for Tanzania is the scenario in the second column of the results tables, labeled “EU discriminatory services.” With no initial rent capture, the gains for Tanzania of an agreement with the EU are three times greater than the gains from an agreement with the Africa region. With initial rent capture, gains of an agreement with the EU are seven times greater than the gains from an agreement with the Africa region. We show in the sensitivity section that there is a small possibility of losses from an agreement with the Africa region in the initial rent capture case.

Why are the gains larger for the agreement with the “northern” region? As we discussed above, trade with and FDI from large technologically advanced regions can be expected to lead to technology diffusion that increases total factor productivity. Although trade and FDI from small developing countries can contribute to technology diffusion, it has been estimated to do so to a significantly lesser extent, at least for research and development intensive sectors. The elasticity of the number of varieties (firms) with respect to price is the parameter in our model that captures that effect, and the values we have chosen are in table 6B.²⁴ Table 21 shows that we estimate that the number of varieties from the EU substantially increases as a result of preferential liberalization with the EU, while table 18 shows that the estimated expansion of varieties from the Africa region is much more modest in response to

²⁴ The elasticity of supply corresponds to the share of the sector’s costs that are due to a specific factor of production. In all of the imperfectly competitive sectors, we assume there are four specific factors: one for each region in the model. Then, as industry output expands, the price of the specific factor necessary for production of that variety increases, thereby increasing the cost of production of firms. Since the cost of production of firms increases as the industry supply increases, the supply curve of each region will slope up in each of these sectors. And higher cost shares of the specific factor will lead to less elastic supply curves in that sector.

preferential liberalization with respect to the African region. We show in the sensitivity analysis below that this elasticity of supply parameter is very important for the results: preferential agreements in services are more likely to be beneficial the higher the supply elasticities of the partner country's services suppliers and the lower the supply elasticities of the excluded countries services suppliers.

More substantial gains from combining the Africa FTA with a FTA with Europe. In tables 7 and 8, in the column labeled "EU-Africa FTA," we show our estimates for the impacts of agreeing to a FTA with both the EU and the Africa region. The estimated gains are approximately the sum of the separate agreements. This shows that Tanzania can significantly augment the gains it may realize from an agreement with the Africa region, by adding a FTA with the EU.

Harrison, Rutherford and Tarr (2002) found that, for Chile, the gains from combining free trade agreements would be more than additive. Harrison, Rutherford, Tarr and Gurgel (2004) found similar results for Brazil. That is, the gains of the two agreements combined exceeded the gains of the two separate agreements. The reason is that if Chile, for example, agreed to a free trade agreement with the U.S., then competition from the U.S. would greatly reduce the trade diversion associated with an agreement with neighboring developing countries. But there are the possibilities of trade diversion with the rest of the world region, so the gains from combined agreements are not necessarily greater than the gains from the separate agreements.

Non-discriminatory liberalization would result in a six-fold increase in the gains compared with preferential liberalization with the EU. With non-discriminatory liberalization, Tanzanians would be able to access goods and services from the least cost supplier in the world. This would eliminate all trade diversion losses, reduce any adverse terms of trade losses and result in the maximum number of new foreign varieties for productivity improvement from trade and FDI liberalization. Consequently, the gains are much larger in this case. Because the rest of the world has a much larger share of the goods market in Tanzania than it enjoys in the services sectors, the gains from non-discriminatory liberalization come more from liberalization of goods than from services.

The largest gains come from reduction in the barriers that domestic as well as foreign firms face. Consistent with the work of Jensen, Rutherford and Tarr (2009) in a model with an aggregate rest of the world, we find that the largest gains for Tanzania would come from liberalization of the non-discriminatory barriers in services. That is, when we estimate the impact of a 50 percent reduction in the non-discriminatory services barriers on top of unilateral liberalization of all discriminatory services barriers, the estimated gains are 7.0 percent of consumption with no rent capture or 5.4 percent of consumption with initial rent capture.

Sector Impacts

In table 9, we present results for the percentage change in output by sector for four scenarios: an FTA with the EU; and FTA with the Africa region; and FTA with the EU and the Africa region combined; and unilateral liberalization. Details of what is included in these scenarios are explained in table 7.

In general we see an expansion of the output of the business services sectors in all scenarios. Multinational firms in the business services sectors are located in the home country and their output is defined as part of industry output. Reduction of barriers against one partner regions, generally reduces the number of firms from the other three regions in the model, but on balance the output of the sector expands. To see what happens to EU firms, versus Tanzanian and other firms, it is necessary to view the tables that report the change in the number of firms by scenario.

Outside of business services, we estimate that the tourism and hotel and restaurant sectors are the sectors that will expand the greatest (tourism almost doubles in size with unilateral liberalization). The tourism sector is an intensive user of business services, such as transportation and banking services. Regulatory reforms will decrease the price and allow for quality improvements in these business services, which permits the tourism sector to operate more cheaply and offer better quality services.

Given that we assume that total employment and the capital stock are fixed in the medium term, if labor expands in some sectors, it must contract in other sectors. Given the large

expansion in several sectors, especially services, we must have declines in others in the medium term. We estimate declines in output in several sectors, especially those that use business services less intensively. Moreover, since we assume zero tariffs in our unilateral reform scenario, sugarcane, which is the one of the more highly protected sector, is estimated to decline. The stark result from table 9 is that for sectors that experience output declines, the contractions are generally much more moderate in the regional preferential scenarios than in the unilateral scenario. This follows from the less substantial drop in overall protection to any sector.

IX. Sensitivity Analysis

In this section we assess the impact of parameter values and key modeling assumptions on the results. Through our “piecemeal sensitivity analysis” we will determine the most important parameters for the results, and we will assess how important for the results are rent capture or additional varieties from reform in services sectors under increasing returns to scale. In the piecemeal sensitivity analysis, we change the value of a single parameter while holding the values of all other parameters unchanged at our central elasticity values. We present piecemeal sensitivity analysis of the two most relevant policy scenarios. In table 22, we examine the prospective free trade agreement with the EU and in table 23, we examine the agreement with the Africa region.

Given uncertainty of parameter values and the rent capture assumption, point estimates of the results may be viewed with skepticism. In our “systematic sensitivity analysis,” we execute 30,000 simulations. In each simulation, we allow the computer to randomly select the values of all parameters, subject to the specified probability distributions of the parameters. Through the systematic sensitivity analysis we will be able to assess how robust the results are and obtain confidence intervals of the results.

Rent Capture Assumption-

In the row labeled θ_r we retain the increasing returns to scale assumption in the services sectors and selected goods sectors, but allow initial rent capture in the services sectors to be either zero (central value) or 100 percent (upper value). We see that there is approximately a 20 percent reduction in the welfare gain from a free trade agreement with the EU if rents are captured initially (from a welfare gain of 0.35 percent of consumption to 0.27 percent of consumption). In the case of an agreement with the African region, the gains fall even more dramatically in percentage terms, from a welfare gain of 0.10 percent of consumption to 0.03 percent of consumption in our central elasticity case. We show below, that with initial rent capture, there are parameter values that result in negative welfare changes for an agreement with the Africa region.

Impact of Constant Returns to Scale—Possible Negative Welfare Effects

In the row labeled θ_r –CRTS model, we assume constant returns to scale in all sectors, which eliminates the Dixit-Stiglitz externality from additional varieties. We allow initial rent capture in the services sectors to be either zero (central value) or 100 percent (upper value). We see that without the Dixit-Stiglitz variety externality, the gains from an agreement with the EU fall dramatically and can be negative with the Africa region. With no initial rent capture, the gains for the EU agreement would be approximately 0.04 percent of consumption and would fall to -0.03 with initial rent capture. In the case of an agreement with the Africa region, the gains are 0.05 with no initial rent capture and are -0.02 with initial rent capture.

Piecemeal Sensitivity Analysis

Three parameters stand out as having a strong impact on the results. The elasticity of substitution between firm varieties in imperfectly competitive services sectors, $\sigma(q_i, q_j)$ has a very strong impact. Following from the Le Chatelier principle, larger elasticities typically lead to larger welfare gains in response to welfare improving reforms, as the economy can adapt more readily. Unlike other elasticities, however, a lower value of $\sigma(q_i, q_j)$ increases the welfare gains. This is because lower values of this elasticity imply that varieties are less close to each other, so additional varieties are worth more. Since the policy shocks in goods are much less, the same elasticity variation in goods has a much smaller impact. The elasticity of substitution between value-added and business services, $\sigma(va, bs)$, also has a strong impact. The better firms are able

to substitute business services for labor and capital, the more the economy will gain from the reforms that reduce the quality adjusted price of business services. Finally, for the agreement with the EU, a strong impact comes from changes in the value of ϵ_{EU} , the elasticity of EU multinational service firm supply with respect to the price of EU services in Tanzania. Larger values of this parameter mean that tariff preferences that open opportunities for EU service firms to provide new varieties, will not be so quickly choked by the increased cost of the specific factor required for EU firm expansion. Similarly, for the agreement with the Africa region, ϵ_{AFR} , the elasticity of African multinational service firm supply with respect to the price of African services in Tanzania has a strong impact. We conduct more detailed sensitivity analysis on this parameter below.

Impact of Partner and Excluded Country Elasticities of Multinational Service Firm Supply—why it is more likely to obtain gains from large technologically advanced partners

In figures 4 and 5, we depict the impact and interrelationship of the elasticities of firm supply from partner and excluded countries. In figure 4, we examine the estimates for the welfare effects in Tanzania of a 50 percent preferential reduction of barriers in services against African partners. On the vertical axis is the set of elasticities of firm supply of African partners with respect to price (values by sector are shown in table 6B). We scale this set of elasticities from one-half to twice the central values. On the horizontal axis we scale the central values of the elasticities of firm supply of all excluded countries from one-half of their central values to twice their central values. Excluded regions in the case are the EU and Rest of the World. In figure 5, we do analogous simulations, except that since the preferential liberalization is with the EU, the EU elasticities are on the vertical axis and we scale the elasticities of the African region and the Rest of the World on the horizontal axis. In the left hand side panel, we present results with no initial rent capture, but initial rent capture is shown on the right hand side panel.

Regarding preferential reduction of barriers with African partners, we see in figure 4 that, with initial rent capture, there is a range of elasticities that result in losses for Tanzania. Without initial rent capture, however, there are gains for all these values, albeit small gains.

We see from figures 4 and 5 that the gains to the home country increase the higher the elasticity of supply of firms in partner countries and the lower the elasticity of supply of firms in excluded countries, with the partner country elasticity being the more important. Preferential reduction of barriers, leads to an increase in firms (varieties) and productivity from partner countries, but a loss of service providers (varieties) from all excluded regions and the home country, results in a loss of productivity for sectors using these services. The lost productivity from lost varieties from the regions excluded and the home country from the preferential liberalization in services is analogous to the trade diversion losses in perfect competition. When firm elasticities in partner countries are high, the after tax price increase for firms in partner countries from preferential reduction of barriers induces a large increase in partner country varieties, boosting productivity. For excluded countries, the price decrease of partner countries shifts in demand for their products and lowers their price; but the lower price induces fewer lost varieties when firms in excluded countries have low elasticities. In addition to the variety impacts in imperfect competition, as explained above, in perfect competition the rent and terms of trade impacts reinforce the argument that high elasticities of partners and low elasticities of excluded countries increase the likelihood of welfare gains from a preferential agreement in services.

Systematic Sensitivity Analysis

In the systematic sensitivity analysis, we execute the model 30,000 times and harvest the results for desired variables. In each individual simulation, we allow the computer to select values of all the parameters in the model (the parameters in table 22), based on the specified probability density functions (pdfs) of the parameters. We assume uniform probability density functions, with upper and lower values of the pdfs given by the upper and lower values in the piecemeal sensitivity analysis table. We include initial rent capture in the systematic sensitivity analysis, with the rent capture parameter allowed to take values between zero and one with a uniform pdf.

The results for preferential reduction of barriers with African partners on welfare, output and labor are shown in figures 6-8 and similar figures for the preferential trade agreement with

the EU in figures 9-11. The welfare results for preferential reduction of barriers in services with the Africa region, depicted in figure 6, are rather robust and somewhat skewed toward larger gains. A 95 percent confidence interval for equivalent variation as a percent of consumption is: .031 to .241 around a sample mean of .097. There is a negative value for equivalent variation in only two of the simulations.

The welfare results for a free trade agreement with the EU that includes services are depicted in figure 9. A 95 percent confidence interval for equivalent variation as a percent of consumption is: .217 to .877 around a sample mean of .399. There are no simulations with negative estimated welfare changes.

In figures 7 and 10, we show “box and whisker” diagrams for the sample distribution of the percentage change in output by sector. Sectors are on the horizontal axis and the percentage change in output is shown on the vertical axis. The bars in the box are the means of the distributions. Fifty percent confidence intervals are depicted by the boxes, while the vertical lines show 95 percent confidence intervals.

The means of the systematic sensitivity results show a similar pattern to the point estimates regarding the expansion of the services sectors. While the confidence intervals are rather tight for most sectors, they reveal a large range of uncertainty for several sectors. With respect to the EU agreement, while the sign of the direction of change does not change within the 95 percent confidence interval, the confidence intervals of expected output change are large for tourism, water transportation, cashew nuts. The sign does change, however, for the output effect on the coffee sector, suggesting considerable uncertainty for this result. Regarding negative output impacts, results appear rather robust within a 95 percent confidence interval. For the Africa agreement, most sectors have tight confidence intervals, but the insurance, water transportation and coffee sectors have a large range of uncertainty (including some sign changes on the direction of the impact), so the sensitivity analysis reveals that we can not a great deal of confidence in the sign of the impacts for these three sectors.

X. Results for Preferential Reduction of Barriers in Professional Services Liberalization

In these scenarios we consider the impact of a preferential reduction in barriers in professional services, but assume that there is no reduction of barriers in other services sectors. We execute the same policy scenarios that we executed in the earlier section, where all services barriers are reduced on a preferential basis. The results are shown in tables 24-27. In table 24, we assume no initial rent capture, but in table 25, we assume initial rent capture.

We find that preferential liberalization of professional services with respect to its African regional partners would be slightly beneficial for Tanzania in our central elasticity case with no initial rent capture, but virtually valueless with initial rent capture. But if preferential liberalization with the Africa region is combined with an agreement with the EU, the gains (in the no initial rent capture case) would increase five times. If the liberalization of professional services commitments is extended to all foreign partners (called “unilateral” in the tables), the gains would increase by eleven times. Thus, these results suggest that preferential liberalization in the region may be a useful, but wider liberalization, with larger partners or multilaterally will yield much larger gains.

Finally, we estimate that a serious effort to reduce non-discriminatory regulatory barriers (that is, barriers that raise the costs of Tanzanians as well as foreign professional services providers in Tanzania) would double the benefits of multilateral liberalization in Tanzania. That is, regulatory barriers that are non-discriminatory appear to be at least as costly to Tanzania as discriminatory barriers.

As we mentioned in section V, we used engineering services as a proxy for all services when we estimated the barriers and calculated the market shares of different regions. Experts in this field in East Africa have suggested that engineering services are likely less constrained than some other services, notably legal services. This would imply that the ad valorem equivalents of the barriers would be higher if averaged with the other more protected sectors, and the gains from non-discriminatory liberalization would be higher. In some other sectors, like accounting, there is a much greater foreign presence. With higher barriers, discriminatory liberalization with the Africa region in accounting could displace a larger number of varieties in a sector like accounting and increase trade diversion.

XI. Conclusions

In this paper we have developed an innovative small open economy computable general equilibrium model of the Tanzanian economy that is capable of assessing the impact of the preferential liberalization of barriers against multinational service providers. We have provided a discussion of the welfare economics of services liberalization, in which we argue that it is likely that the gains from preferential reduction of barriers against multinational services will be larger if the partner region is large. We find that Tanzania would obtain small gains from a preferential reduction of barriers in services with the Africa region in our central elasticity case. Gains from a free trade agreement with the EU that includes a preferential 50 percent reduction in the ad valorem equivalents of the barriers in the services sectors will produce significant gains for Tanzania, deriving primarily from services commitments. Gains from liberalization with the EU region are considerably larger because of the larger amount of technology diffusion associated with trade and FDI with large industrialized countries, captured in our model as a relatively large increase in the number of varieties. In addition, when rents are captured initially, the terms of trade loss on partner services and the lost rents on services from the Rest of the World are larger when partners have low supply elasticities. We have conducted extensive sensitivity analysis to determine confidence intervals for the results and found that there is a set of values for key parameters that lead to estimated losses for preferential liberalization of services with the Africa region.

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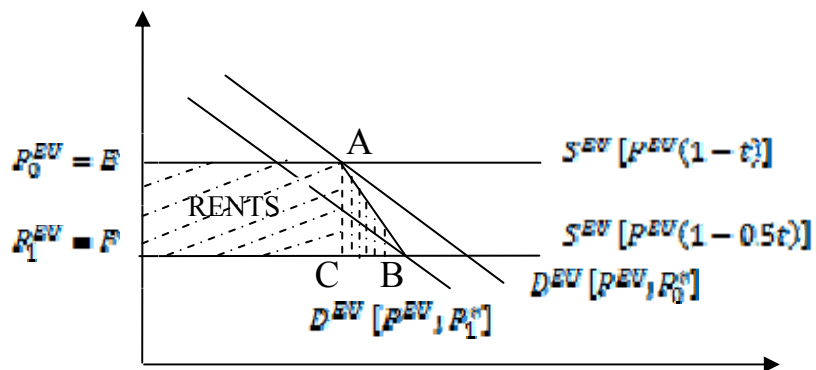
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Figure 1: Tanzanian Preferential Liberalization in Services with the EU:

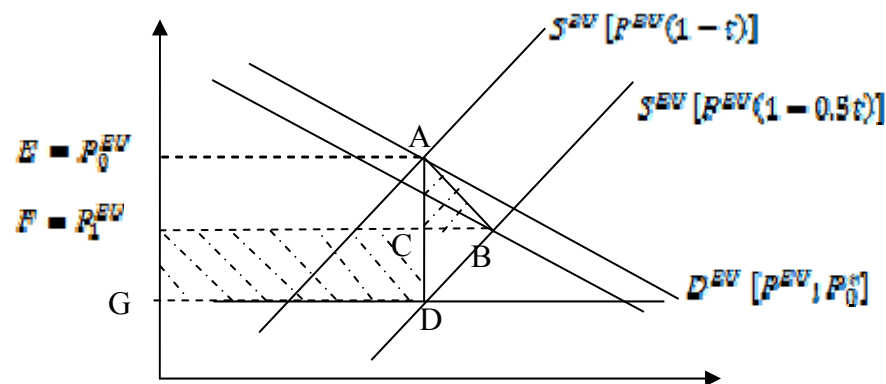
Part A: Partial equilibrium welfare effects in the market for EU services in Tanzania

Case I: Perfectly Elastic EU Supply



The supply curve of the EU shifts down due to the 50% reduction in barriers against the EU. The demand curve for EU services also shifts down as the vector of prices of EU substitutes declines in equilibrium. Initial equilibrium is at A and moves to B. The change in consumers' surplus (ΔCS), RENTS and welfare (ΔW) are: $\Delta CS = EABF$; $\Delta RENTS = EACF$. Then $\Delta W = ABC > 0$ with initial rent capture by Tanzania. $\Delta W = ABC + EACF = \Delta CS > 0$ with no initial rent capture initially.

Case II: EU has upward sloping supply

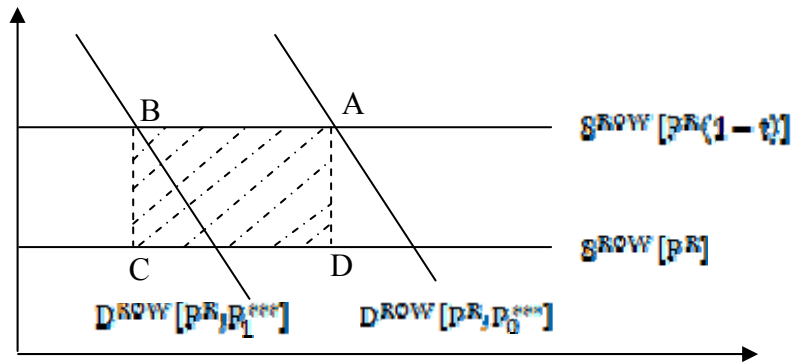


The supply curve of the EU shifts down due to the 50% reduction in barriers against the EU. The demand curve for EU services also shifts down as the vector of prices of EU substitutes declines in equilibrium. Initial equilibrium is at A and moves to B. The change in consumers' surplus $\Delta CS = EABF > 0$, $\Delta RENTS = -EADG < 0$, change in the Terms of Trade $\Delta TOT = -FCDG < 0$. The change in welfare $\Delta W = \Delta CS > 0$ with no initial rent capture, $\Delta W = ABC - FCDG$ with initial rent capture.

Figure 2: Tanzanian Preferential Liberalization in Services with the EU:

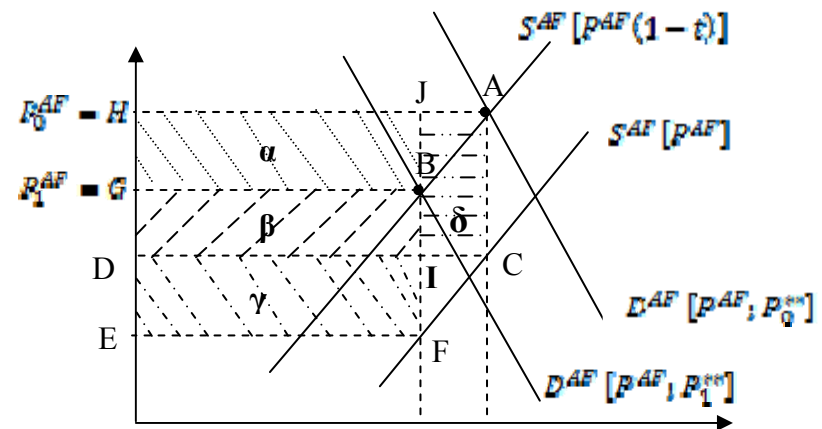
Part B: Partial equilibrium welfare effects in the markets for African and Rest of the World services in Tanzania

Rest of World Market: Welfare Effects



Demand for rest of world services declines due to preferential agreement. Equilibrium for ROW moves from A to B. RENTS decline by ABCD. If RENTS are initially captured the change in welfare is $-ABCD < 0$. If RENTS are not captured initially, there is no welfare change in this market.

Africa Market: Welfare Effects

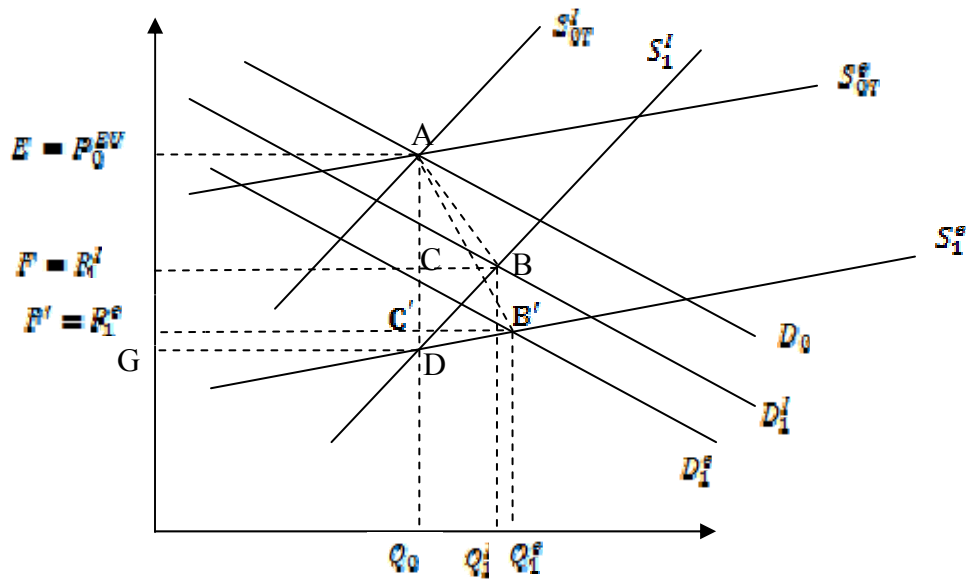


Initial equilibrium is at A and the price of EU and other substitutes decrease from the vector P_0^* to P_1^* . RENTS initially are $HACD = t P_0^{AF} \cdot Q_0 = \alpha + \beta + \delta$. RENTS at the new equilibrium are $GBFE = t P_1^{AF} \cdot Q_1 = \beta + \gamma$. The change in RENTS = $t [P_1^{AF} Q_1 - P_0^{AF} Q_0] < 0$. If the supply curves are parallel, the change in rents = $-\delta$. There is a Terms of Trade gain equal to the shaded area α . With no initial rent capture, the change in welfare is $\alpha > 0$. If rents are captured initially by Tanzanians, the welfare change is $\alpha - \delta$.

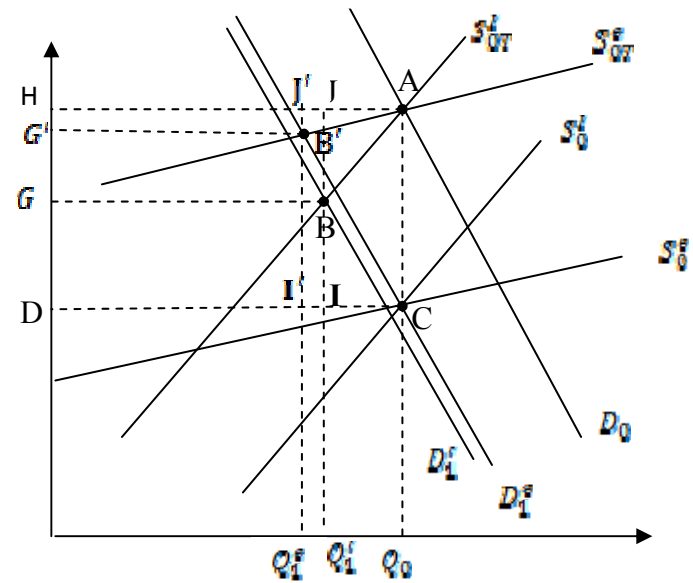
Figure 3: Partial Equilibrium Impacts of Supply Elasticities on Welfare Changes from Preferential Liberalization of Services:

High supply elasticities of partners increase likely gains, but excluding countries with high supply elasticities increase likely losses.

**Case I: Welfare Gains in Market for Partner Country
Services Increase with the Supply Elasticity**



**Case II: Welfare Losses in the Market for Excluded Country
Services Increase with the Supply Elasticity**

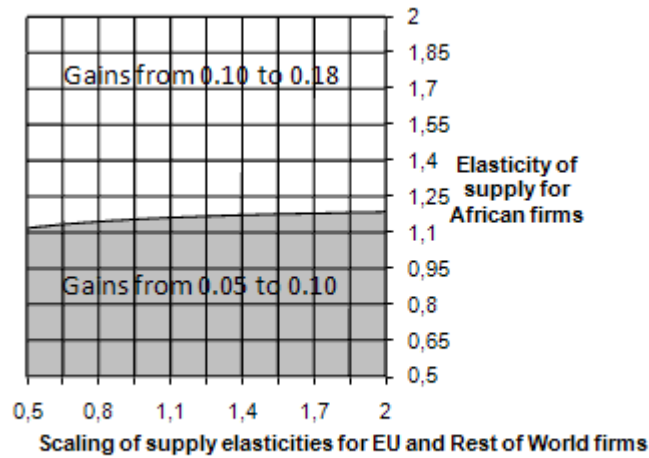


Both the less elastic (S_0^l) and more elastic (S_0^e) tax ridden supply curves must pass through the initial equilibrium at point A; and to be consistent with the estimated ad valorem barrier, the undistorted less elastic (S_1^l) and undistorted more elastic (S_1^e) supply curves must both pass through the point D. After liberalization, with a larger elasticity, the new equilibrium shifts to B', and shifts to B with a lower supply elasticity. With initial rent capture, the difference in the welfare between the high elastic and low elasticity cases is: $[\Delta W^e - \Delta W^l] = [AB'C' - F'C'DG] - [ABC - FCDG] = [AB'C' - ABC] + [FCDG - F'C'DG]$. Clearly, $FCDG > F'C'DG$, so the second term is positive; but this term vanishes with no initial rent capture. Since the price falls to F', the height of the triangle AB'C' exceeds the height of triangle ABC. Although ambiguous, we expect $Q_1^e > Q_1^l$ (see text). Then $AB'C' > ABC$ and $[\Delta W^e - \Delta W^l] > 0$.

The initial equilibrium is at point A and moves to B' with higher elasticity, and shifts to B with lower supply elasticity. With a high supply elasticity, the price falls by less, to G' rather than to G. We assume that first order effect on quantity dominates so that $Q_1^e < Q_1^l$ (see text). With initial rent capture, the welfare change is $\Delta W^e = HJ'B'G' - J'I'CA$ in the high elasticity case and is $\Delta W^l = HJBG - JICA$ in the lesser elasticity case; the second terms vanish with no initial rent capture. The difference in the welfare between the high elastic and low elasticity cases is $[\Delta W^e - \Delta W^l] = [HJ'B'G' - J'I'CA] - [HJBG - JICA] = [HJ'B'G' - HJBG] + [JICA - J'I'CA]$. The first term is the difference in the terms of trade gains and is negative. The second term is the lost rents and is also negative in the case of initial rent capture and is zero otherwise.

Figure 4: Impact of Partner and Excluded Countries Supply Elasticities on Welfare Changes from Tanzanian Preferential Liberalization of Services with African Partners: with and without Rent Capture

Case I: No initial rent capture by Tanzania



Case II: Initial rent capture by Tanzania

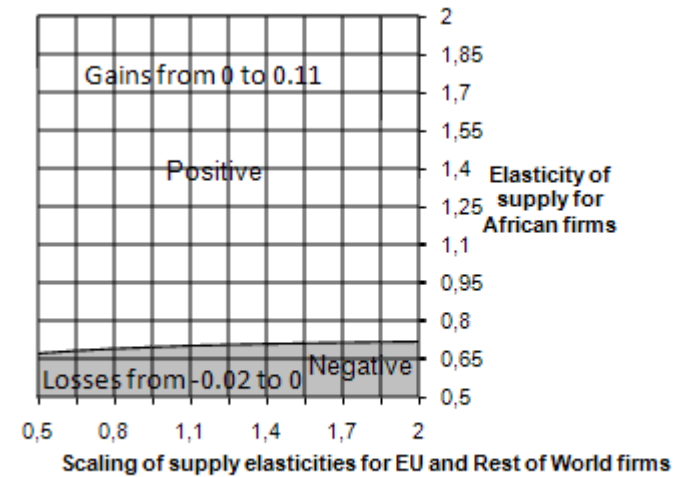
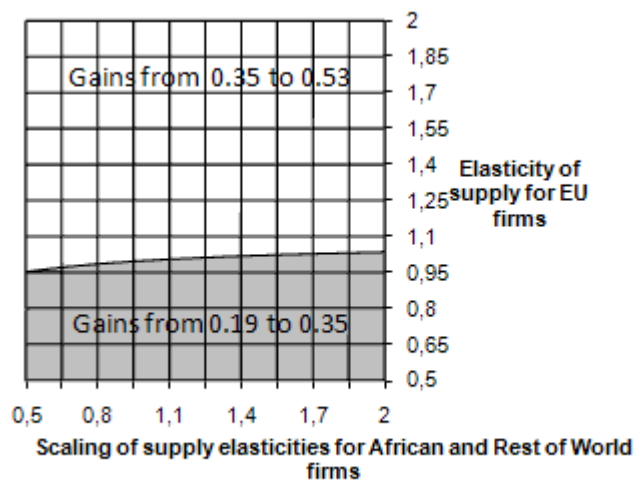
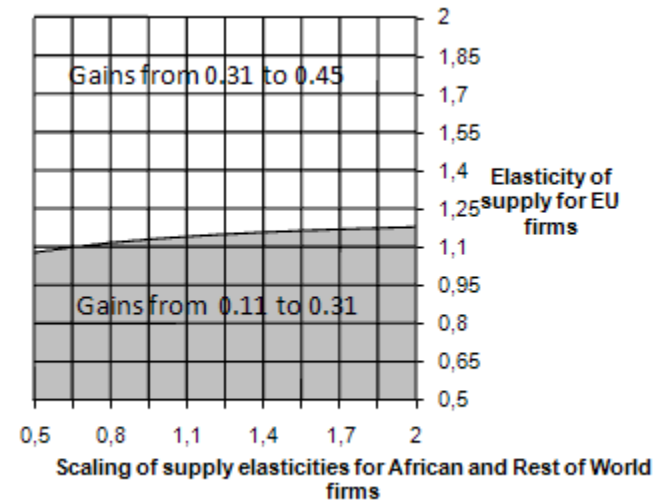


Figure 5: Impact of Partner and Excluded Countries Supply Elasticities on Welfare Changes from Tanzanian Preferential Liberalization of Services with the EU: with and without Rent Capture

Case I: No initial rent capture by Tanzania



Case II: Initial rent capture by Tanzania



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Figure 6: Sample Frequency Distribution of the Welfare Results of Tanzanian Preferential Reduction of Services Barriers Against African Partners—30,000 simulations.

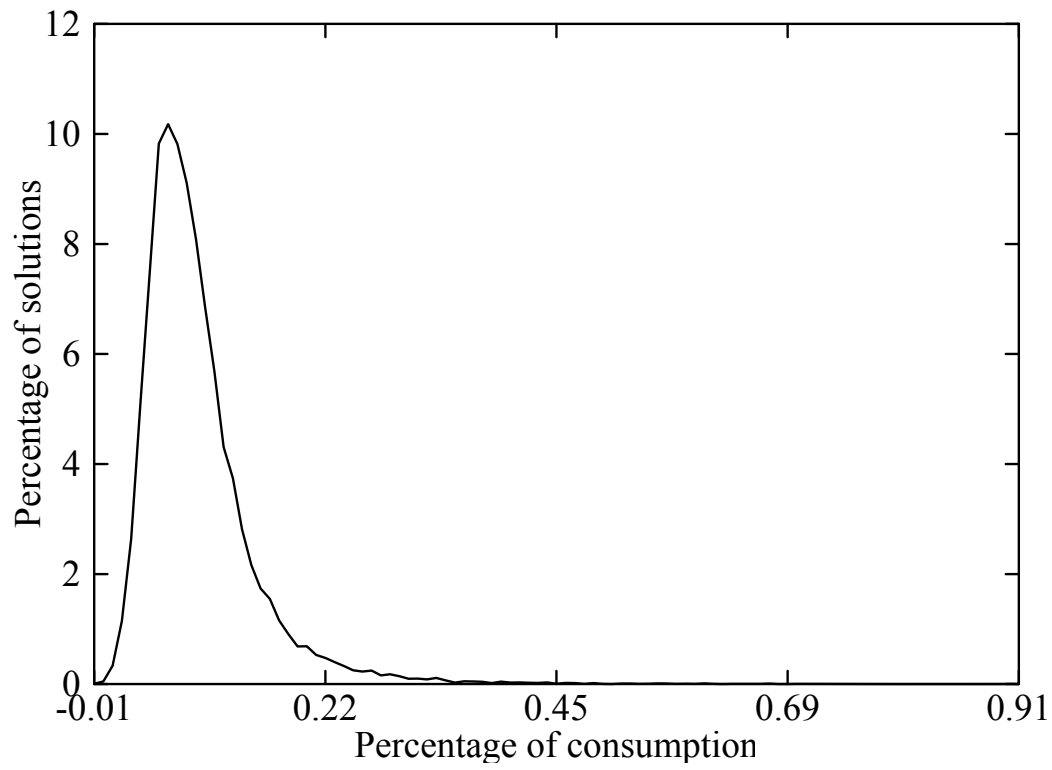
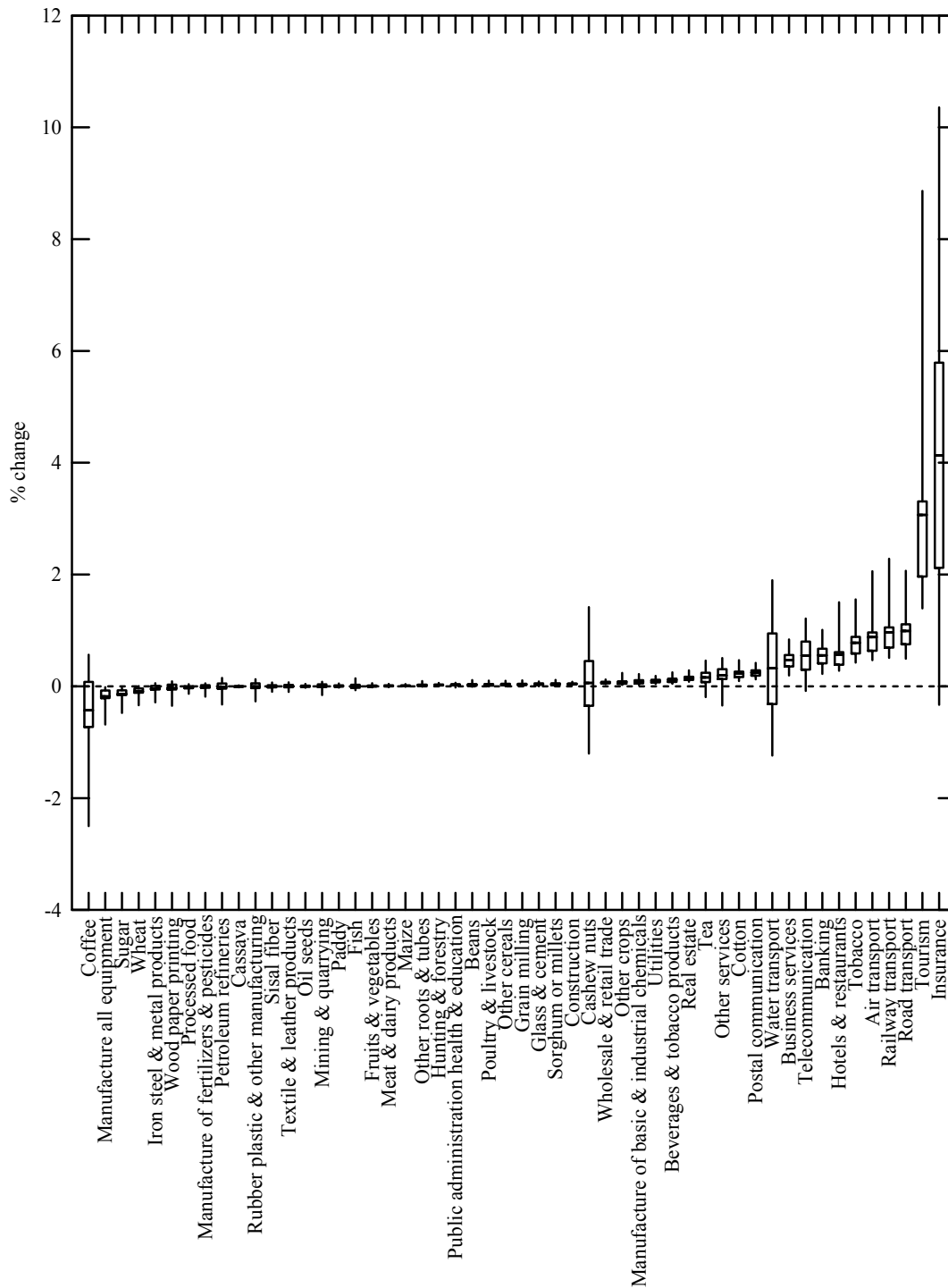
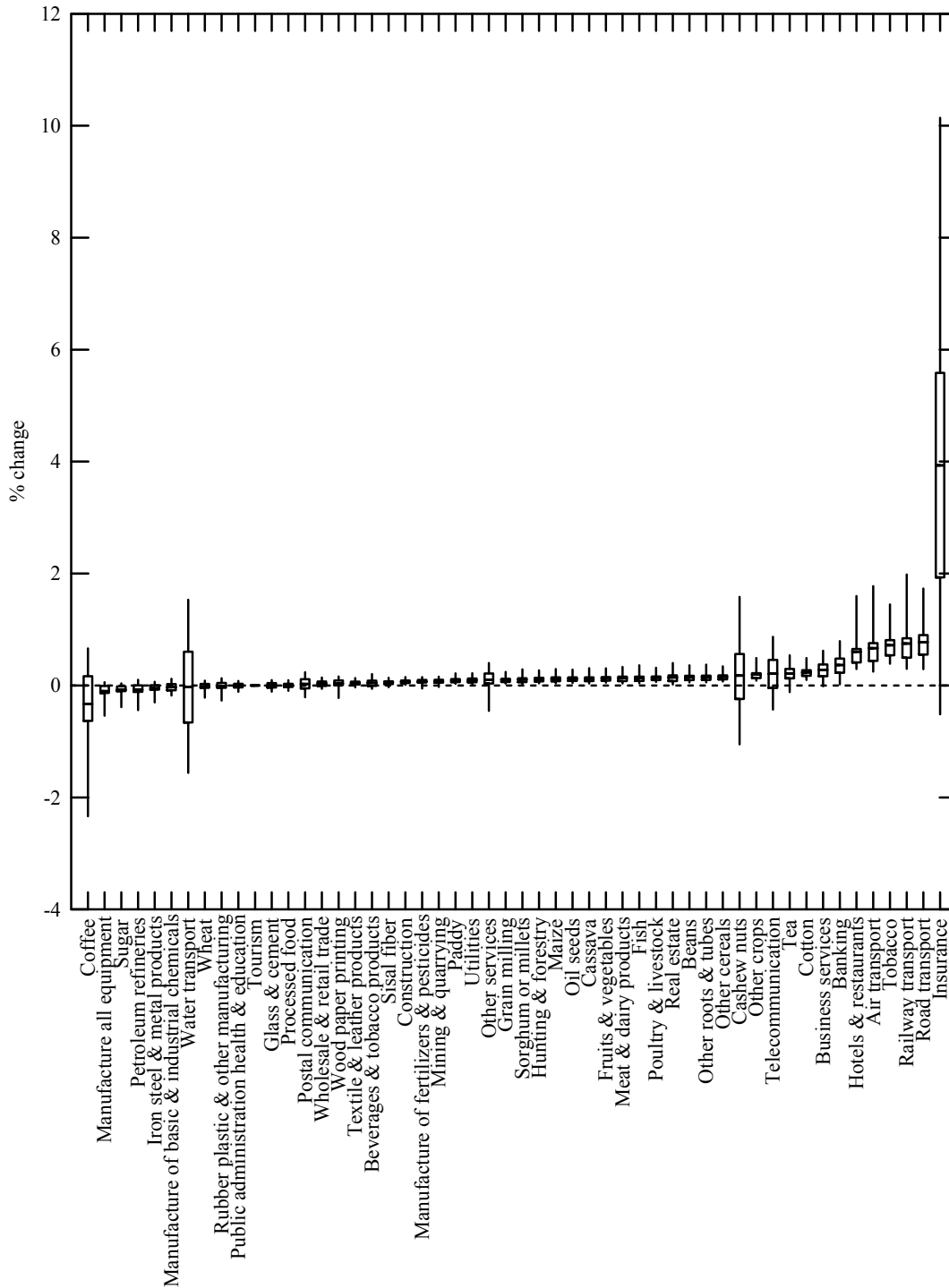


Figure 7: Means, 50 and 95 Percent Confidence Intervals of the Sample Frequency Distributions of the Output Changes by Sector from Tanzanian Preferential Reduction of Services Barriers Against African Partners—30,000 simulations.



Note: The boxes are limited vertically by the 25% and 75% quartiles. The bars in the box are the means. The vertical lines extend to the 2.5% and 97.5% percentiles.

Figure 8: Means, 50 and 95 Percent Confidence Intervals of the Sample Distributions of the Labor Payment Changes by Sector from Tanzanian Preferential Reduction of Services Barriers Against African Partners—30,000 simulations.



Note: The boxes are limited vertically by the 25% and 75% quartiles. The bars in the box are the means. The vertical lines extend to the 2.5% and 97.5% percentiles.

Figure 9: Sample Frequency Distribution of the Welfare Results of Tanzanian Preferential Reduction of Services Barriers Against EU Partners—30,000 simulations.

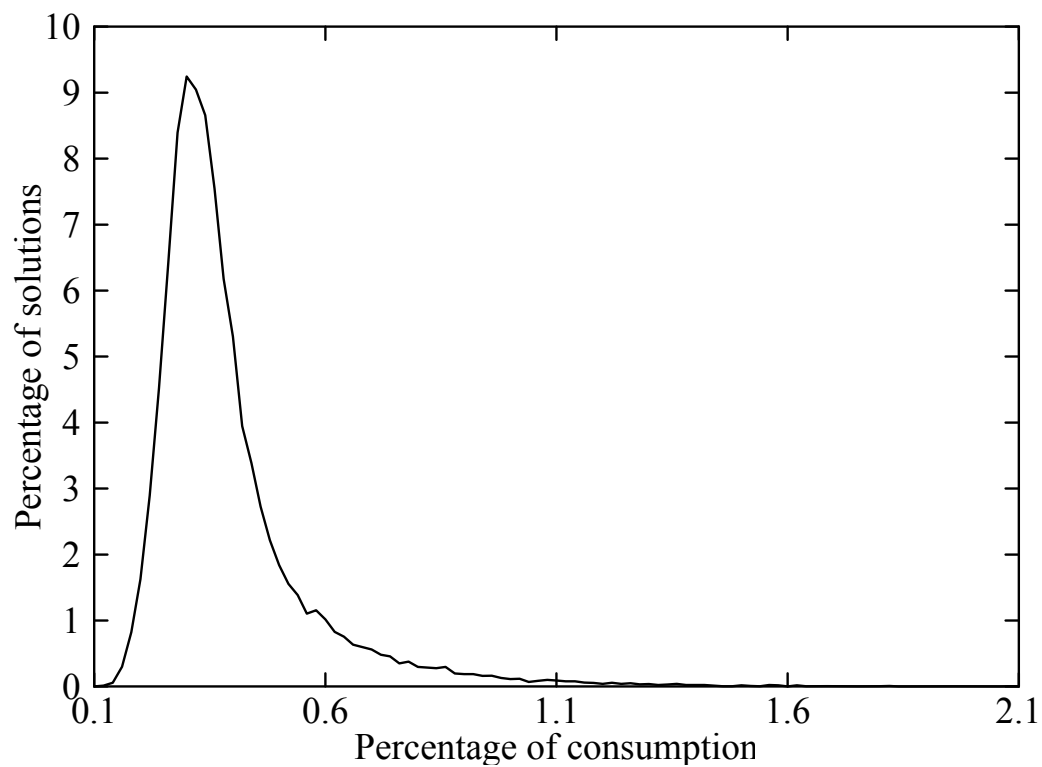
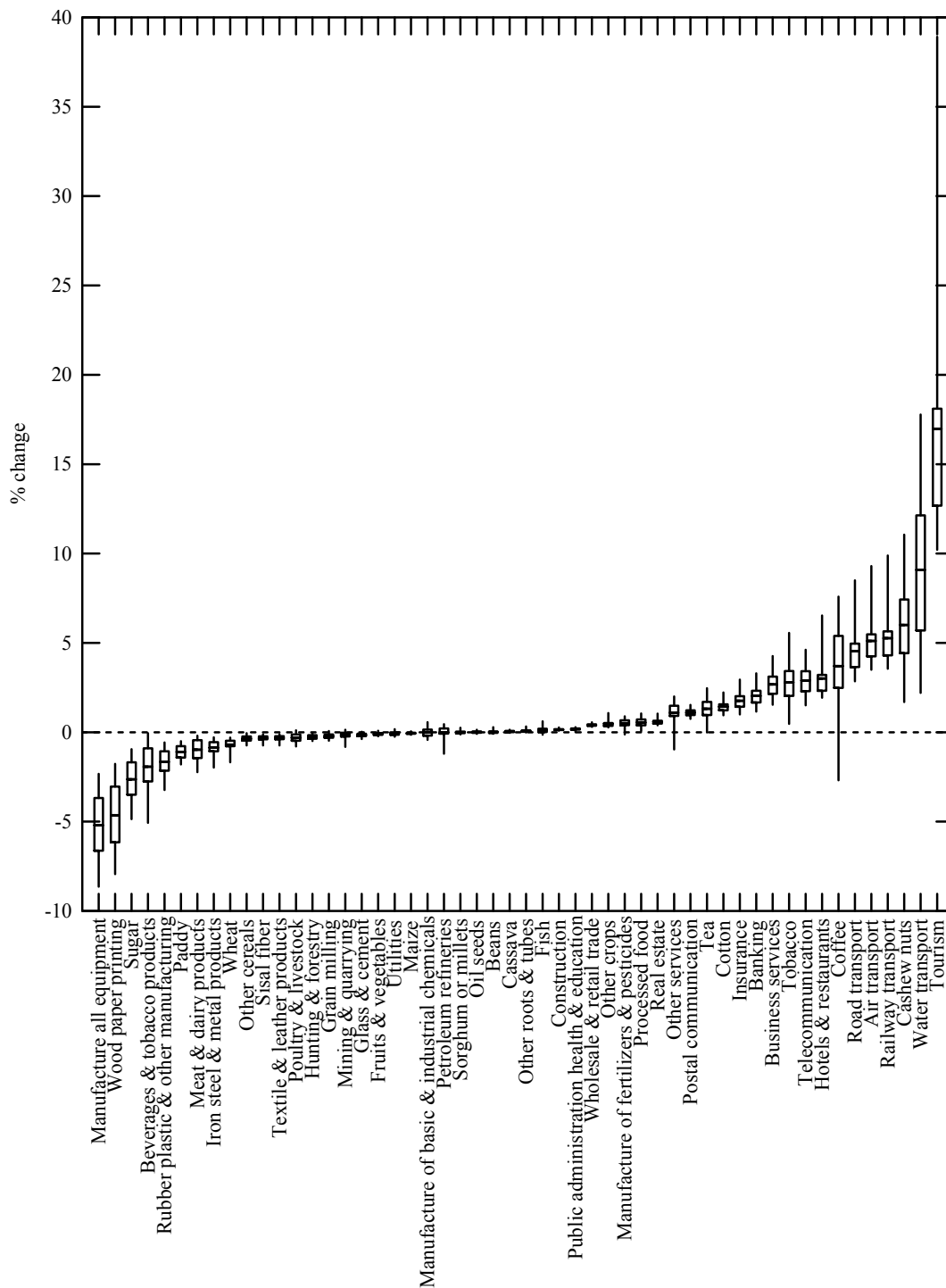
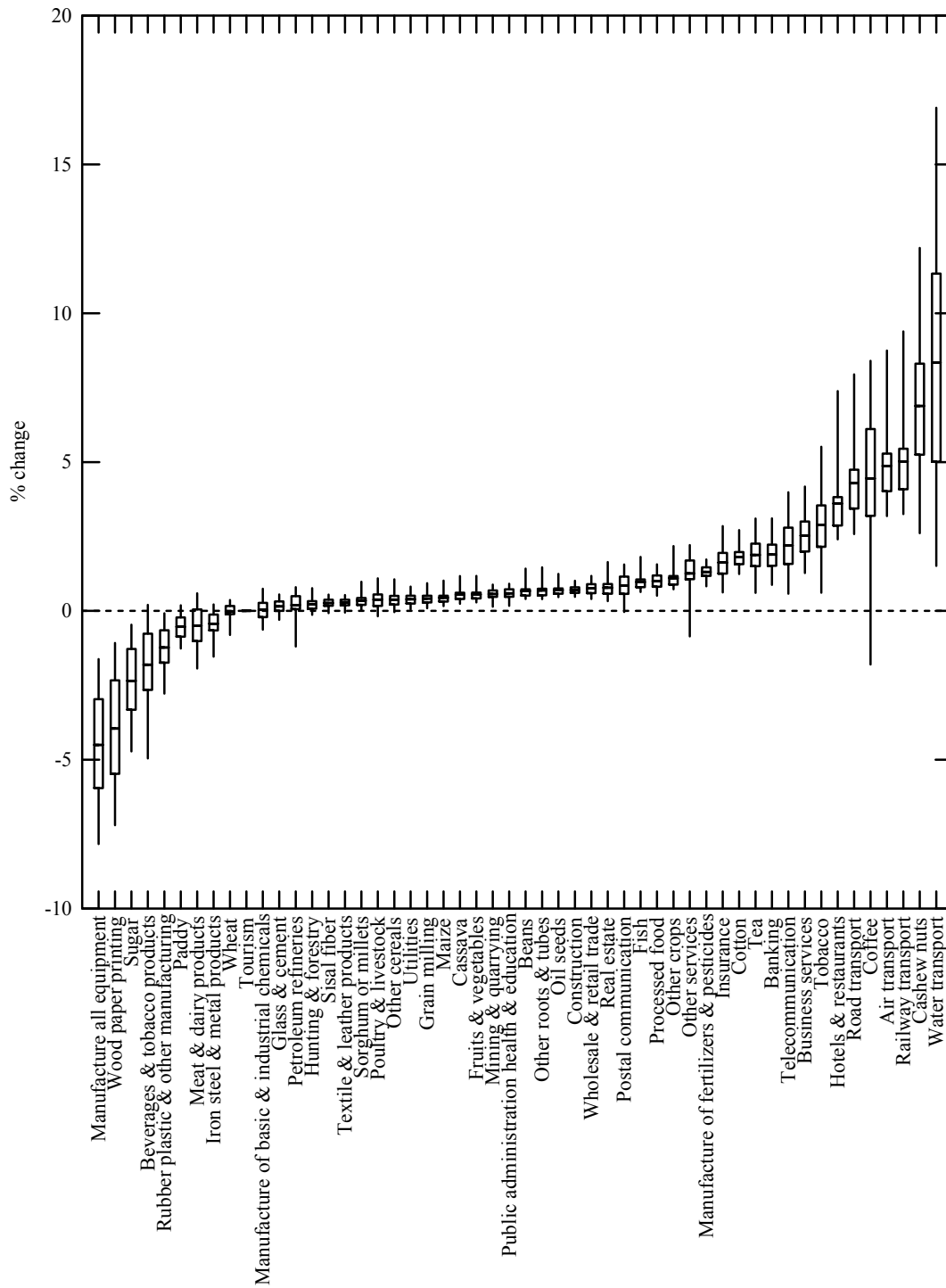


Figure 10: Means, 50 and 95 Percent Confidence Intervals of the Sample Distributions of the Output Changes by Sector from Tanzanian Preferential Reduction of Services Barriers Against EU Partners—30,000 simulations.



Note: The boxes are limited vertically by the 25% and 75% quartiles. The bars in the box are the means. The vertical lines extend to the 2.5% and 97.5% percentiles.

Figure 11: Means, 50 and 95 Percent Confidence Intervals of the Sample Distributions of the Labor Payment Changes by Sector from Tanzanian Preferential Reduction of Services Barriers Against EU Partners—30,000 simulations.



Note: The boxes are limited vertically by the 25% and 75% quartiles. The bars in the box are the means. The vertical lines extend to the 2.5% and 97.5% percentile.

Table 1 – List of Sectors, Factors and Regions in the Tanzania Model

Business Services	Agriculture
Telecommunication	Maize
Insurance	Paddy
Banking	Sorghum or millets
Professional business services	Wheat
Air transport	Beans
Road transport	Cassava
Railway transport	Other cereals
Water transport	Oil seeds
	Other roots & tubes
IRTS Goods	Cotton
Mining & quarrying	Coffee
Grain milling	Tobacco
Processed food	Tea
Beverages & tobacco products	Cashew nuts
Textile & leather products	Sisal fiber
Manufacture of basic & industrial chemicals	Sugar
Manufacture of fertilizers & pesticides	Fruits & vegetables
Petroleum refineries	Other crops
Glass & cement	Poultry & livestock
Iron steel & metal products	
	Other CRTS
Factors of Production	Fish
Child (age 10 to 14)	Hunting & forestry
Female (no formal education)	Meat & dairy products
Female (not finished primary school)	Wood paper printing
Female (not finished secondary school)	Rubber plastic & other manufacturing
Female (secondary or higher education)	Manufacture of equipment
Male (no formal education)	Utilities
Male (not finished primary school)	Construction
Male (not finished secondary school)	Wholesale & retail trade
Male (secondary or higher education)	Hotels & restaurants
Subsistence	Postal communication
Agricultural capital	Real estate
Capital	Other services
Land	Public administration health & education
	Tourism
Regions	
Tanzania	
EU: The 27 member countries of the European Union	
Africa: SADC (Southern African Development Community) & East African Community (EAC)	
EAC: Kenya, Uganda, Rwanda, Burundi	
SADC: Angola, Botswana, Congo, Lesotho, Madagascar, Malawi, Mauritius, Mozambique, Namibia, Seychelles, South Africa, Swaziland, Zambia and Zimbabwe	
Rest of the World: All other countries not included elsewhere	

Table 2 -- Sectoral value-added (% , unless otherwise indicated)

	Labor									Subsistence	Agricultural capital	Capital	Land	GDP	
	Child (age 10 to 14)	Female (no formal education)	Female (not finished primary school)	Female (not finished secondary school)	Female (secondary or higher education)	Male (no formal education)	Male (not finished primary school)	Male (not finished secondary school)	Male (secondary or higher education)					bnTZS	% of total
Business Services															
Telecommunication				1.5	2.7	0.2	0.7	10.1	14.4			70.4		56.5	0.7
Insurance	0.1	0.1	0.5	3.9	3.4	0.4	2.4	12.7	8.4			68.2		4.9	0.1
Banking	0.1	0.1	0.5	3.9	3.4	0.4	2.4	12.7	8.4			68.2		88.3	1.2
Professional business services	0.1	0.1	0.5	3.9	3.4	0.4	2.4	12.7	8.4			68.2		97.7	1.3
Air transport				0.8	1.5	0.1	0.4	5.8	8.2			83.1		20.9	0.3
Road transport				0.8	1.5	0.1	0.4	5.8	8.2			83.1		136.6	1.8
Railway transport				0.8	1.5	0.1	0.4	5.8	8.2			83.1		7.0	0.1
Water transport				1.5	2.7	0.2	0.7	10.1	14.4			70.4		30.6	0.4
Dixit-Stiglitz Goods															
Mining & quarrying	0.1	0.1	0.0	0.0	0.1		0.1	1.3	0.1			98.3		114.8	1.5
Grain milling	0.3	0.5	3.5	24.8		1.6	2.2	34.3	7.3			25.5		51.9	0.7
Processed food		0.2	0.1	0.7	4.0	0.3	0.5	4.8	3.1	16.4		69.9		151.7	2.0
Beverages & tobacco products				0.1	0.4		0.0	1.1	15.4	13.3		69.7		65.4	0.9
Textile & leather products	0.2	0.8	0.8	14.2	4.7	0.4	4.0	21.4	5.1			48.5		232.4	3.1
Manufacture of basic & industrial chemicals								78.1				21.9		16.9	0.2
Manufacture of fertilizers & pesticides								70.4				29.6		3.0	0.0
Petroleum refineries								24.5	2.9			72.6		13.6	0.2
Glass & cement		0.1	0.0	0.0		0.2	0.3	17.7	3.3			78.3		31.5	0.4
Iron steel & metal products					0.5	1.2	3.0	10.4	7.9			77.0		41.8	0.6

Table 2 (continued) -- Sectoral value-added (% , unless otherwise indicated)

	Labor									Subsistence	Agricultural capital	Capital	Land	GDP	
	Child (age 10 to 14)	Female (no formal education)	Female (not finished primary school)	Female (not finished secondary school)	Female (secondary or higher education)	Male (no formal education)	Male (not finished primary school)	Male (not finished secondary school)	Male (secondary or higher education)					bnTZS	% of total
Agriculture															
Maize	0.2	1.8	1.2	7.9	0.0	0.8	2.2	2.5	0.2	68.2	10.5	4.5	750.2	9.9	
Paddy	0.2	1.9	2.1	18.7	0.1	1.1	6.3	8.4	0.7	23.1	26.3	11.2	283.5	3.7	
Sorghum or millets	0.4	3.9	0.6	5.1		1.8	2.0	2.9	0.1	66.4	11.7	5.0	100.1	1.3	
Wheat								47.3		5.4	33.1	14.1	17.5	0.2	
Beans		3.8	2.5	20.3	0.1	1.0	4.0	3.3	0.2	30.4	24.1	10.3	178.4	2.4	
Cassava	0.1	1.1	0.6	3.4	0.0	0.6	2.0	1.6	0.2	81.2	6.5	2.8	152.0	2.0	
Other cereals	0.5	5.5	2.3	19.3	0.1	2.7	6.3	6.9	0.4	12.2	30.7	13.1	25.7	0.3	
Oil seeds	0.6	3.3	1.6	16.9		2.3	6.6	5.0	0.2	26.9	25.9	10.8	114.1	1.5	
Other roots & tubers	0.8	1.6	1.3	11.9			4.2	3.6	0.2	53.2	16.2	6.9	122.7	1.6	
Cotton	4.4	0.9	2.7	10.4		2.5	9.7	11.9	0.1		44.6	12.7	56.1	0.7	
Coffee		1.6	0.9	11.5		1.7	6.7	11.5	0.5	6.3	49.0	10.2	76.9	1.0	
Tobacco		2.3	1.8	12.0	0.2	2.7	8.4	11.3	1.8		47.5	12.0	50.5	0.7	
Tea							39.2			1.2	47.8	11.7	26.2	0.3	
Cashew nuts	0.8	2.5	0.5	8.3		4.4	9.8	13.7			48.2	11.9	98.2	1.3	
Sisal fiber		5.4				13.7	11.1	16.7	3.1		35.0	15.0	7.1	0.1	
Sugar			26.8				22.3			1.5	35.3	14.2	123.1	1.6	
Fruits & vegetables	0.7	1.2	1.0	16.2	0.3	1.7	3.7	5.2	0.4	40.1	21.0	8.5	504.5	6.7	
Other crops	1.1	1.0		11.8	0.1	3.5	6.9	2.8	0.2	43.7	20.7	8.2	61.4	0.8	
Poultry & livestock	3.9	2.4	1.0	17.6	0.8	3.5	5.4	5.8	0.7	18.4	28.4	11.9	250.1	3.3	
Other CRTS															
Fish		1.9		3.2		6.5	14.9	18.6		6.0	35.6	13.3	316.5	4.2	
Hunting & forestry				11.1		1.1		7.5	0.8	59.4	14.1	5.9	279.8	3.7	
Meat & dairy products				0.1	0.2	0.0	0.2	0.5	0.0	87.2	11.8		176.3	2.3	
Wood paper printing	0.0	0.0		0.3	0.5	1.4	1.0	15.7	3.8		77.2		72.9	1.0	
Rubber plastic & other manufacturing				4.1	2.1			0.3	11.0	3.8	78.7		17.7	0.2	
Manufacture of equipment				0.5	0.2			2.1	2.6	3.2	91.3		48.8	0.6	
Utilities				0.5	0.4	1.1	0.8	8.0	9.4		79.9		131.7	1.7	
Construction	0.2	0.1		0.3	0.7	1.4	7.4	46.7	11.1		32.2		340.8	4.5	
Wholesale & retail	0.0	0.1	0.2	1.3	0.4	0.2	0.5	3.0	2.2		92.2		792.2	10.5	
Hotels & restaurants	0.0	0.9	1.3	6.6	0.6	0.0	0.2	5.1	2.3		82.9		271.4	3.6	
Postal communication				1.5	2.7	0.2	0.7	10.1	14.4		70.4		4.0	0.1	
Real estate				0.0	0.6		0.0	0.7	4.2	82.4	12.0		452.1	6.0	
Other services	0.1	0.1	0.5	3.9	3.4	0.4	2.4	12.7	8.4		68.2		36.1	0.5	
Public administration health & social work		0.1	0.4	8.9	23.3	0.2	1.4	14.8	46.8		4.2		460.3	6.1	

Table 3 -- Trade Flows

	Imports			Exports		
	bnIZS	% of total	% of consumption	bnIZS	% of total	% of output
IRTS Goods and Services						
Business Services						
Telecommunication	32.3	1.6	21.2	12.1	1.0	9.1
Insurance	2.1	0.1	26.7	3.1	0.2	35.4
Banking	36.8	1.8	26.7	55.3	4.4	35.4
Professional business services	40.7	2.0	26.7	61.2	4.8	35.4
Air transport	6.8	0.3	16.6	2.5	0.2	6.9
Road transport	44.6	2.2	16.6	16.6	1.3	6.9
Railway transport	2.3	0.1	16.6	0.8	0.1	6.9
Water transport	17.5	0.9	21.2	6.5	0.5	9.1
Dixit-Stiglitz Goods						
Mining & quarrying	14.7	0.7	11.3	18.9	1.5	14.3
Grain milling	15.2	0.8	2.4	6.5	0.5	1.0
Processed food	75.7	3.8	16.3	6.8	0.5	1.6
Beverages & tobacco products	15.5	0.8	9.2	1.1	0.1	0.7
Textile & leather products	73.0	3.6	17.6	16.3	1.3	3.9
Manufacture of basic & industrial chemicals	114.6	5.7	63.4	3.1	0.2	4.7
Manufacture of fertilizers & pesticides	12.4	0.6	51.2	0.1	0.0	0.5
Petroleum refineries	240.3	11.9	86.4	0.1	0.0	0.4
Glass & cement	6.9	0.3	7.7	6.5	0.5	7.2
Iron steel & metal products	128.5	6.4	49.1	1.0	0.1	0.8
Agriculture						
Maize	16.7	0.8	3.7	1.0	0.1	0.2
Paddy	20.5	1.0	6.5	2.4	0.2	0.7
Sorghum or millets	0.0	0.0	0.0	0.1	0.0	0.1
Wheat	18.9	0.9	42.4	0.0	0.0	0.2
Beans	0.0	0.0	0.0	1.0	0.1	0.6
Cassava	0.0	0.0	0.0	0.0	0.0	0.0
Other cereals	0.0	0.0	0.0	0.1	0.0	0.4
Oil seeds	0.3	0.0	0.3	4.0	0.3	4.2
Other roots & tubers	0.0	0.0	0.0	0.0	0.0	0.0
Cotton	0.0	0.0	0.0	36.7	2.9	35.1
Coffee	0.0	0.0	0.0	83.8	6.6	81.3
Tobacco	0.1	0.0	0.4	42.5	3.4	50.4
Tea	0.2	0.0	1.0	23.3	1.8	53.0
Cashew nuts	0.0	0.0	0.0	87.2	6.9	81.3
Sisal fiber						
Sugar	49.9	2.5	27.5	12.0	0.9	7.4
Fruits & vegetables	7.6	0.4	2.2	24.3	1.9	6.9
Other crops	0.1	0.0	0.3	4.2	0.3	10.4
Poultry & livestock	3.2	0.2	1.3	6.1	0.5	2.5
Other CRTS						
Fish	0.1	0.0	0.1	62.1	4.9	18.4
Hunting & forestry	0.6	0.0	0.3	5.2	0.4	3.1
Meat & dairy products	3.5	0.2	1.7	0.6	0.0	0.2
Wood paper printing	67.4	3.3	33.0	5.4	0.4	3.7
Rubber plastic & other manufacturing	64.2	3.2	54.4	1.3	0.1	2.3
Manufacture of equipment	555.8	27.6	82.3	7.6	0.6	6.5
Utilities						
Construction	2.4	0.1	0.3			
Wholesale & retail trade						
Hotels & restaurants						
Postal communication	2.3	0.1	21.2	0.9	0.1	9.1
Real estate						
Other services	15.0	0.7	26.7	22.6	1.8	35.4
Tourism	286.8	14.3	100.0	539.1	42.7	100.0
Public administration health & education	17.4	0.9	1.1	71.3	5.6	4.5

Table 4 – Trade Flows by Trading Partner (%)

	Imports			Exports		
	European Union	Africa	Rest of the World	European Union	Africa	Rest of the World
Business Services						
Telecommunication	32	39	29	32	39	29
Insurance	2	98	0	2	98	0
Banking	26	13	61	26	13	61
Professional business services	35	19	46	35	19	46
Air transport	43	14	43	43	14	43
Road transport	10	70	20	10	70	20
Railway transport	0	0	100	0	0	100
Water transport	45	27	27	45	27	27
Dixit-Stiglitz Goods						
Mining & quarrying	10	39	50	0	12	88
Grain milling	78	8	14	0	96	3
Processed food	7	2	91	2	61	36
Beverages & tobacco products	51	36	13	5	88	7
Textile & leather products	3	7	90	13	50	37
Manufacture of basic & industrial chemicals	29	15	56	2	78	20
Manufacture of fertilizers & pesticides	33	15	52	0	100	0
Petroleum refineries	0	9	90	1	90	9
Glass & cement	14	13	73	22	44	34
Iron steel & metal products	10	38	52	18	47	34
Agriculture						
Maize	0	75	25	0	46	54
Paddy	13	2	85	0	65	35
Sorghum or millets	0	97	3	6	41	53
Wheat	0	0	100	0	65	35
Beans	53	47	0	79	1	21
Cassava	52	27	21	77	4	18
Other cereals	98	0	2	0	100	0
Oil seeds	13	80	7	3	3	94
Other roots & tubers	21	11	68	5	72	23
Cotton	1	0	99	9	4	87
Coffee	16	30	54	73	1	25
Tobacco	41	59	0	76	2	22
Tea	65	15	20	26	63	11
Cashew nuts	0	0	100	30	11	59
Sisal fiber	0	0	100	27	3	70
Sugar	7	21	72	90	9	1
Fruits & vegetables	26	18	56	6	3	90
Other crops	12	19	69	49	1	50
Poultry & livestock	41	58	1	12	21	67
Other CRTS						
Fish	11	7	82	65	8	28
Hunting & forestry	5	33	62	5	13	82
Meat & dairy products	20	50	30	0	23	76
Wood paper printing	24	34	42	2	64	34
Rubber plastic & other manufacturing	16	13	71	0	90	10
Manufacture of equipment	37	11	52	18	60	22
Utilities	0	0	100	0	0	100
Construction	0	0	100	0	0	100
Wholesale & retail trade	0	0	100	0	0	100
Hotels & restaurants	0	0	100	0	0	100
Postal communication	0	0	100	0	0	100
Real estate	0	0	100	0	0	100
Other services	0	0	100	0	0	100
Tourism	0	0	100	0	0	100
Public administration health & education	0	0	100	0	0	100

Source: Authors' calculations.

Table 5 -- Benchmark Distortions (%)

	Tariff	Sales Tax	Regulatory barriers	
			All firms	Foreign firms
Business Services				
Telecommunication			3.0	8.0
Insurance			18.0	36.0
Banking			37.0	25.0
Professional business services			5.5	10.9
Air transport			20.0	2.0
Road transport			30.0	5.0
Railway transport			40.0	
Water transport			86.0	39.0
Dixit-Stiglitz Goods				
Mining & quarrying	5.3	4.2		
Grain milling	9.3	0.4		
Processed food	8.5	7.1		
Beverages & tobacco products	33.3	11.4		
Textile & leather products	24.0	14.1		
Manufacture of basic & industrial chemicals	3.2	14.2		
Manufacture of fertilizers & pesticides		0.1		
Petroleum refineries	2.6	1.5		
Glass & cement	6.1	18.5		
Iron steel & metal products	6.6	2.8		
Agriculture				
Maize	0.8	0.1		
Paddy	20.8			
Sorghum or millets		0.0		
Wheat	8.7	0.9		
Beans	47.8	0.8		
Cassava	34.4	5.3		
Other cereals	8.8	2.0		
Oil seeds	5.5	0.2		
Other roots & tubers	0.6	5.0		
Cotton	1.2	2.0		
Coffee	16.8	27.8		
Tobacco	26.9	2.6		
Tea	22.2	28.0		
Cashew nuts	22.2	6.2		
Sisal fiber				
Sugar	28.2	1.8		
Fruits & vegetables	8.2	0.1		
Other crops	5.3	12.4		
Poultry & livestock	10.5	2.8		
Other CRTS				
Fish	24.3	2.5		
Hunting & forestry		3.6		
Meat & dairy products	54.3	13.0		
Wood paper printing	13.1	3.0		
Rubber plastic & other manufacturing	5.2	7.1		
Manufacture of equipment	5.3	0.0		

Note: Utilities, Construction, Wholesale and Retail Trade, Hotels and Restaurants, Postal Communication, Real Estate, Other Services. Public Administration and Health Care and Tourism have no distortions and are excluded from the table.

Source: Author's estimates. See Jensen, Rutherford and Tarr (2009) for details.

Table 6A – Market Shares in Services Sectors with FDI (%)

	Tanzania	European Union	Africa	Rest of the World
Business Services				
Telecommunication	31	22	27	20
Insurance	53	1	46	0
Banking	77	6	3	14
Professional business services	63	13	7	17
Air transport	30	30	10	30
Road transport	80	2	14	4
Railway transport	1	0	0	99
Water transport	45	25	15	15

Source: See Appendix

Table 6B: Estimates of elasticity of firms with respect to price for Tanzania by sector and by Tanzanian trading partner

	R&D intensity	Elasticity Estimates		
		R&D expenditures divided by sales (times 1000) for the US*		
		Africa	EU	ROW
SERVICES				
telecommunications	52-high	2.5	13.4	20
banking	4-low	3.3	3.3	10
insurance	4-low	3.3	3.3	10
professional services	116-high	2.5	13.4	20
air transport**	medium	1.9	10	15
road transport	low	3.3	3.3	10
rail transport**	medium	1.9	10	15
water transport**	medium	1.9	10	15
MANUFACTURING				
mining and quarrying	0-low	3.3	3.3	10
beverages and tobacco	14-low	3.3	3.3	10
grain milling***	7-low	3.3	3.3	10
processed food	7-low	3.3	3.3	10
textiles and apparel	13-low	3.3	3.3	10
petroleum refineries	2-low	3.3	3.3	10
chemicals	34-medium	1.9	10	15
fertilizers and pesticides***	34-medium	1.9	10	15
iron, steel and metal products	7-low	3.3	3.3	10
glass and cement	0-17-low	3.3	3.3	10

*Based on average R&D expenditures for the years 2004 and 2005. The average for all US industries was 36. See table E1 for details.

**We evaluate transportation as a medium R&D sector since three sectors dominate R&D expenditures of US multinationals operating abroad. These are transportation, chemicals and computers and electronics. Moreover, about two-thirds of all R&D expenditures of foreign multinationals operating in the US was performed in the same three sectors. See "U.S. and International Research and Development: Funds and Technology Linkages," at <http://www.nsf.gov/statistics/seind04/c4/c4s5.htm>.

***Food is the proxy for grain milling; chemicals is the proxy for fertilizers and pesticides; primary and fabricated metals are the proxies for iron, steel and metal products; for glass and cement we use an average of plastics, rubber, mineral and wood products.

SOURCE: R&D and sales data from National Science Foundation, Division of Science Resources Statistics, *Survey of Industrial Research and Development: 2005, Data Tables*. Available at: http://www.nsf.gov/statistics/nsf10319/content.cfm?pub_id=3750&id=3.

Table 7: Summary of Results, no initial rent capture case (results are percentage change from initial equilibrium, unless otherwise indicated)

Scenario definition	Benchmark	EU Discriminatory					EU-Africa		Unilateral Discriminatory	Unilateral	Unilateral &
		EU FTA	Services	EU Tariffs	Africa FTA	FTA	Unilateral	Services	Tariffs	Domestic	
50% reduction of discriminatory barriers on EU services firms	No	Yes	Yes	No	No	Yes	Yes	Yes	No	Yes	
50% reduction of discriminatory barriers on African services firm	No	No	No	No	Yes	Yes	Yes	Yes	No	Yes	
50% reduction of discriminatory barriers on ROW services firms	No	No	No	No	No	No	Yes	Yes	No	Yes	
50% reduction of regulatory barriers for all services firms	No	No	No	No	No	No	No	No	No	Yes	
Removal of tariffs on EU sourced goods	No	Yes	No	Yes	No	Yes	Yes	No	Yes	Yes	
Removal of tariffs on ROW sourced goods	No	No	No	No	No	No	Yes	No	Yes	Yes	
Aggregate welfare											
Welfare (EV as % of consumption)		0.35	0.30	0.05	0.10	0.44	1.71	0.72	0.96	6.98	
Welfare (EV as % of GDP)		0.32	0.27	0.04	0.09	0.40	1.55	0.65	0.86	6.31	
Government budget											
Tariff revenue (% of GDP)	1.3	0.9	1.3	0.9	1.3	0.9		1.3			
Tariff revenue		-24.9	0.7	-25.4	0.2	-24.7	-100.0	1.5	-100.0	-100.0	
Aggregate trade											
Real exchange rate		0.3	0.0	0.3	0.0	0.3	2.5	0.0	2.5	0.3	
Aggregate exports		6.3	0.5	5.8	0.8	7.2	44.9	1.9	41.8	77.5	
Factor Earnings											
Subsistence Factor		0.4	0.4	0.0	0.1	0.5	2.7	0.9	1.7	8.8	
Child labor (age 10 to 14)		0.8	0.3	0.5	0.1	0.9	3.9	0.8	3.1	8.6	
Female labor (no formal education)		0.8	0.3	0.6	0.1	1.0	5.6	0.7	4.8	10.7	
Female labor (not finished primary school)		-0.4	0.3	-0.7	0.1	-0.3	-6.9	0.6	-7.4	-5.8	
Female labor (not finished secondary school)		0.7	0.3	0.4	0.1	0.8	3.3	0.8	2.5	8.1	
Female labor (secondary or higher education)		0.8	0.3	0.5	0.0	0.8	1.8	0.5	1.3	3.6	
Male labor (no formal education)		1.0	0.2	0.7	0.1	1.1	6.8	0.6	6.1	11.0	
Male labor (not finished primary school)		0.7	0.2	0.4	0.1	0.8	3.1	0.6	2.5	6.0	
Male labor (not finished secondary school)		0.8	0.3	0.5	0.1	0.9	3.2	0.7	2.5	6.7	
Male labor (secondary or higher education)		0.8	0.3	0.4	0.0	0.8	3.2	0.6	2.5	6.2	
Capital		0.9	0.3	0.6	0.1	1.0	5.3	0.7	4.5	9.6	
Agricultural land		0.7	0.3	0.4	0.1	0.8	4.7	0.6	4.1	8.6	
Factor adjustments											
Subsistence Factor		0.1	0.0	0.1	0.0	0.1	0.5	0.0	0.5	0.8	
Child labor (age 10 to 14)		0.3	0.1	0.4	0.0	0.3	2.0	0.1	2.1	2.3	
Female labor (no formal education)		0.4	0.1	0.4	0.0	0.4	3.1	0.2	3.2	2.9	
Female labor (not finished primary school)		0.7	0.1	0.7	0.0	0.8	7.3	0.2	7.0	10.2	
Female labor (not finished secondary school)		0.3	0.1	0.3	0.0	0.3	2.5	0.2	2.5	3.3	
Female labor (secondary or higher education)		0.2	0.1	0.1	0.0	0.2	1.8	0.3	1.8	2.8	
Male labor (no formal education)		0.4	0.1	0.5	0.0	0.4	3.3	0.2	3.5	3.1	
Male labor (not finished primary school)		0.5	0.1	0.5	0.0	0.5	4.3	0.3	4.3	5.4	
Male labor (not finished secondary school)		0.4	0.1	0.3	0.0	0.4	2.9	0.3	2.8	4.2	
Male labor (secondary or higher education)		0.3	0.1	0.2	0.0	0.3	1.4	0.3	1.2	3.4	
Capital		0.5	0.1	0.5	0.1	0.5	3.3	0.3	3.2	5.0	
Agricultural land		0.4	0.1	0.5	0.0	0.4	3.5	0.2	3.6	3.3	

Source: Authors' estimates.

Table 8: Summary of Results, Initial Rent Capture Case (results are percentage change from initial equilibrium, unless otherwise indicated)

Scenario definition	Benchmark	EU FTA	EU Discriminatory		Africa FTA	EU-Africa		Unilateral	Unilateral	Unilateral	Unilateral
			Services	EU Tariffs		Discriminatory Services	Tariffs		Discriminatory Tariffs		Domestic
50% reduction of discriminatory barriers on EU services firms	No	Yes	Yes	No	No	Yes	Yes	Yes	No	Yes	
50% reduction of discriminatory barriers on African services firm	No	No	No	No	Yes	Yes	Yes	Yes	No	Yes	
50% reduction of discriminatory barriers on ROW services firms	No	No	No	No	No	No	Yes	Yes	No	Yes	
50% reduction of regulatory barriers for all services firms	No	No	No	No	No	No	No	No	No	Yes	
Removal of tariffs on EU sourced goods	No	Yes	No	Yes	No	Yes	Yes	No	Yes	Yes	
Removal of tariffs on ROW sourced goods	No	No	No	No	No	No	Yes	No	Yes	Yes	
Aggregate welfare											
Welfare (EV as % of consumption)		0.27	0.22	0.05	0.03	0.29	1.48	0.49	0.96	5.37	
Welfare (EV as % of GDP)		0.24	0.20	0.04	0.02	0.27	1.34	0.44	0.86	4.85	
Government budget											
Tariff revenue (% of GDP)	1.3	0.9	1.3	0.9	1.3	0.9		1.3			
Tariff revenue		-24.9	0.6	-25.4	0.2	-24.8	-100.0	1.4	-100.0	-100.0	
Aggregate trade											
Real exchange rate		0.3	0.1	0.3	0.0	0.3	2.5	0.1	2.5	0.5	
Aggregate exports		6.4	0.5	5.8	0.9	7.2	44.9	2.0	41.8	76.1	
Factor Earnings											
Subsistence Factor		0.3	0.3	0.0	0.0	0.3	2.4	0.6	1.7	7.0	
Child labor (age 10 to 14)		0.7	0.2	0.5	0.1	0.8	3.7	0.6	3.1	7.2	
Female labor (no formal education)		0.8	0.2	0.6	0.1	0.9	5.4	0.5	4.8	9.2	
Female labor (not finished primary school)		-0.4	0.2	-0.7	0.0	-0.4	-7.0	0.5	-7.4	-6.4	
Female labor (not finished secondary school)		0.6	0.3	0.4	0.1	0.7	3.2	0.6	2.5	7.2	
Female labor (secondary or higher education)		0.8	0.3	0.5	0.1	0.9	2.1	0.8	1.3	5.5	
Male labor (no formal education)		0.9	0.2	0.7	0.1	1.0	6.7	0.5	6.1	9.9	
Male labor (not finished primary school)		0.6	0.2	0.4	0.1	0.7	3.1	0.5	2.5	5.4	
Male labor (not finished secondary school)		0.8	0.3	0.5	0.1	0.9	3.3	0.8	2.5	7.4	
Male labor (secondary or higher education)		0.9	0.4	0.4	0.1	1.0	3.5	1.0	2.5	8.5	
Capital		0.9	0.3	0.6	0.1	1.0	5.4	0.8	4.5	10.4	
Agricultural land		0.6	0.2	0.4	0.1	0.7	4.5	0.4	4.1	7.1	
Factor adjustments											
Subsistence Factor		0.1	0.0	0.1	0.0	0.1	0.5	0.0	0.5	0.9	
Child labor (age 10 to 14)		0.3	0.1	0.4	0.0	0.3	2.0	0.1	2.1	2.3	
Female labor (no formal education)		0.4	0.1	0.4	0.0	0.4	3.1	0.2	3.2	3.1	
Female labor (not finished primary school)		0.7	0.1	0.7	0.0	0.7	7.3	0.2	7.0	10.1	
Female labor (not finished secondary school)		0.3	0.1	0.3	0.0	0.4	2.5	0.2	2.5	3.3	
Female labor (secondary or higher education)		0.2	0.1	0.1	0.0	0.3	1.8	0.4	1.8	3.4	
Male labor (no formal education)		0.4	0.1	0.5	0.0	0.5	3.4	0.2	3.5	3.2	
Male labor (not finished primary school)		0.5	0.1	0.5	0.0	0.5	4.3	0.2	4.3	5.3	
Male labor (not finished secondary school)		0.4	0.1	0.3	0.1	0.4	3.0	0.3	2.8	4.5	
Male labor (secondary or higher education)		0.3	0.2	0.2	0.1	0.4	1.5	0.5	1.2	4.3	
Capital		0.5	0.2	0.5	0.1	0.6	3.4	0.4	3.2	5.6	
Agricultural land		0.4	0.1	0.5	0.0	0.5	3.5	0.2	3.6	3.3	

Source: Authors' estimates.

Table 9: Output and Employment Impacts from Liberalisation (% change from benchmark)

No initial rent capture case

	Unilateral Liberalization		EU-Africa FTA		African FTA		EU FTA	
	Output	Labor income	Output	Labor income	Output	Labor income	Output	Labor income
Business Services								
Telecommunication	5.4	5.7	2.4	1.5	0.0	-0.3	2.4	1.8
Insurance	5.3	6.9	3.4	3.1	1.7	1.6	1.6	1.5
Banking	5.9	7.4	2.0	1.8	0.4	0.2	1.7	1.6
Professional business services	5.7	7.3	2.6	2.3	0.3	0.1	2.4	2.2
Air transport	24.4	26.4	5.1	4.7	0.6	0.5	4.5	4.2
Road transport	22.1	24.0	4.6	4.2	0.6	0.5	4.0	3.8
Railway transport	26.0	28.0	5.4	5.0	0.7	0.6	4.7	4.4
Water transport	10.5	10.9	6.1	5.2	-1.1	-1.4	7.2	6.5
Dixit-Stiglitz Goods								
Mining & quarrying	-3.7	0.7	0.0	0.7	0.0	0.1	0.0	0.6
Grain milling	0.1	2.9	-0.2	0.4	0.0	0.1	-0.2	0.3
Processed food	-2.1	1.0	0.6	1.0	0.0	0.0	0.6	1.0
Beverages & tobacco products	-2.6	-0.2	-2.1	-2.0	0.1	0.0	-2.2	-2.1
Textile & leather products	-24.3	-22.0	-0.2	0.3	0.0	0.1	-0.3	0.3
Manufacture of basic & industrial chemicals	-0.4	1.3	0.0	0.0	0.1	0.0	-0.1	0.0
Manufacture of fertilizers & pesticides	2.8	6.2	0.6	1.4	0.0	0.1	0.6	1.3
Petroleum refineries	-6.6	-4.1	0.2	0.3	0.0	0.0	0.2	0.4
Glass & cement	-2.7	0.3	-0.1	0.2	0.0	0.0	-0.1	0.2
Iron steel & metal products	-9.1	-6.0	-0.7	-0.3	0.0	0.0	-0.7	-0.3
Agriculture								
Maize	-0.2	2.7	0.0	0.5	0.0	0.1	-0.1	0.4
Paddy	-6.0	-2.9	-1.1	-0.5	0.0	0.1	-1.1	-0.6
Sorghum or millets	0.5	3.3	0.0	0.4	0.1	0.1	0.0	0.3
Wheat	-12.8	-9.6	-0.6	0.1	0.0	0.0	-0.6	0.1
Beans	-0.1	3.4	0.0	0.7	0.0	0.1	0.0	0.6
Cassava	-0.2	2.8	0.0	0.6	0.0	0.1	0.0	0.5
Other cereals	-0.2	3.7	-0.3	0.5	0.0	0.1	-0.4	0.3
Oil seeds	-0.7	3.0	0.1	0.8	0.0	0.1	0.0	0.7
Other roots & tubers	0.1	3.3	0.1	0.7	0.0	0.1	0.1	0.6
Cotton	-10.2	-7.4	1.6	1.9	0.2	0.2	1.4	1.7
Coffee	35.6	41.1	4.0	4.7	-0.2	-0.1	4.2	4.8
Tobacco	21.8	25.0	2.9	3.0	0.6	0.6	2.3	2.4
Tea	10.9	15.0	1.5	2.1	0.2	0.2	1.3	1.9
Cashew nuts	50.6	57.3	6.0	6.9	0.1	0.2	5.9	6.7
Sisal fiber	-24.3	-21.2	-0.2	0.4	0.0	0.1	-0.3	0.3
Sugar	-23.5	-22.7	-2.5	-2.2	-0.1	0.0	-2.4	-2.1
Fruits & vegetables	-0.3	3.2	-0.1	0.6	0.0	0.1	-0.1	0.5
Other crops	2.5	6.2	0.5	1.1	0.1	0.2	0.4	1.0
Poultry & livestock	0.4	4.2	-0.2	0.5	0.0	0.1	-0.3	0.4
Other CRTS								
Fish	2.1	6.5	0.1	1.0	0.0	0.1	0.1	0.9
Hunting & forestry	-1.0	1.9	-0.2	0.3	0.0	0.1	-0.3	0.2
Meat & dairy products	-2.8	0.0	-0.8	-0.3	0.0	0.1	-0.8	-0.4
Wood paper printing	-12.8	-9.1	-4.5	-3.9	0.0	0.0	-4.5	-3.9
Rubber plastic & other manufacturing	-8.3	-5.1	-1.5	-1.1	0.0	0.0	-1.5	-1.1
Manufacture of equipment	-10.5	-6.5	-5.1	-4.4	-0.1	-0.1	-5.0	-4.4
Utilities	-4.6	-1.1	0.0	0.4	0.1	0.1	-0.1	0.3
Construction	0.1	3.3	0.2	0.7	0.0	0.0	0.1	0.6
Wholesale & retail trade	0.6	4.1	0.4	0.7	0.1	0.0	0.4	0.7
Hotels & restaurants	14.7	19.2	2.9	3.4	0.4	0.4	2.5	3.0
Postal communication	2.0	3.5	1.3	0.8	0.2	0.0	1.1	0.9
Real estate	1.4	3.5	0.6	0.8	0.1	0.1	0.5	0.7
Other services	1.5	4.0	1.5	1.5	0.2	0.1	1.3	1.5
Tourism	95.9		16.1		2.3		13.8	
Public administration health & education	0.8	2.9	0.2	0.6	0.0	0.0	0.2	0.6

Source: Authors' estimates.

Table 10: Impacts on Imports from Unilateral Liberalisation (% change from benchmark)

No initial rent capture case

	European Union	Africa	Rest of the World
Business Services			
Telecommunication	-3.5	-5.1	-3.1
Insurance	-9.5	-9.5	
Banking	-5.8	-5.8	-3.6
Professional business services	-2.5	-4.0	-2.2
Air transport	13.4	8.6	15.0
Road transport	14.8	14.8	17.0
Railway transport			12.7
Water transport	-18.7	-24.6	-16.5
Dixit-Stiglitz Goods			
Mining & quarrying	23.5	6.6	72.0
Grain milling	43.9	6.0	89.8
Processed food	18.6	-11.3	77.4
Beverages & tobacco products	128.9	16.9	176.1
Textile & leather products	43.2	-9.6	306.9
Manufacture of basic & industrial chemicals	7.6	-1.4	8.8
Manufacture of fertilizers & pesticides	11.6	4.3	13.3
Petroleum refineries	-5.1	-5.1	7.2
Glass & cement	25.3	1.3	79.0
Iron steel & metal products	10.4	-13.1	33.3
Agriculture			
Maize	4.8	1.5	4.8
Paddy	90.7	-10.6	90.7
Sorghum or millets		-1.9	-1.9
Wheat	16.9		16.9
Beans	359.1	-3.7	
Cassava	200.7	-7.7	200.7
Other cereals	41.6		41.6
Oil seeds	28.2	3.3	28.2
Other roots & tubers	5.7	3.3	5.7
Cotton	-7.8		-7.8
Coffee	312.6	122.0	312.6
Tobacco	201.2	16.1	201.2
Tea	152.8	13.2	152.8
Cashew nuts			460.3
Sisal fiber			
Sugar	75.0	-35.2	75.0
Fruits & vegetables	38.5	1.1	38.5
Other crops	32.9	8.0	32.9
Poultry & livestock	55.8	4.6	55.8
Other CRTS			
Fish	154.7	6.6	154.7
Hunting & forestry	0.5	0.5	0.5
Meat & dairy products	447.1	-3.4	447.1
Wood paper printing	45.1	-11.4	45.1
Rubber plastic & other manufacturing	10.4	-9.8	10.4
Manufacture of equipment	5.6	-14.1	5.6
Utilities			
Construction			-1.4
Wholesale & retail trade			
Hotels & restaurants			
Postal communication			-0.4
Real estate			
Other services			2.1
Tourism			95.9
Public administration health & education			-0.9

Source: Authors' estimates.

**Table 11: Impacts on Exports from Unilateral Liberalisation (% change from benchmark)
no initial rent capture case**

	European Union	Africa	Rest of the World
Business Services			
Telecommunication	2.2	2.2	2.2
Insurance	-1.5	-1.5	
Banking	0.0	0.0	0.0
Professional business services	1.2	1.2	1.2
Air transport	0.6	0.6	0.6
Road transport	8.0	8.0	8.0
Railway transport			0.9
Water transport	-1.1	-1.1	-1.1
Dixit-Stiglitz Goods			
Mining & quarrying	-5.2	-5.2	-5.2
Grain milling	1.5	1.5	1.5
Processed food	44.2	44.2	44.2
Beverages & tobacco products	-1.5	-1.5	-1.5
Textile & leather products	-8.5	-8.5	-8.5
Manufacture of basic & industrial chemicals	3.1	3.1	3.1
Manufacture of fertilizers & pesticides		-0.1	-0.1
Petroleum refineries	-1.8	-1.8	-1.8
Glass & cement	0.4	0.4	0.4
Iron steel & metal products	20.1	20.1	20.1
Agriculture			
Maize		-2.4	-2.4
Paddy		-7.0	-7.0
Sorghum or millets	2.4	2.4	2.4
Wheat	-11.6	-11.6	-11.6
Beans	-4.1	-4.1	-4.1
Cassava	-2.4	-2.4	-2.4
Other cereals		-3.7	
Oil seeds	-5.5	-5.5	-5.5
Other roots & tubes			
Cotton	-9.7	-9.7	-9.7
Coffee	27.7	27.7	27.7
Tobacco	21.1	21.1	21.1
Tea	7.3	7.3	7.3
Cashew nuts	40.5	40.5	40.5
Sisal fiber			
Sugar	-15.1	-15.1	-15.1
Fruits & vegetables	-4.5	-4.5	-4.5
Other crops	-1.1	-1.1	-1.1
Poultry & livestock	-4.3	-4.3	-4.3
Other CRTS			
Fish	-3.8	-3.8	-3.8
Hunting & forestry	-3.5	-3.5	-3.5
Meat & dairy products	-5.3	-5.3	-5.3
Wood paper printing	-14.9	-14.9	-14.9
Rubber plastic & other manufacturing	-7.3	-7.3	-7.3
Manufacture of equipment	-7.6	-7.6	-7.6
Utilities			
Construction			
Wholesale & retail trade			
Hotels & restaurants			
Postal communication			4.0
Real estate			
Other services			1.2
Tourism			95.9
Public administration health & education			2.4

Source: Authors' estimates.

Table 12: Impacts on Number of Firms from Unilateral Liberalisation (% change from benchmark)

No initial rent capture case

	Tanzania	European Union	Africa	Rest of the World
Business Services				
Telecommunication	-1.6	16.0	5.1	18.9
Insurance	-5.5	47.5	47.2	
Banking	-2.8	32.8	32.8	88.0
Professional business services	-0.7	29.5	8.9	35.0
Air transport	5.0	28.0	7.6	34.6
Road transport	14.3	22.9	22.9	57.1
Railway transport	1.4			21.7
Water transport	-16.1	72.7	15.3	94.9
Dixit-Stiglitz Goods				
Mining & quarrying	-2.2	15.0	2.5	49.5
Grain milling	0.1	23.7	-1.9	56.1
Processed food	-1.9	7.3	-15.3	47.1
Beverages & tobacco products	-2.2	62.5	-2.8	98.1
Textile & leather products	-21.9	13.7	-21.3	167.8
Manufacture of basic & industrial chemicals	-0.4	3.6	-3.0	4.4
Manufacture of fertilizers & pesticides	2.7	8.7	3.3	10.0
Petroleum refineries	-5.5	-6.9	-5.8	3.5
Glass & cement	-2.3	14.2	-3.0	51.6
Iron steel & metal products	-8.1	4.6	-12.7	20.9

Source: Authors' estimates.

Table 13: Impacts on Imports from EU-Africa FTA (% change from benchmark)

No initial rent capture case			
	European Union	Africa	Rest of the World
Business Services			
Telecommunication	-0.9	-3.0	-4.4
Insurance	-10.6	-10.6	
Banking	0.0	0.0	-1.3
Professional business services	0.1	-1.7	-2.4
Air transport	2.6	1.1	1.7
Road transport	2.3	2.3	2.2
Railway transport			2.2
Water transport	-9.1	-18.1	-22.7
Dixit-Stiglitz Goods			
Mining & quarrying	21.7	4.5	6.3
Grain milling	46.9	8.6	8.6
Processed food	42.8	7.4	5.9
Beverages & tobacco products	131.1	18.2	16.3
Textile & leather products	88.9	22.7	23.4
Manufacture of basic & industrial chemicals	15.8	1.5	-0.8
Manufacture of fertilizers & pesticides	2.6	1.0	3.0
Petroleum refineries	3.9	2.6	2.9
Glass & cement	30.0	5.1	4.7
Iron steel & metal products	30.7	2.8	0.6
Agriculture			
Maize	4.0	0.7	0.7
Paddy	110.7	-1.2	-1.2
Sorghum or millets		0.2	0.2
Wheat	40.1		0.3
Beans	349.8	-5.7	
Cassava	207.0	-5.8	-5.8
Other cereals	39.1		-0.7
Oil seeds	25.8	1.4	1.4
Other roots & tubers	3.8	1.5	1.5
Cotton	6.8		1.8
Coffee	125.3	21.2	21.2
Tobacco	149.3	-3.9	-3.9
Tea	118.3	-2.2	-2.2
Cashew nuts			28.3
Sisal fiber			
Sugar	161.1	-3.4	-3.4
Fruits & vegetables	37.8	0.6	0.6
Other crops	25.9	2.3	2.3
Poultry & livestock	49.8	0.6	0.6
Other CRTS			
Fish	144.7	2.4	2.4
Hunting & forestry	0.4	0.4	0.4
Meat & dairy products	458.4	-1.4	-1.4
Wood paper printing	56.2	-4.7	-4.7
Rubber plastic & other manufacturing	20.2	-1.8	-1.8
Manufacture of equipment	14.9	-6.4	-6.4
Utilities			
Construction			0.1
Wholesale & retail trade			
Hotels & restaurants			
Postal communication			-0.7
Real estate			
Other services			0.3
Tourism			16.1
Public administration health & education			0.1

Source: Authors' estimates.

Table 14: Impacts on Exports from EU-Africa FTA (% change from benchmark)

No initial rent capture case			
	European Union	Africa	Rest of the World
Business Services			
Telecommunication	1.2	1.2	1.2
Insurance	-2.8	-2.8	
Banking	0.9	0.9	0.9
Professional business services	0.8	0.8	0.8
Air transport	0.9	0.9	0.9
Road transport	2.4	2.4	2.4
Railway transport			0.9
Water transport	-0.3	-0.3	-0.3
Dixit-Stiglitz Goods			
Mining & quarrying	-0.9	-0.9	-0.9
Grain milling	-0.3	-0.3	-0.3
Processed food	2.1	2.1	2.1
Beverages & tobacco products	-1.1	-1.1	-1.1
Textile & leather products	-0.6	-0.6	-0.6
Manufacture of basic & industrial chemicals	1.1	1.1	1.1
Manufacture of fertilizers & pesticides		-0.1	-0.1
Petroleum refineries	0.1	0.1	0.1
Glass & cement	0.1	0.1	0.1
Iron steel & metal products	1.2	1.2	1.2
Agriculture			
Maize		-1.0	-1.0
Paddy		-1.9	-1.9
Sorghum or millets	-0.3	-0.3	-0.3
Wheat	-1.6	-1.6	-1.6
Beans	-1.5	-1.5	-1.5
Cassava	-1.0	-1.0	-1.0
Other cereals		-1.8	
Oil seeds	-1.6	-1.6	-1.6
Other roots & tubes			
Cotton	1.4	1.4	1.4
Coffee	2.2	2.2	2.2
Tobacco	3.4	3.4	3.4
Tea	0.9	0.9	0.9
Cashew nuts	3.8	3.8	3.8
Sisal fiber			
Sugar	-2.1	-2.1	-2.1
Fruits & vegetables	-1.6	-1.6	-1.6
Other crops	-0.9	-0.9	-0.9
Poultry & livestock	-1.8	-1.8	-1.8
Other CRTS			
Fish	-1.8	-1.8	-1.8
Hunting & forestry	-1.2	-1.2	-1.2
Meat & dairy products	-1.6	-1.6	-1.6
Wood paper printing	-4.7	-4.7	-4.7
Rubber plastic & other manufacturing	-1.2	-1.2	-1.2
Manufacture of equipment	-4.1	-4.1	-4.1
Utilities			
Construction			
Wholesale & retail trade			
Hotels & restaurants			
Postal communication			2.9
Real estate			
Other services			2.1
Tourism			16.1
Public administration health & education			0.3

Source: Authors' estimates.

Table 15: Impacts on Number of Firms from EU-Africa FTA (% change from benchmark)

No initial rent capture case

	Tanzania	European Union	Africa	Rest of the World
Business Services				
Telecommunication	-1.1	19.8	6.1	-6.5
Insurance	-6.8	44.9	44.6	
Banking	0.2	40.9	40.9	-1.1
Professional business services	-0.2	35.9	10.6	-3.9
Air transport	1.1	9.0	2.7	4.3
Road transport	2.8	9.5	9.5	5.8
Railway transport	0.8			4.5
Water transport	-11.6	106.9	19.7	-37.4
Dixit-Stiglitz Goods				
Mining & quarrying	0.0	13.7	1.0	2.3
Grain milling	-0.2	25.6	0.0	0.0
Processed food	0.5	24.0	-0.7	-1.7
Beverages & tobacco products	-1.7	63.7	-2.0	-3.3
Textile & leather products	-0.2	42.0	0.3	0.7
Manufacture of basic & industrial chemicals	0.0	9.6	-0.9	-2.6
Manufacture of fertilizers & pesticides	0.6	2.0	0.8	2.2
Petroleum refineries	0.2	1.4	0.1	0.4
Glass & cement	-0.1	17.5	-0.2	-0.4
Iron steel & metal products	-0.6	19.1	-0.9	-2.5

Source: Authors' estimates.

Table 16: Impacts on Imports from African FTA (% change from benchmark)

No initial rent capture case

	European Union	Africa	Rest of the World
Business Services			
Telecommunication	-1.2	-0.3	-1.3
Insurance	-14.4	-10.9	
Banking	-0.5	0.8	-0.6
Professional business services	-0.3	0.3	-0.3
Air transport	0.3	0.4	0.3
Road transport	-0.2	0.1	-0.2
Railway transport			0.3
Water transport	-2.7	-1.0	-2.8
Dixit-Stiglitz Goods			
Mining & quarrying	3.5	3.5	3.9
Grain milling	9.0	9.0	9.4
Processed food	8.6	8.5	9.1
Beverages & tobacco products	21.5	21.5	21.7
Textile & leather products	22.5	22.5	22.9
Manufacture of basic & industrial chemicals	2.9	2.8	2.9
Manufacture of fertilizers & pesticides	0.3	0.1	0.3
Petroleum refineries	2.4	2.5	2.6
Glass & cement	5.4	5.4	5.6
Iron steel & metal products	4.2	4.2	4.3
Agriculture			
Maize	0.5	0.5	0.5
Paddy	0.4	0.4	0.4
Sorghum or millets		0.4	0.4
Wheat	0.2		0.2
Beans	0.5	0.5	
Cassava	0.6	0.6	0.6
Other cereals	0.4		0.4
Oil seeds	0.5	0.5	0.5
Other roots & tubers	0.6	0.6	0.6
Cotton	0.5		0.5
Coffee	3.8	3.8	3.8
Tobacco	0.7	0.7	0.7
Tea	0.9	0.9	0.9
Cashew nuts			4.7
Sisal fiber			
Sugar	0.3	0.3	0.3
Fruits & vegetables	0.6	0.6	0.6
Other crops	0.7	0.7	0.7
Poultry & livestock	0.5	0.5	0.5
Other CRTS			
Fish	0.7	0.7	0.7
Hunting & forestry	0.5	0.5	0.5
Meat & dairy products	0.5	0.5	0.5
Wood paper printing	0.3	0.3	0.3
Rubber plastic & other manufacturing	0.1	0.1	0.1
Manufacture of equipment	0.1	0.1	0.1
Utilities			
Construction			0.2
Wholesale & retail trade			
Hotels & restaurants			
Postal communication			-0.1
Real estate			
Other services			0.1
Tourism			2.3
Public administration health & education			0.0

Source: Authors' estimates.

Table 17: Impacts on Exports from African FTA (% change from benchmark)

No initial rent capture case

	European Union	Africa	Rest of the World
Business Services			
Telecommunication	0.1	0.1	0.1
Insurance	-4.1	-4.1	
Banking	0.0	0.0	0.0
Professional business services	0.1	0.1	0.1
Air transport	0.1	0.1	0.1
Road transport	0.1	0.1	0.1
Railway transport			0.1
Water transport	0.3	0.3	0.3
Dixit-Stiglitz Goods			
Mining & quarrying	-0.2	-0.2	-0.2
Grain milling	-0.2	-0.2	-0.2
Processed food	-0.5	-0.5	-0.5
Beverages & tobacco products	0.0	0.0	0.0
Textile & leather products	-0.1	-0.1	-0.1
Manufacture of basic & industrial chemicals	0.1	0.1	0.1
Manufacture of fertilizers & pesticides		-0.1	-0.1
Petroleum refineries	0.0	0.0	0.0
Glass & cement	-0.1	-0.1	-0.1
Iron steel & metal products	-0.1	-0.1	-0.1
Agriculture			
Maize		-0.5	-0.5
Paddy		-0.4	-0.4
Sorghum or millets	-0.3	-0.3	-0.3
Wheat	-0.3	-0.3	-0.3
Beans	-0.5	-0.5	-0.5
Cassava	-0.6	-0.6	-0.6
Other cereals		-0.4	
Oil seeds	-0.5	-0.5	-0.5
Other roots & tubers			
Cotton	0.1	0.1	0.1
Coffee	-0.6	-0.6	-0.6
Tobacco	0.6	0.6	0.6
Tea	-0.1	-0.1	-0.1
Cashew nuts	-0.3	-0.3	-0.3
Sisal fiber			
Sugar	-0.4	-0.4	-0.4
Fruits & vegetables	-0.5	-0.5	-0.5
Other crops	-0.4	-0.4	-0.4
Poultry & livestock	-0.4	-0.4	-0.4
Other CRTS			
Fish	-0.4	-0.4	-0.4
Hunting & forestry	-0.4	-0.4	-0.4
Meat & dairy products	-0.4	-0.4	-0.4
Wood paper printing	-0.3	-0.3	-0.3
Rubber plastic & other manufacturing	-0.1	-0.1	-0.1
Manufacture of equipment	-0.3	-0.3	-0.3
Utilities			
Construction			
Wholesale & retail trade			
Hotels & restaurants			
Postal communication			0.4
Real estate			
Other services			0.3
Tourism			2.3
Public administration health & education			0.0

Source: Authors' estimates.

Table 18: Impacts on Number of Firms from African FTA (% change from benchmark)

No initial rent capture case

	Tanzania	European Union	Africa	Rest of the World
Business Services				
Telecommunication	-0.5	-1.9	7.5	-2.2
Insurance	-7.9	-13.6	43.2	
Banking	-0.2	-0.4	41.1	-0.8
Professional business services	0.0	-0.4	11.7	-0.5
Air transport	0.2	0.6	1.8	0.7
Road transport	-0.1	-0.1	6.4	-0.2
Railway transport	0.1			0.6
Water transport	-1.1	-4.4	29.8	-5.2
Dixit-Stiglitz Goods				
Mining & quarrying	0.0	0.2	0.2	0.5
Grain milling	0.0	0.3	0.3	0.6
Processed food	0.0	0.2	0.2	0.6
Beverages & tobacco products	0.1	0.1	0.1	0.2
Textile & leather products	0.0	0.2	0.2	0.4
Manufacture of basic & industrial chemicals	0.1	0.1	0.0	0.1
Manufacture of fertilizers & pesticides	0.0	0.2	0.1	0.2
Petroleum refineries	0.0	0.0	0.1	0.1
Glass & cement	0.0	0.1	0.1	0.2
Iron steel & metal products	0.0	0.0	0.0	0.1

Source: Authors' estimates.

Table 19: Impacts on Imports from EU FTA (% change from benchmark)

No initial rent capture case

	European Union	Africa	Rest of the World
Business Services			
Telecommunication	0.3	-2.7	-3.2
Insurance	4.9	0.3	
Banking	0.5	-0.8	-0.8
Professional business services	0.4	-2.0	-2.1
Air transport	2.4	0.8	1.4
Road transport	2.5	2.2	2.4
Railway transport			1.9
Water transport	-6.6	-18.2	-20.9
Dixit-Stiglitz Goods			
Mining & quarrying	21.3	4.2	5.6
Grain milling	46.4	8.2	7.9
Processed food	42.4	7.2	5.1
Beverages & tobacco products	130.7	17.9	15.9
Textile & leather products	88.6	22.5	22.8
Manufacture of basic & industrial chemicals	15.6	1.5	-1.0
Manufacture of fertilizers & pesticides	2.4	0.9	2.7
Petroleum refineries	3.9	2.5	2.7
Glass & cement	29.8	4.9	4.4
Iron steel & metal products	30.7	2.8	0.4
Agriculture			
Maize	3.5	0.2	0.2
Paddy	109.9	-1.6	-1.6
Sorghum or millets		-0.2	-0.2
Wheat	39.8		0.1
Beans	347.5	-6.2	
Cassava	205.3	-6.3	-6.3
Other cereals	38.5		-1.2
Oil seeds	25.2	0.9	0.9
Other roots & tubers	3.2	0.9	0.9
Cotton	6.3		1.3
Coffee	117.6	17.1	17.1
Tobacco	147.5	-4.6	-4.6
Tea	116.4	-3.1	-3.1
Cashew nuts			23.1
Sisal fiber			
Sugar	160.4	-3.7	-3.7
Fruits & vegetables	37.0	0.0	0.0
Other crops	25.1	1.6	1.6
Poultry & livestock	49.0	0.1	0.1
Other CRTS			
Fish	143.0	1.7	1.7
Hunting & forestry	0.0	0.0	0.0
Meat & dairy products	455.8	-1.9	-1.9
Wood paper printing	55.9	-4.9	-4.9
Rubber plastic & other manufacturing	20.0	-2.0	-2.0
Manufacture of equipment	14.9	-6.5	-6.5
Utilities			
Construction			-0.1
Wholesale & retail trade			
Hotels & restaurants			
Postal communication			-0.6
Real estate			
Other services			0.2
Tourism			13.8
Public administration health & education			0.1

Source: Authors' estimates.

Table 20: Impacts on Exports from EU FTA (% change from benchmark)

No initial rent capture case

	European Union	Africa	Rest of the World
Business Services			
Telecommunication	1.1	1.1	1.1
Insurance	1.2	1.2	
Banking	0.9	0.9	0.9
Professional business services	0.7	0.7	0.7
Air transport	0.8	0.8	0.8
Road transport	2.3	2.3	2.3
Railway transport			0.8
Water transport	-0.1	-0.1	-0.1
Dixit-Stiglitz Goods			
Mining & quarrying	-0.7	-0.7	-0.7
Grain milling	-0.1	-0.1	-0.1
Processed food	2.7	2.7	2.7
Beverages & tobacco products	-1.1	-1.1	-1.1
Textile & leather products	-0.5	-0.5	-0.5
Manufacture of basic & industrial chemicals	1.1	1.1	1.1
Manufacture of fertilizers & pesticides		0.0	0.0
Petroleum refineries	0.1	0.1	0.1
Glass & cement	0.2	0.2	0.2
Iron steel & metal products	1.3	1.3	1.3
Agriculture			
Maize		-0.5	-0.5
Paddy		-1.6	-1.6
Sorghum or millets	0.0	0.0	0.0
Wheat	-1.3	-1.3	-1.3
Beans	-1.0	-1.0	-1.0
Cassava	-0.5	-0.5	-0.5
Other cereals		-1.4	
Oil seeds	-1.1	-1.1	-1.1
Other roots & tubes			
Cotton	1.3	1.3	1.3
Coffee	2.8	2.8	2.8
Tobacco	2.8	2.8	2.8
Tea	1.0	1.0	1.0
Cashew nuts	4.2	4.2	4.2
Sisal fiber			
Sugar	-1.7	-1.7	-1.7
Fruits & vegetables	-1.1	-1.1	-1.1
Other crops	-0.4	-0.4	-0.4
Poultry & livestock	-1.3	-1.3	-1.3
Other CRTS			
Fish	-1.4	-1.4	-1.4
Hunting & forestry	-0.8	-0.8	-0.8
Meat & dairy products	-1.2	-1.2	-1.2
Wood paper printing	-4.5	-4.5	-4.5
Rubber plastic & other manufacturing	-1.1	-1.1	-1.1
Manufacture of equipment	-3.8	-3.8	-3.8
Utilities			
Construction			
Wholesale & retail trade			
Hotels & restaurants			
Postal communication			2.5
Real estate			
Other services			1.8
Tourism			13.8
Public administration health & education			0.3

Source: Authors' estimates.

Table 21: Impacts on Number of Firms from EU FTA (% change from benchmark)

No initial rent capture case

	Tanzania	European Union	Africa	Rest of the World
Business Services				
Telecommunication	-0.7	22.1	-1.4	-4.5
Insurance	1.1	71.9	0.9	
Banking	0.4	41.5	-0.1	-0.3
Professional business services	-0.2	36.5	-1.1	-3.5
Air transport	0.9	8.4	0.9	3.6
Road transport	2.9	9.6	2.9	6.0
Railway transport	0.7			3.9
Water transport	-10.5	116.4	-12.9	-35.0
Dixit-Stiglitz Goods				
Mining & quarrying	0.0	13.4	0.8	1.7
Grain milling	-0.2	25.3	-0.3	-0.5
Processed food	0.5	23.7	-0.8	-2.2
Beverages & tobacco products	-1.8	63.5	-2.2	-3.5
Textile & leather products	-0.2	41.8	0.1	0.3
Manufacture of basic & industrial chemicals	-0.1	9.5	-0.9	-2.7
Manufacture of fertilizers & pesticides	0.6	1.8	0.7	2.0
Petroleum refineries	0.2	1.4	0.1	0.2
Glass & cement	-0.1	17.4	-0.3	-0.6
Iron steel & metal products	-0.6	19.1	-1.0	-2.6

Source: Authors' estimates.

Table 22: Piecemeal Sensitivity Analysis of Tanzania-EU FTA

Parameter	Parameter value			% Welfare Change (EV)		
	Lower	Central	Upper	Lower	Central	Upper
$\sigma(q_i, q_j)$ – services sectors	1.5	3	4.5	2.11	0.35	0.27
$\sigma(q_i, q_j)$ – goods sectors	See below			0.45	0.35	0.32
$\sigma(va, bs)$	0.625	1.25	1.875	0.27	0.35	0.45
$\sigma(D, M)$	2	4	6	0.31	0.35	0.40
$\sigma(L, K)$	0.5	1	1.5	0.34	0.35	0.36
$\sigma(A_1, \dots, A_n)$	NA	0	0.25	NA	0.35	0.36
$\sigma(D, E)$	2	4	6	0.33	0.35	0.37
ϵ_{IZA}	Central values of all 4 sets of ϵ			0.34	0.35	0.36
ϵ_{EU}	parameters are listed in table 6B.			0.19	0.35	0.45
ϵ_{AFR}	Lower and upper values are 0.5			0.35	0.35	0.35
ϵ_{ROW}	and 1.5 times central values.			0.36	0.35	0.35
θ_r	NA	0	1	NA	0.35	0.27
θ_r - CRTS model	NA	0	1	NA	0.04	-0.03
θ_m	0.025	0.05	0.075	0.35	0.35	0.35
$\sigma(q_i, q_j)$ – goods sectors						
Processed food	4.8	9.6	14.4			
Beverages & tobacco products	1.5	2.3	3.1			
Textile & leather products	2.8	3.6	4.4			
Manufacture of basic & industrial chemicals	1.7	2.5	3.3			
Manufacture of fertilizers & pesticides	1.6	2.4	3.2			
Petroleum refineries	2.8	3.6	4.4			
Glass & cement	2.3	4.6	6.9			
Iron steel & metal products	3.7	7.3	11			
Mining & quarrying	2.8	3.6	4.4			
Grain milling	2.4	3.2	4			
Key:						
$\sigma(q_i, q_j)$: Elasticity of substitution between firm varieties in imperfectly competitive sectors						
$\sigma(va, bs)$: Elasticity of substitution between value-added and business services						
$\sigma(D, M)$: Elasticity of substitution between domestic and imported varieties						
$\sigma(L, K)$: Elasticity of substitution between primary factors of production in value added						
$\sigma(A_1, \dots, A_n)$: Elasticity of substitution in intermediate production between composite Armington aggregate goods						
$\sigma(D, E)$: Elasticity of transformation (domestic output versus exports)						
ϵ_{IZA} : Elasticity of national service firm supply with respect to price of output						
ϵ_{EU} : Elasticity of EU service firm supply with respect to price of output						
ϵ_{AFR} : Elasticity of AFR service firm supply with respect to price of output						
ϵ_{ROW} : Elasticity of Rest of World service firm supply with respect to price of output						
θ_r : Share of rents in services sectors captured by domestic agents						
θ_m : Shares of value added in multinational firms due to specialized primary factor imports						
Source: Authors' estimates.						

Table 23: Piecemeal Sensitivity Analysis of Tanzania-Africa FTA

Parameter	Parameter value			% Change in Welfare (EV)		
	Lower	Central	Upper	Lower	Central	Upper
$\sigma(q_i, q_j)$ – services sectors	1.5	3	4.5	1.00	0.10	0.06
$\sigma(q_i, q_j)$ – goods sectors	See below			0.11	0.10	0.09
$\sigma(va, bs)$	0.625	1.25	1.875	0.08	0.10	0.12
$\sigma(D, M)$	2	4	6	0.10	0.10	0.10
$\sigma(L, K)$	0.5	1	1.5	0.10	0.10	0.10
$\sigma(A_1, \dots, A_n)$	NA	0	0.25	NA	0.10	0.10
$\sigma(D, E)$	2	4	6	0.09	0.10	0.10
ϵ_{TZA}	Central values of all 4 sets of ϵ			0.10	0.10	0.10
ϵ_{EU}	parameters are listed in table 6B.			0.10	0.10	0.10
ϵ_{AFR}	Lower and upper values are 0.5			0.05	0.10	0.14
ϵ_{ROW}	and 1.5 times central values.			0.10	0.10	0.10
θ_r	NA	0	1	NA	0.10	0.03
θ_r - CRTS model	NA	0	1	NA	0.05	-0.02
θ_m	0.025	0.05	0.075	0.10	0.10	0.10
$\sigma(q_i, q_j)$ – goods sectors						
Processed food	4.8	9.6	14.4			
Beverages & tobacco products	1.5	2.3	3.1			
Textile & leather products	2.8	3.6	4.4			
Manufacture of basic & industrial chemicals	1.7	2.5	3.3			
Manufacture of fertilizers & pesticides	1.6	2.4	3.2			
Petroleum refineries	2.8	3.6	4.4			
Glass & cement	2.3	4.6	6.9			
Iron steel & metal products	3.7	7.3	11			
Mining & quarrying	2.8	3.6	4.4			
Grain milling	2.4	3.2	4			
Key:						
$\sigma(q_i, q_j)$: Elasticity of substitution between firm varieties in imperfectly competitive sectors						
$\sigma(va, bs)$: Elasticity of substitution between value-added and business services						
$\sigma(D, M)$: Elasticity of substitution between domestic and imported varieties						
$\sigma(L, K)$: Elasticity of substitution between primary factors of production in value added						
$\sigma(A_1, \dots, A_n)$: Elasticity of substitution in intermediate production between composite Armington aggregate goods						
$\sigma(D, E)$: Elasticity of transformation (domestic output versus exports)						
ϵ_{TZA} : Elasticity of national service firm supply with respect to price of output						
ϵ_{EU} : Elasticity of EU service firm supply with respect to price of output						
ϵ_{AFR} : Elasticity of AFR service firm supply with respect to price of output						
ϵ_{ROW} : Elasticity of Rest of World service firm supply with respect to price of output						
θ_r : Share of rents in services sectors captured by domestic agents						
θ_m : Shares of value added in multinational firms due to specialized primary factor imports						
Source: Authors' estimates.						

Table 24: Summary of Results of Professional Services Policies --No initial rent capture case

(results are percentage change from initial equilibrium, unless otherwise indicated)

Scenario definition	Domestic &	Domestic	Unilateral	EU	Africa	EU & Africa	Rest of World
	Discriminatory Services	Services	Discriminatory Services	Discriminatory Services	Discriminatory Services	Discriminatory Services	Discriminatory Services
50% reduction of discriminatory barriers on EU services firms	Yes	No	Yes	Yes	No	Yes	No
50% reduction of discriminatory barriers on African services firm	Yes	No	Yes	No	Yes	Yes	No
50% reduction of discriminatory barriers on ROW services firms	Yes	No	Yes	No	No	No	Yes
50% reduction of regulatory barriers for all services firms	Yes	Yes	No	No	No	No	No
Aggregate welfare							
Welfare (EV as % of consumption)	0.24	0.13	0.11	0.04	0.01	0.05	0.06
Welfare (EV as % of GDP)	0.22	0.12	0.10	0.04	0.01	0.04	0.06
Government budget							
Tariff revenue (% of GDP)	1.26	1.25	1.25	1.25	1.25	1.25	1.25
Tariff revenue	0.36	0.12	0.21	0.09	0.01	0.10	0.13
Aggregate trade							
Real exchange rate	0.04	0.02	0.03	0.01	0.00	0.01	0.02
Aggregate exports	-0.13	-0.23	0.09	0.03	0.03	0.06	0.03
Factor Earnings							
Subsistence Factor	0.24	0.13	0.11	0.04	0.01	0.05	0.06
Child labor (age 10 to 14)	0.16	0.05	0.10	0.04	0.01	0.05	0.06
Female labor (no formal education)	0.13	0.03	0.09	0.03	0.01	0.04	0.05
Female labor (not finished primary school)	0.19	0.08	0.09	0.04	0.01	0.04	0.06
Female labor (not finished secondary school)	0.20	0.08	0.11	0.04	0.01	0.05	0.06
Female labor (secondary or higher education)	0.28	0.16	0.12	0.05	0.00	0.05	0.08
Male labor (no formal education)	0.08	0.00	0.07	0.03	0.01	0.04	0.04
Male labor (not finished primary school)	0.12	0.03	0.08	0.03	0.01	0.04	0.05
Male labor (not finished secondary school)	0.24	0.11	0.12	0.05	0.01	0.06	0.08
Male labor (secondary or higher education)	0.29	0.15	0.13	0.05	0.00	0.06	0.08
Capital	0.17	0.06	0.10	0.04	0.01	0.05	0.06
Agricultural land	0.07	0.00	0.07	0.03	0.01	0.03	0.04
Factor adjustments							
Subsistence Factor	0.02	0.01	0.01	0.00	0.00	0.01	0.01
Child labor (age 10 to 14)	0.09	0.06	0.03	0.01	0.00	0.01	0.02
Female labor (no formal education)	0.12	0.08	0.04	0.02	0.00	0.02	0.02
Female labor (not finished primary school)	0.07	0.04	0.03	0.01	0.00	0.02	0.02
Female labor (not finished secondary school)	0.09	0.06	0.03	0.01	0.00	0.01	0.02
Female labor (secondary or higher education)	0.15	0.08	0.06	0.02	0.00	0.03	0.04
Male labor (no formal education)	0.16	0.11	0.05	0.02	0.00	0.02	0.03
Male labor (not finished primary school)	0.13	0.09	0.04	0.02	0.00	0.02	0.03
Male labor (not finished secondary school)	0.13	0.08	0.05	0.02	0.00	0.02	0.03
Male labor (secondary or higher education)	0.14	0.08	0.06	0.02	0.00	0.03	0.04
Capital	0.14	0.08	0.06	0.02	0.00	0.03	0.04
Agricultural land	0.14	0.10	0.04	0.02	0.00	0.02	0.03

Source: Authors' estimates.

Table 25: Summary of Results of Professional Services Policies --Initial Rent Capture Case

(results are percentage change from initial equilibrium, unless otherwise indicated)

Scenario definition	Domestic &	Domestic	Unilateral	EU	Africa	EU & Africa	Rest of World
	Discriminatory Services	Services	Discriminatory Services	Discriminatory Services	Discriminatory Services	Discriminatory Services	Discriminatory Services
50% reduction of discriminatory barriers on EU services firms	Yes	No	Yes	Yes	No	Yes	No
50% reduction of discriminatory barriers on African services firm	Yes	No	Yes	No	Yes	Yes	No
50% reduction of discriminatory barriers on ROW services firms	Yes	No	Yes	No	No	No	Yes
50% reduction of regulatory barriers for all services firms	Yes	Yes	No	No	No	No	No
Aggregate welfare							
Welfare (EV as % of consumption)	0.20	0.12	0.08	0.03	0.00	0.03	0.05
Welfare (EV as % of GDP)	0.18	0.10	0.07	0.03	0.00	0.03	0.05
Government budget							
Tariff revenue (% of GDP)	1.26	1.25	1.25	1.25	1.25	1.25	1.25
Tariff revenue	0.32	0.11	0.19	0.08	0.01	0.09	0.12
Aggregate trade							
Real exchange rate	0.05	0.02	0.03	0.01	0.00	0.01	0.02
Aggregate exports	-0.13	-0.23	0.09	0.03	0.03	0.06	0.03
Factor Earnings							
Subsistence Factor	0.20	0.11	0.07	0.03	0.00	0.03	0.05
Child labor (age 10 to 14)	0.13	0.04	0.08	0.03	0.01	0.04	0.05
Female labor (no formal education)	0.09	0.02	0.06	0.03	0.00	0.03	0.04
Female labor (not finished primary school)	0.17	0.08	0.08	0.03	0.00	0.04	0.05
Female labor (not finished secondary school)	0.18	0.08	0.10	0.04	0.01	0.04	0.06
Female labor (secondary or higher education)	0.33	0.17	0.15	0.06	0.01	0.07	0.09
Male labor (no formal education)	0.06	-0.01	0.06	0.02	0.01	0.03	0.03
Male labor (not finished primary school)	0.11	0.03	0.08	0.03	0.01	0.04	0.05
Male labor (not finished secondary school)	0.27	0.12	0.14	0.06	0.01	0.07	0.08
Male labor (secondary or higher education)	0.33	0.17	0.16	0.06	0.01	0.07	0.09
Capital	0.19	0.07	0.12	0.05	0.01	0.05	0.07
Agricultural land	0.04	-0.01	0.04	0.02	0.00	0.02	0.03
Factor adjustments							
Subsistence Factor	0.02	0.01	0.01	0.00	0.00	0.00	0.01
Child labor (age 10 to 14)	0.09	0.06	0.03	0.01	0.00	0.01	0.02
Female labor (no formal education)	0.12	0.08	0.03	0.01	0.00	0.01	0.02
Female labor (not finished primary school)	0.07	0.04	0.03	0.01	0.00	0.01	0.02
Female labor (not finished secondary school)	0.09	0.06	0.03	0.01	0.00	0.02	0.02
Female labor (secondary or higher education)	0.18	0.09	0.08	0.03	0.01	0.04	0.05
Male labor (no formal education)	0.15	0.11	0.05	0.02	0.00	0.02	0.03
Male labor (not finished primary school)	0.13	0.09	0.05	0.02	0.00	0.02	0.03
Male labor (not finished secondary school)	0.16	0.09	0.07	0.03	0.00	0.03	0.04
Male labor (secondary or higher education)	0.17	0.09	0.08	0.03	0.01	0.04	0.05
Capital	0.14	0.08	0.07	0.03	0.00	0.03	0.04
Agricultural land	0.13	0.10	0.04	0.02	0.00	0.02	0.03

Source: Authors' estimates.

Table 26: Impacts on Number of Professional Services Firms from Liberalisation Barriers in Professional Services

No initial rent capture case, (% change from benchmark)

	Domestic & Discriminatory Services	Domestic Services	Unilateral Discriminatory Services	EU Discriminatory Services	Africa Discriminatory Services	EU & Africa Discriminatory Services	Rest of World Discriminatory Services
Tanzania	3.0	5.2	-2.2	-0.9	-0.1	-1.0	-1.3
European Union	32.1	7.0	22.9	33.5	-0.8	32.3	-7.1
Africa	9.6	2.4	7.1	-1.7	11.6	9.6	-2.6
Rest of the World	38.2	8.2	27.0	-5.6	-1.0	-6.4	35.3

Source: Authors' estimates.

Table 27: Output and Employment Impacts from Preferential Reduction in Barriers in Professional Services

No initial rent capture case	(% change from benchmark)							
	Unilateral		EU & Africa		Africa		EU	
	Discriminatory Services		Discriminatory Services		Discriminatory Services		Discriminatory Services	
	Output	Labor income	Output	Labor income	Output	Labor income	Output	Labor income
Business Services								
Telecommunication	0.52	0.07	0.24	0.03	0.03	0.00	0.21	0.03
Insurance	0.69	0.39	0.32	0.18	0.04	0.02	0.28	0.16
Banking	0.71	0.41	0.33	0.19	0.04	0.02	0.29	0.16
Professional business services	2.61	2.30	1.12	0.98	0.04	0.02	1.09	0.97
Air transport	0.47	0.18	0.23	0.09	0.04	0.02	0.19	0.07
Road transport	0.46	0.16	0.22	0.08	0.04	0.02	0.18	0.06
Railway transport	0.51	0.21	0.24	0.11	0.04	0.02	0.20	0.08
Water transport	0.48	0.04	0.22	0.02	0.03	0.00	0.19	0.02
Dixit-Stiglitz Goods								
Mining & quarrying	0.11	0.13	0.05	0.06	0.01	0.01	0.04	0.05
Grain milling	0.04	0.07	0.02	0.03	0.00	0.00	0.02	0.03
Processed food	0.04	0.04	0.02	0.02	0.00	0.00	0.02	0.01
Beverages & tobacco products	0.09	0.08	0.04	0.03	0.01	0.00	0.04	0.03
Textile & leather products	0.06	0.08	0.03	0.04	0.01	0.01	0.02	0.03
Manufacture of basic & industrial chemicals	0.09	0.01	0.04	0.01	0.01	0.00	0.04	0.01
Manufacture of fertilizers & pesticides	-0.04	0.04	-0.02	0.02	0.00	0.01	-0.02	0.02
Petroleum refineries	0.12	0.11	0.05	0.05	0.01	0.01	0.05	0.05
Glass & cement	0.07	0.06	0.03	0.03	0.01	0.00	0.03	0.03
Iron steel & metal products	0.07	0.06	0.03	0.03	0.01	0.00	0.03	0.02
Agriculture								
Maize	0.02	0.12	0.01	0.06	0.00	0.01	0.01	0.05
Paddy	0.02	0.11	0.01	0.05	0.00	0.01	0.01	0.04
Sorghum or millets	0.03	0.12	0.02	0.05	0.00	0.01	0.01	0.05
Wheat	-0.02	0.07	-0.01	0.03	0.00	0.00	-0.01	0.03
Beans	0.03	0.13	0.02	0.06	0.00	0.01	0.01	0.05
Cassava	0.01	0.12	0.01	0.05	0.00	0.01	0.01	0.05
Other cereals	0.04	0.13	0.02	0.06	0.00	0.01	0.02	0.05
Oil seeds	0.03	0.12	0.01	0.06	0.00	0.01	0.01	0.05
Other roots & tubers	0.03	0.13	0.01	0.06	0.00	0.01	0.01	0.05
Cotton	0.09	0.15	0.05	0.07	0.01	0.02	0.03	0.06
Coffee	-0.59	-0.49	-0.26	-0.21	-0.01	-0.01	-0.24	-0.21
Tobacco	0.11	0.16	0.06	0.08	0.02	0.02	0.04	0.06
Tea	0.02	0.09	0.01	0.05	0.01	0.01	0.01	0.03
Cashew nuts	-0.76	-0.66	-0.33	-0.28	-0.02	-0.01	-0.32	-0.28
Sisal fiber	0.06	0.14	0.03	0.06	0.01	0.01	0.02	0.05
Sugar	-0.03	0.05	-0.01	0.02	0.00	0.00	-0.01	0.02
Fruits & vegetables	0.02	0.12	0.01	0.06	0.00	0.01	0.01	0.05
Other crops	0.04	0.13	0.02	0.06	0.00	0.01	0.01	0.05
Poultry & livestock	0.02	0.12	0.01	0.05	0.00	0.01	0.01	0.05
Other CRTS								
Fish	-0.01	0.09	0.00	0.04	0.00	0.01	0.00	0.04
Hunting & forestry	0.06	0.12	0.03	0.06	0.00	0.01	0.03	0.05
Meat & dairy products	0.03	0.13	0.02	0.06	0.00	0.01	0.01	0.05
Wood paper printing	0.19	0.23	0.09	0.10	0.01	0.01	0.08	0.09
Rubber plastic & other manufacturing	0.14	0.12	0.07	0.06	0.01	0.01	0.06	0.05
Manufacture of equipment	0.01	0.07	0.00	0.03	0.00	0.00	0.00	0.03
Utilities	0.14	0.15	0.07	0.07	0.01	0.01	0.06	0.06
Construction	0.06	0.11	0.03	0.05	0.00	0.01	0.03	0.05
Wholesale & retail trade	0.07	0.00	0.03	0.00	0.00	0.00	0.03	0.00
Hotels & restaurants	0.22	0.23	0.11	0.11	0.02	0.02	0.09	0.09
Postal communication	0.41	0.11	0.19	0.05	0.03	0.01	0.17	0.04
Real estate	0.23	0.06	0.11	0.03	0.01	0.00	0.09	0.02
Other services	0.77	0.58	0.35	0.26	0.05	0.03	0.31	0.23
Tourism	0.42		0.23		0.07		0.16	
Public administration health & education	0.06	0.05	0.03	0.02	0.00	0.00	0.02	0.02

Source: Authors' estimates.

Table 28: Piecemeal Sensitivity Analysis for Preferential Liberalization between Tanzania and the Africa Region in Professional Services

Parameter	Parameter value			% Change in Welfare (EV)		
	Lower	Central	Upper	Lower	Central	Upper
$\sigma(q_i, q_j)$ – services sectors	1.5	3	4.5	0.113	0.007	0.004
$\sigma(q_i, q_j)$ – goods sectors		See below		0.008	0.007	0.007
$\sigma(va, bs)$	0.625	1.25	1.875	0.006	0.007	0.009
$\sigma(D, M)$	2	4	6	0.007	0.007	0.007
$\sigma(L, K)$	0.5	1	1.5	0.007	0.007	0.007
$\sigma(A_1, \dots, A_n)$	NA	0	0.25	NA	0.007	0.007
$\sigma(D, E)$	2	4	6	0.007	0.007	0.007
ϵ_{TZA}	Central values of all 4 sets of ϵ			0.007	0.007	0.007
ϵ_{EU}	parameters are listed in table 6B.			0.007	0.007	0.007
ϵ_{AFR}	Lower and upper values are 0.5			0.004	0.007	0.010
ϵ_{ROW}	and 1.5 times central values.			0.007	0.007	0.007
θ_r	NA	0	1	NA	0.007	0.002
θ_r - CRTS model	NA	0	1	NA	0.003	-0.001
θ_m	0.025	0.05	0.075	0.007	0.007	0.007
$\sigma(q_i, q_j)$ – goods sectors						
Processed food	4.8	9.6	14.4			
Beverages & tobacco products	1.5	2.3	3.1			
Textile & leather products	2.8	3.6	4.4			
Manufacture of basic & industrial chemicals	1.7	2.5	3.3			
Manufacture of fertilizers & pesticides	1.6	2.4	3.2			
Petroleum refineries	2.8	3.6	4.4			
Glass & cement	2.3	4.6	6.9			
Iron steel & metal products	3.7	7.3	11			
Mining & quarrying	2.8	3.6	4.4			
Grain milling	2.4	3.2	4			
Key:						
$\sigma(q_i, q_j)$: Elasticity of substitution between firm varieties in imperfectly competitive sectors						
$\sigma(va, bs)$: Elasticity of substitution between value-added and business services						
$\sigma(D, M)$: Elasticity of substitution between domestic and imported varieties						
$\sigma(L, K)$: Elasticity of substitution between primary factors of production in value added						
$\sigma(A_1, \dots, A_n)$: Elasticity of substitution in intermediate production between composite Armington aggregate goods						
$\sigma(D, E)$: Elasticity of transformation (domestic output versus exports)						
ϵ_{TZA} : Elasticity of national service firm supply with respect to price of output						
ϵ_{EU} : Elasticity of EU service firm supply with respect to price of output						
ϵ_{AFR} : Elasticity of AFR service firm supply with respect to price of output						
ϵ_{ROW} : Elasticity of Rest of World service firm supply with respect to price of output						
θ_r : Share of rents in services sectors captured by domestic agents						
θ_m : Shares of value added in multinational firms due to specialized primary factor imports						
Source: Authors' estimates.						

Table 29: Piecemeal Sensitivity Analysis for Preferential Liberalization between Tanzania and the EU in Professional Services

Parameter	Parameter value			% Welfare Change (EV)		
	Lower	Central	Upper	Lower	Central	Upper
$\sigma(q_i, q_j)$ – services sectors	1.5	3	4.5	0.26	0.04	0.03
$\sigma(q_i, q_j)$ – goods sectors	See below			0.05	0.04	0.04
$\sigma(va, bs)$	0.625	1.25	1.875	0.03	0.04	0.05
$\sigma(D, M)$	2	4	6	0.04	0.04	0.04
$\sigma(L, K)$	0.5	1	1.5	0.04	0.04	0.04
$\sigma(A_1, \dots, A_n)$	NA	0	0.25	NA	0.04	0.04
$\sigma(D, E)$	2	4	6	0.04	0.04	0.04
ϵ_{TZA}	Central values of all 4 sets of ϵ			0.04	0.04	0.04
ϵ_{EU}	parameters are listed in table 6B.			0.03	0.04	0.05
ϵ_{AFR}	Lower and upper values are 0.5			0.04	0.04	0.04
ϵ_{ROW}	and 1.5 times central values.			0.04	0.04	0.04
θ_r	NA	0	1	NA	0.04	0.03
θ_r - CRTS model	NA	0	1	NA	0.01	0.00
θ_m	0.025	0.05	0.075	0.04	0.04	0.04
$\sigma(q_i, q_j)$ – goods sectors						
Processed food	4.8	9.6	14.4			
Beverages & tobacco products	1.5	2.3	3.1			
Textile & leather products	2.8	3.6	4.4			
Manufacture of basic & industrial chemicals	1.7	2.5	3.3			
Manufacture of fertilizers & pesticides	1.6	2.4	3.2			
Petroleum refineries	2.8	3.6	4.4			
Glass & cement	2.3	4.6	6.9			
Iron steel & metal products	3.7	7.3	11			
Mining & quarrying	2.8	3.6	4.4			
Grain milling	2.4	3.2	4			
Key:						
$\sigma(q_i, q_j)$: Elasticity of substitution between firm varieties in imperfectly competitive sectors						
$\sigma(va, bs)$: Elasticity of substitution between value-added and business services						
$\sigma(D, M)$: Elasticity of substitution between domestic and imported varieties						
$\sigma(L, K)$: Elasticity of substitution between primary factors of production in value added						
$\sigma(A_1, \dots, A_n)$: Elasticity of substitution in intermediate production between composite Armington aggregate goods						
$\sigma(D, E)$: Elasticity of transformation (domestic output versus exports)						
ϵ_{TZA} : Elasticity of national service firm supply with respect to price of output						
ϵ_{EU} : Elasticity of EU service firm supply with respect to price of output						
ϵ_{AFR} : Elasticity of AFR service firm supply with respect to price of output						
ϵ_{ROW} : Elasticity of Rest of World service firm supply with respect to price of output						
θ_r : Share of rents in services sectors captured by domestic agents						
θ_m : Shares of value added in multinational firms due to specialized primary factor imports						
Source: Authors' estimates.						

Appendix A: Trade Data and Tariff Rates for Tanzania's Trade Partners

Trade Data by Regional Partner and Sector

To obtain the shares of imports and exports from the different regions of our model, we used trade data for 2007 obtained from WITS access to the COMTRADE database.

The regions of our model are Tanzania, the European Union, the East African Customs Union plus SADC and the Rest of the World. For the European Union, we took the 27 member countries as of 2007. In this appendix, we calculate and report data for the East African Customs Union and SADC separately. For the East African Customs Union, we took Kenya, Uganda, Rwanda and Burundi. For SADC we took Angola, Botswana, Democratic Republic of Congo, Lesotho, Madagascar, Malawi, Mauritius, Mozambique, Namibia, South Africa, Swaziland, Zambia and Zimbabwe. Trade shares for the "Africa" region in our model are the sum of East Africa Customs Union plus SADC. Rest of the World is the residual.

We mapped two digit sectors from the COMTRADE database into the sectors of our model. The exact mapping is defined in the first table below. We used Tanzania as the reporter country for both exports and imports. Results for both exports and imports are reported in the subsequent two tables.

Tariff Data.

We were fortunate to receive unusually detailed collected tariff data from the Tanzania Revenue Authority. That is, we received data on collected import duties (tariffs) and import values at the eight digit tariff line level. The collected tariff rates for the sectors in our model are obtained by first aggregating the eight digit tariff line level tariff collections and import values to the sectors of our model. The ratio of tariff collections to import values for each sector of our model is then calculated to give estimates of the collected tariff rates, which in turn are incorporated into our SAM. The tariff rates are shown in Table 4 of the main text. Applying

these tariff rates across all sectors implies that tariff revenue in the revised database is about 1.3% of GDP, which is consistent with collected revenues in Tanzania.²⁵ The SAM has some detail on taxes, which include direct taxes on households and enterprises, import tariffs, producer taxes, indirect (sales) taxes and factor taxes. The data for import tariffs are replaced with collected tariff rate data for the year 2006.

Given that Tanzania participates in preferential trade areas with the East Africa Customs Union and the South African Development Community, it was necessary to make further adjustments. That is, since, in principle, tariff rates should be zero within these preferential trade areas, we set tariff collections on imports from SADC and EACU (our Africa region) at zero. We then increased the tariff rates for the other regions in our model so that the overall weighted average collected tariff rate is unchanged. We used the trade flow data, disaggregated by regions and sectors of our model to weight the tariff rates. This adjustment has the impact of raising the collected tariff rates for the regions in our model where positive tariff rates apply. The resulting adjusted tariff rates are reported in Table 4.

²⁵ For the year 2006, aggregate data from Tanzania show that tariff collections are 1.47 percent of GDP.

Notes on Product/Sector Classifications in SITC Revision 2

Product	SITC Classification (Rev. 2)
All goods	0 to 9
Dixit-Stiglitz Goods	
Beverages and tobacco	1
Food manufactures (excl. bev & tob) **	012+014++0224+023+024++0252+037+046 to 048+056+058+0612+0615+0619+062+0712+0722+0723+073+0812 to 0918+09+41+42+43
Printing and publishing	64
Mineral fuels	3
Chemicals	5
Metals and machines	67+68+69+7
Non-metallic products	66
Other manufactures (excl. CRTS sectors)	62+81+82+83+87+88+89
Agriculture (excl. food manuf & bev, tob)	0+1+2+4-27-28-1-above food manufacturing products
Other goods	All goods-Dixit/Stiglitz goods-above agriculture
Agricultural Products	
Maize	044
Wheat	041
Rice	042
Barley	043
Other cereals	045
Cotton	263
Sugar	061
Coffee	071
Tea	074
Roots and tubers	0548
Oil seeds and pulses	22
Fruits	057+058
Vegetables	054+056
Cut flowers	2927
Other crops	072+075+081
Beef	0111
Dairy products	02
Poultry	0114
Meats of sheep and goats	0112
Other livestock	00+0113+0115+0116+0118
Other CRTS Goods	
Fishing	03
Forestry	24+25
Mining	27+28
Meats and dairy	01+02
Grain milling	046+047
Sugar & bakery confectionary	062+073+048
Textiles and clothing	65+84
Leather and footwear	61+85
Wood and papers	63+64

Note: ** based on all processed and manufacturing food products

Product	Partner					export shares				
	EAC	EU27	SADC	ROW	WLD	EAC	EU27	SADC	ROW	WLD
All goods	258,044	421,282	368,109	1,091,912	2,139,347					
Maize	4,270	0	1,193	6,491	11,954	0.36	0.00	0.10	0.54	1
Rice	2,500	0	68	1,406	3,973	0.63	0.00	0.02	0.35	1
Sorghum & millets/buckwheat	100	40	159	338	638	0.16	0.06	0.25	0.53	1
Wheat/meslin	19,832	3	161	10,959	30,956	0.64	0.00	0.01	0.35	1
Beans, Soya beans	0	129	1	34	164	0.00	0.79	0.00	0.21	1
Cassava/crude anim/veg matl nes	1,099	32,390	767	7,572	41,829	0.03	0.77	0.02	0.18	1
Other cereals (barley,rye, oats)	0	0	4	0	4	0.00	0.00	1.00	0.00	1
Oil seeds excl soya beans	578	1,087	271	31,491	33,426	0.02	0.03	0.01	0.94	1
Veg root/tuber prep/pres	0	6	79	25	109	0.00	0.05	0.72	0.22	1
Cotton	1,076	5,137	1,498	51,661	59,372	0.02	0.09	0.03	0.87	1
Coffee	572	86,326	900	29,801	117,599	0.00	0.73	0.01	0.25	1
Tobacco, raw and wastes	434	72,477	1,485	20,425	94,822	0.00	0.76	0.02	0.22	1
Tea	22,635	10,200	2,603	4,528	39,966	0.57	0.26	0.07	0.11	1
Cashew nuts, fresh/dried	355	8,243	2,703	16,129	27,431	0.01	0.30	0.10	0.59	1
Sisal etc unspun/tow/waste	75	1,637	82	4,239	6,033	0.01	0.27	0.01	0.70	1
Sugar/mollasses/honey	173	21,438	2,041	123	23,776	0.01	0.90	0.09	0.01	1
Veg & fruits, excl nuts	1,744	3,925	217	55,018	60,904	0.03	0.06	0.00	0.90	1
Other crops (cocoa, spices, nuts, ex	202	12,312	17	12,683	25,215	0.01	0.49	0.00	0.50	1
Poultry & livestock	35	147	234	841	1,258	0.03	0.12	0.19	0.67	1
Fish/shellfish/etc.	11,037	107,050	1,604	45,889	165,580	0.07	0.65	0.01	0.28	1
Hunting & forestry	2,239	1,205	729	19,516	23,689	0.09	0.05	0.03	0.82	1
Mining & quarrying	25,702	451	4,009	220,122	250,284	0.10	0.00	0.02	0.88	1
Meats & dairy products	271	11	311	1,913	2,505	0.11	0.00	0.12	0.76	1
Grain milling products	12,346	78	29,440	1,493	43,357	0.28	0.00	0.68	0.03	1
Processed food	10,846	776	9,663	12,129	33,413	0.32	0.02	0.29	0.36	1
Beverages & tobacco products	2,906	429	4,735	591	8,661	0.34	0.05	0.55	0.07	1
Textiles & leather products	18,820	10,640	20,595	29,200	79,256	0.24	0.13	0.26	0.37	1
Wood & paper products	14,322	595	943	8,081	23,941	0.60	0.02	0.04	0.34	1
Chemicals, excl. fertilizer	6,481	814	19,939	6,726	33,960	0.19	0.02	0.59	0.20	1
Manufactured fertilizers	15,599	0	9,750	2	25,351	0.62	0.00	0.38	0.00	1
Petroleum and products	10,512	110	1,889	1,301	13,812	0.76	0.01	0.14	0.09	1
Rubber & plastic products	515	20	7,947	957	9,439	0.05	0.00	0.84	0.10	1
Glass & cement	3,344	17,199	31,558	26,702	78,802	0.04	0.22	0.40	0.34	1
Iron & metal products	5,982	5,387	7,872	10,123	29,365	0.20	0.18	0.27	0.34	1
Machinery & transport equipment	25,503	17,369	31,523	21,171	95,565	0.27	0.18	0.33	0.22	1

Source: SITC Revision 3 data from UN COMTRADE Statistics.

Table A3: Tanzanian Imports by Sector and Partner of the Model in 2007 (in thousands of US dollars and shares by partner)										
Product	Partner					export shares				
	EAC	EU27	SADC	ROW	WORLD	EAC	EU27	SADC	ROW	WORLD
All goods	110,087	1,046,227	684,108	4,078,599	5,919,022	0.02	0.18	0.12	0.69	1
Maize	198	1	1,536	577	2,313	0.09	0.00	0.66	0.25	1
Rice	75	667	7	4,257	5,006	0.02	0.13	0.00	0.85	1
Sorghum & millets/buckwheat	0	0	302	10	312	0.00	0.00	0.97	0.03	1
Wheat/meslin	0	1	0	233,495	233,496	0.00	0.00	0.00	1.00	1
Beans, Soya beans	1	675	609	0	1,284	0.00	0.53	0.47	0.00	1
Cassava/crude anim/veg matl nes	242	2,084	852	837	4,014	0.06	0.52	0.21	0.21	1
Other cereals (barley,rye, oats)	0	1,442	0	24	1,466	0.00	0.98	0.00	0.02	1
Oil seeds excl soya beans	1,208	686	2,935	341	5,169	0.23	0.13	0.57	0.07	1
Veg root/tuber prep/pres	5	352	171	1,121	1,649	0.00	0.21	0.10	0.68	1
Cotton	0	2	0	183	185	0.00	0.01	0.00	0.99	1
Coffee	11	36	55	121	223	0.05	0.16	0.25	0.54	1
Tobacco, raw and wastes	0	2,057	2,934	2	4,993	0.00	0.41	0.59	0.00	1
Tea	0	13	3	4	21	0.01	0.63	0.16	0.19	1
Cashew nuts, fresh/dried	0	0	0	1	1	0.00	0.00	0.20	0.80	1
Sisal etc unspun/tow/waste	0	0	0	0	0	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!
Sugar/mollasses/honey	161	4,849	13,584	46,882	65,475	0.00	0.07	0.21	0.72	1
Veg & fruits, excl nuts	25	2,088	1,445	4,529	8,087	0.00	0.26	0.18	0.56	1
Other crops (cocoa, spices, nuts, ex	25	37	36	217	315	0.08	0.12	0.11	0.69	1
Poultry & livestock	421	521	324	19	1,285	0.33	0.41	0.25	0.01	1
Fish/shellfish/etc.	2	248	151	1,889	2,289	0.00	0.11	0.07	0.82	1
Hunting & forestry	14	112	744	1,409	2,279	0.01	0.05	0.33	0.62	1
Mining & quarrying	6,947	8,295	24,484	39,968	79,695	0.09	0.10	0.31	0.50	1
Meats & dairy products	443	1,105	2,287	1,637	5,472	0.08	0.20	0.42	0.30	1
Grain milling products	146	19,097	1,737	3,537	24,518	0.01	0.78	0.07	0.14	1
Processed food	4,620	21,149	2,570	275,296	303,635	0.02	0.07	0.01	0.91	1
Beverages & tobacco products	573	14,428	9,706	3,826	28,533	0.02	0.51	0.34	0.13	1
Textiles & leather products	1,546	2,647	5,437	90,898	100,528	0.02	0.03	0.05	0.90	1
Wood & paper products	2,034	18,142	23,795	32,411	76,382	0.03	0.24	0.31	0.42	1
Chemicals, excl. fertilizer	15,904	177,325	77,229	345,066	615,524	0.03	0.29	0.13	0.56	1
Manufactured fertilizers	492	21,948	9,573	34,800	66,812	0.01	0.33	0.14	0.52	1
Petroleum and products	23,838	8,188	141,512	1,584,422	1,757,960	0.01	0.00	0.08	0.90	1
Rubber & plastic products	933	15,070	11,490	66,676	94,169	0.01	0.16	0.12	0.71	1
Glass & cement	7,415	11,754	3,474	61,536	84,179	0.09	0.14	0.04	0.73	1
Iron & metal products	15,508	40,123	136,733	211,008	403,372	0.04	0.10	0.34	0.52	1
Machinery & transport equipment	16,544	597,393	162,321	851,018	1,627,276	0.01	0.37	0.10	0.52	1

Source: SITC Revision 3 data from UN COMTRADE Statistics.

Appendix B: Documentation of the Calculation of Ownership Shares for Tanzania

I. Telecommunications in Tanzania

Company Market Shares

The data source for market shares of the fixed line and mobile telephone companies in Tanzania was the website of the Tanzania Communications Regulatory Authority. It provides yearly mobile and fixed-line phone subscription information.²⁶ Table 4 of their website lists the six phone service providers in Tanzania and the number of subscribers for the mobile and fixed-line markets. The information allows us to calculate the market shares for each of the six companies.

²⁶ <http://www.tcra.go.tz/publications/telecom.html>.

Ownership shares

For most of the firms, the ownership data were derived from Paul Buddle Communications, “Tanzania—Telecoms Market Overview and Statistics,” dated April 5, 2008. For the five relevant companies we have the following ownership information.²⁷

Zanzibar Telecommunications Corporaton (Zantel): Etisalat of the UAE acquired a 34% stake, with the government retaining 18%. The other shareholders are Kintbury Investment of the Channel Islands (24%) and MEECO International of Tanzania (24%).

Vodacom Tanzania: Vodacom Tanzania is a subsidiary of South Africa-based Vodacom (Pty) Ltd, which owns 65% of the company. The remainder is held by Tanzanian companies Planetel Communications (16%) and Caspian Construction (19%).²⁸

MIC Tanzania (also known as TIGO): Luxemburg-based Millicom International Cellular (MIC) owned 84% of the company until it assumed 100% ownership in early 2006 when it bought out other minority shareholders.

Celtel Tanzania: Celtel Tanzania Ltd is 60% owned by Celtel International and 40% owned by the Tanzanian government. Celtel International is a subsidiary of the Zain Group of Kuwait.

TTCL: Although it is in the process of privatization, it is 100 percent owned by the Government of Tanzania.

Ownership Share Results

The results for market share by country (in percent) are as follows: Tanzania, 31; EU, 22; EAC, 0; SADC, 27; Rest of World, 20 (see Table B1). In our model, we sum the shares of SADC and EAC for our Africa region.

II. Banks in Tanzania

Bank Market Shares

The data source was Bankscope, an on-line data source for about 29,000 banks world-wide.²⁹ Through Bankscope, we obtained data on total assets by bank in Tanzania, owners-shareholders of the bank and the percent of the bank owned by each owner-shareholder. Market share of each bank was defined based on the bank’s assets as a share of total bank assets in the country. We divided the regions into the European Union, East African Customs Union (EAC),

²⁷ The market share of Benson Informatics, rounded to the nearest one-tenth of one percent is zero. Consequently we ignore Benson.

²⁸ Planetel Communications and Caspian Construction are local TZ companies. See the Mail & Guardian Online at: <http://www.mg.co.za/article/2007-04-13-vodacoms-elite-network>

²⁹ It combines data from the main information provider, Fitch Ratings, and nine other sources, with software for searching and analysis. Each bank report contains balance sheet and income statements with up to 200 data items.

SADC (less the EAC) and Rest of the World.³⁰ In our model, we sum the shares of EAC and SADC (less EAC) to obtain the shares of our Africa region.

Ownership Shares of Banks

Each bank's market share was then allocated among geographic regions according to the shares of ownership of the bank. We then summed across the banks to obtain total market shares by region. In many cases, however, the Bankscope data was inadequate to allocate ownership shares by region. In these cases, we investigated bank websites, to obtain the required ownership information. The results of our supplementary inquiries are listed below.

The results we get are that owners of the banking sector of Tanzania are as follows (in percent): Tanzania, 77; EU, 6; EAC, 2; SADC, 1; ROW, 14 (see Table B2).

Supplementary Information on Ownership Shares of Tanzanian Banks

- Tanzania Postal Bank – 100% Tanzanian:
“United Republic of Tanzania , 45.3%; Revolutionary Government of Zanzibar, 11.0%; Tanzania Posts Corporation, 33.2%; TP & TC SACCOS, 10.5%.” <http://www.postalbank.co.tz/about.htm>.
- Azania Bank Limited – “The Current shareholders of the Bank are as follows:
National Social Security Fund (NSSF), 40%; Parastatal Pension Fund (PPF), 35%; Public Service Pension Fund (PSPF), 14%; East African Development Bank, 7%; Tanzanian Individual including staff, 4%.” <http://www.azaniabank.co.tz/azania/about.htm> .
- Consolidated Bank of Kenya Limited — “The bank is fully owned by the Government of Kenya with the majority shareholding in the bank (51%) held by the Treasury through the Deposit Protection Fund. The remaining shareholding is spread over twenty five (25) parastatals and other government related/controlled organizations.” http://www.consolidated-bank.com/index.php?option=com_content&task=view&id=12&Itemid=57.
- Faulu Kenya Limited – “Faulu Kenya Limited is incorporated in Kenya under the Companies Act and is a 70% owned subsidiary of Food for the Hungry International, which is registered in Switzerland.” http://www.faulukenya.com/images/stories/pdf/Faulu_Annual_Report_2007.pdf .
- Commercial Bank of Africa – “wholly Kenyan owned.” http://www.cba.co.ke/default2.php?active_page_id=117 .
- Micro Provident Tanzania Limited – BW 85% – <http://www.letshego.com/index.php?id=8>
Accessed 3 April 2009.
- Tanzania Investment Bank – 99.3% TZ – “Subscribers to the share capital of the bank are the Government of the United Republic of Tanzania (99.098%), Consolidated Holding Corporation (0.676%) and the National Insurance Corporation of Tanzania Limited (0.226%)” <http://www.tib.co.tz/incorporation.html>.

³⁰ Although we calculated data for the U.S. and the U.K. separately, these were aggregated into the Rest of the World and the European Union, respectively.

III. Tanzanian Insurance Companies

The source of premium data for all Tanzanian insurance companies was the Commissioner of Insurance for Tanzania, *Annual Marketing Report, 2007*. These data are for the year 2007 and were provided by a consultant as they were not publicly available. Based on these premium data, we calculated the market shares of each of the companies. We defined company market share as the share of total premium income in this market.

The source of the ownership shares of each of the companies is the 2009 report on the non-life insurance market of Axco entitled ‘Insurance Market Information: Non-Life.’ From this source we obtained the share of ownership for all companies by country.

In Table B3, we list the result of these calculations.: Tanzania, 53.2; EU, 1.3; EAC, 39.6; SADC,5.9; ROW, 0.

Table B1: Tanzania Telecommunications Sector Ownership Shares, by Region

Telecommunications Company	Shareholder (ISO Country Code)	Ownership %	Subscribers		Company Market	Market Share by Region (%)							
			Mobile	Fixed		TZ	GB	EU	EAC	SADC	US	ROW	
Benson Informatics Limited			3,000		0.02%								
CelTel Tanzania			3,862,371		32.01%								
	CelTel International (Zain Group) (KW)	0.60											19.21%
	TZ government (TZ)	0.40				12.80%							
MIC Tanzania (TIGO)	Millicom International Cellular (MIC) (LU)	1.00	2,569,527		21.30%			21.30%					
Tanzania Telecommunications Co Ltd (TTCL)	Gov't of Tanzania (TZ)	1.00	105,804	116,265	1.84%	1.84%							
Vodacom Tanzania			5,408,439		44.83%								
	Vodacom (Pty) Ltd (ZA)	0.65								29.14%			
	Planetel Communications (TZ)	0.16				7.17%							
	Caspian Construction (TZ)	0.19				8.52%							
Zanzibar Telecommunications Corp (Zantel)			1,057,652	7,544	8.83%								
	Gov't of Zanzibar (TZ)	0.18				1.59%							
	Etisalat (AE)	0.34											3.00%
	Kintbury Investment (GB)	0.24					2.12%						
	MEECO International of Tanzania (TZ)	0.24				2.12%							
	Total Subscribers (Fixed-line and Mobile) =		12,065,406				KE	GB	EU	EAC	COM	US	ROW
							34.04%	2.12%	21.30%	0.00%	29.14%	0.00%	22.21%
							Scaled Share						
							31.29%	1.95%	19.57%	0.00%	26.78%	0.00%	20.41%

Table B2: Tanzania Banking Sector Ownership Shares, by Region (1 of 2)

Bank	Shareholder (ISO Country Code)	Ownership %	Total Assets (2006 USD)	Company Market Share	Market Share by Region (%)						
					TZ	GB	EU	EAC	SADC	US	ROW
1st Adili Bancorp Ltd											
AccessBank Tanzania Limited	African Development Bank (IL)	15.80									
African Banking Corporation Tanzania Ltd	Abc Holdings Limited (BW)	74.00	37803	0.45%					0.45%		
Akiba Commercial Bank			29375	0.35%							
	Accion International (US)	20.00								0.24%	
	Cpp - Incofin (BE)	8.93					0.11%				
	Incofin CVSO (BE)	-									
	Interconsult Ltd (TZ)	-									
	Nederlandse Financierings-Maatschappij	-									
	Parastatal Pensions Fund (TZ)	-									
	Triodos Investment Management B.V. (NL)	-									
Azania Bank Limited	Azania Bank Limited (TZ)	93.00	40070	0.48%	0.48%						
Bank M (Tanzania) Limited											
Bank of Baroda (Tanzania) Ltd	Bank Of Baroda (IN)	100.00	34027	0.41%							0.41%
Bank of Tanzania	State Of Tanzania (TZ)	100.00	3103713	37.15%	37.15%						
Barclays Bank Tanzania	Barclays Bank Plc (GB)	100.00	257673	3.08%		3.08%					
Bayport Financial Services			2707	0.03%							
BOA Bank (Tanzania) Ltd	African Financial Holding Sa-African Financ	34.08	54029	0.65%			0.65%				
Capital Finance Ltd											
CF Union Bank Ltd			23389	0.28%							
Citibank Tanzania Limited	Citibank Overseas Investment Corp (US)	100.00	386973	4.63%						4.63%	
Commercial Bank of Africa	Commercial Bank Of Africa (KE)	100.00	18353	0.22%				0.22%			
CRDB Bank Plc			712012	8.52%							
	Danida Investment Fund (TZ)	30.00			6.42%						
	Parastatal Pensions Fund (TZ)	8.80			1.88%						
	IIP Limited (??)	5.60									
	National Insurance Corporation (??)	2.70									
	Kagera Cooperative Union (??)	1.80									
	Western Tobacco Coop. Union (??)	1.50									
	Shirecu (??)	1.30									
	Hans Macha (??)	1.20									
	CMG Investment Limited (??)	1.10									
	Lindi Development Corporation (??)	1.10									
	Local Authorities Provident Fund (TZ)	1.00			0.21%						
Dar es Salaam Community Bank Limited			23040	0.28%							
	Others	26.31									
	Dar Es Salaam City Council (TZ)	19.00			0.07%						
	Ilala Municipal Council (TZ)	18.23			0.07%						
	Kinondoni Municipal Council (TZ)	18.23			0.07%						
	Temeke Municipal Council (TZ)	18.23			0.07%						

Table B2: Tanzania Banking Sector Ownership Shares, by Region (2 of 2)

Bank	Shareholder (ISO Country Code)	Owner ship %	Total Assets (2006 USD)	Company Market Share	Market Share by Region (%)							
					TZ	GB	EU	EAC	SADC	US	ROW	
Diamond Trust Bank of Tanzania Ltd.	Diamond Trust Bank Kenya Limited (KE)	55.40	59873	0.72%				0.72%				
Eximbank Tanzania			211645	2.53%								
FBME Bank Limited			1067365	12.78%								
Finca Tanzania Limited												
Furaha Finance Ltd												
Greenland Bank (Tanzania) Ltd												
Habib African Bank Ltd			32038	0.38%								
International Commercial Bank (Tanzania) Ltd			24749	0.30%								
Kenya Commercial Bank (Tanzania) Limited	Kenya Commercial Bank Ltd (KE)	100.00	40379	0.48%				0.48%				
Micro Provident Tanzania Limited	Micro Provident Tanzania Limited (BW)	85.00	264	0.00%					0.00%			
National Bureau de Change Limited												
National Microfinance Bank Limited			630469	7.55%								
	Government (TZ)	30.00			2.87%							
	Rabobank Nederland (US)	34.90								3.33%		
	National Investment Co., Ltd. (TW)	6.60									0.63%	
	Eximbank Tanzania (TZ)	5.80			0.55%							
	Tccia Investment Company Limited (TZ)	1.70			0.16%							
NBC Ltd-National Bank of Commerce Limited	Absa Group Limited (ZA)	55.00	642372	7.69%					7.69%			
People's Bank of Zanzibar Limited			57328	0.69%								
Promotion of Rural Initiatives and Development Enterprises Limited												
Savings & Finance Commercial Bank	East African Development Bank (II)	33.00	28262	0.34%							0.34%	
Stanbic Bank Tanzania	Stanbic Africa Holdings Limited (GB)	100.00	254507	3.05%		3.05%						
Standard Chartered Bank Tanzania	Standard Chartered Holdings (Africa) B.V. (100.00	441159	5.28%			5.28%					
Tanzania Development Finance Company Lim	Abc Holdings Limited (BW)	68.00										
Tanzania Investment Bank	Tanzania Investment Bank (TZ)	99.30	60444	0.72%	0.72%							
Tanzania Postal Bank			58082	0.70%								
	State Of Tanzania (TZ)	45.30			0.31%							
	Tanzania Posts & Telecommunications Sav	10.50			0.07%							
	Tanzania Posts Corporation (TZ)	33.20			0.23%							
	Zanzibar Revolutionary Government (TZ)	11.00			0.08%							
Twiga Bancorp Limited	National Bank Of Commerce Limited-Nbc L	100.00	22741	0.27%	0.27%							
			Grand Total =	8354842								
					Market Share	50.01%	3.08%	0.76%	1.42%	0.46%	8.21%	1.04%
					Scaled Share	76.97%	4.75%	1.16%	2.19%	0.70%	12.63%	1.60%

Table B3: Tanzania Insurance Sector Ownership Shares, by Region (1 of 2)

Insurance Company	Shareholder (ISO Country Code)	Ownership %	Income (millions USD 2007)	Company Market Share	Market Share by Region (%)						
					TZ	GB	EU	EAC	SADC	US	ROW
Alliance Insurance Corp.			12.6	10.71%							
	Union Trust Investments Ltd. (TZ)	55.00			5.89%						
	Heritage Insurance Company (T) Ltd	45.00						4.82%			
AAR Insurance Co.	AAR Holdings (KE)	100.00	0.9	0.76%				0.76%			
Heritage Insurance Co. (T) Ltd.			22.6	19.20%							
	Heritage Insurance Company (KE)	60.00						11.52%			
	MAC Group (TZ)	40.00			7.68%						
Jubilee Insurance Co. of Tanzania			11.1	9.43%							
	Jubilee Insurance of Kenya (KE)	66.00						6.22%			
	Domestic shareholders (TZ)	34.00			3.21%						
Lion of Tanzania Insurance Co.			5.5	4.67%							
	Lion of Kenya (KE)	53.00						2.48%			
	Tanzania Development Finance Com	47.00			2.20%						
	And other TZ shareholders (TZ)										
Mgen Tanzania Insurance Co. Ltd.	Madison Insurance Group (ZM)	100.00	1.7	1.44%					1.44%		
Niko Insurance (Tanzania) Ltd.			6.2	5.27%							
	Nico Holdings Ltd (MW)	66.00						3.48%			
	Amir Jamal (TZ)	34.00			1.79%						
Phoenix of Tanzania Assurance Co. Ltd.			10.1	8.58%							
	Phoenix of East Africa (KE)	51.00						4.38%			
	TZ citizens (TZ)	34.00			2.92%						
	British citizen (GB)	15.00				1.29%					
Prosperity Life Care Insurance (T) Ltd.	Prosperity Life Care Insurance (ZA)	100.00	1.1	0.93%					0.93%		
Reliance Insurance Co. (T) Ltd.			6.0	5.10%							
	Pan Africa Insurance (KE)	30.00						1.53%			
	A group of Tanzanian businessmen (70.00			3.57%						
Real Insurance Tanzania Ltd. (Royal Insurance)			5.2	4.42%							
	Real Insurance (KE)	55.00						2.43%			
	Local shareholders (TZ)	45.00			1.99%						

Appendix C : Estimates of the Dixit-Stiglitz Elasticities of Substitution for Goods

It was necessary for us to obtain estimates of the Dixit-Stiglitz product variety elasticities of substitution for the imperfectly competitive sectors in our model. Christian Broda, Joshua Greenfield and David Weinstein (2006) estimated Dixit-Stiglitz product variety elasticities of substitution at the 3 digit level in 73 countries. Among the 73 countries, there were four in sub-Saharan Africa: the Central African Republic, Madagascar, Malawi and Mauritius. We judged that Madagascar was the country closest in characteristics to Tanzania, so we took the values of the elasticities estimated for Madagascar as a proxy for the elasticities for Tanzania.

Broda et al., estimate 3 digit elasticities for 130 goods sectors, but there are 34 goods sectors in our model, It was necessary to map the sectors estimated by Broda et al. into the sectors of our model. In table C1 of this appendix, we show the mapping for the imperfectly competitive sectors. (These elasticities are not relevant in our model for perfectly competitive sectors.)

Next, since there are often multiple sectors from Broda et al. mapped into a single sector in our model, it was necessary to determine a method of weighting the Broda et al. elasticities. There are reasons to use both export shares as well as import shares. A larger share of a subcategory in imports reflects more imports, and more likely there are more varieties of imports. So weighting by the import share of a subcategory is better than an unweighted measure. Domestic varieties are also important. Since we do not have production data for the subcategories, we use export shares as a proxy for domestic production by subcategory. Analogously, weighting subcategories by export shares is better than unweighted categories. Since both import shares and export shares are useful in the weighting, we take one half the shares of both exports and imports as the weights. We obtained the data for the import and export shares from the COMTRADE database. The resulting elasticities are reported in table C1.

For the sensitivity analysis, we must take upper and lower bounds of the elasticities. Unfortunately, Broda et al. only report point estimates in their on-line Excel file. In the paper itself, however, Broda et al. (2006, table 4, p. 36) list the standard error of the median Dixit-Stiglitz estimate for the country. The standard errors are rather small for most countries. In the case of Madagascar, the median Dixit-Stiglitz elasticity is 3.6 with a standard error (of the median estimate) of 0.27.

Although we don't have standard errors at the product line level, we use the overall estimate of the standard error to guide our choice of upper and lower values of the estimates. The low standard error suggests that we do not need to take very large ranges to check for robustness. For central values of 3.6 or less, we took plus or minus three times the average standard error of 0.27. CGE modelers have often doubled and halved the central estimate in the sensitivity. For central values greater than 3.6, we took plus or minus 50% of the value of the parameter, which gives a wider band than plus or minus three times the standard error. For these elasticities, this presents a tougher test of the robustness of our model.

Broda, Christian , Joshua Greenfield and David Weinstein (2006), "From Groundnuts to Globalization: A Structural Estimate of Trade and Growth," National Bureau of Economic Research Working Paper 12512. Available at:
<http://faculty.chicagobooth.edu/christian.broda/website/research/unrestricted/TradeElasticities/TradeElasticities.html>.

Sector in our Model	Matching HS-3 Code from Broda et al estimates	weighted elasticity of substitution
Processed food	110, 150, 151, 160, 170, 180 190, 200, 210	10
Beverages & tobacco products	220, 240	2
Textile & leather products	510-630, 650, 420	4
Manufacture of basic & industrial chemicals	280-391	3
Manufacture of fertilizers & pesticides	310	2
Petroleum refineries	271	4
Glass & cement	680-702	5
Iron steel & metal products	720-831	7
Mining & quarrying	270, 271	4
Grain milling	110	3

Source: Authors calculations based on estimates from Broda, Greenfield and Weinstein (2006).

Appendix D: Engineering Services in Tanzania - Restrictiveness Index³¹

Table 1 below is a table taken from Nguyen-Hong (2000) for Vietnam in which the components of the engineering restrictiveness index as well as the scoring options are presented. The actual scores in table 1 are for Vietnam. The scores for Tanzania and the reasons for the scoring follow below the table. The Tanzania scores are based on the results of the World Bank Regulatory Survey in East Africa³² and the World Bank Survey on Applied Policies in Services³³.

Barriers to establishment

Form of establishment Score 0.5

All forms of legal entities (sole proprietorship, limited liability partnerships, general partnership, individual enterprise, limited liability companies and public limited companies) are permitted for both domestic and foreign firms.

However, according to the Engineering Registration Act no. 63 Para 12: “1) No person or body of persons not citizen of the United Republic shall be registered as a local consultant or consulting firm unless—(a) in the case of natural person, he is a citizen of the United Republic; (b) in the case of a company, it is incorporated in Tanzania and the majority of its shares are owned by the citizens of the

³¹ The work on the estimation of the ad valorem equivalents of the barriers in engineering services was done by Josaphat Kweka with the guidance of Nora Dihel.

³² The regulatory surveys were conducted by local consultants who interviewed the professional associations in the examined East African countries in 2009.

³³ The policy surveys were conducted by The World Bank Research Department in 2008-2009.

United Republic. If these conditions are not met, the company shall be registered as a foreign consulting firm”. Thus, only some form of incorporation permitted.

Table D1: Professions Restrictiveness Index

Weight - foreign index	Weight - domestic index	Score	Restriction
<i>Barriers to establishment</i>			
0.0800	0.0800	1.00	Form of establishment Prohibition on incorporation
		0.50	Some form of incorporation permitted
		0.00	No restrictions
0.0800		1.00	Foreign partnership/association/joint venture Prohibition on partnership/association/joint venture with foreign professionals
		0.50	Partnership/joint venture with foreign professionals required
		0.00	No restrictions
0.0500			Investment and ownership by foreign professionals The score will be proportional to maximum equity participation permitted in a professional firm. For example, ownership to a maximum of 49 per cent of law firm would receive a score of 0.51.
0.0500	0.0500		Investment and ownership by non-professional investors The score will be proportional to maximum non-professional equity participation permitted in a professional firm. For example, ownership to a maximum of 49 per cent of law firm would receive a score of 0.51.
0.1350		1.00	Nationality/citizenship requirements Nationality required to qualify, become member of professional body, or to practice
		0.25	Nationality required to obtain professional title, but practice is relatively free
		0.00	No restrictions
0.1350		1.00	Residency and local presence Permanent or prior residency (more than 12 months) required
		0.75	Less than 12 months prior residency
		0.50	Prior residency required for local training
		0.25	Domicile or representative office only
		0.00	No restrictions
0.1000		1.00	Quotas/economic tests on the number of foreign professionals and firms Quotas/economic needs tests
		0.50	Some restrictions apply
		0.00	No restrictions

Weight - foreign index	Weight - domestic index	Score	Restriction
0.1000			Licensing and accreditation of foreign professionals
		1.00	Local retraining required for full license
		0.75	Local examination required in all cases
		0.50	Case by case assessment of foreign qualification/licence
		0.25	Aptitude tests
		0.00	Foreign licence/qualifications sufficient to practice
	0.0500		Licensing and accreditation of domestic professionals (scores additive)
		0.25	Compulsory membership of professional association
		0.25	Professional examination requirements
		0.25	Practical experience requirements
		0.25	Higher education requirements
0.0200			Movement of People - Permanent
		1.00	No entry of executives, senior managers or specialists
		0.80	Executives, specialists or senior managers can stay a period of up to 1 year
		0.60	Executives, specialists or senior managers can stay a period of up to 2 years
		0.40	Executives, specialists or senior managers can stay a period of up to 3 years
		0.20	Executives, specialists or senior managers can stay a period of up to 4 years
		0.00	Executives, specialists or senior managers can stay a period of 5 or more years
			<i>Barriers to ongoing operations</i>
0.0500	0.0500		Activities reserved by law to the profession
		1.00	4 core activities and over
		0.75	3 core activities
		0.50	2 core activities
		0.25	1 core activity
		0.00	None
0.0500	0.0500		Multidisciplinary practices
		1.00	Prohibition on partnership with other professionals
		0.50	Majority partnership required
		0.00	No restrictions
0.0500	0.0500		Advertising, marketing and solicitation
		1.00	Advertising, marketing and solicitation restricted
		0.50	Some form of advertising, marketing or solicitation allowed
		0.00	No restrictions

Weight - foreign index	Weight - domestic index	Score	Restriction
0.0500	0.0500		Fee setting
		1.00	Mandatory minimum or maximum fees
		0.50	Restrictions for some groups or activities
		0.00	No restrictions
0.0200			Licensing requirements on management
		1.00	All directors/managers or at least a majority of them must be nationals or residents
		0.75	At least one director/managers must be nationals or residents
		0.50	Directors and managers must be locally licensed
		0.25	Directors and managers must be domiciled
		0.00	No restrictions
0.0200			Other restrictions (scores additive)
		0.33	Restrictions on hiring professionals
		0.33	Restrictions on the use of firm's international names
		0.33	Government procurement - restrictions towards foreigners
		0.00	No restrictions
0.0100			Movement of people - Temporary
		1.00	No temporary entry of executives, senior managers or specialists
		0.75	Temporary entry of executives, senior managers or specialists up to 30 days
		0.50	Temporary entry of executives, senior managers or specialists up to 60 days
		0.25	Temporary entry of executives, senior managers or specialists up to 90 days
		0.00	Temporary entry of executives, senior managers or specialists over 90 days
1.0000	0.3800		Total

Source: Nguyen-Hong (2000).

Foreign partnership/joint venture/association Score 0.5

The information provided in the section on the form of establishment suggests that if a foreign firm is not in a partnership/joint venture, then it can be only a branch. Therefore, the score is 0.5.

Investment and ownership by foreign professionals Score 0.5

The majority of a company's shares have to be owned by Tanzanians.

Investment and ownership by non-professional investors Score 0.5

The majority of a company's shares have to be owned by Tanzanians.

Nationality/citizenship requirements Score 0

No restrictions.

Residency and local presence Score 0

No restrictions.

Quotas/economic tests on the number of foreign professionals and firms Score 0

No restrictions.

Licensing and accreditation of domestic professionals Score 1

Compulsory membership in professional association, professional examination, practical experience, and proof of higher education are required.

Licensing and accreditation of foreign professionals Score 0.5

Case by case assessment of foreign qualifications. According to the Contractors Registration Act Cap270 “the Council may require an applicant for registration under this section to appear before it or produce documents relating to his work or employment”.

Movement of people - permanent Score 0.25

The Contractors Registration Act Cap 270: “the Council may, if it is satisfied that this professional and general conduct renders him a fit and proper person to be registered, direct that he be registered under this section for the duration of the specific assignment or for such period as the Council may specify”. Such as case by case assessment received a score of 0.5 (see the example of Vietnam in the Compendium). However, in Tanzania, professionals can be granted longer term /permanent permits if requested and dictated by market demand; therefore, the Country Office suggested to allocate a score of 0.25 to take into account this open-ended possibility.

On-going operations**Activities reserved by law to the profession Score 1**

Domestic firms have exclusive rights / shared exclusive rights in 9 out of 10 categories. In addition, foreign firms can provide only 5 of the 10 categories (discriminatory rule).

Multidisciplinary practices Score 0.6

There are no restrictions on inter-professional cooperation (partnerships, associations, joint ventures) for both domestic and foreign suppliers. However, for consulting engineers there is a requirement for majority partnership. Also, foreign firms are not allowed to provide representation for obtaining permits - discriminatory practice.

Advertising, marketing and solicitation- foreign Score 0.5

Advertising and marketing by engineering professionals is not prohibited. Same provisions apply to domestic and foreign suppliers. However, foreign suppliers licensed to practice in Tanzania are not allowed to use their foreign supplier's name in advertising and marketing activities.

Advertising, marketing and solicitation - domestic Score 0

Advertising and marketing by engineering professionals is not prohibited.

Fee setting - domestic Score 1

Fees and prices are regulated – there are binding minimum prices for all engineering services. According to ERB these measures regarding fees are applicable to domestic services providers only (they do not apply to foreign engineering service providers licensed to practice in Tanzania).

Fee setting- foreign Score 0

Fee regulations do not apply to foreign engineering service providers licensed to practice in Tanzania).

Licensing requirements on management Score 0

No restrictions.

Movement of people – Temporary Score 0.5

Case by case decision

Other restrictions (Addition categories) Score 1

Restrictions on use of firm's international name, restrictions on hiring professionals and government procurement restrictions towards foreigners.

Sources:

Dee, P. (2005), "A compendium of barriers to services trade", prepared for the World Bank,
http://www.crawford.anu.edu.au/pdf/staff/phillippa_dee/Combined_report.pdf

Nguyen-Hong, D. (2000), "Restrictions on Trade in Professional Services", Productivity Commission Staff Research Paper, Ausinfo, Canberra. Available at:
<http://www.pc.gov.au/research/staffresearch/rotips>

World Bank Regulatory Survey in East Africa conducted in the context of the Project "Trade in Professional Services in East Africa" in 2009.

World Bank Survey on Applied Policies in Services conducted by DECRG in 2008-2009.

Appendix E: Data on Research and Development Expenditures and Sales for the United States in 2004 and 2005.

TABLE E1. Funds for industrial R&D and sales for companies performing industrial R&D in the United States, by industry: 2004 and 2005

Industry and company size	NAICS codes	All R&D			Sales in \$millions in 2005	Ratio of R&D expenses to sales (x1,000)
		2004	2005	2004-2005 average		
		\$millions				
All industries	21-23, 31-33, 42, 44-81	208,301	226,159	217,230	6,119,133	36
Manufacturing industries	31-33	147,288	158,190	152,739	3,998,256	38
Food	311	2,254	2,716	2,485	374,342	7
Beverage and tobacco products	312	555	539	547	38,003	14
Textiles, apparel, and leather	313-16	570	816	693	51,639	13
Wood products	321	D	D	0	27,002	0
Paper, printing, and support activities	322, 323	D	D	0	159,608	0
Petroleum and coal products	324	1,603	D	802	404,317	2
Chemicals	325	D	42,995	21,498	624,344	34
Pharmaceuticals and medicines	3254	31,477	34,839	33,158	273,377	121
Plastics and rubber products	326	D	1,760	880	90,176	10
Nonmetallic mineral products	327	787	894	841	50,344	17
Primary metals	331	727	631	679	110,960	6
Fabricated metal products	332	1,512	1,375	1,444	174,165	8
Machinery	333	6,579	8,531	7,555	230,941	33
Computer and electronic products	334	48,296	D	24,148	472,330	51
Electrical equipment, appliances, and components	335	2,664	2,424	2,544	101,398	25
Transportation equipment	336	D	D	0	957,051	See note
Motor vehicles, trailers, and parts	3361-63	15,677	D	7,839	646,486	12
Aerospace products and parts	3364	13,086	15,005	14,046	227,271	62
Other transportation equipment	other 336	D	D	0	83,294	0
Furniture and related products	337	408	400	404	48,534	8
Miscellaneous manufacturing	339	4,388	5,143	4,766	83,103	57
Medical equipment and supplies	3391	3,343	4,374	3,859	56,661	68
Other miscellaneous manufacturing	other 339	1,045	769	907	26,442	34
		\$millions				
		All R&D				
		2004	2005	2004-2005 average		
		\$millions				
Nonmanufacturing industries	21-23, 42, 44-81	61,013	67,969	64,491	2,120,877	30
Mining, extraction, and support activities	21	D	D	0	33,665	0
Utilities	22	202	210	206	223,395	1
Construction	23	1,481	D	741	57,187	13
Wholesale trade	42	D	D	0	107,485	0
Retail trade	44, 45	1,596	D	798	232,150	3
Transportation and warehousing*	48, 49	D	D	0	79,436	See Note
Information	51	22,593	23,836	23,215	445,489	52
Finance, insurance, and real estate	52, 53	1,708	3,030	2,369	580,380	4
Professional, scientific, and technical services	54	28,709	32,021	30,365	261,500	116
Architectural, engineering, and related services	5413	4,265	4,687	4,476	50,121	89
Computer systems design and related services	5415	11,575	13,592	12,584	136,376	92
Scientific R&D services	5417	11,355	12,299	11,827	34,516	343
Other professional, scientific, and technical services: other	54	1,514	1,444	1,479	40,487	37
Health care services	621-23	500	989	745	25,076	30
Other nonmanufacturing ^b	55, 56, 61, 624, 71, 72, 81	1,595	2,137	1,866	75,115	25

*We evaluate transportation as a medium R&D sector since three sectors dominate R&D expenditures of US multinationals operating abroad. These are transportation, chemicals and computers and electronics. Moreover, about two-thirds of all R&D expenditures of foreign multinationals operating in the US was performed in the same three sectors. See "U.S. and International Research and Development: Funds and Technology Linkages," at <http://www.nsf.gov/statistics/seind04/c4/c4s5.htm>.

SOURCE: Calculated from data in National Science Foundation, Division of Science Resources Statistics, *Survey of Industrial Research and Development: 2005, Data Tables*. Available at: http://www.nsf.gov/statistics/nsf10319/content.cfm?pub_id=3750&id=3.