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What Determines whether Preferential Liberalization of Barriers against Foreign Investors in Services Are Beneficial or Immizerising: Application to the Case of Kenya

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Abstract
Despite the fact that many modern preferential trade agreements include commitments to foreign investors in imperfectly competitive services sectors, the literature has not established conditions under which these agreements are beneficial or harmful. The authors fill that void by developing a model with monopolistic competition and foreign direct investment in services with Dixit-Stiglitz endogenous productivity effects from additional varieties. They specify a numerical model, with probability distributions of all parameters. The model is executed 30,000 times, and results are reported as probability of an outcome, based on the sample distribution. In order to ground the results in reality, the authors apply the model to Kenya. They show that preferential commitments in services could be immizerising. Losses are more likely the greater the share of initial rent capture on the services barriers in our home country and the more technologically advanced are the excluded regions relative to the partner region.

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Keywords Immizerising services liberalization; preferential liberalization; multinationals; monopolistic competition; foreign direct investment; endogenous productivity effects

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What Determines Whether Preferential Liberalization of Barriers against Foreign Investors in Services are Beneficial or Immizerising: Application to the case of Kenya

I. Introduction

Since the early 1990s, regional trade agreements have surged; 283 have been notified to the WTO and were in force as of February 2010.[1] Commitments to foreign investors in services are now key aspects of modern FTA agreements negotiated with the EU and the US, and in some other agreements. The literature, however, contains neither analytical nor numerical results on the general equilibrium welfare impacts of preferential commitments to foreign investors in the presence of imperfect competition in services sectors.[2] Given that commitments to foreign investors in services sectors (many of which are imperfectly competitive) are key aspects of modern FTA agreements, the objective of this paper is to determine if such agreements can be immizerising, and the conditions that make it more or less likely the agreements are beneficial. Further, we develop a numerical general equilibrium framework to assess these agreements in practice.

It is well known that the welfare effects of preferential trade in goods are ambiguous, with welfare losses possible in perfectly competitive models due to the loss of tariff revenue on the decline in imports from excluded countries. In services, however, there typically is no tax revenue on barriers to foreign investors, leading some experts to suggest that gains from preferential liberalization of services are much more likely than in goods (Mattoo and Fink, 2001). But Mattoo and Fink acknowledge that if the home country is capturing rents from the barriers, these rents play the same role in preferential liberalization of services as tariffs in goods, leading to possible losses.[3] And despite the fact that key

[1]See http://www.wto.org/english/tratop_e/region_e/region_e.htm. This does not include a significant number of regional agreements that are in force (among developing countries) that have not been notified to the WTO.
[2] There have been several numerical modeling papers in recent years that examine FDI in services, without a regional dimension, including Markusen, Rutherford and Tarr (2005), Konan and Maskus (2006), Rutherford and Tarr (2008), Brown and Stern (2001), Dee et al. (2003), Jensen *et al*. (2007, 2010), and Balistreri *et al*. (2009).
[3] See Jensen and Tarr (2010) for a detailed analytical treatment.

sectors in the negotiations are characterized by imperfect competition (like banking, insurance and telecommunications), there has not been any analytical work assessing the welfare impacts with imperfect competition.[4]

Any modeling effort must take into account the mounting evidence on the productivity gains of FDI in services.[5] The essential features of the problem, however, (general equilibrium, imperfect competition, foreign direct investment and endogenous productivity effects) make the model sufficiently complex that analytic solutions are exceedingly difficult. Consequently, we construct a numerical model which contains these features (endogenous productivity effects from Dixit-Stiglitz variety effects) and specify probability distributions of all parameters. We execute the model 30,000 times, where each simulation is based on a random draw of all the parameter values. The results are reported as probability of an outcome, based on the sample distribution.

In order to ground the results in reality, we apply the model to Kenya, a developing country that is facing a range of regional trade agreements that include services including the Economic Partnership Agreements with the European Union and the Tripartite Free Trade Agreement among the Common Market for Eastern and Southern Africa (COMESA), the East African Customs Union and the South African Development Community (SADC).[6] We build on the 55 sector small open economy model of Kenya by Balistreri, Rutherford and Tarr (2009), but decompose the rest of the world into the European Union, our Africa region and the Rest of the World. In each imperfectly competitive sector, firm types differ by sector and region. Based on the now extensive econometric literature begun by Coe and Helpman (1995), we allow the Dixit-Stiglitz endogenous productivity effects to vary by the level of development of the partner region, and by sector.

[4] Mattoo and Fink (2001) develop analytic results that show that due to "first mover" advantages, preferential liberalization in services could result in reduced gains from subsequent multilateral liberalization. But they do not show a case of where the preferential liberalization, ceteris paribus, results in welfare losses.

[5] See Francois and Hoekman (2010) for a survey of more than a dozen empirical studies that support this finding. Also see the survey in Jensen and Tarr (2010) for additional studies. Support comes from a variety of sources including studies that use firm level data, such as Arnold et al. (2011) for the Czech Republic and Fernandes and Paunov (2012) for Chile, and studies that use cross country growth regressions, e.g., Mattoo *et al*. (2006) and Fernandes (2009).

[6] See Appendix table 1for a list of COMESA and East African Customs Union countries.

Preferential liberalization of services barriers results in an increase in varieties (with productivity gains) from regional partners, but losses of varieties (and lost productivity) from excluded countries. The possible losses for Kenya in a services agreement with our Africa region show that, with some plausible parameter values, there is an imperfect competition analogy to trade diversion in goods whereby preferential commitments in services could be immizerising due to a loss of varieties of services from excluded countries combined with lost domestic rents.

Piecemeal sensitivity analysis shows that the two most important parameters in the model are the share of rents captured by domestic agents and the parameter that captures the capacity of a region to transfer technology to Kenya. We present results of detailed sensitivity analysis with these parameters that show that the gains are both larger and more likely to be positive the more technologically advanced is the partner region relative to the excluded regions, and the less the rent capture on initial barriers in services. While there are no tariffs or taxes on FDI in services, if Kenyans are assumed to capture the rents from barriers in services, then, even in a constant returns to scale version of our model, the mean estimate is that Kenya would lose from preferential liberalization with the Africa region.

The paper is organized as follows. In section II, we provide an overview of the Kenyan services sectors. We discuss how we estimated the tariff equivalents of the barriers in services in section III. We provide an overview of the model in section IV and a discussion of the data in section V. The central results are presented in section VI and sensitivity results are presented in section VII. Conclusions are presented in section VIII.

II. Overview of the Kenyan Service Sectors[7]

Transportation

Kenya's port, rail and road transportation facilities are plagued by significant bureaucratic and regulatory problems (on which we focus) as well as investment problems—problems that raise the costs of transportation of its goods. In both 2011 and 2012, Kenya was ranked 141st out of 183 countries on the Doing Business Survey category known as "Trading Across Borders." In 2011, the costs of exporting a

[7] For more details of the services sectors in Kenya, see Balistreri and Tarr (2011).

container were $2055 and the costs of importing a container were $2190.[8] While these costs are about average for sub-Saharan Africa, Freund and Rocha (2011) have shown that transit delays and costs have significantly impeded Africa's exports, especially on inland transportation.

One bright spot in the Kenyan transportation network is its air transportation services. In recent years, Kenya allowed private sector development (both Kenyan and foreign) of air transportation links. The efficient air transportation services facilitate the important tourism sector and have been instrumental in the development of the Kenyan cut flower industry.

Telecommunications

Kenya's telecommunications services have been expensive compared with other sub-Saharan African countries and even more when compared with those of East and South Asia. Data transmissions are especially expensive by international standards.[9] Perhaps more importantly, is the low efficiency of service provision (see World Bank, 2007, pp.45-47). Kenya has required that telephone companies must be at least 30 percent owned by Kenyan nationals, a constraint that likely leads to some rent capture by Kenyans. Problems related to the licensing of the third mobile telephone provider and the "Second National Operator" were primarily due to this restraint. In fact, the Government has acknowledged that the 30 percent ownership requirement has delayed licensing of additional telecom operators.

Banking and Insurance

Relative to other countries in Africa, Kenya has a well developed financial sector. Nonetheless, medium, small and micro enterprises have severe problems accessing credit and obtaining insurance (World Bank, 2007). In practice, affiliates of multinational banks are provided full market access and national treatment, but Kenya has not "bound" this practice at the WTO. The European Union has requested that Kenya commit to national treatment of foreign investment in the sector by binding this commitment at the WTO. Branch banking by foreign banks, however, is not permitted.

Regarding the regulatory environment in insurance, **c**ross border provision of insurance is limited to cargo insurance and reinsurance services. In addition, the ownership of an insurance company must be

[8]See http://www.doingbusiness.org/data/exploretopics/trading-across-borders.
[9] Surprisingly, this does not appear to have improved in 2010 after the completion of the underwater fiber-optic cable connection to Kenya.

at least one-third Kenyan and one-third of the members of the Boards of Directors must be Kenyan (restraints that may allow Kenyans to capture rents on incumbent multinational enterprises operating in Kenya).

Professional Services

There are rather severe restrictions on the rights of foreigners to operate with a license in many of the professional services sectors, including legal, accounting, auditing and engineering services. Foreign professionals working in Kenya must typically do so in the office of a licensed Kenyan, providing rents to Kenyans.

III. 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. Our methodology builds on a series of studies supported by the Australian Productivity Commission, especially the papers by Warren (2000) in telecommunications, Kalirajan et al. (2000) in financial services, Kang (2000) in transportation services and Nguyen-Hong (2000) in engineering services. For each of these service sectors, the authors first developed a matrix to evaluate and score the regulatory environment in the sector they were studying. The regulatory regimes are evaluated on criteria such as ease of getting a license; measures that restrict a form of commercial presence; maximum ownership shares allowed for foreign investors; and whether senior executives are allowed to work in the country either permanently or temporarily. They collected data and assessed the regulatory regimes of many countries. Evaluations of each criterion were transformed into a quantitative score and weights were assigned to each criterion so that the regulatory regimes of each country were transformed a "restrictiveness index." They then regressed the price of services against their restrictiveness index and other relevant variables to determine the impact of the regulatory barriers on the price of services.[10] Through this regression, it is possible to obtain an ad valorem equivalence of the regulatory barriers in the countries of their sample.

Our methodology assumes that the international regression estimated by these authors applies to Kenya. To build on their regression estimates, it is necessary to score the identical matrix of regulatory

[10]Warren estimated quantity impacts and then using elasticity estimates was able to obtain price impacts.

barriers. For this task, we first need to assess the regulatory environment in the services sectors in our model. This was based on a 54 page questionnaire of the regulatory regimes in key Kenyan business services sectors, namely, insurance, banking, fixed line and mobile telecommunications services and maritime transportation services and a separate questionnaire in engineering services.[11] We supplemented this questionnaire information based on a good set of studies on the services sectors that were presented at the conference on "Trade in Services" in Nairobi, Kenya on March 26-27, 2007 (attended by one of the authors) and World Bank reports, including World Bank (2007).

Based on the information obtained, Mircheva (2007) scored the regulatory regimes in fixed line and mobile telecommunications, banking, insurance and maritime transportation services sectors and produced a measure of the trade restrictiveness index for each sector. Mircheva then used her calculation of the restrictiveness indices for the various Kenyan services sectors in the regression for the corresponding services sector to obtain the price impact of the regulatory barriers. From the price impact estimate, she calculated the ad valorem equivalents of the discriminatory and non-discriminatory barriers in her services sectors. In the case of professional services, we used engineering services as a proxy for all professional services and the work was carried out by Josaphat Kweka.[12] The results of the estimation are presented in table 1.

The alternative to the methodology we have chosen is to estimate a gravity equation, as has been done in several studies, including Francois et al. (2005). An advantage of the gravity approach is that it allows the authors to estimate the ad valorem equivalents of barriers in services for many countries and sectors without having to collect data on the regulatory regimes. But the gravity model requires data on services flows which are typically only available on a cross-border basis; so it ignores barriers to foreign direct investment in services. The principal advantage of our approach over a gravity estimation procedure is that our estimates are specifically linked to the regulatory regime, including the important barriers against

[11] We thank Ms. Sonal Sejpal of the Kenyan law firm of Anjarwalla & Khanna Advocates for leading the research work on the general effort. Nora Dihel led the survey in engineering services.

[12] See appendix D, "Engineering Services in Kenya." Since the methodology requires the existence of a cross-country regression estimate of the impact of barriers to foreign direct investment, and engineering services is the only professional service for which it exists, we must use engineering services as our proxy.

foreign direct investment. In our discussions in Kenya and elsewhere, policy-makers wanted to know the barriers that are in place that gave rise to the ad valorem equivalents. Being able to link the estimates to the regulatory regime gave credibility in the discussions with government policy-makers, and began the discussion of what are the most important reform issues.

Nonetheless, we acknowledge that our estimates are subject to a margin of error. As a result, when we conduct sensitivity analysis, we include in the sensitivity analysis estimates of the ad valorem equivalents of the barriers in our services sectors.

IV. Overview of the Model

A full algebraic description of the model may be found in appendix F. Here we provide a general description of the structure while focusing on the extensions to a model that can address preferential liberalization. The principal extension from earlier work of Balistreri *et al*. (2009) is that we disaggregate the rest of the world region into three regions: (1) the European Union; (2) the union of the East African Customs Union and COMESA, which we call our African region; and (3) the Rest of the World. We retain the small open economy model framework, so only Kenya is modeled fully. There are 55 sectors in the model shown in table 1. The primary factors are skilled, semi-skilled and unskilled labor; 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. Each firm type in each imperfectly competitive sector requires its own sector specific capital; this implies that there are decreasing returns to scale in the use of the mobile factors and industry marginal cost curves for firms of the same type slope up. This is explained algebraically in appendix G.

There are three categories of sectors 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. In the imperfectly competitive sectors, this requires introducing different firm types with distinct cost structures for each region.

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 20 of the agriculture sectors and 19 manufacturing or services sectors listed in table 1. In these sectors, products are differentiated by country of origin, i.e., we employ the Armington assumption. All 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 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.

Goods produced subject to increasing returns to scale

In all imperfectly competitive goods and services sectors, goods are differentiated at the firm level. Firms in each region are assumed to have identical cost structures, but the costs of firms differ across regions. So there are four firm types per sector in the model—one representative firm type for each region. We assume that the seven manufactured goods may be produced domestically or imported from firms in any region in the model. Firms in these industries set prices such that marginal cost (which does not vary with output) equals marginal revenue; and there is free entry, which drives profits to zero. Foreigners produce the goods abroad at constant marginal cost but incur a fixed cost of exporting to Kenya. 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. 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.

Since we assume that consumers have a love of variety with a Dixit-Stiglitz demand structure for products in all imperfectly competitive sectors, to be consistent, we assume that foreign consumers also have a love of variety with the same demand structure. Then Kenyan firms in these sectors face a Dixit-Stiglitz demand structure in their export markets. Analogous to domestic pricing, we assume that Kenyan firms set prices on export markets based on the large group monopolistic competition assumption. It follows from these two assumptions that the elasticity of demand for Kenyan firms on their exports in imperfectly competitive markets is the Dixit-Stiglitz elasticity of substitution.[13] Alterative elasticities of export demand, including perfectly elastic demand, as in our perfectly competitive sectors, are inconsistent with the symmetric treatment of home and foreign markets in these products. Firms then set marginal revenue equal to marginal costs in each of the three export markets; then the export markets contribute to the quasi-rents of the firm and affect the entry and exit decisions of domestic firms.

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 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.[14] Changes in industry-level output occur through entry or exit of firms. The number of varieties (firms) affects the productivity of the use of imperfectly competitive goods based on the standard Dixit-Stiglitz formulation. The effective cost

[13] This is an extension of Balistreri *et al*. (2009), where it was assumed that export demand in imperfectly competitive sectors is perfectly elastic.

[14] If we were to drop the large group monopolistic assumption and allow firms to take the reactions of their competitors into account in their price or quantity setting decisions, then increased competition from liberalization would decrease price-cost margins, increase output per firm and lead to welfare gains from rationalization. Such a model, however, would not necessarily lead to larger welfare estimates than our model with large group monopolistic pricing. Since output per firm increases, the economy would obtain fewer varieties from the liberalization of services and less of a gain from the Dixit-Stiglitz externality. That is, there is a welfare tradeoff between rationalization gains and the Dixit-Stiglitz variety externality. Markusen (2011) has developed a small illustrative CGE model with the Krugman style cost structure and Dixit-Stiglitz demand structure employed in this paper. He builds two models on this structure: one with Bertrand pricing among firms and a second model with large group monopolistic pricing. He shows that with Bertrand pricing there are substantial welfare gains from rationalization, as well as Dixit-Stiglitz variety gains. But, given his parameterization, the overall welfare gains are slightly less than in the monopolistic competition model due to the fact that there are fewer varieties obtained from the liberalization.

function for users of goods produced subject to increasing returns to scale declines in the total number of firms in the industry.[15]

Service sectors that are produced under increasing returns to scale and imperfect competition

These nine sectors are telecommunications, banking and insurance services, various transportation services and professional business services. There is evidence that there are economies of scale in these sectors in some range of their output, even if the larger firms in some of the sectors operate under constant returns to scale. Then perfect competition is not possible, even though a large number of firms could exist.[16] Given that services cannot be stored, FDI to achieve a domestic presence (what is known as the proximity burden) has historically been crucial to the effective delivery of services. While technological change has progressively allowed more services to be supplied on a cross-border basis, to effectively compete in services "trade," it still is likely that it requires more of a domestic presence than trade in goods, which suggests that cross border services are not good substitutes for service providers who have a domestic presence. [17] 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.

Crucial to the results, we allow multinational service firms to establish a presence in Kenya to compete with Kenyan 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 the same pricing rules as in the imperfectly competitive goods sectors. Thus, again there are no rationalization impacts.

[15]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.

[16] See Tarr (2012) for references and a brief discussion of econometric papers that estimate economies of scale in all of these sectors.

[17] Data on the sales of foreign affiliates of U.S. firms suggests that sales through FDI are the most important channel for U.S. firms to sell services to foreigners (Francois and Hoekman, 2010, p.655). See Francois and Hoekman (2010), Francois (1990) and Markusen (1989) for elaboration of the proximity burden in services.

For domestic firms, costs are defined by the costs of primary factors and intermediate inputs. When multinationals service providers decide to establish a presence in Kenya, 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 Kenyan primary factors, in addition to intermediate factor inputs. Foreign provision of services differs from foreign provision of goods, since the service providers use Kenyan 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 Kenyan 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 entry. Reduction in the constraints on foreign direct investment will induce foreign entry[18] 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).

Evidence on the role of trade and FDI in increasing total factor productivity through technology transfer

Grossman and Helpman (1991) have developed models of economic growth that have highlighted the role of trade and greater variety of intermediate goods as a vehicle for technological spillovers that allow less developed countries to close the technological gap with industrialized countries.[19] Winters et al. (2004, 84) summarize the empirical literature by concluding that "the recent empirical evidence seems to suggest that openness and trade liberalization have a strong influence on productivity and its rate of change." Beginning with the path-breaking work of Coe and Helpman (1995), a rich empirical literature now exists

[18] The data in table 2 reveal that the Africa region has a zero market share in four of the business services sectors. Our model assumes that the market share of the Africa region will remain at zero in any counterfactual simulation.
[19] Trade or services liberalization may increase productivity and growth indirectly through its positive impact on the development of institutions. 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.

that shows that important mechanisms for the transmission of knowledge and the increase in total factor productivity are the purchase of imported intermediate goods and inward foreign direct investment. Several papers, such as Coe, Helpman, and Hoffmaister (1997) and Keller (2000), show that for small developing countries, trading with large technologically advanced countries is crucial for TFP growth. 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. Regarding foreign direct investment, we have cited several papers above that show that FDI that leads to a diverse set of services suppliers improves total factor productivity. Although FDI in the same sector has ambiguous effects on productivity, 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, 2010; Jabbour and Mucchielli, 2007). A more detailed summary of this literature is provided in Jensen and Tarr (2010, Appendix E).

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. Based on Schiff et al (2002), we assign central values to this elasticity based on the region and the research and development intensity of the sector. The assigned central values for these parameters by sector and region are in table 2. We conduct extensive sensitivity analysis on this parameter, both piecemeal and systematic.

V. Data of the Model

Social Accounting Matrix

The key data source for our study is the social accounting matrix taken from Kiringai,Thurlow and Wanjala (2006). Given our focus on services, we found it necessary to disaggregate the single

transportation sector into five sectors and the single financial services sector into insurance, and banking and other financial services.[20] A full listing of the sectors is provided in table 1.

.

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 Kenya, the European Union, the East African Customs Union plus COMESA and the Rest of the World. We mapped two digit sectors from the COMTRADE database into the sectors of our model.[21]

Tariff Data

We started with MFN tariff rates at the eight digit level taken from the website of the Kenyan government. These tariff rates were then aggregated to the sectors of our model, using simple averages. At MFN rates, however, the implied tariff revenues were larger than reported collections. This is largely due to tariff preferences to regional partners and other preference items or tariff exemptions. In 2005, the ratio of total taxes on imports to the total value of imports was 8.4 percent.[22] Since zero tariffs apply on all imports from the East African Customs Union and from COMESA, we apply the MFN tariff rates only on the trade flows from outside of these African regions (EU and Rest of World in our model) and take a weighted average tariff rate of the MFN rates on the non-East African regions. The resulting weighted average tariff rate on non-East African imports still exceeds 8.4 percent. We then equi-proportionally reduced all the MFN tariffs in our model so that the estimated collected tariffs on imports from the EU and Rest of World divided by the total value of import is 8.4 percent. The resulting tariff rates (applied only to non-East African imports) are reported in Table 1.

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 Kenyan, EU, African and Rest of the World firms. This entailed acquiring a list of all banks

[20]The decomposition was based on value of output data of the various transportation sectors published in the *Economic Survey, 2006* and *Statistical Abstract, 2006* by the Kenyan Central Bureau of Statistics.
[21]See appendix A for the mapping of sectors and countries and results for both exports and imports.
[22]Economic Survey (2006, pp. 103, 115).

operating in Kenya 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 2.[23]

Estimates of the Dixit-Stiglitz Elasticities of Substitution for Goods

Broda *et al*. (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 Kenya, so we took the values of the elasticities estimated for Madagascar as a proxy for the elasticities for Kenya. Of the 34 goods sectors in our model, seven are imperfectly competitive. These are the goods sectors in which the Dixit-Stiglitz elasticity of substitution is less than six. One exception was metals and machines, where production function estimates indicate this is an increasing returns to scale sector (see, for example, Tarr, 1984). The elasticity of substitution values are shown in table 4 and details are in appendix C.

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

We execute several scenarios to assess the impacts of Kenya 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 Kenyan ad valorem equivalents of the barriers against foreign investors in services are reduced by fifty percent with respect to the region with which Kenya has an agreement. We assume that Kenya 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 *et al*. (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

[23]See appendix B for full documentation.

against investors in services, we examine the impact of a fifty percent reduction of non-discriminatory barriers against service providers combined with unilateral liberalization of discriminatory barriers.

As discussed in Jensen and Tarr (2010), who captures the rents from the barriers is very 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 Kenyans do not capture any rents from the barriers. In the second scenario, we assume that the discriminatory barriers generate rents that are captured by Kenyans. These results are presented in table 3. In our systematic sensitivity analysis, in each of the 30,000 scenarios, we allow the share of rents captured by Kenyans to vary stochastically between zero and one.

Aggregate Effects[24]

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 sectors.

Significant 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 Kenya of 0.7 percent of consumption with no initial rent capture and 0.5 percent of consumption if there is initial rent capture by Kenyans. 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 Kenya from preferential liberalization of tariffs with the EU are invariant to the rent capture in services assumption at 0.2 percent of consumption. But, if there is initial rent capture, the gains to Kenya of preferential liberalization of services fall from 0.5 percent of consumption to 0.3 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—0.3 percent of consumption in the case of no initial rent capture and 0.1 percent of consumption in the case of rent capture initially by Kenya. 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 Kenya is the scenario in the second column of the central results table, labeled "EU discriminatory services." With no initial rent capture, the gains for Kenya of an agreement with the EU are 60 percent greater than the gains from an agreement with the Africa region. With initial rent capture, gains of an agreement with the EU are three times greater than the gains from an agreement with the Africa region. We show in the sensitivity

[24] Discussion of additional scenarios in the table may be found in Balistreri and Tarr (2011).

section that there is a 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 2.[25] In Balistreri and Tarr (2011) we show that the number of varieties from the EU substantially increases as a result of preferential liberalization with the EU, while the estimated expansion of varieties from the Africa region is much more modest in response to 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.

Non-discriminatory liberalization would result in a five-fold increase in the gains compared with preferential liberalization with the EU. With non-discriminatory liberalization, Kenyans 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 Kenya 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 Balistreri, Rutherford and Tarr (2009) in a model with an aggregate rest of the world, we find that the largest gains for Kenya would come from liberalization of the non-discriminatory barriers in services. That is, when we estimate the impact of a fifty percent reduction in the non-discriminatory services barriers on top of unilateral liberalization of all discriminatory services barriers,

[25]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 industry marginal cost 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 industry marginal cost curves in that sector.

the estimated gains are 10.3 percent of consumption with no rent capture or 7.0 percent of consumption with initial rent capture.

VII. Sensitivity Analysis

Given uncertainty of parameter values and the rent capture assumption, point estimates of the results may be viewed with skepticism. In this section we assess the impact of parameter values and key modeling assumptions on the results. In table 4, we show the "piecemeal sensitivity analysis," where we change the value of a single parameter while holding the values of all other parameters unchanged at our central elasticity values. This table also shows the impact of some key modeling assumptions.

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 selected goods and services sectors, but allow the initial rent capture share in the services sectors to be either zero (central value) or 1 (upper value). We see that there is approximately a forty percent reduction in the welfare gain from a free trade agreement with the EU if rents are captured initially (from a welfare gain of 0.67 percent of consumption to 0.49 percent of consumption). In the case of an agreement with the African region, the gains fall even more dramatically, from a welfare gain of 0.29 percent of consumption to a gain of 0.05 percent of consumption in our central elasticity case.

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 the initial rent capture share in the services sectors to be either zero (central value) or 1 (upper value). We see that without the Dixit-Stiglitz variety externality, the gains from an agreement with the EU fall dramatically. With no initial rent capture, the gains for the EU agreement would be .09 percent of consumption, and would fall to a negative value (-0.06 percent of consumption) with initial rent capture. In the case of an agreement with the Africa region, the gains are 0.14 percent of consumption with no initial rent capture and are negative (-0.06 percent of consumption) with initial rent capture.

In the row labeled IRTS by sector, the results show that the increasing returns to scale (IRTS) assumption is much more important in the services sectors than in the goods sectors. In the agreement with the Africa region, the gains are only slightly diminished if we assume CRTS in all goods sectors. Since the agreement with the EU also involves tariff reduction against imports of EU goods, the IRTS

assumption in goods results in non-trivial additional gains from the Dixit-Stiglitz externality of additional varieties of goods.

Piecemeal Sensitivity Analysis of Parameters

Ad valorem equivalents (AVEs) of the barriers against services providers—magnification of gains or losses. In the three rows of table 4 that begin with the label AVE, we see that magnifying the AVEs, magnifies the welfare impacts, either gains or losses; but the key pattern of the results regarding the relatively greater welfare gains from the agreement with the EU is robust to the AVE values. In these scenarios, with lower (upper) values, we scale all the AVEs of services sectors listed in table 1 by 0.5 (1.5). We employ all central model parameters in the row labeled AVE. Then the gains from a free trade agreement with either region are approximately 1.5 times the central values with high AVEs and about one-half of the central values with low AVEs. In the row labeled AVE & $\theta r = 1$, we allow for loss of domestic rents on services with preferential liberalization. The loss of domestic rents in Kenya reduces the estimated gains of all scenarios, but gains from the EU agreement are always larger. Finally, in the row labeled AVE, $\theta r = 1$ & ε_{AFR}= low, we vary the AVEs, allow for loss of domestic rents from services liberalization, and also employ low values of the elasticities of supply from the Africa region. With low elasticities from the Africa region, Kenya will gain few varieties or technology from the preferential liberalization of services with the Africa region. We see that Kenya loses from its preferential liberalization of services with the Africa region independent of the AVEs of the services barriers. But the absolute value of the losses are greater, the greater are the AVEs. With higher AVEs, partner countries obtain a larger price advantage over excluded countries, so there is a larger decline in the demand for excluded countries services following preferential services liberalization. The greater decline in demand for excluded countries products leads to a greater loss of varieties from excluded countries. Since the elasticity of supply from the Africa region is low, there are few additional varieties from the partner region and the welfare loss is greater with higher AVEs.

Model Parameters. Four model 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. At the low end of the elasticity range, the estimated gains are almost 10 per cent of consumption from a preferential agreement with the EU and five percent of consumption from an agreement with the Africa region. 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, but its impact is nonetheless significant. The elasticity of substitution

between value-added and business services, σ(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, there is a strong impact from changes in the value of ε_{EU}, the elasticity of multinational service firm supply with respect to the price of output. 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. For the agreement with Africa, there is a strong impact of the parameter ε_{AFR}.

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 1 and 2, we present the results of 300 additional simulation to assess the impact and interrelationship of the elasticities of firm supply from partner and excluded countries, with and without initial rent capture in Kenya. In figure 1, we examine the estimates for the welfare effects in Kenya of a fifty 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. We scale this set of elasticities from between one-half to twice their 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 this case are the EU and Rest of the World. In figure 2, 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 that, with initial rent capture, there is a significant range of elasticities that result in losses for Kenya. Without initial rent capture, however, there are gains for all these values.

We see from figures 1 and 2 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 by far the more important. Preferential reduction of barriers, leads to an increase in firms (varieties) and productivity from partner countries; but it also leads to a loss of service providers (varieties) from all excluded regions and the home country, which results in a loss of productivity. 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, thereby making it more likely that the preferential liberalization is welfare enhancing. 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 (the excluded country impact is more significant in figure 2). In addition to the variety impacts in imperfect competition, the rent and terms of trade impacts (which are present in perfect competition) 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 randomly select values of all the parameters in the model (the parameters in table 4), 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 sample distributions of the results for preferential reduction of barriers with African partners on welfare and output, respectively, are shown in figures 3 and 5. Figure 4 and appendix figure 7 are similar for the welfare and output impacts, respectively, of a preferential trade agreement with the EU. For the Africa-Kenya FTA, we find that 1.9 percent of the 30,000 simulations yield a negative welfare result, which we interpret as a 1.9 percent probability that preferential liberalization with the Africa region will be immizerising. A 95 percent confidence interval for equivalent variation as a percent of consumption is: 0.008 to 0.417 around a sample mean of .203.[26] For a free trade agreement with the EU that includes services, there are no negative welfare results. A 95 percent confidence interval for equivalent variation as a percent of consumption is: 0.37 to 0.94 around a sample mean of 0.63.[27]

To further establish the relative importance of technology transfer in the choice of partners in preferential trade arrangements, we executed a second systematic sensitivity analysis of 30,000 runs. In this alternative systematic sensitivity analysis, we choose uniform pdfs for ε_{AFR}, ε_{EU} and ε_{ROW} with lower and upper bounds for ε_{AFR} of 1 and 3, for ε_{EU} of 5 and 15 and for ε_{ROW} of 7.5 and 22.5. All other probability distributions for all other parameters are unchanged, i.e., are as in table 4. Our estimate of the median gains from a preferential agreement with the Africa region falls, and the chance of the agreement

[26] 90 percent and 99 percent confidence intervals are 0.033 to 0.384 and -0.029 to 0.479, respectively.
[27] 90 and 99 percent confidence intervals are 0.41 to .89 and 0.30 to 1.07, respectively.

yielding negative welfare results increases to 9.5 percent. Our piecemeal sensitivity analysis above suggests that the key change is the lower pdf for ε_{AFR}.

In figure 5, we show "box and whisker" diagrams for the sample distribution of the percentage change in output by sector for a preferential services agreement with African partners. (See appendix, figure 2 for the similar figure for the EU.) Sectors are on the horizontal axis and the percentage change in output is shown on the vertical axis. The bars in the boxes are the means of the distributions. Fifty percent confidence intervals are depicted by the boxes, while the vertical lines show 95 percent confidence intervals.

Regarding the means of the distributions, the striking result is, where there are declines in sector output, the contractions are generally very moderate. This contrasts with our results (not shown) that there are somewhat larger output declines for the agreement with the European Union and much more substantial output declines for these sectors in the unilateral scenario. This follows from the less substantial increase in competition or drop in overall protection to any sector in a preferential trade arrangement with the African countries.

Regarding the sensitivity analysis at the sector level, for the Africa agreement we see that the confidence intervals are rather tight for most sectors. But they reveal a large range of uncertainty for five sectors (other manufactured food, coffee, mining, road services and maritime services) where 50 percent confidence intervals indicate the sectors will expand; but 95 percent confidence intervals contain negative values. We conclude the predicted output changes for these five sectors are not robust. 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 other manufactured food, maritime transportation, coffee and mining (among the expanding sectors) and (on the negative side) sugarcane, other manufactures and metals and machines. We can have confidence in the sign of the direction of change, but not in the magnitude of the mean estimate for these sectors.

VIII. Conclusions

In this paper we have shown that under imperfect competition with foreign direct investment and the Dixit-Stiglitz variety externality, welfare losses from preferential reduction of services barriers are possible. We showed that the losses are more likely the more technologically advanced are the excluded regions relative to the partner region and the more the home country captures rents from the existing services barriers. Our systematic sensitivity analysis shows that the mean estimate of the gains to Kenya from preferential reduction of barriers in services with the Africa region is very small, and there is a 1.9 percent chance that it would lose from such an agreement. Estimated gains for the agreement with the European Union are two to three times larger and occur with probability one. We estimate that

multilateral liberalization dominates preferential liberalization, as it would yield gains five times greater than a preferential agreement with the European Union.

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Table 1 Benchmark Distortions

	Tariff	Sales Tax	Regulatory barriers: All firms	Regulatory barriers: Foreign firms
Business Services				
Communication			6.0	4.0
Insurance		0.6	13.0	26.0
Banking and other financial services		0.6	17.0	
Professional business services			3.7	11.9
Road services			15.0	30.0
Railway transport			25.0	
Maritime transport			57.0	40.0
Pipeline transport				
Airline transport			2.0	2.0
Dixit-Stiglitz Goods				
Beverages & tobacco	30.4	44.0		
Grain milling	25.8	9.4		
Sugar & bakery & confectionary	23.5	19.5		
Petroleum	10.4	22.4		
Chemicals	8.8	4.8		
Metals and machines	9.5	5.2		
Non metallic products	19.3	0.7		
Agriculture				
Maize	29.6			
Wheat	11.0			
Rice	27.6			
Barley	9.9			
Cotton	12.5	12.5		
Other cereals	9.9			
Sugarcane	64.2	19.4		
Coffee	19.7			
Tea	19.7	5.1		
Roots & tubers				
Pulses & oil seeds	6.7	0.0		
Fruits	19.5			
Vegetables	19.7	0.1		
Cut flowers	19.7			
Others crops	2.7	3.4		
Beef	19.7			
Dairy	28.9			
Poultry	19.7			
Sheep goat and lamb for slaughter				
Other livestock	19.7			
Other CRTS				
Fishing	19.7			
Mining	1.2	4.1		
Meat & dairy	27.6	15.5		
Other manufactured food	15.8	5.5		
Printing and publishing		12.1		
Textile & clothing	14.4	8.5		
Leather & footwear	13.8	14.5		
Wood & paper	9.2	5.9		
Other manufactures	17.2	3.0		
Trade		1.9		
Hotels		13.9		

Note: The following are also CRTS sectors of the model, but with zero benchmark distortions: forestry, water, electricity, construction, real estate, administration, health, education.

Source: Authors' estimates. See Balistreri, Rutherford, and Tarr (2009) for details.

Table 2 -- Market Shares in Kenyan Services Sectors with FDI (%) and estimates of elasticity of firms' supply with respect to price for Kenya by sector and by Kenyan trading partner region

	Market Shares in Services Sectors with FDI				Elasticity of supply with respect to price by Kenyan trading partner region			R&D expenditures divided by sales (times 1000) for the US*
BUSINESS SERVICES	**Kenya**	**EU**	**Africa**	**ROW**	**Africa**	**EU**	**ROW**	
Communication	26	49	0	25	2.5	13.4	20	52-high
Insurance	85	4	0	11	3.3	3.3	10	4-low
Banking	62	29	0	9	3.3	3.3	10	4-low
Professional services	94	2	2	2	2.5	13.4	20	116-high
Road services	80	2	14	4	3.3	3.3	10	low
Railway transport**	0	0	0	100	1.9	10	15	medium
Maritime transport**	45	25	15	15	1.9	10	15	medium
Pipeline transport**	70	0	13	18	1.9	10	15	medium
Airline transport**	30	30	10	30	1.9	10	15	medium
MANUFACTURING								
beverages and tabacco					3.3	3.3	10	14-low
grain milling***					3.3	3.3	10	7-low
sugar&bakery&confectioners***					3.3	3.3	10	7-low
petroleum					3.3	3.3	10	2-low
chemicals					1.9	10	15	34-medium
metals and machines***					1.9	10	15	33-medium
non-metallic products***					3.3	3.3	10	0-17-low

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

**We evaluate transportation as a medium R&D sector since three sectrors dominate R&D expenditures of US multinationals operating abroad. These are transportation, chemiicals and computers and electronics. Moreover, about two-thirds of all R&D expenditur

***Food is the proxy for grain mlling and sugar, bakery and confectioners; machinery is used for metals and machines; for non-metallic products, we used plastics, rubber, mineral and wood products.

Source: Authors' estimates. For details, see Balistreri and Tarr (2011).

Table 3: Summary of Results (results are percentage change from initial equilibrium, unless otherwise indicated)

No initial rent capture case except numbers in parentheses. Values in parentheses are for the initial rent capture case.

Scenario definition	Benchmark	**EU FTA**	EU Discriminatory Services	EU Tariffs	**Africa FTA**	**EU-Africa FTA**	**Unilateral**	Unilateral Discriminatory Services	Unilateral Tariffs	**Unilateral & 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 firms	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)		**0.7** (0.5)	**0.5** (0.3)	**0.2** (0.2)	**0.3** (0.1)	**1.0** (0.5)	**3.6** (2.9)	**1.5** (0.9)	**2.0** (2.0)	**10.3** (7.0)
Welfare (EV as % of GDP)		**0.6** (0.4)	**0.4** (0.3)	**0.1** (0.1)	**0.2** (0.0)	**0.8** (0.5)	**3.0** (2.5)	**1.3** (0.7)	**1.7** (1.7)	**8.6** (5.9)
Government budget										
Tariff revenue (% of GDP)	3.6	**2.1**	2.9	2.1	**2.9**	**2.1**		2.9		
Tariff revenue		**-29.0**	-0.1	-28.9	**-0.1**	**-29.1**	**-100.0**	-0.3	-100.0	**-100.0**
Aggregate trade										
Real exchange rate		**0.9**	0.3	0.6	**0.2**	**1.2**	**4.0**	0.9	3.1	**5.8**
Aggregate exports		**3.2**	0.1	3.1	**0.3**	**3.5**	**12.6**	0.5	11.9	**15.4**
Factor Earnings										
Skilled labor		**2.2**	0.7	1.5	**0.5**	**2.7**	**9.0**	2.2	6.5	**15.3**
Semi-skilled labor		**1.1**	0.5	0.6	**0.3**	**1.4**	**5.6**	1.5	4.1	**10.3**
Unskilled labor		**1.5**	0.6	0.9	**0.3**	**1.9**	**7.4**	1.9	5.3	**14.3**
Capital		**1.5**	0.5	0.9	**0.3**	**1.8**	**7.0**	1.7	5.1	**12.4**
Land		**2.6**	0.4	2.2	**0.5**	**3.0**	**7.7**	1.4	6.1	**10.0**
Factor adjustments										
Skilled labor		**0.5**	0.3	0.3	**0.2**	**0.7**	**2.1**	0.9	1.3	**4.2**
Semi-skilled labor		**0.7**	0.2	0.7	**0.1**	**0.8**	**2.5**	0.6	1.9	**4.5**
Unskilled labor		**0.2**	0.1	0.1	**0.0**	**0.2**	**0.7**	0.2	0.5	**1.3**
Capital		**0.3**	0.1	0.3	**0.0**	**0.3**	**1.3**	0.3	1.2	**2.2**
Land		**1.0**	0.5	0.7	**0.4**	**1.4**	**3.7**	1.4	2.2	**7.2**

Source: Authors' estimates.

Table 4: Piecemeal Sensitivity Analysis of Kenya-EU and Kenya-Africa FTAs

in Equivalent Variation (EV) as a percentage of consumption

	Parameter Value			EV of EU-Kenya FTA			EV of Africa-Kenya FTA		
Parameter	Lower	Central	Upper	Lower	Central	Upper	Lower	Central	Upper
$\sigma(q_i, q_j)$ – services sectors	2	3	4	1.19	0.67	0.54	0.62	0.29	0.19
$\sigma(q_i, q_j)$ – goods sectors		see below		1.06	0.67	0.59	0.32	0.29	0.28
σ(va, bs)	0.625	1.25	1.875	0.55	0.67	0.82	0.25	0.29	0.33
σ(D, M)	2	4	6	0.65	0.67	0.69	0.28	0.29	0.29
σ(L, K)	0.5	1	1.5	0.64	0.67	0.70	0.28	0.29	0.29
$\sigma(A_1,\ldots A_n)$	0	0	0.25	0.67	0.67	0.67	0.29	0.29	0.29
σ(D, E)	2	4	6	0.65	0.67	0.69	0.28	0.29	0.29
ε_{TZA}	Central values of all 4 sets of eta			0.61	0.67	0.72	0.31	0.29	0.27
ε_{EU}	parameters are listed in table 2.			0.25	0.67	0.96	0.29	0.29	0.29
ε_{AFR}	Lower values are 0.5 all central values and			0.68	0.67	0.67	0.14	0.29	0.43
ε_{ROW}	upper values are 1.5 times all central			0.90	0.67	0.55	0.29	0.29	0.29
ε_{AFR} & θr =1	values for the selected ε.			0.49	0.49	0.48	-0.09	0.05	0.20
θ_r	NA	0	1	NA	0.67	0.49	NA	0.29	0.05
θ_r - CRTS model	NA	0	1	NA	0.09	-0.06	NA	0.14	-0.06
IRTS by sector	goods only	services only	goods & services	0.21	0.51	0.67	0.14	0.27	0.29
AVE	Lower (upper) values of the ad valorem			0.39	0.67	1.05	0.14	0.29	0.45
AVE & θr =1	equivalents are 0.5 (1.5) times all the AVEs			0.29	0.49	0.77	0.02	0.05	0.11
AVE, θr =1 & ε_{AFR}= low.	listed in table 1.			0.30	0.49	0.77	-0.04	-0.09	-0.15
export demand	NA	Central	perf. elastic in all	NA	0.67	0.78	NA	0.29	0.30
θ_m	0.025	0.05	0.075	0.67	0.67	0.67	0.29	0.29	0.29
$\sigma(q_i, q_j)$ – goods sectors									
sugar and bakery	2.12	2.93	3.74						
beverages and tabacco	1.52	2.33	3.14						
chemicals	2.01	2.82	3.63						
metals and machines	8.35	16.69	25.04						
grain milling	2.43	3.24	4.05						
nonmetallic products	2.805	5.61	8.415						
petroleum	2.75	3.56	4.37						

Key:

$\sigma(q_i, q_j)$: Elasticity of substitution between firm varieties in imperfectly competitive sectors

σ(va, bs): Elasticity of substitution between value-added and business services

σ(D, M): Elasticity of substitution between domestic and imported varieties

σ(L, K): Elasticity of substitution between primary factors of production in value added

$\sigma(A_1,\ldots A_n)$: Elasticity of substitution in intermediate production between composite Armington aggregate goods

σ(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

IRTS by sector: in goods (services) only, business services (Dixit-Stiglitz goods) in table 1 are CRTS.

AVE: ad valorem equivalents of regulatory barriers in services; ε_{AFR}= low means ε_{AFR}= 0.5 central values..

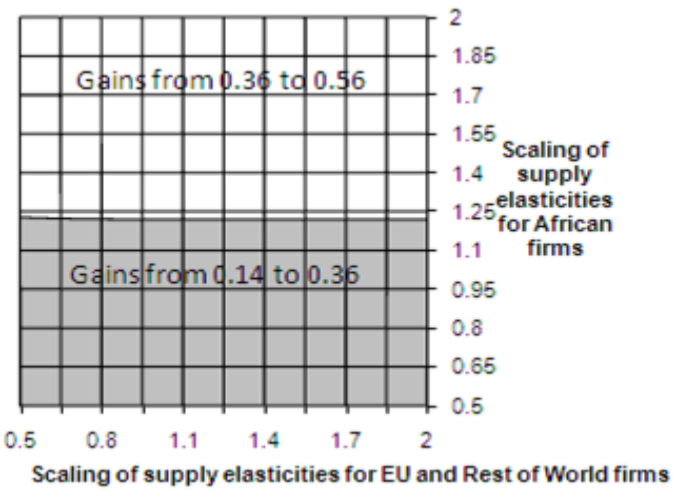
export demand: in the upper case, perfectly elastic export demand is assumed for all model sectors.

θ_m: Shares of value added in multinational firms due to specialized primary factor imports

Source: Authors' estimates.

Figure 1 Sensitivity Analysis of Kenyan Preferential Liberalization of Services with African Partners: Impact of Partner and Excluded Country Supply Elasticity, with and without Rent Capture

Case I: No initial rent capture by Kenya



Case II: Initial rent capture by Kenya

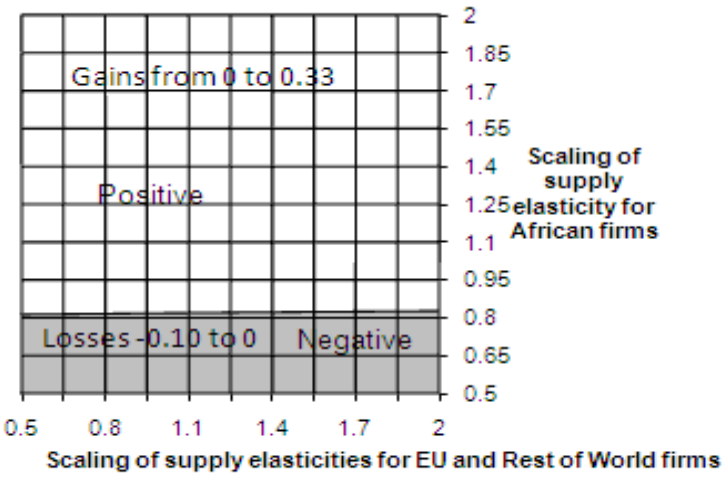
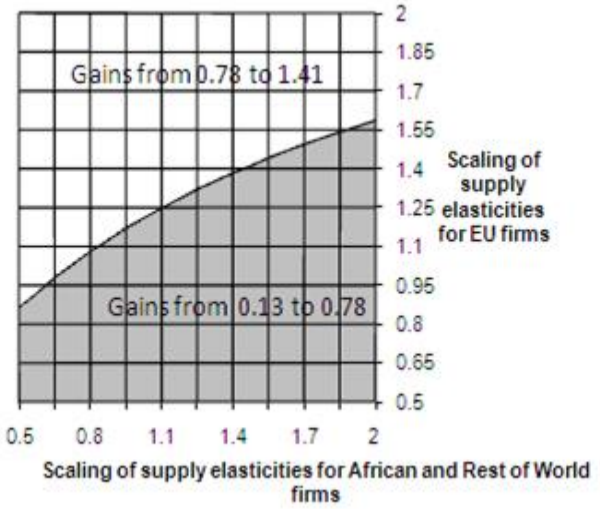


Figure 2: Sensitivity Analysis of Kenyan Preferential Liberalization of Services with the EU: Impact of Partner and Excluded Country Supply Elasticity, with and without Rent Capture

Case I: No initial rent capture by Kenya



Case II: Initial rent capture by Kenya

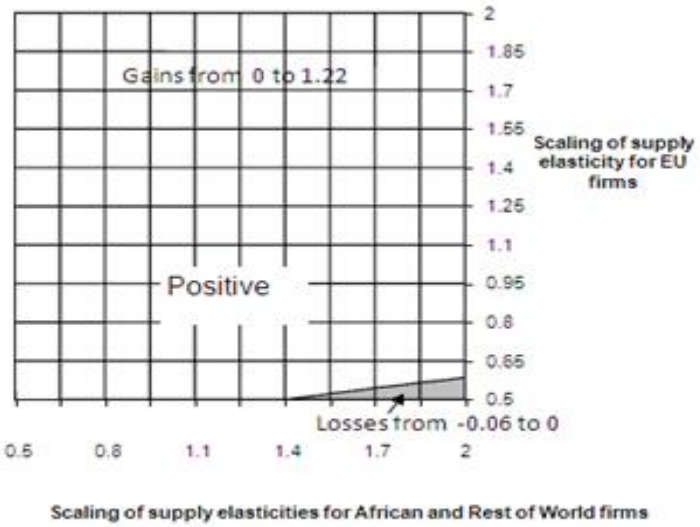


Figure 3: Sample Frequency Distribution of the Welfare Results of Kenyan Preferential Reduction of Services Barriers against African Partners—30,000 simulations.

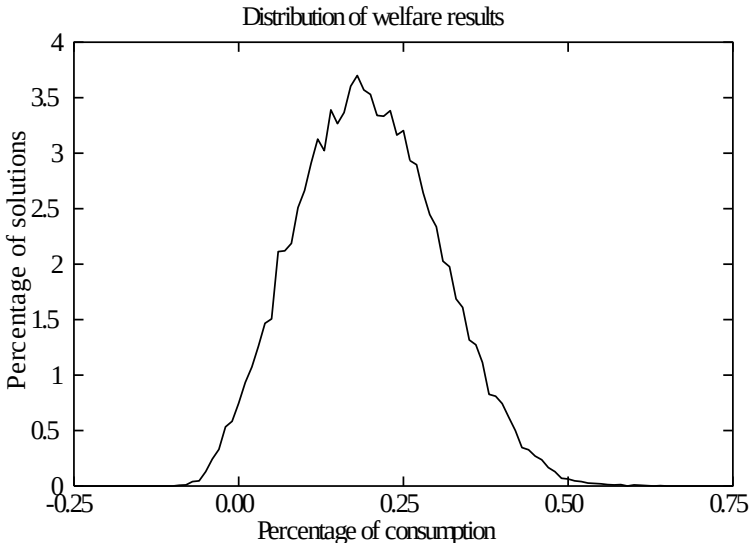


Figure 4: Sample Frequency Distribution of the Welfare Results of Kenyan Preferential Reduction of Services Barriers Against EU Partners—30,000 simulations.

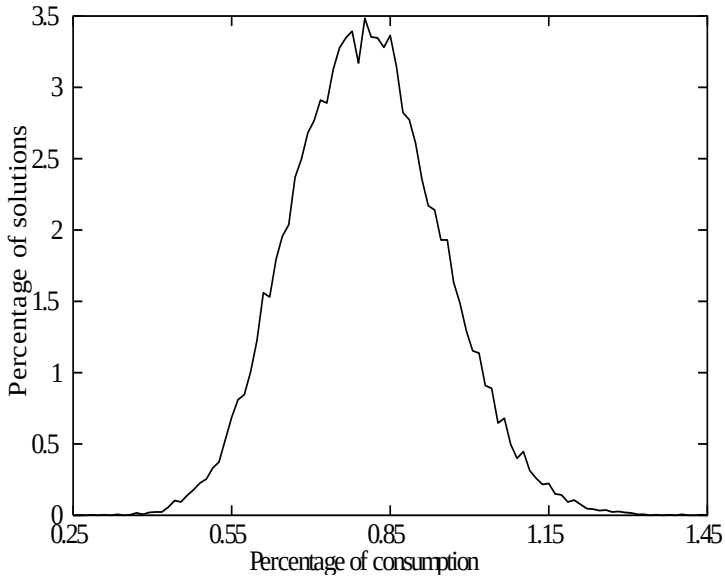
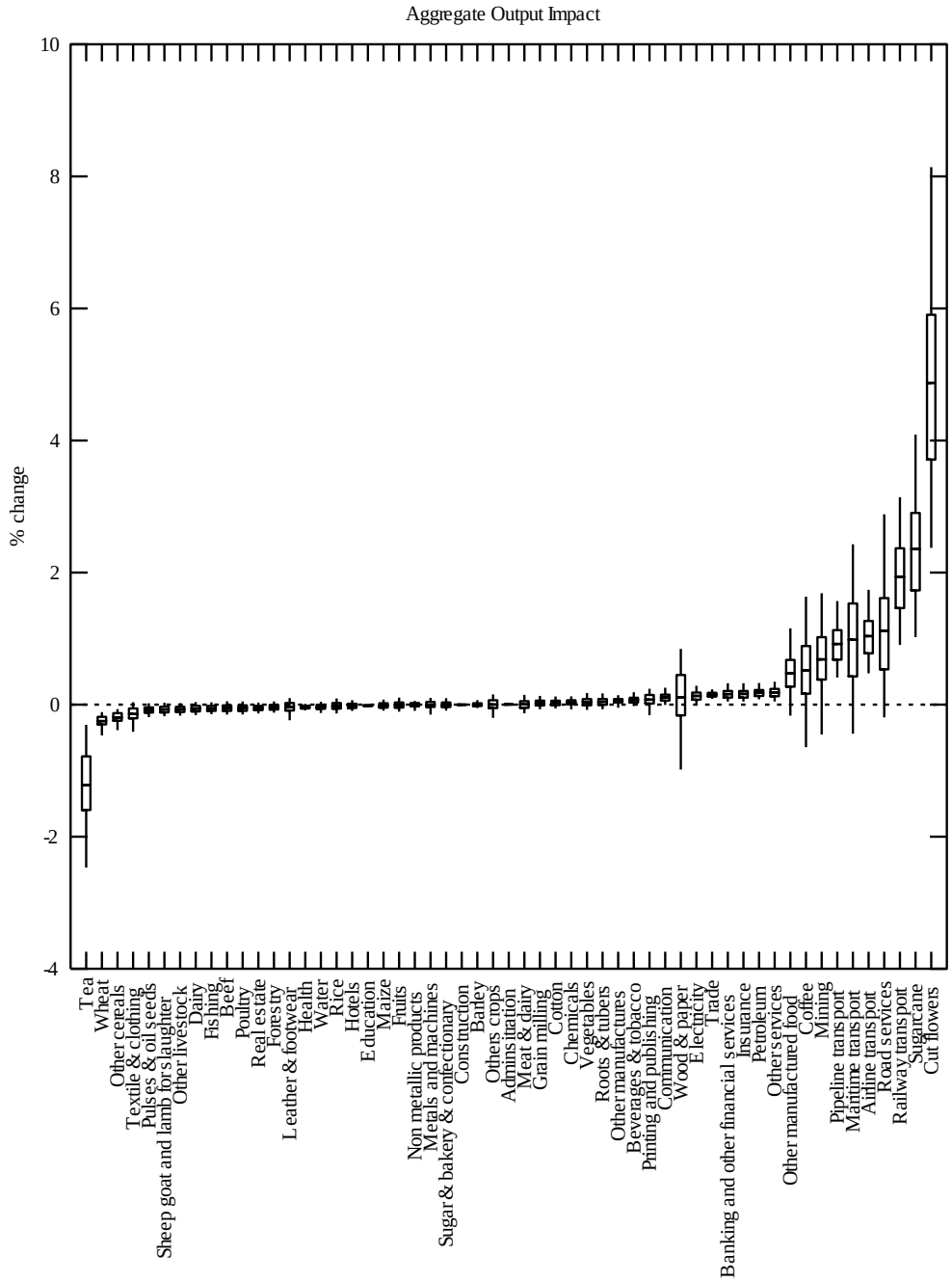


Figure 5: Means, 50 and 95 Percent Confidence Intervals of the Sample Frequency Distributions of the Output Changes by Sector from Kenyan Preferential Reduction of Services Barriers Against African Partners—30, 000 simulations.



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.

Data and Mathematical Appendices and Supplementary Tables and Figures

Appendix Tables 1-26

Appendix Figures 1-8.

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

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

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

Appendix D: Engineering Services in Kenya - Restrictiveness Index

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

Appendix F: Kenya Model with Multiple FDI and Trade Partners (Algebraic Strcuture)

Appendix G: A Note of the Relationship Between Sector Specific Capital and the Elasticity of Supply in Applied General Equilibrium Models of Imperfect Competition

Table 1 -- List of Sectors in the Kenya Model

Business Services
Communication
Insurance
Banking and other financial services
Professional business services
Road services
Railway transport
Maritime transport
Pipeline transport
Airline transport

IRTS Goods
Beverages & tobacco
Grain milling
Sugar & bakery & confectionary
Petroleum
Chemicals
Metals and machines
Non metallic products

Factors of Production
Skilled labor
Semi-skilled labor
Unskilled labor
Capital
Land

Regions
Kenya
Africa (East African Customs Union + COMESA)
EU (27)
Rest of World

Note: East African Custom Union includes (besides Kenya) Burundi, Rwanda, Tanzania and Uganda. COMESA includes Burundi, Comoros, Democratic Republic of Congo, Djibouti, Egypt, Eritrea, Ethiopia, Kenya, Libya, Madagascar, Malawi, Mauritius, Rwanda, Seychelles, Sudan, Swaziland, Zambia and Zimbabwe.

Agriculture (CRTS)
1.Maize
2.Wheat
3.Rice
4.Barley
5.Cotton
6.Other cereals
7.Sugarcane
8.Coffee
9.Tea
10.Roots & tubers
11.Pulses & oil seeds
12.Fruits
13.Vegetables
14.Cut flowers
15.Others crops
16.Beef
17.Dairy
18.Poultry
19.Sheep goat and lamb for slaughter
20.Other livestock

Other CRTS
21.Fishing
22.Forestry
23.Mining
24.Meat & dairy
O25.ther manufactured food
26.Textile & clothing
27.Leather & footwear
28.Wood & paper
29.Printing and publishing
30.Other manufactures
31.Water; 32.Electricity
33. Construction; 34.Trade
35.Hotels; 36. Real Estate
37. Administration
38. Health; 39. Education

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

	Labor					GDP	
	Skilled labor	Semi-skilled labor	Unskilled labor	Capital	Land	BKS (Billions of Kenyan Shillings)	% of total
Business Services							
Communication	3.7	19.7	13.7	62.9		30.6	3.1
Insurance	1.2	5.4	19.3	74.0		21.1	2.2
Banking and other financial services	1.2	5.4	19.3	74.0		45.7	4.7
Professional business services	23.1	4.4	14.3	58.3		94.5	9.7
Road services	9.9	34.6	5.5	50.0		42.0	4.3
Railway transport	9.9	34.6	5.5	50.0		1.2	0.1
Maritime transport	9.9	34.6	5.5	50.0		4.6	0.5
Pipeline transport	9.9	34.6	5.5	50.0		2.1	0.2
Airline transport	9.9	34.6	5.5	50.0		16.9	1.7
Dixit-Stiglitz Goods							
Beverages & tobacco		0.7	34.0	65.2		13.7	1.4
Grain milling	2.1	9.5	2.9	85.5		9.6	1.0
Sugar & bakery & confectionary	7.9	36.8	11.7	43.6		4.4	0.5
Petroleum		0.4	1.3	98.4		3.9	0.4
Chemicals	16.4	5.4	29.7	48.5		7.1	0.7
Metals and machines	2.8	55.0	2.9	39.2		8.2	0.8
Non metallic products	0.5	9.8		89.7		23.1	2.4
Agriculture							
Maize	10.7	48.0	0.2	10.7	30.4	28.9	3.0
Wheat	0.7	25.0		20.6	53.7	0.4	0.0
Rice	24.8	21.2		22.6	31.3	1.1	0.1
Barley	1.1	24.9		20.6	53.4	0.7	0.1
Cotton	17.4	26.3	0.1	12.7	43.5	0.3	0.0
Other cereals	8.6	24.6	0.2	23.5	43.2	0.1	0.0
Sugarcane	7.6	37.6	0.3	11.5	43.1	1.8	0.2
Coffee	14.6	30.1	0.2	12.2	42.8	5.6	0.6
Tea	13.9	45.3	0.2	10.6	30.0	35.0	3.6
Roots & tubers	11.6	38.3	0.3	31.9	18.0	10.0	1.0
Pulses & oil seeds	12.0	38.0	0.5	11.9	37.7	19.0	1.9
Fruits	15.3	34.0	0.2	10.6	39.9	13.5	1.4
Vegetables	14.7	38.7	0.3	29.8	16.5	22.0	2.2
Cut flowers	35.2	19.7	0.1	10.3	34.7	11.7	1.2
Others crops	15.3	36.5	0.6	27.3	20.3	7.3	0.7
Beef	24.8	36.2	0.5	38.5		13.9	1.4
Dairy	26.1	35.7	0.2	38.1		23.6	2.4
Poultry	15.3	43.4	0.8	40.5		15.2	1.6
Sheep goat and lamb for slaughter	28.2	36.9	0.2	34.6		5.1	0.5
Other livestock	6.5	35.4	0.2	58.0		3.8	0.4

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

Other CRTS						
Fishing	3.7	7.4		88.8	3.9	0.4
Forestry	3.1	23.2		73.7	7.0	0.7
Mining	16.4	30.9		52.7	3.2	0.3
Meat & dairy	3.2	27.6	0.0	69.2	11.9	1.2
Other manufactured food	8.3	36.1	0.5	55.1	0.9	0.1
Printing and publishing		44.8		55.2	5.7	0.6
Textile & clothing	57.0	9.3	0.6	33.1	5.4	0.6
Leather & footwear	13.9	2.3		83.9	5.2	0.5
Wood & paper	4.4	7.1	27.1	61.4	2.9	0.3
Other manufactures	3.3	63.9	0.6	32.3	29.8	3.0
Water		28.8	10.9	60.3	13.1	1.3
Electricity	0.7	25.4	1.5	72.3	12.9	1.3
Construction	1.5	14.9	2.5	81.1	51.8	5.3
Trade	16.6	5.6	7.0	70.8	63.6	6.5
Hotels	51.1	5.0	0.9	43.1	9.8	1.0
Real estate	0.3	29.8	13.0	57.0	56.2	5.8
Adminsitration	1.1	12.1	8.0	78.8	49.3	5.1
Health	1.6	2.6	92.5	3.2	21.2	2.2
Education	0.8	2.9	66.4	30.0	74.9	7.7

Table 3 -- Trade Flows

	Imports			Exports		
	BKS	% of total	% of supply	BKS	% of total	% of output
Business Services						
Communication				1.9	0.8	4.1
Insurance	2.4	0.7	7.5	0.4	0.2	1.5
Banking and other financial services	5.1	1.5	7.6	0.9	0.4	1.5
Professional business services						
Road services	29.9	9.0	30.7	20.3	8.3	23.1
Railway transport	1.0	0.3	29.7			
Maritime transport	3.7	1.1	29.8	2.6	1.1	23.1
Pipeline transport	1.7	0.5	29.7	1.2	0.5	23.1
Airline transport	12.9	3.9	30.1	9.0	3.7	23.1
Dixit-Stiglitz Goods						
Beverages & tobacco	1.4	0.4	5.1	12.1	4.9	30.4
Grain milling	0.7	0.2	2.1			
Sugar & bakery & confectionary	2.9	0.9	14.6	2.0	0.8	10.8
Petroleum	60.0	18.0	56.8	14.7	6.0	49.0
Chemicals	50.4	15.1	67.2	12.9	5.2	71.2
Metals and machines	48.0	14.4	69.4	5.0	2.0	55.8
Non metallic products	2.9	0.9	8.7	3.8	1.5	11.1
Agriculture						
Maize	0.7	0.2	2.0	0.3	0.1	0.6
Wheat	10.9	3.3	96.1	0.1	0.0	14.6
Rice	3.9	1.2	53.7			
Barley				0.1	0.0	11.0
Cotton				0.0	0.0	7.4
Other cereals				0.0	0.0	41.2
Sugarcane	1.5	0.4	42.5	1.5	0.6	33.7
Coffee				11.7	4.8	86.6
Tea	0.4	0.1	9.0	47.1	19.1	91.5
Roots & tubers						
Pulses & oil seeds	0.5	0.1	3.4	8.1	3.3	38.3
Fruits				2.0	0.8	18.2
Vegetables	0.5	0.1	2.7	7.9	3.2	31.0
Cut flowers				21.3	8.7	98.4
Others crops	0.7	0.2	6.0	4.5	1.8	29.9
Beef						
Dairy						
Poultry						
Sheep goat and lamb for slaughter						
Other livestock						
Other CRTS						
Fishing						
Forestry						
Mining	0.4	0.1	31.5	6.1	2.5	95.2
Meat & dairy	1.0	0.3	2.9	12.8	5.2	25.7
Other manufactured food	22.9	6.8	76.4	2.8	1.2	69.6
Printing and publishing	11.1	3.3	34.9			
Textile & clothing	9.4	2.8	43.6	4.4	1.8	31.2
Leather & footwear	1.6	0.5	9.9	3.5	1.4	20.4
Wood & paper	2.9	0.9	43.4	8.4	3.4	88.9
Other manufactures	35.4	10.6	43.9	14.7	6.0	22.2
Water						
Electricity						
Construction						
Trade						
Hotels						
Real estate	7.4	2.2	10.1	1.5	0.6	2.3
Adminsitration						
Health						
Education						

Table 4 -- Benchmark Distortions (%)

			Regulatory barriers	
	Tariff	Sales Tax	All firms	Foreign firms
Business Services				
Communication			6.0	4.0
Insurance		0.6	13.0	26.0
Banking and other financial services		0.6	17.0	
Professional business services			3.7	11.9
Road services			15.0	30.0
Railway transport			25.0	
Maritime transport			57.0	40.0
Pipeline transport				
Airline transport			2.0	2.0
Dixit-Stiglitz Goods				
Beverages & tobacco	30.4	44.0		
Grain milling	25.8	9.4		
Sugar & bakery & confectionary	23.5	19.5		
Petroleum	10.4	22.4		
Chemicals	8.8	4.8		
Metals and machines	9.5	5.2		
Non metallic products	19.3	0.7		
Agriculture				
Maize	29.6			
Wheat	11.0			
Rice	27.6			
Barley	9.9			
Cotton	12.5	12.5		
Other cereals	9.9			
Sugarcane	64.2	19.4		
Coffee	19.7			
Tea	19.7	5.1		
Roots & tubers				
Pulses & oil seeds	6.7	0.0		
Fruits	19.5			
Vegetables	19.7	0.1		
Cut flowers	19.7			
Others crops	2.7	3.4		
Beef	19.7			
Dairy	28.9			
Poultry	19.7			
Sheep goat and lamb for slaughter				
Other livestock	19.7			
Other CRTS				
Fishing	19.7			
Forestry				
Mining	1.2	4.1		
Meat & dairy	27.6	15.5		
Other manufactured food	15.8	5.5		
Printing and publishing		12.1		
Textile & clothing	14.4	8.5		
Leather & footwear	13.8	14.5		
Wood & paper	9.2	5.9		
Other manufactures	17.2	3.0		
Water				
Electricity				
Construction				
Trade		1.9		
Hotels		13.9		
Real estate				
Adminsitration				
Health				

Education

Source: Authors' estimates. See Balistreri, Rutherford, and Tarr (2009) for details.

Table 5 -- Trade Flows by Trading Partner (%)

	Imports			Exports		
	European Union	Africa	Rest of the World	European Union	Africa	Rest of the World
Business Services						
Communication				66	0	34
Insurance	23	0	77	23	0	77
Banking and other financial services	75	1	24	75	1	24
Professional business services						
Road services	10	70	20	10	70	20
Railway transport	0	0	100			
Maritime transport	45	27	27	45	27	27
Pipeline transport	0	41	59	0	41	59
Airline transport	43	14	43	43	14	43
Dixit-Stiglitz Goods						
Beverages & tobacco	23	58	20	7	57	37
Grain milling	13	32	55			
Sugar & bakery & confectionary	20	15	65	3	73	24
Petroleum	3	2	94	0	58	41
Chemicals	28	6	66	0	69	30
Metals and machines	27	2	70	3	78	19
Non metallic products	24	4	72	5	86	9
Agriculture						
Maize	0	91	9	0	27	73
Wheat	3	0	97	0	28	72
Rice	0	16	84			
Barley				0	100	0
Cotton				12	2	86
Other cereals				1	64	35
Sugarcane	4	65	31	0	98	2
Coffee				59	1	40
Tea	0	1	99	19	24	57
Roots & tubers						
Pulses & oil seeds	1	76	24	60	2	38
Fruits				76	6	18
Vegetables	11	43	46	89	2	9
Cut flowers				81	6	13
Others crops	14	58	28	15	53	32
Beef						
Dairy						
Poultry						
Sheep goat and lamb for slaughter						
Other livestock						
Other CRTS						
Fishing						
Forestry						
Mining	5	5	90	28	43	29
Meat & dairy	12	17	71	1	74	26
Other manufactured food	7	16	77	34	56	10
Printing and publishing	35	19	45			
Textile & clothing	3	7	89	1	18	80
Leather & footwear	3	1	96	18	48	35
Wood & paper	34	16	50	4	87	10
Other manufactures	36	2	61	14	70	17
Water						
Electricity						
Construction						
Trade						
Hotels						
Real estate	33	33	33	33	33	33
Adminsitration						
Health						
Education						

Source: Authors' estimates.

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

	Kenya	European Union	Africa	Rest of the World
Business Services				
Communication	26	49	0	25
Insurance	85	4	0	11
Banking and other financial services	62	29	0	9
Professional business services	94	2	2	2
Road services	80	2	14	4
Railway transport	0	0	0	100
Maritime transport	45	25	15	15
Pipeline transport	70	0	13	18
Airline transport	30	30	10	30

Source: Authors' estimates. See appendix for details.

Table 6B: Estimates of elasticity of firms with respect to price for Kenya by sector and by Kenyan trading partner region						
	R&D intensity					
	R&D expenditures divided by sales (times 1000) for the US*	**Elasticity Estimates**				
		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						
beverages and tabacco	14-low	3.3	3.3	10		
grain milling***	7-low	3.3	3.3	10		
sugar&bakery&confectioners***	7-low	3.3	3.3	10		
petroleum	2-low	3.3	3.3	10		
chemicals	34-medium	1.9	10	15		
metals and machines***	33-medium	1.9	10	15		
non-metallic products***	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.						
**We evaluate transportation as a medium R&D sector since three sectrors dominate R&D expenditures of US multinationals operating abroad. These are transportation, chemiicals and computers and electronics. Moreover, about two-thirds of all R&D expenditures of foreign multinationals operatingi 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 mlling and sugar, bakery and confectioners; machinery is used for metals and machines; for non-metallic products, we used plastics, rubber, mineral and wood products.						
Development: 2005, Data Tables . Available at: http://www.nsf.gov/statistics/nsf10319/content.cfm?pub_id=3750&id=3. See appendix E for details of the calculations.						

Table 7: Summary of Results (results are percentage change from initial equilibrium, unless otherwise indicated)

No initial rent capture case

Scenario definition	Benchmark	EU FTA	EU Discriminatory Services	EU Tariffs	Africa FTA	EU-Africa FTA	Unilateral	Unilateral Discriminatory Services	Unilateral Tariffs	Unilateral & 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 firms	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)		**0.7**	0.5	0.2	**0.3**	**1.0**	**3.6**	1.5	2.0	**10.3**
Welfare (EV as % of GDP)		**0.6**	0.4	0.1	**0.2**	**0.8**	**3.0**	1.3	1.7	**8.6**
Government budget										
Tariff revenue (% of GDP)	3.6	**2.1**	2.9	2.1	**2.9**	**2.1**		2.9		
Tariff revenue		**-29.0**	-0.1	-28.9	**-0.1**	**-29.1**	**-100.0**	-0.3	-100.0	**-100.0**
Aggregate trade										
Real exchange rate		**0.9**	0.3	0.6	**0.2**	**1.2**	**4.0**	0.9	3.1	**5.8**
Aggregate exports		**3.2**	0.1	3.1	**0.3**	**3.5**	**12.6**	0.5	11.9	**15.4**
Factor Earnings										
Skilled labor		**2.2**	0.7	1.5	**0.5**	**2.7**	**9.0**	2.2	6.5	**15.3**
Semi-skilled labor		**1.1**	0.5	0.6	**0.3**	**1.4**	**5.6**	1.5	4.1	**10.3**
Unskilled labor		**1.5**	0.6	0.9	**0.3**	**1.9**	**7.4**	1.9	5.3	**14.3**
Capital		**1.5**	0.5	0.9	**0.3**	**1.8**	**7.0**	1.7	5.1	**12.4**
Land		**2.6**	0.4	2.2	**0.5**	**3.0**	**7.7**	1.4	6.1	**10.0**
Factor adjustments										
Skilled labor		**0.5**	0.3	0.3	**0.2**	**0.7**	**2.1**	0.9	1.3	**4.2**
Semi-skilled labor		**0.7**	0.2	0.7	**0.1**	**0.8**	**2.5**	0.6	1.9	**4.5**
Unskilled labor		**0.2**	0.1	0.1	**0.0**	**0.2**	**0.7**	0.2	0.5	**1.3**
Capital		**0.3**	0.1	0.3	**0.0**	**0.3**	**1.3**	0.3	1.2	**2.2**
Land		**1.0**	0.5	0.7	**0.4**	**1.4**	**3.7**	1.4	2.2	**7.2**

Source: Authors' estimates.

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

Initial Rent Capture Case

Scenario definition	Benchmark	EU FTA	EU Discriminatory Services	EU Tariffs	Africa FTA	EU-Africa FTA	Unilateral	Unilateral Discriminatory Services	Unilateral Tariffs	Unilateral & 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 firms	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)		**0.5**	0.3	0.2	**0.1**	**0.5**	**2.9**	0.9	2.0	**7.0**
Welfare (EV as % of GDP)		**0.4**	0.3	0.1	**0.0**	**0.5**	**2.5**	0.7	1.7	**5.9**
Government budget										
Tariff revenue (% of GDP)	3.6	**2.1**	2.9	2.1	**2.9**	**2.1**		2.9		
Tariff revenue		**-29.0**	-0.1	-28.9	**-0.1**	**-29.1**	**-100.0**	-0.4	-100.0	**-100.0**
Aggregate trade										
Real exchange rate		**0.9**	0.3	0.6	**0.2**	**1.1**	**4.0**	0.9	3.1	**5.5**
Aggregate exports		**3.2**	0.1	3.1	**0.2**	**3.4**	**12.4**	0.4	11.9	**14.3**
Factor Earnings										
Skilled labor		**2.2**	0.7	1.5	**0.5**	**2.7**	**8.9**	2.2	6.5	**14.7**
Semi-skilled labor		**1.1**	0.5	0.6	**0.3**	**1.4**	**5.6**	1.5	4.1	**10.0**
Unskilled labor		**1.5**	0.6	0.9	**0.3**	**1.8**	**7.4**	1.9	5.3	**14.6**
Capital		**1.4**	0.5	0.9	**0.3**	**1.7**	**6.9**	1.6	5.1	**12.2**
Land		**2.5**	0.3	2.2	**0.4**	**2.9**	**7.5**	1.1	6.1	**8.5**
Factor adjustments										
Skilled labor		**0.6**	0.4	0.3	**0.3**	**0.9**	**2.3**	1.1	1.3	**5.0**
Semi-skilled labor		**0.8**	0.3	0.7	**0.2**	**0.9**	**2.5**	0.8	1.9	**4.9**
Unskilled labor		**0.2**	0.1	0.1	**0.1**	**0.3**	**0.8**	0.4	0.5	**2.0**
Capital		**0.3**	0.1	0.3	**0.1**	**0.4**	**1.4**	0.4	1.2	**2.7**
Land		**1.0**	0.4	0.7	**0.4**	**1.4**	**3.7**	1.5	2.2	**7.2**

Source: Authors' estimates.

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

No initial rent capture case

	Unilateral FTA		EU-Africa FTA		Africa FTA		EU FTA	
	Output	Labor income	Output	Labor income	Output	Labor income	Output	Labor income
Business Services								
Communication	3.0	8.3	1.1	2.3	0.2	0.3	0.9	2.0
Insurance	4.1	9.8	0.9	2.0	0.2	0.4	0.7	1.6
Banking and other financial services	2.4	7.7	0.9	2.1	0.2	0.4	0.7	1.7
Professional business services	4.1	10.5	1.5	3.1	0.2	0.4	1.3	2.6
Road services	6.5	9.4	2.8	3.0	0.4	0.5	2.3	2.4
Railway transport	12.6	14.3	6.1	5.7	1.8	1.4	4.2	4.2
Maritime transport	14.3	16.8	8.2	8.2	-0.2	-0.6	8.2	8.7
Pipeline transport	5.5	7.0	2.7	2.3	0.8	0.4	1.9	1.9
Airline transport	6.6	8.4	3.2	2.8	0.9	0.4	2.3	2.4
Dixit-Stiglitz Goods								
Beverages & tobacco	6.2	12.1	0.6	1.9	0.1	0.3	0.5	1.6
Grain milling	2.7	10.0	0.5	2.4	0.1	0.4	0.4	1.9
Sugar & bakery & confectionary	-2.4	4.0	0.4	2.1	0.1	0.4	0.3	1.7
Petroleum	0.7	3.5	3.4	4.0	0.2	0.2	3.2	3.7
Chemicals	1.5	7.3	-0.4	1.0	0.0	0.3	-0.4	0.7
Metals and machines	-8.4	-3.3	-3.7	-2.5	0.0	0.3	-3.7	-2.7
Non metallic products	-14.2	-9.7	-1.0	0.6	0.0	0.3	-1.0	0.3
Agriculture								
Maize	1.7	7.1	0.6	2.1	0.1	0.3	0.6	1.8
Wheat	-27.7	-24.9	-2.7	-0.9	-0.2	0.1	-2.4	-1.0
Rice	-29.8	-27.0	0.6	2.0	0.1	0.3	0.5	1.7
Barley	3.3	10.0	0.1	2.2	0.0	0.4	0.1	1.8
Cotton	2.5	7.6	0.5	1.9	0.1	0.3	0.4	1.6
Other cereals	-2.1	3.9	-0.9	1.1	-0.2	0.1	-0.6	0.9
Sugarcane	-31.0	-30.2	-3.2	-3.4	2.3	1.9	-5.5	-5.4
Coffee	52.4	60.9	15.5	17.4	0.4	0.7	15.1	16.8
Tea	-7.3	-2.1	-1.6	0.0	-1.2	-1.0	-0.3	1.1
Roots & tubers	0.6	4.9	0.3	1.4	0.1	0.3	0.2	1.1
Pulses & oil seeds	0.3	5.7	0.1	1.7	0.0	0.3	0.1	1.4
Fruits	-0.4	5.0	-0.1	1.4	0.1	0.3	-0.2	1.1
Vegetables	-0.7	4.8	0.3	1.8	0.1	0.3	0.2	1.5
Cut flowers	21.1	27.1	11.2	12.7	4.8	4.9	6.1	7.4
Others crops	1.0	5.6	1.2	2.5	0.1	0.3	1.2	2.2
Beef	2.2	9.3	0.6	2.5	0.0	0.4	0.6	2.1
Dairy	0.4	7.1	0.1	1.9	0.0	0.3	0.1	1.5
Poultry	0.6	7.1	0.1	1.8	0.0	0.3	0.1	1.5
Sheep goat and lamb for slaughter	0.9	7.9	0.1	2.0	0.0	0.4	0.1	1.7
Other livestock	-0.5	6.1	0.0	1.7	0.0	0.3	-0.1	1.3
Other CRTS								
Fishing	0.3	7.3	-0.1	1.7	0.0	0.4	-0.1	1.3
Forestry	0.1	6.8	0.0	1.8	0.0	0.4	0.0	1.4
Mining	81.3	96.4	9.0	10.8	0.8	1.0	8.1	9.7
Meat & dairy	7.1	13.6	0.9	2.4	0.1	0.3	0.8	2.0
Other manufactured food	49.6	63.3	8.1	10.5	0.7	1.1	7.4	9.3
Printing and publishing	6.2	12.6	0.8	2.1	0.1	0.3	0.7	1.8
Textile & clothing	-4.4	3.1	-0.1	2.2	-0.1	0.4	-0.1	1.8
Leather & footwear	4.7	12.8	0.4	2.3	0.0	0.4	0.4	2.0
Wood & paper	4.3	11.6	-0.8	0.8	0.1	0.5	-0.9	0.4
Other manufactures	-12.1	-7.3	-6.2	-5.1	0.0	0.3	-6.3	-5.4
Water	-0.5	5.9	0.1	1.8	0.0	0.3	0.1	1.4
Electricity	0.5	6.7	0.4	1.9	0.1	0.4	0.2	1.5
Construction	0.0	6.0	0.0	1.5	0.0	0.3	0.0	1.2
Trade	3.4	7.6	1.1	2.0	0.1	0.2	1.0	1.7
Hotels	0.4	5.6	0.0	1.3	0.0	0.3	0.0	1.1
Real estate	-2.3	3.5	-0.5	1.0	0.0	0.3	-0.5	0.7
Adminsitration	0.0	6.4	0.0	1.6	0.0	0.3	0.0	1.3
Health	-0.3	7.0	-0.2	1.6	0.0	0.3	-0.2	1.3
Education	-0.3	6.7	-0.1	1.7	0.0	0.3	-0.1	1.4

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			
Communication			
Insurance	-1.0		5.5
Banking and other financial services	3.4	3.4	3.9
Professional business services			
Road services	-6.3	-6.3	-4.2
Railway transport			-3.0
Maritime transport	-20.9	-25.2	-19.1
Pipeline transport		-0.9	-0.5
Airline transport	-2.6	-3.2	-2.4
Dixit-Stiglitz Goods			
Beverages & tobacco	67.0	-6.6	148.7
Grain milling	59.6	-13.9	218.3
Sugar & bakery & confectionary	43.7	-20.8	118.6
Petroleum	2.8	-25.4	6.5
Chemicals	5.1	-14.2	6.0
Metals and machines	6.0	-19.8	9.1
Non metallic products	37.4	-24.2	187.9
Agriculture			
Maize	173.2	-3.1	173.2
Wheat	4.2	-31.4	4.2
Rice	65.3	-37.6	65.3
Barley			
Cotton			
Other cereals			
Sugarcane	216.2	-56.5	216.2
Coffee			
Tea	58.3	-22.9	58.3
Roots & tubers			
Pulses & oil seeds	31.3	1.4	31.3
Fruits			
Vegetables	98.7	-3.2	98.7
Cut flowers			
Others crops	11.6	0.4	11.6
Beef			
Dairy			
Poultry			
Sheep goat and lamb for slaughter			
Other livestock			
Other CRTS			
Fishing			
Forestry			
Mining	-26.0	-29.4	-26.0
Meat & dairy	107.8	-21.6	107.8
Other manufactured food	16.5	-35.3	16.5
Printing and publishing	-3.4	-3.4	-3.4
Textile & clothing	29.2	-24.5	29.2
Leather & footwear	44.1	-14.1	44.1
Wood & paper	17.9	-17.2	17.9
Other manufactures	26.6	-32.8	26.6
Water			
Electricity			
Construction			
Trade			
Hotels			
Real estate	4.3	4.3	4.3
Administration			
Health			
Education			

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			
Communication	0.2		0.2
Insurance	-6.6		-6.6
Banking and other financial services	-1.6	-1.6	-1.6
Professional business services			
Road services	5.1	5.1	5.1
Railway transport			23.8
Maritime transport	3.4	3.4	3.4
Pipeline transport		6.8	6.8
Airline transport	6.4	6.4	6.4
Dixit-Stiglitz Goods			
Beverages & tobacco	13.8	13.8	13.8
Grain milling			
Sugar & bakery & confectionary	15.0	15.0	15.0
Petroleum	16.2	16.2	16.2
Chemicals	7.5	7.5	7.5
Metals and machines	52.8	52.8	52.8
Non metallic products	20.1	20.1	20.1
Agriculture			
Maize	6.0	6.0	6.0
Wheat		-25.3	-25.3
Rice			
Barley		-3.5	
Cotton	1.9	1.9	1.9
Other cereals	-5.1	-5.1	-5.1
Sugarcane	-15.5	-15.5	-15.5
Coffee	55.7	55.7	55.7
Tea	-7.0	-7.0	-7.0
Roots & tubers			
Pulses & oil seeds	-0.7	-0.7	-0.7
Fruits	-3.3	-3.3	-3.3
Vegetables	-0.8	-0.8	-0.8
Cut flowers	21.4	21.4	21.4
Others crops	1.3	1.3	1.3
Beef			
Dairy			
Poultry			
Sheep goat and lamb for slaughter			
Other livestock			
Other CRTS			
Fishing			
Forestry			
Mining	85.2	85.2	85.2
Meat & dairy	23.5	23.5	23.5
Other manufactured food	77.4	77.4	77.4
Printing and publishing			
Textile & clothing	6.6	6.6	6.6
Leather & footwear	18.1	18.1	18.1
Wood & paper	5.5	5.5	5.5
Other manufactures	3.6	3.6	3.6
Water			
Electricity			
Construction			
Trade			
Hotels			
Real estate	-8.2	-8.2	-8.2
Administration			
Health			
Education			

Source: Authors' estimates.

Table 12: Impacts on Number of Firms from Unilateral Liberalisation (% change from benchmark)
No initial rent capture case

	Kenya	European Union	Africa	Rest of the World
Business Services				
Communication	-1.8	5.3		6.2
Insurance	-6.3	33.4		91.4
Banking and other financial services	1.4	1.7	1.7	3.5
Professional business services	1.1	50.7	13.7	61.1
Road services	-0.3	39.8	39.7	128.3
Railway transport				7.5
Maritime transport	-9.0	86.4	16.7	115.9
Pipeline transport	3.9		3.0	12.2
Airline transport	3.3	9.1	2.7	11.1
Dixit-Stiglitz Goods				
Beverages & tobacco	5.5	50.6	-5.4	116.4
Grain milling	2.2	45.5	-11.5	169.9
Sugar & bakery & confectionary	-2.3	33.4	-17.1	92.2
Petroleum	0.6	2.2	-20.6	5.1
Chemicals	1.4	3.9	-11.3	4.7
Metals and machines	-7.3	4.6	-15.9	7.0
Non metallic products	-10.5	28.9	-20.1	144.9

Source: Authors' estimates.

Table 13: Impacts on Imports from combined EU and Aftrica FTAs

No initial rent capture case (% change from benchmark)

	European Union	Africa	Rest of the World
Business Services			
Communication			
Insurance	3.4		-0.4
Banking and other financial services	0.6	0.6	0.8
Professional business services			
Road services	-3.5	-3.5	-4.3
Railway transport			-1.9
Maritime transport	-11.8	-18.1	-20.7
Pipeline transport		-0.8	-0.7
Airline transport	-1.4	-1.9	-1.8
Dixit-Stiglitz Goods			
Beverages & tobacco	75.3	-1.5	-2.5
Grain milling	79.3	-1.7	-3.4
Sugar & bakery & confectionary	72.5	-3.6	-7.0
Petroleum	36.0	-0.8	-1.7
Chemicals	43.7	-4.4	-14.3
Metals and machines	129.4	-8.5	-43.3
Non metallic products	72.1	-2.6	-6.8
Agriculture			
Maize	178.7	-1.1	-1.1
Wheat	51.1	-0.6	-0.6
Rice	164.2	-0.3	-0.3
Barley			
Cotton			
Other cereals			
Sugarcane	521.0	-14.6	-14.6
Coffee			
Tea	104.5	-0.4	-0.4
Roots & tubers			
Pulses & oil seeds	29.9	0.3	0.3
Fruits			
Vegetables	102.5	-1.4	-1.4
Cut flowers			
Others crops	11.5	0.4	0.4
Beef			
Dairy			
Poultry			
Sheep goat and lamb for slaughter			
Other livestock			
Other CRTS			
Fishing			
Forestry			
Mining	1.5	-3.1	-3.1
Meat & dairy	153.6	-4.3	-4.3
Other manufactured food	72.7	-4.1	-4.1
Printing and publishing	-0.6	-0.6	-0.6
Textile & clothing	69.5	-0.9	-0.9
Leather & footwear	67.6	0.0	0.0
Wood & paper	32.1	-7.2	-7.2
Other manufactures	59.8	-15.1	-15.1
Water			
Electricity			
Construction			
Trade			
Hotels			
Real estate	0.5	0.5	0.5
Administration			
Health			
Education			

Source: Authors' estimates.

Table 14: Impacts on Exports from Combined EU-Africa FTA

No initial rent capture case (% change from benchmark)

	European Union	Africa	Rest of the World
Business Services			
Communication	0.2		0.2
Insurance	-0.2		-0.2
Banking and other financial services	0.4	0.4	0.4
Professional business services			
Road services	2.6	2.6	2.6
Railway transport			11.8
Maritime transport	1.7	1.7	1.7
Pipeline transport		3.8	3.8
Airline transport	3.6	3.6	3.6
Dixit-Stiglitz Goods			
Beverages & tobacco	1.9	1.9	1.9
Grain milling			
Sugar & bakery & confectionary	3.6	3.6	3.6
Petroleum	4.6	4.6	4.6
Chemicals	1.2	1.2	1.2
Metals and machines	26.0	26.0	26.0
Non metallic products	2.6	2.6	2.6
Agriculture			
Maize	2.4	2.4	2.4
Wheat		-4.5	-4.5
Rice			
Barley		-2.4	
Cotton	0.5	0.5	0.5
Other cereals	-2.1	-2.1	-2.1
Sugarcane	2.8	2.8	2.8
Coffee	16.6	16.6	16.6
Tea	-1.7	-1.7	-1.7
Roots & tubers			
Pulses & oil seeds	-0.1	-0.1	-0.1
Fruits	-1.0	-1.0	-1.0
Vegetables	1.0	1.0	1.0
Cut flowers	11.4	11.4	11.4
Others crops	1.7	1.7	1.7
Beef			
Dairy			
Poultry			
Sheep goat and lamb for slaughter			
Other livestock			
Other CRTS			
Fishing			
Forestry			
Mining	9.4	9.4	9.4
Meat & dairy	3.5	3.5	3.5
Other manufactured food	11.9	11.9	11.9
Printing and publishing			
Textile & clothing	0.2	0.2	0.2
Leather & footwear	0.6	0.6	0.6
Wood & paper	-0.5	-0.5	-0.5
Other manufactures	-0.2	-0.2	-0.2
Water			
Electricity			
Construction			
Trade			
Hotels			
Real estate	-1.3	-1.3	-1.3
Administration			
Health			
Education			

Source: Authors' estimates.

Table 15: Impacts on Number of Firms from Combined EU-Africa FTA
No initial rent capture case (% change from benchmark)

	Kenya	European Union	Africa	Rest of the World
Business Services				
Communication	-1.4	7.0		-5.4
Insurance	-0.3	42.2		-0.6
Banking and other financial services	0.6	0.6	0.6	1.2
Professional business services	0.2	46.4	12.8	0.6
Road services	-0.5	41.1	41.0	-4.2
Railway transport				3.6
Maritime transport	-7.0	120.3	20.3	-35.0
Pipeline transport	2.0		1.4	5.6
Airline transport	1.8	7.1	2.1	2.2
Dixit-Stiglitz Goods				
Beverages & tobacco	0.6	56.5	-1.2	-2.0
Grain milling	0.4	59.5	-1.3	-2.8
Sugar & bakery & confectionary	0.4	53.9	-2.9	-5.6
Petroleum	3.2	27.2	-0.6	-1.4
Chemicals	-0.4	33.3	-3.4	-11.1
Metals and machines	-3.2	96.9	-6.7	-33.9
Non metallic products	-0.7	53.8	-2.1	-5.5

Source: Authors' estimates.

Table 16: Impacts on Imports from African FTA

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

	European Union	Africa	Rest of the World
Business Services			
Communication			
Insurance	0.1		0.1
Banking and other financial services	0.1	0.1	0.2
Professional business services			
Road services	-3.0	-2.3	-3.1
Railway transport			-0.6
Maritime transport	-2.5	-1.7	-2.5
Pipeline transport		-0.3	-0.3
Airline transport	-0.4	-0.4	-0.4
Dixit-Stiglitz Goods			
Beverages & tobacco	0.0	0.0	0.1
Grain milling	0.0	0.0	0.0
Sugar & bakery & confectionary	0.0	0.0	0.1
Petroleum	0.0	0.0	0.0
Chemicals	0.1	0.0	0.1
Metals and machines	0.0	0.0	0.1
Non metallic products	0.1	0.1	0.2
Agriculture			
Maize	0.2	0.2	0.2
Wheat	0.1	0.1	0.1
Rice	0.1	0.1	0.1
Barley			
Cotton			
Other cereals			
Sugarcane	-1.1	-1.1	-1.1
Coffee			
Tea	-0.4	-0.4	-0.4
Roots & tubers			
Pulses & oil seeds	0.2	0.2	0.2
Fruits			
Vegetables	0.0	0.0	0.0
Cut flowers			
Others crops	0.2	0.2	0.2
Beef			
Dairy			
Poultry			
Sheep goat and lamb for slaughter			
Other livestock			
Other CRTS			
Fishing			
Forestry			
Mining	-0.2	-0.2	-0.2
Meat & dairy	0.0	0.0	0.0
Other manufactured food	0.0	0.0	0.0
Printing and publishing	0.1	0.1	0.1
Textile & clothing	0.3	0.3	0.3
Leather & footwear	0.2	0.2	0.2
Wood & paper	0.9	0.9	0.9
Other manufactures	0.2	0.2	0.2
Water			
Electricity			
Construction			
Trade			
Hotels			
Real estate	0.2	0.2	0.2
Administration			
Health			
Education			

Source: Authors' estimates.

Table 17: Impacts on Exports from African FTA

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

	European Union	Africa	Rest of the World
Business Services			
Communication	0.1		0.1
Insurance	0.1		0.1
Banking and other financial services	0.1	0.1	0.1
Professional business services			
Road services	-1.1	-1.1	-1.1
Railway transport			3.6
Maritime transport	1.3	1.3	1.3
Pipeline transport		1.2	1.2
Airline transport	1.2	1.2	1.2
Dixit-Stiglitz Goods			
Beverages & tobacco	0.2	0.2	0.2
Grain milling			
Sugar & bakery & confectionary	0.1	0.1	0.1
Petroleum	0.3	0.3	0.3
Chemicals	0.0	0.0	0.0
Metals and machines	0.0	0.0	0.0
Non metallic products	0.0	0.0	0.0
Agriculture			
Maize	0.0	0.0	0.0
Wheat		-0.5	-0.5
Rice			
Barley		-0.3	
Cotton	0.1	0.1	0.1
Other cereals	-0.5	-0.5	-0.5
Sugarcane	4.1	4.1	4.1
Coffee	0.5	0.5	0.5
Tea	-1.2	-1.2	-1.2
Roots & tubers			
Pulses & oil seeds	-0.1	-0.1	-0.1
Fruits	0.0	0.0	0.0
Vegetables	0.2	0.2	0.2
Cut flowers	4.9	4.9	4.9
Others crops	0.0	0.0	0.0
Beef			
Dairy			
Poultry			
Sheep goat and lamb for slaughter			
Other livestock			
Other CRTS			
Fishing			
Forestry			
Mining	0.8	0.8	0.8
Meat & dairy	0.2	0.2	0.2
Other manufactured food	0.8	0.8	0.8
Printing and publishing			
Textile & clothing	-0.3	-0.3	-0.3
Leather & footwear	-0.1	-0.1	-0.1
Wood & paper	0.1	0.1	0.1
Other manufactures	-0.1	-0.1	-0.1
Water			
Electricity			
Construction			
Trade			
Hotels			
Real estate	-0.1	-0.1	-0.1
Administration			
Health			
Education			

Source: Authors' estimates.

Table 18: Impacts on Number of Firms from African FTA

No initial rent capture case (% change from benchmark)

	Kenya	European Union	Africa	Rest of the World
Business Services				
Communication	0.0	0.1		0.2
Insurance	0.1	0.1		0.2
Banking and other financial services	0.1	0.1	0.1	0.2
Professional business services	0.0	-0.1	12.6	-0.1
Road services	-2.2	-2.8	40.2	-5.5
Railway transport				1.1
Maritime transport	-0.1	-2.8	28.3	-3.4
Pipeline transport	0.6		0.4	1.6
Airline transport	0.7	0.9	1.9	1.0
Dixit-Stiglitz Goods				
Beverages & tobacco	0.1	0.0	0.0	0.0
Grain milling	0.1	0.0	0.0	0.0
Sugar & bakery & confectionary	0.1	0.0	0.0	0.1
Petroleum	0.2	0.0	0.0	0.0
Chemicals	0.0	0.1	0.0	0.1
Metals and machines	0.0	0.0	0.0	0.0
Non metallic products	0.0	0.1	0.1	0.2

Source: Authors' estimates.

Table 19: Impacts on Imports from EU FTA

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

	European Union	Africa	Rest of the World
Business Services			
Communication			
Insurance	3.3		-0.5
Banking and other financial services	0.5	0.5	0.6
Professional business services			
Road services	-0.6	-1.3	-1.3
Railway transport			-1.2
Maritime transport	-9.6	-17.2	-18.8
Pipeline transport		-0.6	-0.4
Airline transport	-1.0	-1.4	-1.4
Dixit-Stiglitz Goods			
Beverages & tobacco	75.2	-1.6	-2.6
Grain milling	79.3	-1.7	-3.5
Sugar & bakery & confectionary	72.4	-3.7	-7.1
Petroleum	36.0	-0.8	-1.8
Chemicals	43.5	-4.4	-14.4
Metals and machines	129.3	-8.5	-43.3
Non metallic products	71.9	-2.7	-7.0
Agriculture			
Maize	178.2	-1.3	-1.3
Wheat	51.0	-0.7	-0.7
Rice	163.9	-0.4	-0.4
Barley			
Cotton			
Other cereals			
Sugarcane	527.5	-13.7	-13.7
Coffee			
Tea	105.4	0.0	0.0
Roots & tubers			
Pulses & oil seeds	29.6	0.1	0.1
Fruits			
Vegetables	102.5	-1.4	-1.4
Cut flowers			
Others crops	11.4	0.2	0.2
Beef			
Dairy			
Poultry			
Sheep goat and lamb for slaughter			
Other livestock			
Other CRTS			
Fishing			
Forestry			
Mining	1.7	-2.9	-2.9
Meat & dairy	153.5	-4.4	-4.4
Other manufactured food	72.6	-4.1	-4.1
Printing and publishing	-0.7	-0.7	-0.7
Textile & clothing	68.9	-1.3	-1.3
Leather & footwear	67.3	-0.2	-0.2
Wood & paper	30.9	-8.1	-8.1
Other manufactures	59.5	-15.3	-15.3
Water			
Electricity			
Construction			
Trade			
Hotels			
Real estate	0.3	0.3	0.3
Administration			
Health			
Education			

Source: Authors' estimates.

Table 20: Impacts on Exports from EU FTA

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

	European Union	Africa	Rest of the World
Business Services			
Communication	0.2		0.2
Insurance	-0.2		-0.2
Banking and other financial services	0.3	0.3	0.3
Professional business services			
Road services	3.6	3.6	3.6
Railway transport			7.9
Maritime transport	0.4	0.4	0.4
Pipeline transport		2.6	2.6
Airline transport	2.5	2.5	2.5
Dixit-Stiglitz Goods			
Beverages & tobacco	1.7	1.7	1.7
Grain milling			
Sugar & bakery & confectionary	3.5	3.5	3.5
Petroleum	4.4	4.4	4.4
Chemicals	1.2	1.2	1.2
Metals and machines	25.9	25.9	25.9
Non metallic products	2.6	2.6	2.6
Agriculture			
Maize	2.4	2.4	2.4
Wheat		-3.9	-3.9
Rice			
Barley		-2.1	
Cotton	0.4	0.4	0.4
Other cereals	-1.6	-1.6	-1.6
Sugarcane	-1.3	-1.3	-1.3
Coffee	16.2	16.2	16.2
Tea	-0.4	-0.4	-0.4
Roots & tubers			
Pulses & oil seeds	0.0	0.0	0.0
Fruits	-1.0	-1.0	-1.0
Vegetables	0.8	0.8	0.8
Cut flowers	6.2	6.2	6.2
Others crops	1.7	1.7	1.7
Beef			
Dairy			
Poultry			
Sheep goat and lamb for slaughter			
Other livestock			
Other CRTS			
Fishing			
Forestry			
Mining	8.5	8.5	8.5
Meat & dairy	3.4	3.4	3.4
Other manufactured food	10.9	10.9	10.9
Printing and publishing			
Textile & clothing	0.5	0.5	0.5
Leather & footwear	0.7	0.7	0.7
Wood & paper	-0.6	-0.6	-0.6
Other manufactures	-0.1	-0.1	-0.1
Water			
Electricity			
Construction			
Trade			
Hotels			
Real estate	-1.2	-1.2	-1.2
Administration			
Health			
Education			

Source: Authors' estimates.

Table 21: Impacts on Number of Firms from EU FTA

No initial rent capture case (% change from benchmark)

	Kenya	European Union	Africa	Rest of the World
Business Services				
Communication	-1.4	6.9		-5.6
Insurance	-0.4	42.0		-0.8
Banking and other financial services	0.5	0.5	0.5	0.9
Professional business services	0.2	46.5	0.2	0.7
Road services	1.7	44.3	0.7	1.4
Railway transport				2.5
Maritime transport	-7.0	127.4	-12.2	-33.1
Pipeline transport	1.4		1.0	3.8
Airline transport	1.2	6.2	0.3	1.1
Dixit-Stiglitz Goods				
Beverages & tobacco	0.4	56.5	-1.3	-2.1
Grain milling	0.4	59.5	-1.4	-2.8
Sugar & bakery & confectionary	0.3	53.9	-3.0	-5.7
Petroleum	3.0	27.1	-0.6	-1.4
Chemicals	-0.4	33.2	-3.5	-11.2
Metals and machines	-3.2	96.8	-6.7	-33.9
Non metallic products	-0.7	53.7	-2.2	-5.6

Source: Authors' estimates.

Table 22: Sensitivity Analysis of Kenya-EU FTA

	Parameter Value			% Welfare Change (EV)		
Parameter	Lower	Central	Upper	Lower	Central	Upper
$\sigma(q_i, q_j)$ – services sectors	1.5	3	4.5	9.99	0.67	0.50
$\sigma(q_i, q_j)$ – goods sectors		see below		1.06	0.67	0.59
σ(va, bs)	0.625	1.25	1.875	0.55	0.67	0.82
σ(D, M)	2	4	6	0.65	0.67	0.69
σ(L, K)	0.5	1	1.5	0.64	0.67	0.70
$\sigma(A_1,\ldots A_n)$	0	0	0.25	0.67	0.67	0.67
σ(D, E)	2	4	6	0.65	0.67	0.69
ε_{KEN}	Central values of all 4 sets of eta			0.61	0.67	0.72
ε_{EU}	parameters are listed in table 6B			0.25	0.67	0.96
ε_{AFR}	Lower values are 0.5 central values and			0.68	0.67	0.67
ε_{ROW}	upper values are 1.5 times central values			0.90	0.67	0.55
share of rents captured	0	0	1	0.67	0.67	0.49
CRTS--share of rents captured	NA	0	1	NA	0.09	-0.06
θ_m	0.025	0.05	0.075	0.67	0.67	0.67
$\sigma(q_i, q_j)$ – goods sectors						
sugar and bakery	2.12	2.93	3.74			
beverages and tabacco	1.52	2.33	3.14			
chemicals	2.01	2.82	3.63			
metals and machines	8.345	16.69	25.035			
gain milling	2.43	3.24	4.05			
nonmetallic products	2.805	5.61	8.415			
petroleum	2.75	3.56	4.37			
Source: Authors' estimates						

Table 23: Sensitivity Analysis of Kenya-Africa FTA

	Parameter Value			% Welfare Change (EV)		
Parameter	Lower	Central	Upper	Lower	Central	Upper
$\sigma(q_i, q_j)$ – services sectors	1.5	3	4.5	5.02	0.29	0.16
$\sigma(q_i, q_j)$ – goods sectors		see below		0.32	0.29	0.28
σ(va, bs)	0.625	1.25	1.875	0.25	0.29	0.33
σ(D, M)	2	4	6	0.28	0.29	0.29
σ(L, K)	0.5	1	1.5	0.28	0.29	0.29
$\sigma(A_1,\ldots A_n)$	0	0	0.25	0.29	0.29	0.29
σ(D, E)	2	4	6	0.28	0.29	0.29
ε_{KEN}	Central values of all 4 sets of eta			0.31	0.29	0.27
ε_{EU}	parameters are listed in table 6B			0.29	0.29	0.29
ε_{AFR}	Lower values are 0.5 central values and			0.14	0.29	0.43
ε_{ROW}	upper values are 1.5 times central values			0.29	0.29	0.29
share of rents captured	0	0	1	0.29	0.29	0.05
CRTS--share of rents captured	NA	0	1	NA	0.14	-0.06
θ_m	0.025	0.05	0.075	0.29	0.29	0.29
$\sigma(q_i, q_j)$ – goods sectors						
sugar and bakery	2.12	2.93	3.74			
beverages and tabacco	1.52	2.33	3.14			
chemicals	2.01	2.82	3.63			
metals and machines	8.345	16.69	25.035			
gain milling	2.43	3.24	4.05			
nonmetallic products	2.805	5.61	8.415			
petroleum	2.75	3.56	4.37			
Source: Authors' estimates						

Table 24: Summary of Results for Professional Services --No Initial Rent Capture Case
(results are percentage change from initial equilibrium, unless otherwise indicated)

Scenario definition	Domestic & Discriminatory Services	Domestic Services	Unilateral Discriminatory Services	EU Discriminatory Services	Africa Discriminatory Services	Africa-EU Discriminatory Services	Rest of World 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 firms	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)	0.71	0.54	**0.16**	**0.06**	0.02	0.08	0.07
Welfare (EV as % of GDP)	0.60	0.45	**0.13**	**0.05**	0.02	0.07	0.06
Government budget							
Tariff revenue (% of GDP)	2.9	2.9	**2.9**	**2.9**	2.9	2.9	2.9
Tariff revenue	-0.1	-0.1	**0.0**	**0.0**	0.0	0.0	0.0
Aggregate trade							
Real exchange rate	0.2	0.1	**0.1**	**0.0**	0.0	0.0	0.0
Aggregate exports	0.6	0.4	**0.2**	**0.1**	0.1	0.1	0.1
Factor Earnings							
Skilled labor	1.0	0.6	**0.4**	**0.2**	0.0	0.2	0.2
Semi-skilled labor	0.5	0.4	**0.1**	**0.1**	0.0	0.1	0.1
Unskilled labor	0.8	0.5	**0.3**	**0.1**	0.0	0.1	0.1
Capital	0.7	0.4	**0.2**	**0.1**	0.0	0.1	0.1
Land	1.2	0.8	**0.4**	**0.1**	0.1	0.2	0.2
Factor adjustments							
Skilled labor	0.5	0.3	**0.2**	**0.1**	0.0	0.1	0.1
Semi-skilled labor	0.4	0.2	**0.1**	**0.0**	0.0	0.1	0.1
Unskilled labor	0.1	0.1	**0.1**	**0.0**	0.0	0.0	0.0
Capital	0.2	0.1	**0.1**	**0.0**	0.0	0.0	0.0
Land	1.1	0.7	**0.3**	**0.1**	0.0	0.2	0.2

Source: Authors' estimates.

Table 25: Summary of Results for Professional Services, initial rent capture case
(results are percentage change from initial equilibrium, unless otherwise indicated)

Scenario definition	Domestic & Discriminatory Services	Domestic Services	Unilateral Discriminatory Services	EU Discriminatory Services	Africa Discriminatory Services	Africa-EU Discriminatory Services	Rest of World 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 firms	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)	0.63	0.52	**0.09**	**0.04**	0.00	0.08	0.05
Welfare (EV as % of GDP)	0.53	0.44	**0.08**	**0.04**	0.00	0.07	0.04
Government budget							
Tariff revenue (% of GDP)	2.9	2.9	**2.9**	**2.9**	2.9	2.9	2.9
Tariff revenue	-0.1	-0.1	**0.0**	**0.0**	0.0	0.0	0.0
Aggregate trade							
Real exchange rate	0.2	0.1	**0.1**	**0.0**	0.0	0.0	0.0
Aggregate exports	0.6	0.4	**0.2**	**0.1**	0.0	0.1	0.1
Factor Earnings							
Skilled labor	1.0	0.6	**0.4**	**0.2**	0.0	0.2	0.2
Semi-skilled labor	0.5	0.3	**0.1**	**0.0**	0.0	0.1	0.1
Unskilled labor	0.8	0.5	**0.3**	**0.1**	0.0	0.1	0.1
Capital	0.6	0.4	**0.2**	**0.1**	0.0	0.1	0.1
Land	1.1	0.8	**0.3**	**0.1**	0.0	0.2	0.2
Factor adjustments							
Skilled labor	0.5	0.3	**0.3**	**0.1**	0.0	0.1	0.1
Semi-skilled labor	0.4	0.2	**0.1**	**0.0**	0.0	0.1	0.1
Unskilled labor	0.2	0.1	**0.1**	**0.0**	0.0	0.0	0.0
Capital	0.2	0.1	**0.1**	**0.0**	0.0	0.0	0.0
Land	1.1	0.7	**0.3**	**0.1**	0.0	0.2	0.1

Source: Authors' estimates.

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

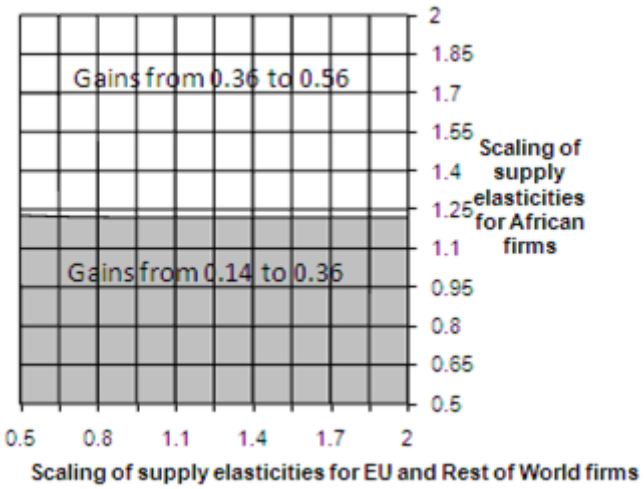
No initial rent capture case **% change from benchmark**

	Domestic & Discriminatory Services	Domestic Services	Unilateral Discriminatory Services	EU Discriminatory Services	Africa Discriminatory Services	Africa-EU Discriminatory Services	Rest of World Discriminatory Services
Kenya	0.5	1.7	-1.1	-0.5	-0.1	-0.6	-0.6
European Union	49.2	5.1	40.2	43.3	-0.4	42.7	-1.6
Africa	13.4	1.7	11.4	-0.5	12.5	12.0	-0.6
Rest of the World	59.2	6.0	48.2	-1.6	-0.4	-2.0	51.4

Source: Authors' estimates.

Figure 1 Sensitivity Analysis of Kenyan Preferential Liberalization of Services with African Partners: Impact of Partner and Excluded Country Supply Elasticity, with and without Rent Capture

Case I: No initial rent capture by Kenya



Case II: Initial rent capture by Kenya

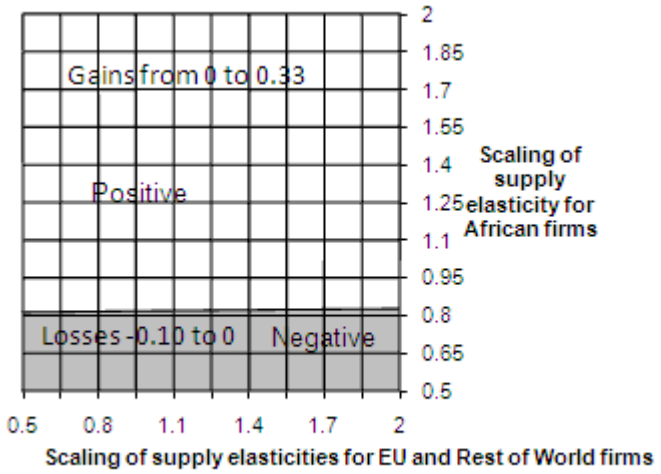
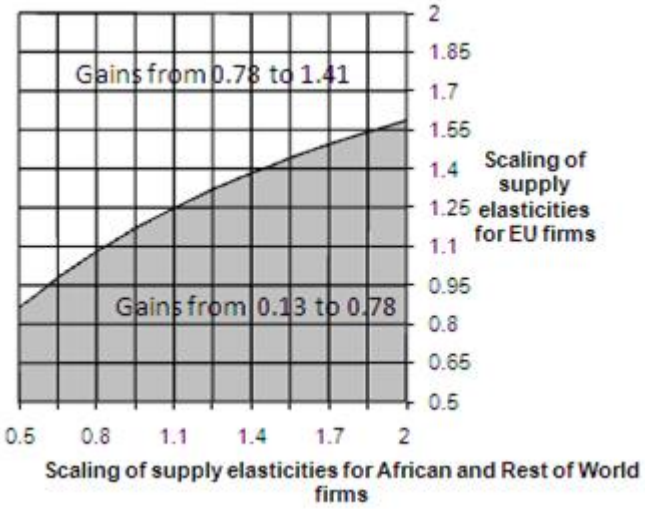


Figure 2: Sensitivity Analysis of Kenyan Preferential Liberalization of Services with the EU: Impact of Partner and Excluded Country Supply Elasticity, with and without Rent Capture

Case I: No initial rent capture by Kenya



Case II: Initial rent capture by Kenya

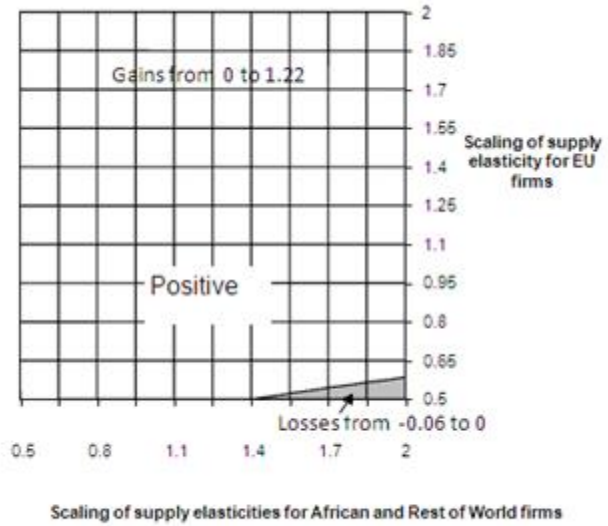


Figure 3: Sample Frequency Distribution of the Welfare Results of Kenyan Preferential Reduction of Services Barriers Against African Partners—30,000 simulations.

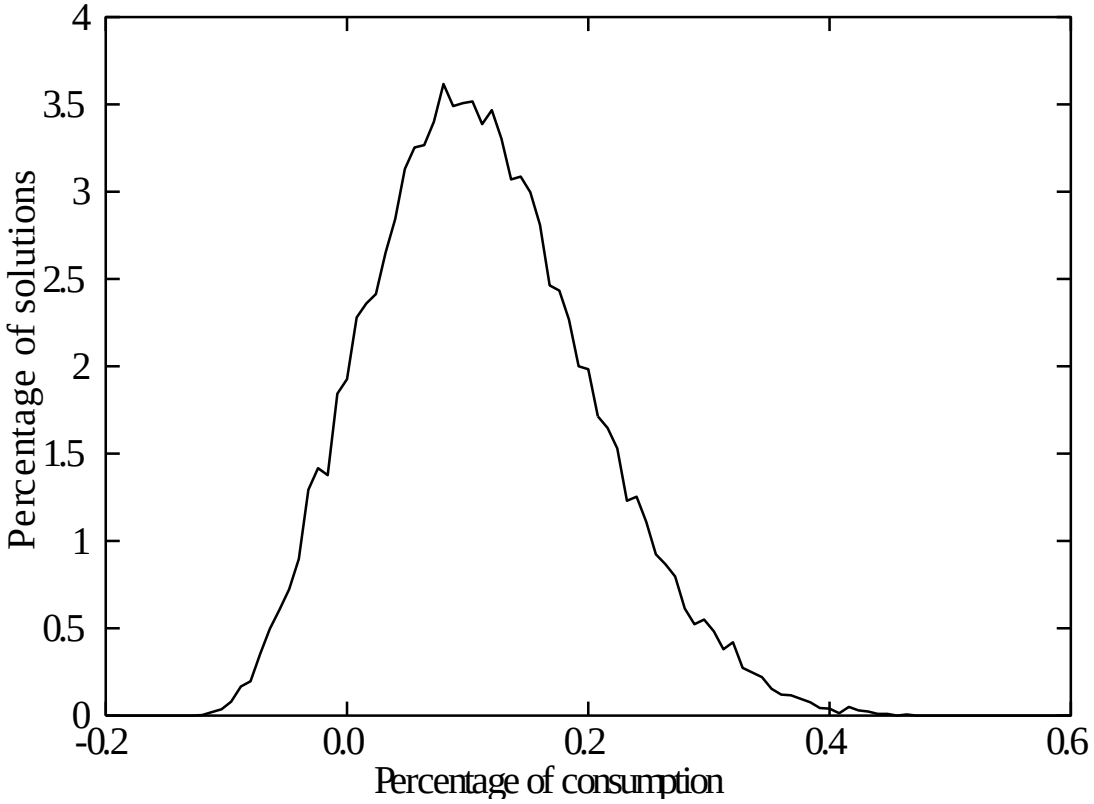
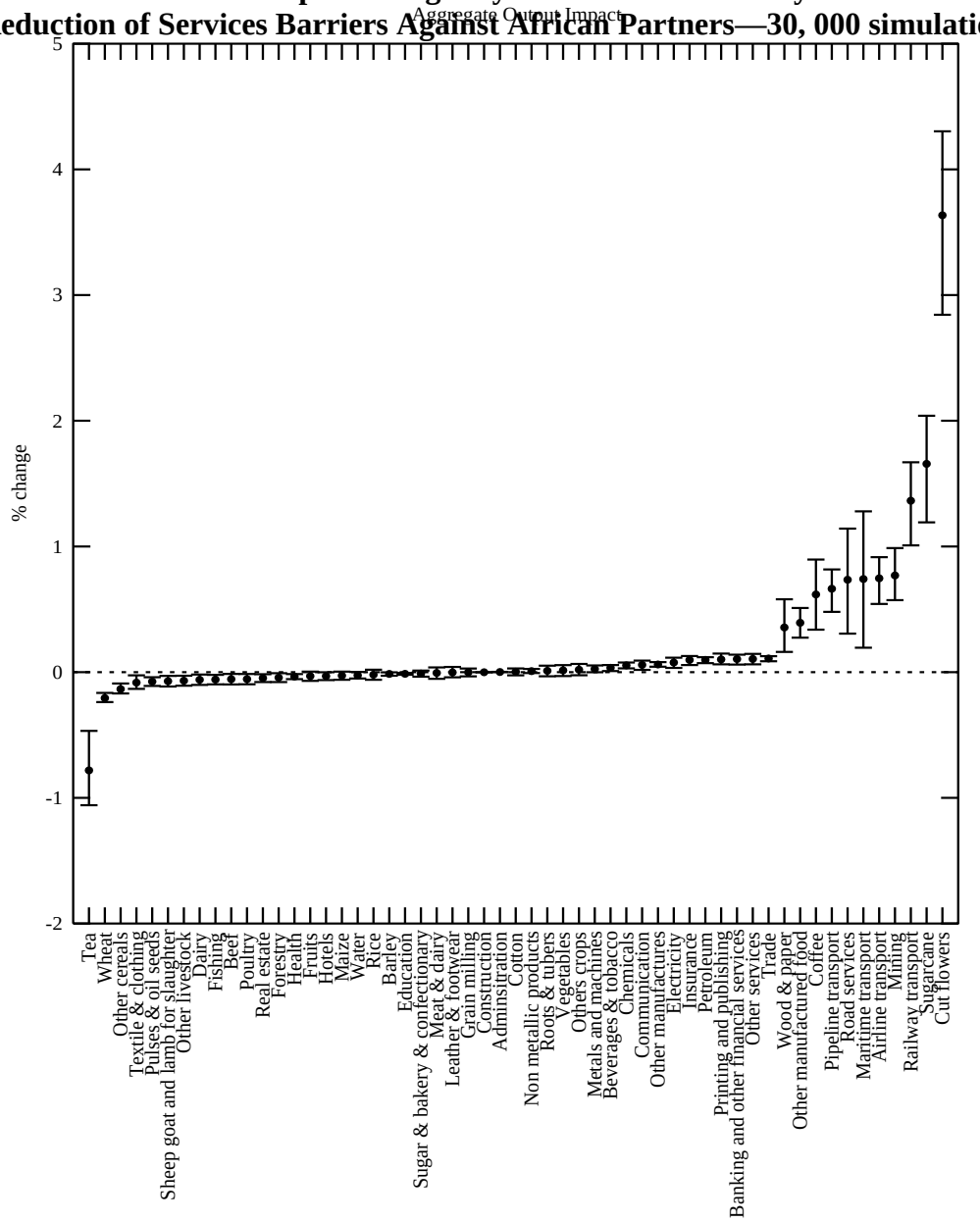
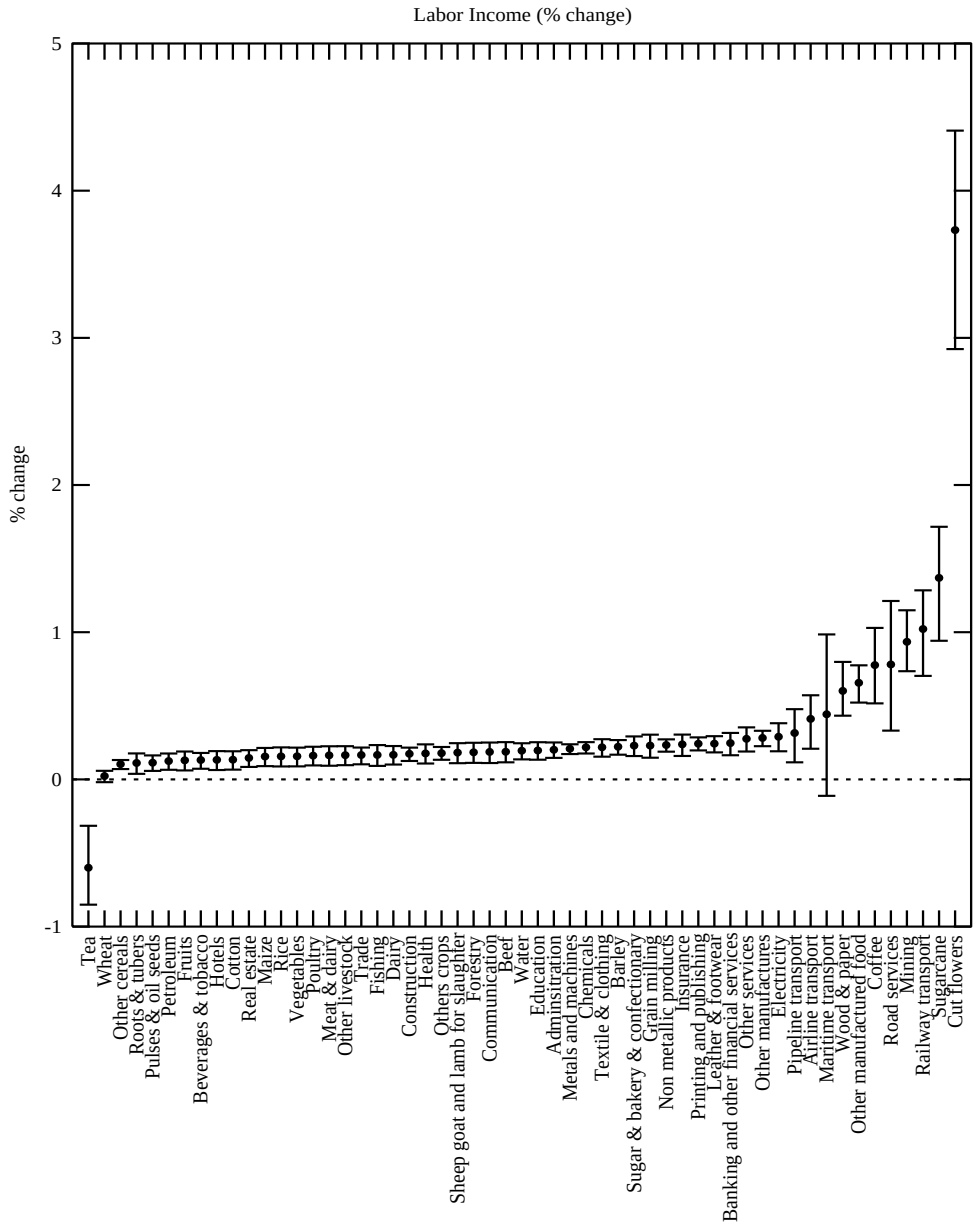


Figure 4: Means, 50 and 95 Percent Confidence Intervals of the Sample Frequency Distributions of the Output Changes by Sector from Kenyan Preferential Reduction of Services Barriers Against African Partners—30, 000 simulations.



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 5: Means, 50 and 95 Percent Confidence Intervals of the Sample Distributions of the Labor Payment Changes by Sector from Kenyan 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 6: Sample Frequency Distribution of the Welfare Results of Kenyan Preferential Reduction of Services Barriers Against EU Partners—30,000 simulations.

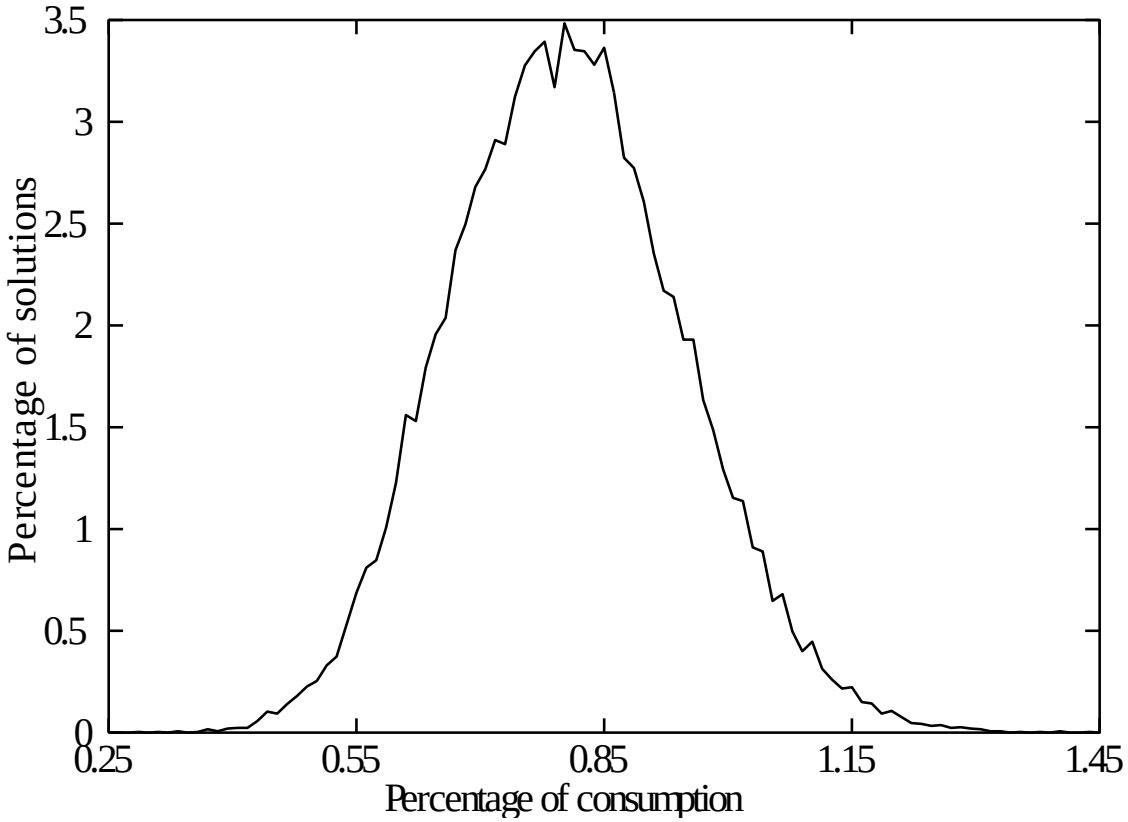
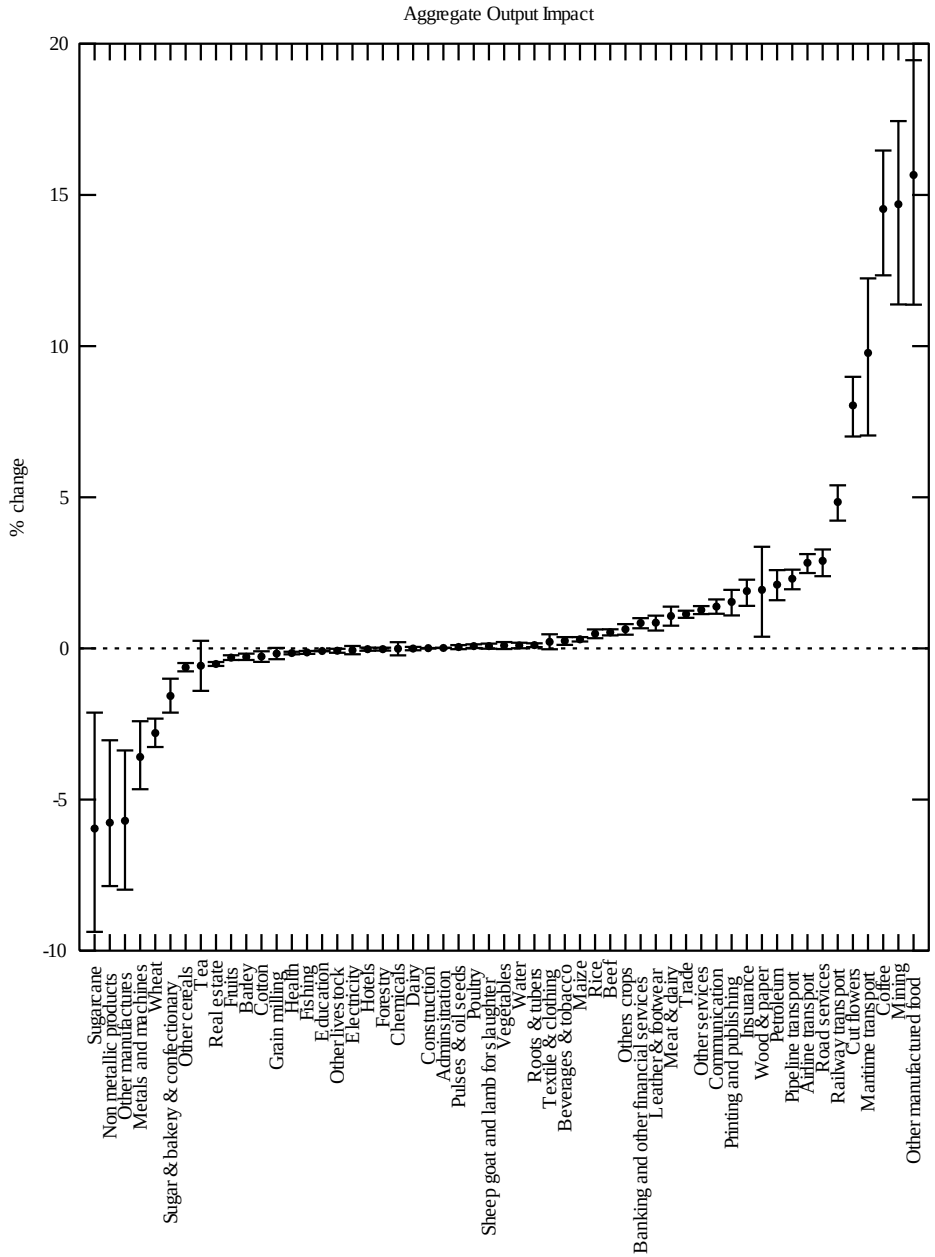
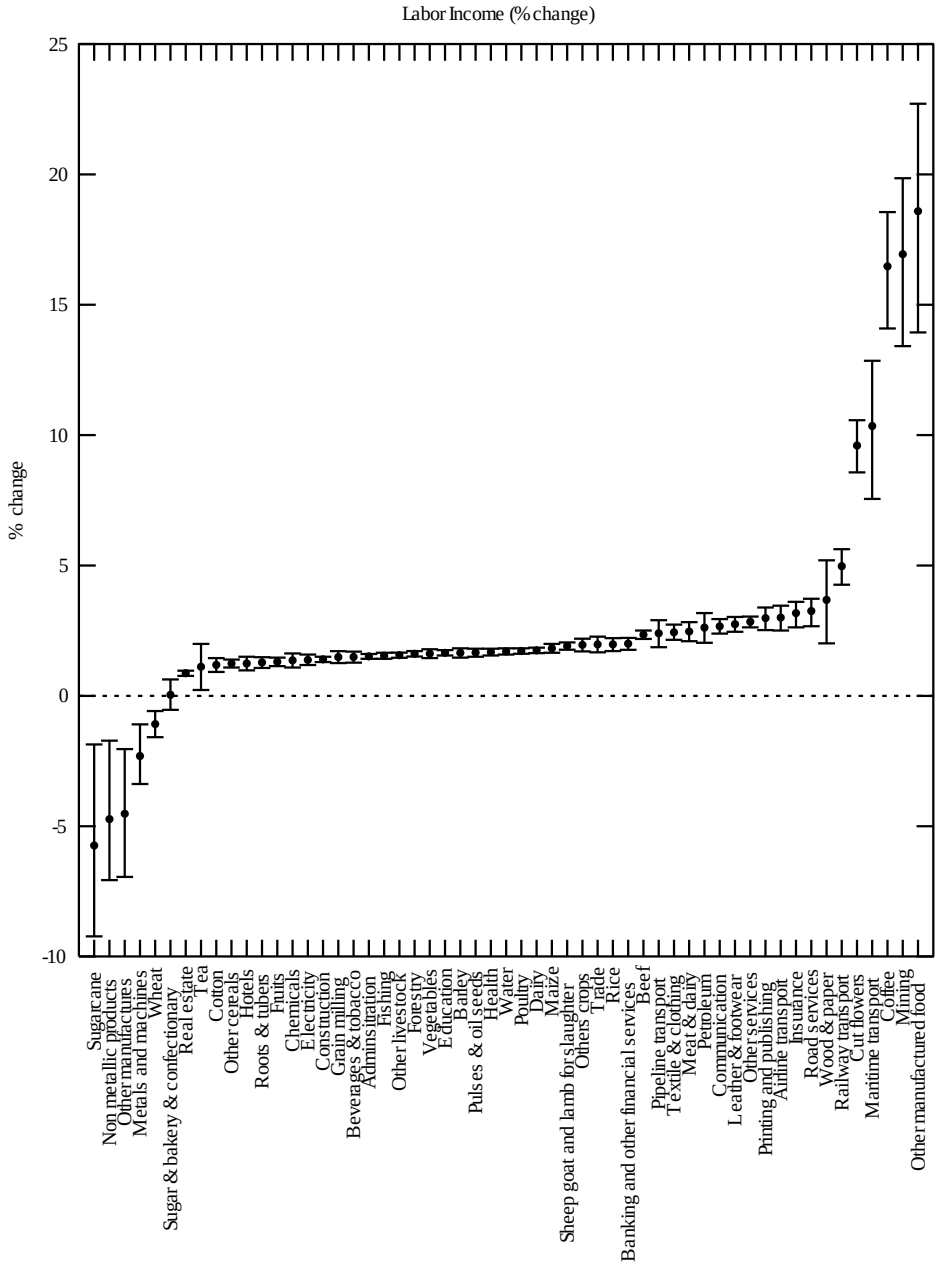


Figure 7: Means, 50 and 95 Percent Confidence Intervals of the Sample Distributions of the Output Changes by Sector from Kenyan Preferential Reduction of Services Barriers Against EU Partners—30,000 simulations.



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 8: Means, 50 and 95 Percent Confidence Intervals of the Sample Distributions of the Labor Payment Changes by Sector from Kenyan 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.

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

Trade Share Data

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 Kenya, the European Union, the East African Customs Union plus COMESA 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 COMESA separately. For the East African Customs Union, we took Tanzania, Uganda, Rwanda and Burundi. For COMESA, in order to avoid double counting, we took the COMESA countries less those in the East African Customs Union, i.e., Comoros, Congo, Djibuti, Egypt, Eritrea, Ethiopia, Libya, Madagascar, Malawi, Mauritius Seychelles, Sudan, Swaziland, Zambia and Zimbabwe. Trade shares for the "Africa" region in our model is the sum of East Africa Customs Union plus COMESA as defined above. 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 Kenya as the reporter country for both exports and imports. Results for both exports and imports are reported in the subsequent three tables, by CRTS and IRTS goods in our model separately.

Tariff Rate Calculations

Tariff and Sales Tax Data. We started with MFN tariff rates at the eight digit level taken from the website of the Kenyan government: www.kra.go.ke/customs/customsdownloads.php. These tariff rates were then aggregated to the sectors of our model, using simple averages.

We obtained data on the total taxes on imports and the total value of imports and took the ratio to obtain the average value of import taxes in the Kenyan economy. In 2005, this was 8.4 percent.[1] That is, on average, Kenyan importers paid 8.4 percent of the value of imports on import taxes that did not apply to domestic production.

As we reported in Balestreri, Rutherford and Tarr (2009), the MFN tariff rates, multiplied times the trade flows, exceed the collected tariff rates. That is, using MFN tariff rates for all trade, the weighted average tariff rate exceeds the collected tariff rate of 8.4 percent for the economy as a whole. Thus, they exaggerate the protection received by Kenyan industry and agriculture. This is due to tariff preferences to regional partners and due to other preference items or tariff exemptions. We assume that zero tariffs apply

[1] Economic Survey (2006, pp. 103, 115).

on all imports from the East African Customs Union and from COMESA. [2] Thus, we apply the MFN tariff rates only on the trade flows from outside of these African regions (EU and Rest of World in our model) and take a weighted average tariff rate of the MFN rates on the non-East African regions. The resulting weighted average tariff rate on non-East African imports still exceeds 8.4 percent. We then equi-proportionally reduced all the MFN tariffs in our model so that the estimated collected tariffs on imports from the EU and Rest of World divided by the total value of import is 8.4 percent.

[2] Kenya agreed to implement zero tariffs on East African Customs Union imports as of January 1, 2005. See Michael-Stahl (2005).

Table A1

Notes on Product/Sector Classifications in SITC Revision 2

Product	SITC Classiifcation (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

Table A2

Kenyan Exports Values and Shares of Agricultural and Other CRTS Products in 2007

	Export value ($ '000)					export shares				
Product	COMESA15	EAC5	EU27	ROW	WLD	COMESA15	EAC5	EU27	ROW	WLD
AGRICULTURE										
Maize	671	2,694	7	9,096	12,468	0.054	0.216	0.001	0.730	1.000
Wheat	2	43	0	119	164	0.013	0.264	0.000	0.723	1.000
Rice	203	318	5	86	613	0.332	0.519	0.009	0.140	1.000
Barley	0	654	0	0	654	0.000	1.000	0.000	0.000	1.000
Other cere	453	107	8	309	877	0.517	0.122	0.009	0.352	1.000
Cotton	4	0	18	126	148	0.025	0.000	0.120	0.855	1.000
Sugar	10,573	8,616	19	336	19,545	0.541	0.441	0.001	0.017	1.000
Coffee	1,093	780	98,647	65,708	166,228	0.007	0.005	0.593	0.395	1.000
Tea	170,298	238	131,530	396,147	698,213	0.244	0.000	0.188	0.567	1.000
Roots and	1	24	7	0	32	0.022	0.739	0.229	0.010	1.000
Oil seeds a	14	157	4,831	3,007	8,009	0.002	0.020	0.603	0.375	1.000
Fruits	2,335	4,878	85,188	20,397	112,797	0.021	0.043	0.755	0.181	1.000
Vegetables	987	4,610	256,893	26,590	289,080	0.003	0.016	0.889	0.092	1.000
Cut flowers	22,982	8	316,343	50,929	390,262	0.059	0.000	0.811	0.130	1.000
Other crop	737	3,739	1,233	2,733	8,442	0.087	0.443	0.146	0.324	1.000
Beef	287	528	0	484	1,299	0.221	0.406	0.000	0.372	1.000
Dairy produ	3,002	10,337	25	3,340	16,704	0.180	0.619	0.001	0.200	1.000
Poultry	101	8	0	9	118	0.856	0.067	0.000	0.077	1.000
Meats of sl	101	283	0	86	469	0.214	0.603	0.000	0.183	1.000
Other lives	150	1,876	69	1,013	3,108	0.048	0.604	0.022	0.326	1.000
OTHER CRTS GOODS										
Fishing	411	162	34,837	25,757	61,167	0.007	0.003	0.570	0.421	1.000
Forestry	412	483	4	169	1,068	0.386	0.452	0.004	0.159	1.000
Mining	2,305	29,358	21,162	21,545	74,369	0.031	0.395	0.285	0.290	1.000
Meats and	3,821	14,847	131	6,576	25,375	0.151	0.585	0.005	0.259	1.000
Grain millin	415	538	49	59	1,062	0.391	0.507	0.046	0.056	1.000
Sugar & ba	14,420	33,297	1,912	16,008	65,637	0.220	0.507	0.029	0.244	1.000
Textiles an	22,415	32,212	3,996	238,463	297,087	0.075	0.108	0.013	0.803	1.000
Leather an	14,512	28,989	15,930	31,441	90,872	0.160	0.319	0.175	0.346	1.000
Wood and	16,394	47,045	2,587	7,287	73,314	0.224	0.642	0.035	0.099	1.000

Source: Based on UN COMTRADE Statistics.

Table A3

Kenyan Imports of Agricultural and Other CRTS Products in 2007

	Import value ($ '000)					Import shares				
Product	COMESA15	EAC5	EU27	ROW	WLD	COMESA15	EAC5	EU27	ROW	WLD
AGRICULTURE										
Maize	625	14,194	0	1,445	16,265	0.038	0.873	0.000	0.089	1.000
Wheat	62	2	3,618	140,505	144,187	0.000	0.000	0.025	0.974	1.000
Rice	8,919	2,563	12	58,559	70,054	0.127	0.037	0.000	0.836	1.000
Barley	0	0	1	0	1	0.000	0.000	1.000	0.000	1.000
Other cereals	0	9,083	3	53	9,139	0.000	0.994	0.000	0.006	1.000
Cotton	214	4,322	0	119	4,655	0.046	0.929	0.000	0.026	1.000
Sugar	72,342	1,914	4,939	35,055	114,249	0.633	0.017	0.043	0.307	1.000
Coffee	41	635	78	1,347	2,101	0.020	0.302	0.037	0.641	1.000
Tea	0	86	22	8,088	8,196	0.000	0.011	0.003	0.987	1.000
Roots and tubers	0	29	662	205	896	0.000	0.032	0.739	0.228	1.000
Oil seeds and pulses	803	16,126	164	5,296	22,388	0.036	0.720	0.007	0.237	1.000
Fruits	1,492	2,848	2,444	7,358	14,141	0.105	0.201	0.173	0.520	1.000
Vegetables	1,589	19,450	5,546	22,592	49,177	0.032	0.396	0.113	0.459	1.000
Cut flowers	0	1,844	7	161	2,012	0.000	0.917	0.003	0.080	1.000
Other crops	55	9,461	2,337	4,599	16,452	0.003	0.575	0.142	0.280	1.000
Beef	0	0	0	0	0	0.000	0.000	1.000	0.000	1.000
Dairy products	693	458	779	3,437	5,367	0.129	0.085	0.145	0.640	1.000
Poultry	0	0	0	0	0	0.000	0.000	1.000	0.000	1.000
Meats of sheep and goats	0	0	0	8	8	0.000	0.000	0.000	1.000	1.000
Other livestock	67	36	246	1,787	2,136	0.031	0.017	0.115	0.836	1.000
OTHER CRTS GOODS										
Fishing	3,155	640	194	4,326	8,315	0.379	0.077	0.023	0.520	1.000
Forestry	1,084	16,979	4,388	9,851	32,301	0.034	0.526	0.136	0.305	1.000
Mining	518	1,272	1,774	33,094	36,658	0.014	0.035	0.048	0.903	1.000
Meats and dairy	781	458	868	5,143	7,249	0.108	0.063	0.120	0.709	1.000
Grain milling	10,092	1,341	4,728	19,656	35,817	0.282	0.037	0.132	0.549	1.000
Sugar & bakery confectionary	3,151	1,400	6,280	20,475	31,307	0.101	0.045	0.201	0.654	1.000
Textiles and clothing	4,815	18,592	10,903	279,109	313,418	0.015	0.059	0.035	0.891	1.000
Leather and footwear	170	117	551	20,191	21,029	0.008	0.006	0.026	0.960	1.000
Wood and papers	30,504	7,720	79,746	115,781	233,751	0.130	0.033	0.341	0.495	1.000

Source: Based on UN COMTRADE Statistics.

Table A4

Kenyan Exports and Imports of Dixit-Stiglitz Goods and Other Products in 2007

	Trade value ($ '000)					Trade Share				
Product	COMESA15	EAC5	EU27	ROW	WLD	COMESA15	EAC5	EU27	ROW	WLD
EXPORTS							**EXPORTS**			
All goods	664,849	952,788	1,084,812	1,378,351	4,080,800	0.163	0.233	0.266	0.338	1.000
Beverages	46,796	47,692	11,535	61,085	167,109	0.280	0.285	0.069	0.366	1.000
Food manu	79,712	98,905	106,990	31,678	317,284	0.251	0.312	0.337	0.100	1.000
Printing an	9,987	41,596	129	3,635	55,347	0.180	0.752	0.002	0.066	1.000
Mineral fue	15,225	86,515	139	72,263	174,143	0.087	0.497	0.001	0.415	1.000
Chemicals	68,878	175,389	1,057	106,367	351,691	0.196	0.499	0.003	0.302	1.000
Metals and	129,528	198,787	11,782	80,253	420,350	0.308	0.473	0.028	0.191	1.000
Non-metall	10,513	87,666	5,697	10,639	114,515	0.092	0.766	0.050	0.093	1.000
Other mani	45,774	88,777	26,412	32,468	193,431	0.237	0.459	0.137	0.168	1.000
Agriculture	211,253	29,739	877,333	627,966	1,746,291	0.121	0.017	0.502	0.360	1.000
Other good	47,183	97,723	43,737	351,997	540,640	0.087	0.181	0.081	0.651	1.000
IMPORTS							**IMPORTS**			
All goods	332,205	191,598	1,812,340	6,653,119	8,989,262	0.037	0.021	0.202	0.740	1.000
Beverages	11,958	27,881	15,716	13,650	69,204	0.173	0.403	0.227	0.197	1.000
Food manu	73,603	19,352	38,219	436,903	568,077	0.130	0.034	0.067	0.769	1.000
Printing an	30,462	7,634	69,199	88,868	196,163	0.155	0.039	0.353	0.453	1.000
Mineral fue	45,727	427	60,393	1,811,868	1,918,415	0.024	0.000	0.031	0.944	1.000
Chemicals	58,989	4,172	322,652	754,982	1,140,796	0.052	0.004	0.283	0.662	1.000
Metals and	60,085	12,273	958,236	2,461,164	3,491,757	0.017	0.004	0.274	0.705	1.000
Non-metall	5,118	491	30,219	90,373	126,201	0.041	0.004	0.239	0.716	1.000
Other mani	7,117	2,616	152,026	257,025	418,784	0.017	0.006	0.363	0.614	1.000
Agriculture	33,340	96,683	64,962	328,230	523,215	0.064	0.185	0.124	0.627	1.000
Other good	5,804	20,070	100,720	410,055	536,649	0.011	0.037	0.188	0.764	1.000

Source: Based on UN COMTRADE Statistics.

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

I. Telecommunications Shares in Kenya

The primary source of data was various publications of Paul Buddle Communications, including "Kenya—Telecoms Market Statistics and Forecasts," March 20, 2008. Table 10 contains mobile phone subscription statistics by company and Table 2 lists the number of fixed-line phone subscribers. We defined market share as the share of total subscribers, summing fixed-line and mobile subscribers.

The telecommunications companies are: Telkom Kenya, Safaricom and Celtel. Ownership shares are as follows. France Telecom purchased 51% of Telkom Kenya in 2007 with the Government of Tanzania holding the remaining 49 percent.[3]. Vodafone held 35% of Safaricom network, with the remainder held by Telkom Kenya (60%) and a local company Mobitelea (5%)."[4]. "Celtel was acquired by MTC of Kuwait for US$3.4 billion in March 2005". MTC was later renamed "Zain Group".[5]

The results for market share by country (in percent) are as follows: Kenya, 26; EU, 49; EAC, 0; COMESA, 0; Rest of World, 25.

II. Bank Shares in Kenya.

Bank Market Shares

The data source for bank market shares was Bankscope, an on-line data source for about 29,000 banks world-wide.[6] Through Bankscope, we obtained data on total assets by bank in Kenya, 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, COMESA and Rest of the World.[7]

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 were 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 Kenya are as follows, in percent: Kenya, 61.8.; EU, 28.7; EAC, 0; COMESA, 0.2; ROW, 9.3. Detailed results on the ownership of the banks are in the tables below.

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[3] http://www.orange.com/en_EN/press/press_releases/cp080917uk.html Accessed 17 April 2009

[4] See Paul Buddle Communications, "The Kenya Regulatory and Fixed-Line Telecoms Overview," March 20, 2008.

[5] See Paul Buddle Communications, "The Kenya Mobile Market Overview," March 20, 2008.

[6] 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.

[7] 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.

Table B1: Kenya Banking Sector Ownership Shares, by Region (1 of 6)

Bank	Shareholder (ISO Country Code)	Ownership %	Total Assets (2006 USD)	Company Market Share	Market Share by Region (%)						
					KE	GB	EU	EAC	COMESA	US	ROW
ABN AMRO Bank NV	Abn Amro Holding Nv (NL)										
African Banking Corporation Limited	Queens Holdings Ltd (KE)	25.00	77,200	0.56%	0.56%						
African Mercantile Banking Company Limited - AMBANK											
Bank of Africa Kenya Limited			93,493	0.68%							
	African Financial Holding Sa-African	19.89					0.16%				
	Bank Of Africa - Madagascar (MG)	20.00							0.16%		
	Nederlandse Financierings-Maatsch	20.00					0.16%				
	Bank Of Africa - Côte D'Ivoire (CI)	15.00									0.12%
	Bank Of Africa - Benin (BJ)	10.11									0.08%
Bank of Baroda (Kenya) Ltd	Bank Of Baroda (IN)	86.70	169,651	1.23%							1.23%
Barclays Bank of Kenya Ltd			1,700,672	12.30%							
	Barclays Bank Plc (GB)	68.50				8.43%					
	Kenyan Public & Institutions (KE)	31.50			3.88%						
Biashara Bank of Kenya Limited											
Calyon	Calyon (FR)										
Central Bank of Kenya	Government Of Kenya (KE)	100.00	3,067,136	22.19%	22.19%						
CFC Stanbic Holdings Limited	Stanbic Africa Holdings Limited (GB)	60.00	581,708	4.21%		4.21%					
Charterhouse Bank Limited											
Chase Bank (Kenya) Limited	Chase Bank (Kenya) Limited (US)	100.00	59,405	0.43%						0.43%	
Citibank NA	Citibank Na (US)	100.00	544,612	3.94%						3.94%	
City Finance Bank Limited											
Commerce Bank Limited											
Commercial Bank of Africa	Commercial Bank of Africa (KE)	100.00	539,477	3.90%	3.90%						
Consolidated Bank of Kenya Limited	Consolidated Bank of Kenya (KE)	100.00	49,528	0.36%	0.36%						
Co-operative Bank of Kenya Ltd			831,354	6.01%							
	Co-Operatives Societies (??)	83.82									
	Individual Members Of Co-Operative	16.18									
Credit Bank Limited			37,606	0.27%							
Daima Bank Limited											
Development Bank of Kenya Ltd	Development Bank of Kenya (KE)	100.00	47,115	0.34%	0.34%						

Table B1: Kenya Banking Sector Ownership Shares, by Region (2 of 6)

Bank	Shareholder (ISO Country Code)	Ownership %	Total Assets (2006 USD)	Company Market Share	Market Share by Region (%)						
					KE	GB	EU	EAC	COMESA	US	ROW
Diamond Trust Bank Kenya Limited			313,234	2.27%							
	Aga Khan Fund For Economic Develop	17.32									0.76%
	Barclays (Kenya) Nominees Ltd (KE)	9.85			0.43%						
	Habib Bank Limited (PK)	9.72									0.43%
	The Jubilee Insurance Company Ltd (	8.77			0.39%						
	Diamond Jubilee Investment Trust (C	1.87				0.08%					
	Craysell Investments Ltd (KE)	1.62			0.07%						
	Noorali Mohan Manji (KE)	1.27			0.06%						
	Ameerali Nazarali Esmail (KE)	**0.92**			0.04%						
Dubai Bank Kenya Limited											
EABS Bank Limited			128,389	0.93%							
	Private Shareholders (KE)	65.59			0.61%						
	LP Holdings (KE)	16.95			0.16%						
	Rajmuk Holdings (KE)	9.41			0.09%						
	Emperor Holdings (KE)	8.05			0.07%						
East African Building Society - EABS											
Equatorial Commercial Bank Limited											
Equity Bank Limited	British-American Investments Compa	11.06	288,544	2.09%	2.09%						
Euro Bank Limited											
Faulu Kenya Limited	Faulu Kenya Limited (CH)	70.00	29,829	0.22%							0.22%
Fidelity Commercial Bank Limited											
Fina Bank Limited			141,005	1.02%							
	Entreprise Banking Group (BW)	20.75									0.21%
	Dhabaria Ltd (KE)	19.81			0.20%						
	Rare Ltd (KE)	17.83			0.18%						
	Sirus Ltd (KE)	15.85			0.16%						
	Snow Point (K) Ltd (KE)	9.91			0.10%						
	Harupa Ltd (KE)	3.96			0.04%						
	Kushan Ltd (KE)	3.96			0.04%						
	Reena Ltd (KE)	3.96			0.04%						

Table B1: Kenya Banking Sector Ownership Shares, by Region (3 of 6)

Bank	Shareholder (ISO Country Code)	Ownership %	Total Assets (2006 USD)	Company Market Share	Market Share by Region (%)						
					KE	GB	EU	EAC	COMESA	US	ROW
First American Bank of Kenya											
First National Finance Bank Ltd.											
Giro Commercial Bank Limited											
Guardian Bank Limited											
Guilders International Bank Limited											
Habib Bank Limited	Habib Bank Limited (PK)										
Housing Finance Company of Kenya Limited			142,700	1.03%							
	Equity Bank Limited (KE)	20.00			0.44%						
	National Social Security Fund (KE)	**7.87**			0.17%						
	Government Of Kenya (KE)	7.32			0.16%						
	Barclays (Kenya) Nominees Ltd 9347 (	4.90			0.11%						
	Northbound Holdings Ltd (??)	4.60									
	Steel Son Limited (KE)	3.55			0.08%						
	Nomura Nominees Ltd A/C Jmm (KE)	3.15			0.07%						
	Ndungu Paul Wanderi (??)	2.35									
	Kibuwa Enterprises Ltd (??)	0.91									
	Kirinyaga Construction Ltd (KE)	0.52			0.01%						
Imperial Bank Limited			135,537	0.98%							
	Abdumal Investments Ltd (??)	14.00									
	Simba Colt Motors Limited (KE)	14.00			0.38%						
	Janco Investments Limited (??)	13.50									
	Kenblest Ltd (??)	12.50									
	Momentum Holdings Limited (KE)	12.50			0.34%						
	Rex Motors Ltd (??)	12.50									
	Ea Motor Industries (Sales & Service:	11.00									
	Reynolds & Co. Limited (IE)	10.00					0.27%				
Industrial and Commercial Development Corporation	Government Of Kenya (KE)	100.00									
Industrial Development Bank Limited											

Table B1: Kenya Banking Sector Ownership Shares, by Region (4 of 6)

Bank	Shareholder (ISO Country Code)	Ownership %	Total Assets (2006 USD)	Company Market Share	Market Share by Region (%)						
					KE	GB	EU	EAC	COMESA	US	ROW
Investments and Mortgages Bank Limited - I&M Bank Limited			322,035	2.33%							
	Biashara Securities Ltd (KE)	21.55			0.53%						
	Minard Holdings Limited (KE)	17.54			0.43%						
	Tecoma Limited (KE)	15.72			0.38%						
	Ziyungi Limited (KE)	15.72			0.38%						
	Mnana Limited (KE)	14.52			0.36%						
	City Trust Limited (KE)	10.14			0.25%						
	Sachit Shah (??)	2.40									
	Sarit S. Shah (??)	**2.40**									
Kenya Commercial Bank LTD			1,333,300	9.64%							
	Permanent Secretary To The Treasury	26.23			5.87%						
	National Social Security Fund (KE)	6.80			1.52%						
	Stanbic Nominees Kenya Limited A/C	3.49			0.78%						
	Sunil Narshi Shah (??)	2.33									
	Kcb Staff Pension Fund (KE)	2.32			0.52%						
	Stanbic Nominees Kenya Limited A/C	1.53			0.34%						
	Nomura Nominees Ltd A/C Jmm (KE)	1.01			0.23%						
	Kenya Reinsurance Corporation Limit	0.87			0.19%						
	Barclays (Kenya) Nominees Ltd A/C 9	0.82			0.18%						
	Barclays (Kenya) Nominees Ltd A/C 1	0.69									
Kenya Commercial Finance Company Limited											
Kenya Post Office Savings Bank		100.00	215,015	1.56%	1.56%						
Kenya Women Finance Trust											
K-REP Bank			75,223	0.54%							
	African Development Bank (II)	15.14									0.41%
	Netherlands Dev. Finance Co (NL)	5.00					0.14%				
Middle East Bank Kenya Limited			49,015	0.35%							
	Fortis Bank (BE)	25.03					0.18%				
	Banque Belgolaise-Belgolaise Bank	25.00					0.18%				
National Bank of Kenya Ltd			520,526	3.77%							
	National Social Security Fund (KE)	48.00			2.58%						
	Government Of Kenya (KE)	22.00			1.18%						

Table B1: Kenya Banking Sector Ownership Shares, by Region (5 of 6)

Bank	Shareholder (ISO Country Code)	Ownership %	Total Assets (2006 USD)	Company Market Share	Market Share by Region (%)						
					KE	GB	EU	EAC	COMESA	US	ROW
NIC Bank Limited			376,210	2.72%							
	First Chartered Securities Ltd (??)	16.44									
	Icea Investment Services Ltd (??)	9.42									
	Livingstone Registrars Ltd. (KE)	8.13			1.11%						
	Rivel Kenya Ltd (KE)	7.73			1.05%						
	Duncan Nderitu Ndegwa (??)	4.56									
	Saimar Ltd (KE)	4.13			0.56%						
	Amwa Holdings Ltd (??)	1.97									
	Kenya Commercial Bank Nominees Lt	**1.65**									
	Thuthuma Ltd (??)	1.27									
	Makimwa Consultants Ltd (??)	1.26									
Oriental Commercial Bank Ltd			20,886	0.15%							
	Pasha Investments Ltd (KE)	13.40			0.08%						
	Sag Investments Ltd (KE)	13.30			0.08%						
Paramount Universal Bank Limited											
Prime Bank			150,617	1.09%							
Prime Capital & Credit Limited											
Prudential Bank Limited											
Reliance Bank Limited											
Southern Credit Banking Corporation			66,003	0.48%							
	Others (??)	28.00									
	Fincity Investments Ltd (??)	23.00									
	Sounthern Shield Holdings Ltd (??)	20.00									
	Sounthern Shield Securities Ltd (??)	19.00									
	Sadrudin Karim Kurji (??)	10.00									
Stanbic Bank Kenya Limited		100.00	372,120	2.69%		2.69%					
Standard Chartered Bank Kenya			1,169,151	8.46%							
	Standard Chartered Holdings (Africa)	73.81					8.11%				
	Kabarak Limited (??)	1.03									
	Old Mutual Life Assurance Company	0.69			0.08%						
	National Social Security Fund (KE)	0.68			0.07%						
	Barclays (Kenya) Nominees Ltd A/C 1	0.59									
	Kenya Commercial Bank Nominees Lt	0.51			0.06%						
	Standard Chartered Africa Holdings L	0.48				0.05%					
	Barclays (Kenya) Nominees Ltd A/C 1	0.45			0.05%						
	Barclays (Kenya) Nominees Ltd A/C 9	0.36			0.04%						

Table B1: Kenya Banking Sector Ownership Shares, by Region (6 of 6)

Bank	Shareholder (ISO Country Code)	Ownership %	Total Assets (2006 USD)	Company Market Share	Market Share by Region (%)						
					KE	GB	EU	EAC	COMESA	US	ROW
The Company for Habitat & Housing in Africa			71,600	0.52%							
Trans-National Bank Limited	Five Kenyan Private Companies (KE)	88.69	42,967	0.31%	0.31%						
Trust Bank Limited											
Universal Bank											
Victoria Commercial Bank Ltd.			61732.04	0.45%							
	35 Other Shareholders (??)	27.24									
	Kingsway Investments Ltd (KE)	16.43			0.12%						
	Jong-Chul Kim (KE)	10.81			0.08%						
	Rochester Holding Limited (KE)	**10.74**			0.08%						
	Monetary Credit Holdings Ltd (KE)	6.65			0.05%						
	Godfrey C. Omondi (KE)	6.05			0.04%						
	Orchid Holdings Ltd (KE)	5.83			0.04%						
	Rajan Janii & Kalapi Jani (??)	5.70									
	Kanji Damji Pattni (KE)	5.39			0.04%						
	Pattni Yogesh K (??)	5.16									

	KE	GB	EU	EAC	COM	US	ROW
Market Share	59.00%	15.46%	9.18%	0.00%	0.16%	4.37%	3.46%
Scaled Share	64.39%	16.87%	10.02%	0.00%	0.17%	4.77%	3.77%

Grand Total = 13,824,591

Supplementary Information on Ownership Shares of Tanzanian Banks from Bank Websites

(Quotes are from the websites listed.)

National Microfinance –"Rabobank, 34.9%; The Government of the United Republic of Tanzania, 30.0%; Public, 21.0%; National Investment Company Limited (NICOL), 6.6%; Exim Bank Tanzania, 5.8%; Tanzania Chambers of Commerce Industries and Agriculture (TCCIA), 1.7%.
http://www.nmbtz.com/about_nmb/shareholder_information.html .

- CRDB Bank Plc – TZ 38.8% – shareholders are listed as follows: "Private individuals, 37.0; Co operatives , 14.0; Companies, 10.2; DANIDA investment fund, 30.0; Parastatals (NIC & PPF), 8.8. " http://www.crdbbank.com/aboutUs.asp Accessed 3 April 2009.

- Commercial Bank of Africa –according to their website they are "wholly Kenyan owned." http://www.cba.co.ke/default2.php?active_page_id=117

- Citibank NA – US 100%

- Kenya Post Office Savings Bank "The bank is wholly owned by the Government of Kenya and reports to the Ministry of Finance." http://www.postbank.co.ke/index.php?do=about.

- K-REP Bank " International Finance Corporation, 16.7%; The African Development Bank, 15.1%; The Netherlands Dev. Finance Co. (FMO), 5.0%; Triodos, 11.0%; ShoreCap International, 8.2%; Kwa (ESOP), 10.0%; K-Rep Group, 25.0%; Founding Members, 5.2%. ICDC-I (Public investment company) 3.8%" http://www.k-repbank.com/index.php?option=com_content&task=view&id=71&Itemid=109 .

- Chase Bank (Kenya) Limited – U.S. 100%

- Development Bank of Kenya Ltd – KE 100% - "Consequently after forty five years the bank ownership changed to one that is Kenyan owned and directed as follows; Industrial & Commercial Development Corporation (ICDC), 89.3%; Transcentury Ltd, 10.7%. " http://www.devbank.com/about.php?subcat=27&title=Shareholders.

III. Kenyan Insurance Companies

The premium information came from the Insurance Industry Annual Report for 2007 of the Association of Kenya Insurers.[8] Table 9 of their report lists premium income by company and type of insurance. We define market share of a company by the company share of total market premia.

For ownership shares, we commissioned a survey from a specialist at the Association of Kenyan Insurers. [9] He provided the data on the ownership shares of the Kenyan companies. In the table below, we list the result of these calculations.

[8] Available at: http://www.akinsure.com/images/aki-annual-report-2007.pdf

[9] We thank Mr. Joseph Luvisia Jamwaka (a fellow of the Life Management Institute of the U.S. and Associate of the Chartered institute of Insurance of the UK) for providing this information.

Table B2: Kenya Insurance Sector Ownership Shares, by Region (1 of 7)

Insurance Company	Shareholder (ISO Country Code)	Ownership %	Income (million KSH 2007)	Company Market Share	Market Share by Region (%)						
					KE	GB	EU	EAC	COMESA	US	ROW
African Merchant Assurance Company			563	1.71%	1.71%						
	Hon. William Ruto (KE)	80.00									
	Silas Simatwo (KE)	20.00									
AIG Insurance Company	AIG (US)	100.00	1,801	5.48%						5.48%	
APA Insurance Company			2355	7.17%	7.17%						
	Apollo Insurance (KE)	60.00									
	Pan Africa Insurance Holdings (KE)	40.00									
Blue Shield Insurance Company			2,273	6.92%	6.92%						
	Beth Ngonyo Mungai (KE)	**40.05**									
	Bermuda Holdings Ltd (KE)	33.10									
	African Theatres Ltd (KE)	13.55									
	James Muigai Ngengi (KE)	3.31									
	Jean Muigai Ngengi (KE)	3.31									
	Peter Kamau Ngengi (KE)	3.31									
	Martha Vincent & Paul Vincent (KE)	3.31									
	Simon Evans Githinji (KE)	0.02									
	Simon Munyi Gachoki (KE)	0.01									
British American Insurance Company			679	2.07%							
	British America (K) Ltd (??)	66.67									
	Jimnah Mbaru (KE)	25.00			1.55%						
	Peter K Munga (KE)	5.00			0.31%						
	Benson I Wairegi (KE)	3.33			0.21%						
Cannon Assurance Company			557	1.70%	1.70%						
	Inder Jit Talwar (KE)	0.00									
	Cannon Holdings (KE)	40.00									
	Evisa Invesments (PVT) Ltd (KE)	28.70									
	PBM Nominees (KE)	31.30									
Concord Insurance Company			585	1.78%	1.78%						
	Dorse Gems International Inc (KE)	32.00									
	Kirumba Mwaura (KE)	36.00									
	James Gacheru (KE)	32.00									

Table B2: Kenya Insurance Sector Ownership Shares, by Region (2 of 7)

Insurance Company	Shareholder (ISO Country Code)	Ownership %	Income (million KSH 2007)	Company Market Share	Market Share by Region (%)						
					KE	GB	EU	EAC	COMESA	US	ROW
Co-operative Insurance Company			1,028	3.13%	3.13%						
	Harambee Co-operative Movement (KE)	9.06									
	Aembu Farmers Co-operative Society Ltd (KE)	8.30									
	Kiambu Unity Finance Co-operative Union (KE)	8.15									
	CIC Staff Co-operative Savings and Credit (KE)	7.27									
	The Co-operative Bank of Kenya (KE)	6.13									
	Bandari Co-operative Savings and Credit (KE)	3.34									
	Mwalimu Co-operative Savings and Credit (KE)	1.59									
	Kipsigis Teachers Savings and Credit (KE)	**1.32**									
	Nacico Savings and Credit Co-operative (KE)	1.10									
	Stima Savings and Credit Co-operative (KE)	1.09									
	Emmanuel Kipkemboi Birech (KE)	1.30									
	Isaac Waithaka Kamunya (KE)	1.12									
	Teresa Wanjiru Thimba (KE)	1.10									
	Leonard Obura Oloo (KE)	0.89									
	Gerald Mbaabu M'ikunyua (KE)	0.84									
	Francis Kamau Ng'ang'a (KE)	0.64									
	Others (KE)	46.76									
Corporate Insurance Company			351	1.07%	1.07%						
	Xanthippe Holdings Ltd (KE)	63.30									
	Ejax Investments Ltd (KE)	36.70									
CFC Life Assurance Company			674	2.05%							
	CfC Stanbic Holdings Group (GB)	60.00			1.23%						
	C Njonjo (KE)										
	U P Jani (KE)										
	J G Kiereini (KE)										
	J H D Milne (UK)										
	M Soundararajan (KE)										
	A Munda (KE)										
	R E Leakey (KE)										
Directline Assurance Company Ltd			259	0.79%	0.79%						
	Royal Credit Limited (KE)	99.70									
	Samuel S. K. Macharia (KE)	0.10									
	Purity G. Macharia (KE)	0.10									
	Dan Korobia (KE)	0.10									

Table B2: Kenya Insurance Sector Ownership Shares, by Region (3 of 7)

Insurance Company	Shareholder (ISO Country Code)	Ownership %	Income (million KSH 2007)	Company Market Share	Market Share by Region (%)						
					KE	GB	EU	EAC	COMESA	US	ROW
Fidelity Shield Insurance Company			684	2.08%	2.08%						
	Southern Shield Holdings Ltd (KE)	66.70									
	Southern Credit Banking Corp. (KE)	24.40									
	Soli Limited (KE)	6.40									
	Kenya Shipping Agency (KE)	1.40									
First Assurance Company			1,038	3.16%	3.16%						
	First Assurance Investment Ltd (KE)	83.00									
	Syndicate Nominee Ltd (KE)	17.00									
Gateway Insurance Company			436	1.33%	1.33%						
	Godfrey W Karauri (KE)	21.20									
	John N Muchuki (KE)	1.40									
	Bethuel M Gecaga (KE)	8.30									
	Muvokanza Limited (KE)	1.40									
	Eliud Ndirangu (KE)	4.30									
	Jerome P N Kariuki (KE)	0.30									
	Raymond Matiba (KE)	0.30									
	Francis Thuo (KE)	1.80									
	Kihara Waithaka (KE)	2.10									
	Mubiru Housing Company (KE)	0.90									
	Maina Kimere & Partners (KE)	5.40									
	Isaac G. Wanjohi (KE)	14.50									
	Wilson Kiragu (KE)	1.40									
	Chief Ezekiel N Onwere (KE)	7.60									
	Isaac Njoroge (KE)	0.60									
	James M Gacheru (KE)	1.10									
Geminia Insurance Company			460	1.40%	1.40%						
	Gikoi Development Co. Ltd (KE)	8.16									
	Mbagi Limited (KE)	34.70									
	Stanley M. Githunguri (KE)	26.53									
	Leonard M Kabetu (KE)	0.30									
	Bimal R. Shah (KE)	5.67									
	Harsha R. Shah (KE)	1.19									
	Hasit K Shah (KE)	1.38									
	Khetshi K Shah (KE)	1.38									
	Universal Roadways (K) Ltd (KE)	5.53									
	Kiriti Shah (KE)	2.67									
	Jay K Shah (KE)	1.38									
	Mona D Shah (KE)	1.38									
	Mona D Shah (KE)	5.68									
	Devchand A. Shah (KE)	2.67									

Table B2: Kenya Insurance Sector Ownership Shares, by Region (4 of 7)

Insurance Company	Shareholder (ISO Country Code)	Ownership %	Income (million KSH 2007)	Company Market Share	Market Share by Region (%)						
					KE	GB	EU	EAC	COMESA	US	ROW
General Accident Insurance			682	2.08%	2.08%						
	Rapun Limited (KE)	49.00									
	J S Insurance Limited (KE)	49.00									
	Shantilal Shah (KE)	2.00									
Heritage All Insurance Company			1505	4.58%							
	CFC (GB)	64.08				2.94%					
	African Liason Consultant Services (KE)	35.92			1.65%						
Insurance Company of East Africa	First Chartered Securities Limited (KE)	100.00	1,173	3.57%	3.57%						
Intra Africa Assurance Company			402	1.22%							
	Robert T. Gachecheh (KE)	10.50			0.18%						
	Archibald Githinji (KE)	7.50			0.13%						
	Mahendra Chandulal (KE)	5.00			0.09%						
	Upenra Ambalal Patel (KE)	5.00			0.09%						
	Jitenra Ambalal Patel (KE)	5.00			0.09%						
	Dinesh Chandulal Patel (KE)	10.00			0.17%						
	Henry Mkangi (KE)	3.00			0.05%						
	Bharat Kumar Patel (KE)	5.00			0.09%						
	Joseph Muriu (KE)	5.00			0.09%						
	Premji Ratna (KE)	5.00			0.09%						
	Ranjaben Suresh Patel (KE)	5.00			0.09%						
	Eleyo Saw Mills (??)	20.00									
	Praful C Patel (KE)	5.00			0.09%						
Invesco Insurance Company			958	2.92%							
Jubilee Insurance Company			2,450	7.46%							
	Jubilee Holdings Ltd (KE)	100.00			7.46%						
	Kenneth Hamish Wooler Shah (KE)	0.00									
	Neville Patrick Gibson Warren (IN)	0.00									
Kenindia Assurance Company			3,028	9.22%							
	Life Insurance Corp. Of India (IN)	10.00									0.92%
	General Insurance Corp Of India (IN)	9.00									0.83%
	New India Assurance Co. Ltd. (IN)	9.00									0.83%
	Oriental Insurance Co. Ltd. (IN)	9.00									0.83%
	United India Insurance Co. Ltd. (IN)	9.00									0.83%
	National Insurance Co. Ltd. (IN)	9.00									0.83%
	Pv Karia (IN)	1.39									0.13%
	M N Mehta (KE)	0.00			0.00%						
	M P Chandaria (KE)	0.00			0.00%						
	Sadasiv Mishra (KE)	0.00			0.00%						
	Simeon Nyachae (KE)	7.00			0.64%						
	Chandaria Foundation Trustees (KE)	7.01			0.65%						
	Mehta Group Of Companies (KE)	6.02			0.55%						
	Lex Holdings (KE)	3.66			0.34%						
	Others (KE)	20.00			1.84%						

Table B2: Kenya Insurance Sector Ownership Shares, by Region (5 of 7)

Insurance Company	Shareholder (ISO Country Code)	Ownership %	Income (million KSH 2007)	Company Market Share	Market Share by Region (%)						
					KE	GB	EU	EAC	COMESA	US	ROW
Kenya Orient Insurance Company			283	0.86%	0.86%						
	Thanak Investments (KE)	90.39									
	Rajwinder Singh (KE)	5.95									
	Avtar Singh Ubhi (KE)	1.80									
	Kahn Singh Ubhi (KE)	1.80									
	Luka Daudi Galgalo (KE)	0.06									
Kenya Alliance Insurance Company	International Controls Limited (??)	100.00	353	1.07%							
Lion of Kenya Insurance Company	First Chartered Security (KE)	80.00	1,217	3.71%	3.71%						
	Kenya Holdings (KE)	**20.00**									
Madison Insurance Company	Amedo Madison Holdings Limited (K	100.00	625	1.90%	1.90%						
Mayfair			273	0.83%	0.83%						
	Adrea Ltd (KE)	27.77									
	Corporate Investments (KE)	12.48									
	A 2 Enterprises (KE)	9.32									
	Tinker Bird Securities (KE)	9.15									
	Kazkazi Maritime Ltd (KE)	3.12									
	Union Logistics (KE)	3.12									
	Marenyo Ltd (KE)	8.32									
	Muhwai Ltd (KE)	6.55									
	Mahesh Doshi And Sheila Doshi (KE)	6.24									
	Nsp Holdings Ltd (KE)	6.24									
	Lakdawalla Investments Ltd (KE)	4.16									
	Bharasa Investments Ltd (KE)	3.54									
Mercantile Life & General Insurance			369	1.12%	1.12%						
	Ecobank Kenya Ltd (KE)	20.00									
	L.P Holdings (KE)	21.00									
	Barclays Trust (KE)	24.00									
	Eabs Bank (KE)	35.00									
Occidental Insurance Company			740	2.25%	2.25%						
	Park Enterprises Ltd (KE)	30.00									
	Oak Investments Ltd (KE)	15.00									
	Landsend Kenya Ltd (KE)	15.00									
	Hansing Ltd (KE)	15.00									
	Rock Investment Ltd (KE)	15.00									
	Ngamacu Ltd (KE)	5.00									
	Maganlal Lakhamshi Dodhia (KE)	2.50									
	Kantilal Maganalal Dodhia (KE)	2.50									

Table B2: Kenya Insurance Sector Ownership Shares, by Region (6 of 7)

Insurance Company	Shareholder (ISO Country Code)	Ownership %	Income (million KSH 2007)	Company Market Share	Market Share by Region (%)						
					KE	GB	EU	EAC	COMESA	US	ROW
Pacis Insurance Company Ltd			162	0.49%	0.49%						
	Luna Registered Trustees (KE)	35.87									
	Archdiocese Of Nairobi (KE)	32.56									
	Association Of Sisterhoods (KE)	5.42									
	Diocese Of Nakuru (KE)	4.65									
	Religious Superior Confrence (KE)	2.34									
	Diocese Of Muranga (KE)	2.20									
	Diocese Of Ngong (KE)	2.09									
	Diocese Of Kisii (KE)	**1.71**									
	Diocese Of Isiolo (KE)	1.63									
	Diocese Of Machakos (KE)	1.12									
	Diocese Of Nyahururu (KE)	1.00									
	Diocese Of Embu (KE)	0.90									
	Diocese Of Garissa (KE)	1.00									
	Diocese Of Marsabit (KE)	1.00									
	Archiocese Of Kisumu (KE)	1.00									
	Catholic University Of East Africa (KE)	1.63									
	Others (KE)	4.00									
Pioneer Life Assurance Company			89	0.27%	0.27%						
	Rose Waruinge (KE)	9.00									
	Mtalaki Mwashimba (KE)	11.00									
	James Olubayi (KE)	80.00									
Phoenix of East Africa Assurance			525	1.60%	1.60%						
	Transworld Investment Limited (KE)	77.87									
	Kiruma International (KE)	8.93									
	Bawan Limited (KE)	3.40									
	Others (KE)	10.00									
Real Insurance Company			746	2.27%							
	Mureka Investments (KE)	69.00			1.57%						
	Zaniki Holdings Ltd (KE)	15.00			0.34%						
	The Globe Insurance Company (UK)	15.00				0.34%					
	Kenya Farmers Association (KE)	1.00			0.02%						
Standard Assurance Company			522	1.59%							

Table B2: Kenya Insurance Sector Ownership Shares, by Region (7 of 7)

Insurance Company	Shareholder (ISO Country Code)	Ownership %	Income (million KSH 2007)	Company Market Share	Market Share by Region (%)						
					KE	GB	EU	EAC	COMESA	US	ROW
Tausi Assurance Company			500	1.52%	1.52%						
	Rasik Kantaria (KE)	10.00									
	Prime Capital Limited (KE)	30.00									
	Brookwood Investment Limited (KE)	7.00									
	Mukesh Patel (KE)	7.14									
	Shantilal Shah (KE)	19.30									
	Rajnikat Sanghrajka (KE)	4.56									
	Nayan Nayendra Thaker (KE)	5.66									
	Others (KE)	**17.00**									
The Monarch Insurance Company			140	0.43%	0.43%						
	Valencia Holding Limited (KE)	50.00									
	Tamasha Corporation Ltd (KE)	50.00									
Trident Insurance Company	Trident Investment Limited (KE)	100.00	360	1.10%	1.10%						
UAP Provincial Insurance Company			2,000	6.09%	6.09%						
	J N Muguiyi (KE)	10.43									
	Centum Investment Company (KE)	24.07									
	C J Kirubi (KE)	24.07									
	Bawan Limited (KE)	35.27									
	Others (KE)	7.00									
					Kenya	GB	EU	EAC	COM	US	ROW
				Market Share	79.64%	3.28%	0.00%	0.00%	0.00%	5.48%	5.19%
	Grand Total (million KSH) =		32,845	Scaled Share	85.09%	3.50%	0.00%	0.00%	0.00%	5.86%	5.55%

IV. Railroad Transportation

In the hope of improved performance, in November 2006, Kenya's (and Uganda's) railways were turned over to Rift Valley Railways, a consortium led by South Africa's Sheltam Trade Close. This consortium won the right to operate the railways for 25 years. They are a monopolist, so **we infer 100 percent ownership to the Rest of the World.** [10]

V. Pipeline Transportation

The Kenya Pipeline Company operates 800 kilometers of pipeline within Kenya for the transport of refined oil products. The pipeline runs from the refinery at the port of Mombassa to the capital of Nairobi, and with its western extension to Eldoret and to Kisimu. This pipeline is operated by the Kenya Pipeline Company, a wholly owned entity of the Government of Kenya.[11]

In addition, there is a 320 kilometer pipeline under construction to extend the pipeline from Eldoret to Kampala Uganda. It is a Public-Private Partnership with the Governments of Uganda and Kenya originally each holding 24.5 percent shares. The remaining 51 percent was to be held by a consortium. Tamoil East Africa, a company registered in Uganda, owns 70 percent of the remainder. Tamoil East Africa is a wholly owned subsidiary of Tamoil Holdings, the Libyan state owned oil firm. The remaining 30 percent in the private consortium is held by Habib Investments, an investment company belonging to Habib Kagimu, a Ugandan businessman. However, in 2008, the Government of Uganda agreed to take only half of its 24.5 percent share and sell the other half to the private sector consortium. Thus, the share of the pipeline extention to Kampala of Tamoil East Africa increased to 44.3 percent and of Habib Investments to 19.0 percent.[12]

We assume that shares of the market are proportional to the kilometers of the pipeline, and allocate ownership shares accordingly. There are 1120 kilometers of pipeline. The finished pipeline is 60 percent of the total and the Kampala extension is 40 percent. The Kenyan government holds 100 percent ownership interest in 800 kilometers (or 60 percent of the total) and 24.5 ownership interest in the remaining 320 kilometers (or 9.8 of the total) for a total share of 69.8 percent. The Uganda ownership share is the sum of the share of the Government of Uganda and the share of Habib Investments, i.e., 12.5 percent (equals .4 * (12.25 + 19.0)). The results are as follows.
Kenya, 69.8; Uganda, 12.5; Rest of World, 17.7.

[10] On May 7, 2009, the Kenyan government announced it would like to renegotiate the contract and build (along with the government of Uganda) a second line to haul more cargo to the inland countries like Uganda, Rwanda and Burundi. See The New Vision, May 7, 2009. Available at: http://www.newvision.co.ug/D/8/220/680519.

[11] See Kenya Pipeline Company on Wikipedia at: http://en.wikipedia.org/wiki/Kenya_Pipeline_Company, and the company website at: http://www.kpc.co.ke/

[12] See "Uganda cedes stake of oil pipeline to Tamoil of Libya, local investors," Libya On-Line, July 21, 2008. Available at: http://www.libyaonline.com/news/details.php?cid=75&id=4830

Appendix C : Estimates of the Dixit-Stiglitz Elasticities of Substitution for Kenyan Imperfectly Competitive 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 Kenya, so we took the values of the elasticities estimated for Madagascar as a proxy for the elasticities for Kenya.

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 elasticiteis 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. The resulting elasticities are reported in table C1.

Broda, Christian , Joshua Greenfield and David Weinstein (2006), "From Groudnuts 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.

Table C1: Estimated Elasticities of Substitution for Varieties in Kenyan Imperfectly Competitive Goods Sectors		
Sector in our Model	**Matching HS-3 Code from Broda et al estimates**	**weighted elasticity of substitution**
Beverages & tobacco	220, 240	2.3
Petroleum	271	3.6
Chemicals	280-391, 390, 393	2.8
Metals and machines	720-854	16.7
Non metallic products	680-702	5.6
Grain milling	110	3.2
Sugar & bakery & confectionary	170	2.9
Source: Authors calculations based on estimates from Broda, Greenfield and Weinstein (2006).		

Appendix D: Engineering Services in Kenya - Restrictiveness Index

The components of the engineering restrictiveness index as well as the scoring options are presented in Table D1.

Table D1: Professions Restrictiveness Index

Weight - foreign index	Weight - domestic index	Score	Restriction
			Barriers to establishment
0.0800	0.0800		**Form of establishment**
		1.00	Prohibition on incorporation
		0.50	Some form of incorporation permitted
		0.00	No restrictions
0.0800			**Foreign partnership/association/joint venture**
		1.00	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			**Nationality/citizenship requirements**
		1.00	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			**Residency and local presence**
		1.00	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			**Quotas/economic tests on the number of foreign professionals and firms**
		1.00	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
			Licensing and accreditation of domestic professionals (scores
	0.0500		**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
			Barriers to ongoing operations
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).

The scoring for Kenya is described below. It is based on the results of the World Bank Regulatory Survey in East Africa[13] and the World Bank Survey on Applied Policies in Services[14].

Barriers to establishment

Form of establishment Score 0.5

Foreign service providers are required to incorporate or establish the businesses locally. There are no restrictions on forms of incorporation.

Foreign partnership/joint venture/association Score 0
No restrictions.

Investment and ownership by foreign professionals Score 0

No restrictions.

Investment and ownership by non-professional investors Score 0.5

An engineering/ consulting firm must have at least one Partner/Director registered as Consulting Engineer who has in force an Annual Practicing Licence in the specified disciplines.

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 1

Entry permits are issued to non-citizens with skills not available at present in the Kenya (class A entry permits for management and technical staff - horizontal measure in Immigration Act Cap 172).

Licensing and accreditation of domestic professionals Score 1

Membership in association is compulsory. Professional examination, practical experience and proof of higher education are required.

Licensing and accreditation of foreign professionals Score 0.75
Foreign professionals must be registered members of the Engineers Association. Foreign professionals must be holder of a diploma, degree or other qualification recognized by the Association of Engineers of Kenya.

Movement of people - permanent Score 0.5

There are limits on the duration of stay; in general, duration of stay is determined on a case by case basis.

[13] The regulatory surveys were conducted by local consultants who interviewed the professional associations in the examined East African countries in 2009.
[14] The policy surveys were conducted by DECRG in 2008-2009.

On-going operations

Activities reserved by law to the profession Score 1

The engineering profession has an exclusive right to perform the following services: design and planning, representation for obtaining permits (signature of designs), tender and contract administration, project management including monitoring of execution, planning and managing maintenance, survey sites, testing and certification and expert witness activities. There is no law prohibiting a foreign provider with a commercial presence in Kenya from providing these services. The engineering profession has a shared right to provide the following services: feasibility studies, environmental assessment, and construction cost management. There is no law prohibiting a foreign provider with a commercial presence in Kenya from providing these services. Apart from design and planning, which can be done elsewhere and sent to Kenya, a foreign provider supplying services (i.e., without commercial presence in Kenya) will need a work permit in order to provide these services.

Multidisciplinary practices Score 0

There are no restrictions on cooperation between engineering professionals and other professionals. The same applies to foreign suppliers.

Advertising, marketing and solicitation Score 1

Advertising and marketing by Kenyan professional engineers as well as foreign suppliers is prohibited.

Fee setting Score 0.5

Prices /fees in the engineering services applicable to the private sector and other institutions outside the government are not regulated. In the case of professional engineering services rendered to the government, prices/fees are determined the Ministry in charge of engineering services but as of 2010, this function will be performed by the Engineering Registration Board (ERB). The ERB will set the prices/fees to be paid for professional engineering services rendered to the government; the service providers will be expected to compete on the technical aspect only.

Licensing requirements on management Score 0

No restrictions.

Movement of people - Temporary Score 0

No restrictions.

Other restrictions (Addition categories) Score 0.33

Restrictions on hiring professionals: Investment Promotion Act 2004 (cap 172) section 13.1. The employment of foreign natural persons for the implementation of foreign investment shall be agreed upon by the contracting parties and approved by Government.

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 Development Research Group, 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 2004	All R&D 2005	All R&D 2004-2005 average	Sales in $millions in 2005	Ratio of R&D expenses to sales (x1,000)
		$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
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 sectrors dominate R&D expenditures of US multinationals operating abroad. These are transportation, chemiicals and computers and electronics. Moreover, about two-thirds of all R&D expenditures of foreign multinationals operatingi 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.

Appendix F:
Kenya Model with Multiple FDI and Trade Partners
(Algebraic Structure)

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Persistent Link: `http://inside.mines.edu/~ebalistr/Papers/kenyaequations.pdf`

This document presents the algebraic formulation of a general-equilibrium numeric-simulation model of the Kenya economy. This model largely follows the structure of our earlier work on developing countries [e.g., Balistreri et al. (2009)].

The model includes 55 goods and services, which are purchased by households, firms, and the government. Let the goods and services be indexed by $g \in G$. Divide these goods and services into the following three categories that define their treatment in the model formulation: ($a.$) Business Services, characterized by monopolistic competition and foreign direct investment (FDI), indexed by $i \in I \subset G$; ($b.$) Dixit-Stiglitz manufacturing sectors, characterized by monopolistic competition, indexed by $j \in J \subset G$; and ($c.$) Constant Returns To Scale (CRTS) goods indexed by $k \in K \subset G$. In the current aggregation there are 9 elements in I, 7 elements in J, and 39 elements in K. Goods and services are also classified by their associated region, indexed by $r \in R$, where there are 4 regions.[F1] The accounts track the incomes of 10 rural and 10 urban households, indexed by $h \in H$, and there are 5 primary factors of production indexed by $f \in F$.

[F1] The current formulation includes Kenya or the domestic region (D), the European Union (EU), important African trade partners (AFR), and the rest-of-world region (ROW), such that $R = \{D, EU, AFR, ROW\}$.

Table F1 summarizes the equilibrium conditions and associated variables. The nonlinear system (of 1,364 equations and variables) is formulated in GAMS/MPSGE and solved using the PATH algorithm. We proceed with a description and algebraic representation of each of the conditions itemized in Table F1.

F.1 Dual representation of technologies and preferences

Technologies and preferences are represented in the Kenya model through value functions that embed the optimizing behavior of agents. Generally, any linearly-homogeneous transformation of inputs into outputs is fully characterized by a unit-cost (or expenditure) function. Setting the output price equal to optimized unit cost yields the equilibrium condition for the activity level of the transformation. That is, a competitive constant-returns activity will increase up to the point that marginal benefit (unit revenue) equals marginal cost. In the case of the Kenya model not all transformations are constant returns, so there are exceptions. In general, however, we will use the convention of setting unit revenues (left-hand side) equal to unit cost (right-hand side) and associating this equilibrium condition with a transformation activity level.

Agents in Kenya wishing to purchase a particular good or service g face an aggregate price PA^g. In constructing the aggregate prices, we will rely on the following notation for the component prices:

PD^g Price of domestic output ($\forall g \in G$),

PM_r^g Price of cross-border imports from region r of Business Services and CRTS goods ($\forall g \in (I \cup K)$),

P_r^g Dixit-Stiglitz price index on region-r varieties ($\forall g \in (I \cup J)$).

Assuming a Constant Elasticity of Substitution (CES) aggregation of the components we

Table F1: General equilibrium conditions

Equilibrium Condition	**(Equation)**		**Associated Variable**	**Dimensions**
Dual representation of preferences and technologies:				
Armington unit-cost functions	(1)	$\forall i \in I$	A^g : Armington Activity	G
	(2)	$\forall j \in J$		
	(3)	$\forall k \in K$		
Dixit-Stiglitz price indexes	(4)	$\forall g \in (I \cup J)$	Q_r^g : D-S Activity by region	$(I+J) \times R$
Zero Profits for Dixit-Stiglitz firms	(5)	$\forall g \in (I \cup J)$	N_r^g : Number of Firms	$(I+J) \times R$
Dixit-Stiglitz composite input prices	(6)	$\forall g \in (I \cup J)$ and $r = D$	Z_r^g : IRTS resource use	$(I+J) \times R$
	(7)	$\forall j \in J$ and $r \neq D$		
	(8)	$\forall i \in I$ and $r \neq D$		
Input-output technologies	(10)	$\forall g \in G$	Y^g: Production level	G
Constant elasticity of transformation	(11)	$\forall k \in K$	X^g: Index on CET activity	G
	(12)	$\forall g \in (I \cup J)$	(No Export Coefficients for $g \in (I \cup J)$)	
Exports	(13)	$\forall k \in K$ and $r \neq D$	EX_r^g: Exports	$G \times (R-1)$
	(14)	$\forall g \in (I \cup J)$ and $r \neq D$		
Imports	(15)	$\forall g \in G$ and $r \neq D$	IM_r^g: Imports (net of FDI-firm imports)	$G \times (R-1)$
Unit expenditure function	(16)		U: Household utility index	1
Unit cost of public purchase	(17)		PUB: Government Activity	1
Unit cost of investment	(18)		INV: Investment Activity	1
Market clearance conditions:				
Composite goods and services	(19)	$\forall g \in G$	PA^g : Composite price indexes	G
D-S composites	(21)	$\forall g \in (I \cup J)$ and $r \neq D$	P_r^g: Prices of D-S composites	$(I+J) \times R$
	(22)	$\forall g \in (I \cup J)$ and $r = D$		
Markets for IRTS composite input	(23)	$\forall g \in (I+J)$	PMC^g: Composite input prices	$(I+J) \times R$
Markets for domestic output	(24)	$\forall k \in K$	PD^g: Domestic output prices	G
	(25)	$\forall i \in I$		
	(26)	$\forall j \in J$		
Markets for export output	(27)	$\forall k \in K$ and $r \neq D$	PX_r^k: Export output prices	$K \times (R-1)$
Markets for gross output	(28)	$\forall g \in G$	PY^g: Output prices	G
Markets for imports	(29)	$\forall i \in I$ and $r \neq D$	PM_r^g: Import prices	$G \times (R-1)$
	(30)	$\forall j \in J$ and $r \neq D$		
	(31)	$\forall k \in K$ and $r \neq D$		
Factor markets	(32)	$\forall f \in F$	PF_f: Factor prices	F
IRTS specific factors	(33)	$\forall g \in (I \cup J)$	PZ_r^g: Sector-specific capital price	$(I+J) \times R$
Fixed real investment	(34)		$PINV$: Unit cost of investment	1
Fixed real public spending	(35)		PG: Unit cost of public good	1
Nominal utility equals Income	(36)		PC: Unit expenditure index	1
Balance of payments	(37)		PFX: Price of foreign exchange	1
Income balance:				
Domestic agent income	(38)		RA_h: Household Income	1
Government budget	(39)		$GOVT$: Government spending	1
Foreign Entrepreneur	(40)		FE: External agent income	1
Auxiliary Conditions:				
Fixed real public spending	(41)		T: Index on direct taxes	1
Total Dimensions:	$6G + 6[(I+J) \times R] + 3[G \times (R-1)] + [K \times (R-1)] + F + H + 13 =$			$1,364$

equate the prices to the CES unit-cost functions:

$$PA^i = \left(\sum_r (P_r^i)^{1-\sigma_F^i} + \sum_r \phi_r^i (PM_r^i)^{1-\sigma_F^i}\right)^{1/(1-\sigma_F^i)} \quad (1)$$

$$PA^j = \left(\sum_r (P_r^j)^{1-\sigma_F^j}\right)^{1/(1-\sigma_F^j)} \quad (2)$$

$$PA^k = \left(\phi_D^k (PD^k)^{1-\sigma_{DM}^k} + \sum_r \phi_r^k (PM_r^k)^{1-\sigma_{DM}^k}\right)^{1/(1-\sigma_{DM}^k)}, \quad (3)$$

where $\sigma_F^g \forall g \in (I \cup J)$ is the Dixit-Stiglitz elasticity of substitution and σ_{DM}^k is the Armington elasticity of substitution on CRTS goods. The arguments of these functions are the component prices. The ϕ parameters are CES distribution parameters that indicate scale and weighting of the arguments. These are calibrated to the Kenyan social accounts such that the accounts are replicated in the benchmark equilibrium.

For the IRTS sectors we have the Dixit-Stiglitz price indexes. These are functions of the number of varieties, firm-level costs, and the optimal markup. Assuming each firm is small relative to the size of the market the demand elasticity for a firm's variety is σ_F^g and the optimal markup over marginal cost is given by $1/(1 - \frac{1}{\sigma_F^g})$. Let marginal cost equal $PMC_r^g \ \forall g \in (I \cup J)$, which is the price of a composite input to the Dixit-Stiglitz firms associated with region-r, and let the number of varieties by region equal $N_r^g \ \forall g \in (I \cup J)$. The price indexes for the Dixit-Stiglitz goods are thus given by

$$P_r^g = \left[N_r^g \left(\frac{PMC_r^g}{1 - \frac{1}{\sigma_F^g}}\right)^{1-\sigma_F^g}\right]^{1/(1-\sigma_F^g)} \qquad \forall g \in (I \cup J). \quad (4)$$

In equilibrium, the number of varieties by region adjusts such that we have zero profits. Denote the Dixit-Stiglitz composite activity level associated with equation (4) by $Q_r^g \ \forall g \in (I \cup J)$. Given the Dixit-Stiglitz aggregation of varieties each firm produces a quantity $Q_r^g (N_r^g)^{\sigma_F^g/(1-\sigma_F^g)}$. Assuming that fixed and variable costs are satisfied using the same

input technology, and a firm-level fixed cost of f_r^g (in composite input units), we have the zero profit condition

$$f_r^g - \frac{Q_r^g (N_r^g)^{\sigma_F^g/(1-\sigma_F^g)}}{\sigma_F^g - 1} = 0 \quad \forall g \in (I \cup J). \tag{5}$$

The technologies for producing the composite inputs for use in the Dixit-Stiglitz sectors depend on the type of sector. For all of the sectors there is a sector-specific capital input from the respective source region. Let $PZ_r^g \; \forall g \in (I \cup J)$ be the price of this sector-specific capital input. Domestic firms (producing goods or services) use domestic inputs, so the unit cost function is given by

$$PMC_r^g = \left[\theta_{Zr}^g (PZ_r^g)^{1-\epsilon_r^g} + \theta_{Dr}^g (PD^g)^{1-\epsilon_r^g}\right]^{1/(1-\epsilon_r^g)}, \quad \text{for} \quad r = D; \tag{6}$$

where ϵ_r^g is the elasticity of substitution between the sector-specific capital input and other inputs, and the θ's are the CES distribution parameters. Imports of Dixit-Stiglitz goods embody the gross of tariff imported inputs:

$$PMC_r^j = \left[\theta_{Zr}^j (PZ_r^j)^{1-\epsilon_r^j} + \theta_{Mr}^j (PM_r^j)^{1-\epsilon_r^j}\right]^{1/(1-\epsilon_r^j)}, \quad \text{for} \quad r \neq D. \tag{7}$$

FDI firms, on the other hand, use domestic inputs as well as a specialized imported service from the sources region. The price of the specialized imports equals the price of foreign exchange (denoted PFX) times one plus the tariff rate (denoted t_{ir}^{imp}). The unit cost for FDI firms is thus given by the following:

$$PMC_r^i = \left[\theta_{Zr}^i (PZ_r^i)^{1-\epsilon_r^i} + (\theta_{Dr}^i PD^i + \theta_{Mr}^i (1 + t_{ir}^{imp}) PFX)^{1-\epsilon_r^i}\right]^{1/(1-\epsilon_r^i)}, \quad \text{for} \quad r \neq D \tag{8}$$

For the CRTS sectors and upstream of the IRTS technologies, we have domestic pro-

duction in accordance with the input output data. Denote the price of this output PY^s, for $s \in G$. The technology includes an upstream Cobb-Douglas value-added nest which then combines business services and ultimately then this composite combines with other intermediates in fixed proportions. Let PF_f indicate the price of primary factor of production $f \in F$ and let P_s^{vas} be the value-added business-services composite price for sector s. The composite of business services and value added is the CES aggregate of two Cobb-Douglas aggregates as follows:

$$P_s^{vas} = \left[\left(\prod_i \gamma_i^s [(1 + t_{is}^{int}) PA_i]^{\alpha_i^s} \right)^{1-\sigma_{vas}} + \left(\prod_f \gamma_f^s [(1 + t_{fs}) PF_f^{\alpha_f^s}] \right)^{1-\sigma_{vas}} \right]^{1/(1-\sigma_{vas})}, \quad (9)$$

where t_{gs}^{int} is the tax in sector s on purchases of good g and t_{fs} is the factor tax. The substitution elasticity between value added and the business services composite is given by σ_{vas}. With P_s^{vas} established, the top-level Leontief unit cost function for sector s is given by

$$PY^s = \beta_{vas}^s P_s^{vas} + \sum_{g \neq I} \beta_g^s (1 + t_{gs}^{int}) PA^g, \quad (10)$$

where the α, β, and γ are share and scale parameters determined in the calibration to the input-output accounts. In the privatization scenarios explored in the Kenya model the γ_f^s parameters can be manipulated to represent pure productivity increases. For example, if the productivity of skilled labor increased by 10% in sector s we would simply multiply γ_{SK}^s by 1.1 raised to the power α_{SK}^s.

For the CRTS sectors a constant elasticity of transformation (CET) activity splits domestic output (with a unit value PY^k) into goods destine for domestic versus the region-specific export markets. Let the export price (for goods destine for region $r \neq D$)

be PX_r^k then the CET technology is given by

$$\left[\gamma_D^k (PD^k)^{1+\sigma_\tau} + \sum_{r \neq D} \gamma_r^k (PX_r^k)^{1+\sigma_\tau}\right]^{1/(1+\sigma_\tau)} = PY^k, \tag{11}$$

where σ_τ indicates the elasticity of transformation and the γ are the CET distribution parameters. In the case of IRTS sectors, we assume that domestic firms use domestic output to produce Dixit-Stiglitz varieties. Thus the CET technology collapses without export coefficients $[\gamma_r^g = 0 \; \forall g \in (I \cup J)]$:

$$PD^g = PY^g \quad \forall g \in (I \cup J). \tag{12}$$

For CRTS sectors the export commodity is traded for foreign exchange at a fixed rate. Let *PFX* equal the price of foreign exchange, and with a choice of units such that all gross of tax unit export prices are one at the benchmark, we have the following specification for the CRTS export activities:

$$PFX = (1 + t_k^{exp}) PX_r^k \quad \text{for} \quad r \neq D, \tag{13}$$

where t_g^{exp} is the export tax. For the IRTS sectors, domestic firms export the firm-level good where foreign agents are assumed to behave according to Dixit-Stiglitz preferences that are the same as domestic agents. Domestic IRTS firms face an export demand elasticity for their variety of σ_F^g and thus price their exports using the optimal markup. In aggregate the IRTS export activities by region are characterized by

$$EX_r^g = \xi_r^g \left[\left(1 - \frac{1}{\sigma_F^g}\right) \frac{PFX}{(1 + t_k^{exp}) PMC_D^g}\right]^{\sigma_F^g} \quad \forall g \in (I \cup J) \text{ and } r \neq D. \tag{14}$$

Cross-border imports are purchased at the price of foreign exchange times one plus

the tariff rate, which sets up the arbitrage condition for each import activity;

$$PM_r^g \quad = \quad (1 + t_{gr}^{imp})PFX \quad \text{for} \quad r \neq D. \tag{15}$$

Final demand includes three categories: household demand, government demand, and investment. The representative agents for each household h are assumed to have identical Cobb-Douglas preferences over the aggregated goods and services. The preferences are specified via a unit expenditure function associated with an economy-wide utility index (U). Let PC be the true-cost-of-living index indicated by the following unit expenditure function:

$$PC = \prod_g [(1 + t_g^{cons})PA^g]^{\mu_C^g}, \tag{16}$$

where the μ are value shares. The government faces a Leontief price index, PG, for government purchases:

$$PG = \sum_g \mu_G^g (1 + t_g^{gov})PA^g. \tag{17}$$

Similarly the price of investment, $PINV$ is a Leontief aggregation of commodity purchases:

$$PINV = \sum_g \mu_{INV}^g (1 + t_g^{inv})PA^g. \tag{18}$$

Equations (1) through (18) define all of the transformation technologies for the model. Next we turn to a specification of the market clearance conditions for each price.

F.2 Market clearance conditions

For each good or service there is a market, and, for any non-zero equilibrium price, supply will equal demand. We will use the convention of equating supply, on the left-hand side, to demand, on the right-hand side. The unit-value functions presented above are

quite useful in deriving the appropriate compensated demand functions, by the envelope theorem (Shephard's Lemma).

Supply of the composite goods and services, trading at PA^g, is given by the activity level, A^g, and demand is derived from each production or final demand activity that uses the good or service. The market clearance condition is given by

$$A^g = \sum_s h_{gs}(Y^s, \boldsymbol{p}) + \mu_C^g U \frac{PC}{(1+t_g^{cons})PA^g} + \mu_G^g PUB + \mu_{INV}^g INV, \tag{19}$$

where $h_{gs}(Y^s, \boldsymbol{p})$ are the conditional input demands (as a function of output and the price vector. These are found by taking the partial derivative of the unit cost function for sector s with respect to the gross of tax price of input g. For inputs that are not business services input demands are proportional to output: $h_{gs}(Y^s, \boldsymbol{p}) = \beta_g^s Y^s \quad \forall g \in (J \cup K)$. The input demands for business services are, however, more complex:

$$h_{is}(Y^s, \boldsymbol{p}) = \alpha_i^s \beta_{vas}^s Y^s \left(\frac{P_s^{srv}}{(1+t_{is}^{int})PA_i} \right) \left(\frac{P_s^{vas}}{P_s^{srv}} \right)^{\sigma_{vas}} \tag{20}$$

where P_s^{srv} is the composite price of business services inputs: $P_s^{srv} = \prod_i \gamma_i^s [(1+t_{is}^{int})PA_i]^{\alpha_i^s}$.

For the IRTS sectors we have market clearance for the Dixit-Stiglitz regional composites:

$$Q_r^g = A^g \left(\frac{PA^g}{P_r^g} \right)^{\sigma_F^g} \forall g \in (I \cup J), \quad \text{for} \quad r \neq D; \tag{21}$$

and for domestic firms we include demand for the Dixit-Stiglitz exports

$$Q_D^g = A^g \left(\frac{PA^g}{P_D^g} \right)^{\sigma_F^g} + \sum_r EX_r^g \quad \forall g \in (I \cup J). \tag{22}$$

The IRTS composite input (trading at PMC_r^g) is supplied by an activity, denoted $Z_r^g \; \forall g \in$

$(I \cup J)$, and is demanded by the firms:

$$Z_r^g = f_r^g N_r^g + Q_r^g (N_r^g)^{1/(1-\sigma_F^g)} \quad \forall g \in (I \cup J). \tag{23}$$

To derive (23) recall that firm-level output is $Q_r^g (N_r^g)^{\sigma_F^g/(1-\sigma_F^g)}$ so the use of the input across all firms is $Q_r^g (N_r^g)^{1/(1-\sigma_F^g)}$ plus the total input use on fixed costs, $f_r^g N_r^g$.

Market clearance for the domestic output of CRTS sectors depends on supply from the CET activity and demand from the Armington activity:

$$\gamma_D^k X^k \left(\frac{PD^k}{PY^k} \right)^{\sigma_\tau} = \phi_D^k A^k \left(\frac{PA^k}{PD^k} \right)^{\sigma_{DM}^k}. \tag{24}$$

For IRTS sectors, supply is simply given by the CET activity (as there are no export coefficients in the CET technology for IRTS sectors). Output is then demanded by either the domestic or FDI firms. The market clearance conditions are given by

$$X^i = \theta_{DD}^i Z_D^i \left(\frac{PMC_D^i}{PD^i} \right)^{\epsilon_D^i} + \sum_{r \neq D} \theta_{Dr}^i Z_r^i \left(\frac{PMC_r^i}{\theta_{Dr}^i PD^i + \theta_{Mr}^i (1 + t_{ir}^{imp}) PFX} \right)^{\epsilon_r^i} \tag{25}$$

for the service sectors, and

$$X^j = \theta_{DD}^j Z_D^j \left(\frac{PMC_D^j}{PD^j} \right)^{\epsilon_D^j} \tag{26}$$

for the Dixit-Stiglitz goods sectors.

Market clearance for exports of CRTS output is given by the CET supply function and demand is given by the export activity level (export demand is perfectly elastic):

$$\gamma_r^k X^k \left(\frac{PX_r^k}{PY^k} \right)^{\sigma_\tau} = EX_r^k, \quad \text{for} \quad r \neq D. \tag{27}$$

Reconciling gross output with the CET activities, we have market clearance for the commodities that trade at PY^g:

$$Y^g = X^g. \tag{28}$$

Import supply is perfectly elastic and import demand is derived from the Armington activities or embodied in the foreign Dixit-Stiglitz firm's inputs. For $r \neq D$, we have the following:

$$IM_r^i = \phi_r^i A^i \left(\frac{PA^i}{PM_r^i} \right)^{\sigma_F^i} \tag{29}$$

$$IM_r^j = \theta_{Mr}^j Z_r^j \left(\frac{PMC_r^j}{PM_r^j} \right)^{\epsilon_r^j} \tag{30}$$

$$IM_r^k = \phi_r^k A^k \left(\frac{PA^k}{PM_r^k} \right)^{\sigma_{DM}^k}. \tag{31}$$

Factor markets clear, where factor supply is given by the exogenous endowments to households, denoted $\overline{S}_f$, and input demands are derived from the cost functions:

$$\overline{S}_f = \sum_s \alpha_f^s \beta_{vas}^s Y^s \left(\frac{P_s^{va}}{(1+t_{fs})PF_f} \right) \left(\frac{P_s^{vas}}{P_s^{va}} \right)^{\sigma_{vas}}, \tag{32}$$

where P_s^{va} is the composite value-added price: $P_s^{va} = \prod_f \gamma_f^s [(1+t_{fs})PF_f]^{\alpha_f^s}$. In addition, we have the market for the specific factor used in the IRTS sectors. Denoting the regional endowments of the specific factors $\overline{SF}_r^g \ \ \forall g \in (I \cup J)$, we have:

$$\overline{SF}_r^g = \theta_{Zr}^g Z_r^g \left(\frac{PMC_r^g}{PZ_r^g} \right)^{\epsilon_r^g} \quad \forall g \in (I \cup J). \tag{33}$$

Real investment equals real savings by households:

$$INV \;=\; \overline{sav}. \tag{34}$$

Real government purchases equal the nominal government budget scaled by the government price index:

$$PUB \;=\; \frac{GOVT}{PG}. \tag{35}$$

Household utility (U) equals nominal income across households scaled by the true-cost-of-living index. That is, we represent an aggregate activity U, which supplies *utils* to the households. For the representative agent of household type h denote nominal income RA. The market clearance condition for *utils* is thus

$$U \;=\; \frac{RA}{PC}. \tag{36}$$

The final market clearance condition reconciles the balance of payments. The supply of foreign exchange includes its generation in the export activities and net borrowing from the rest of the world (net capital account surpluses). The real capital account surplus is held fixed at the exogenous benchmark observation, denoted $\overline{ftrn}$. Foreign exchange is demanded for direct import purchases as well as the payments to foreign agents for their contribution to production.

$$\begin{aligned}\sum_{r\neq D}\sum_{g} EX_r^g + \overline{ftrn} \;&=\; \sum_{r\neq D}\sum_{g} IM_r^g \\ &+\; \sum_{r\neq D}\sum_{i} \theta_{Mr}^i Z_r^i \left(\frac{PMC_r^i}{\theta_{Dr}^i PD^i + \theta_{Mr}^i (1+t_{ir}^{imp}) PFX}\right)^{\epsilon_r^i} \\ &+\; \frac{FE}{PFX},\end{aligned} \tag{37}$$

where *FE* equals the nominal claims that the foreign entrepreneurs have on specific factor rents in the Dixit-Stiglitz manufacturing sectors.

F.3 Income Balance Conditions

The representative agent (household) earns income from factor endowments, but disposable income nets out savings and a direct tax transfer to the government. Real savings is held fixed (by the coefficient $\overline{sav}_h$). We also hold fixed the real level of government spending, but this requires an adjustment in direct taxes on households. Removal of tariffs, for example, impact the government budget and the shortfall is made up for by an endogenous increase in the direct taxes on households. We use the auxiliary variable T to scale the direct taxes appropriately. In addition, the household is assumed to hold any benchmark net international capital flows. The household's budget is given by

$$\begin{aligned} RA &= \sum_f PF_f \overline{S}_f \\ &+ \sum_g PZ^g_{BEL} \overline{SF}^g_{BEL} \\ &- \overline{sav} PINV \\ &- \overline{dtax} PG \times T \\ &+ \overline{ftrn} PFX \end{aligned} \tag{38}$$

The government budget is given by net direct and indirect taxes on domestic and international transactions. The full nominal government budget is

$$\begin{aligned} GOVT &= \overline{dtax}_h PG \times T \\ &+ \sum_g t^{cons}_g PA^g \mu^g_C U \frac{PC}{(1+t^{cons}_g) PA^g} \end{aligned}$$

$$
\begin{aligned}
&+ \sum_g t_g^{inv} PA^g \mu_{INV}^g INV \\
&+ \sum_g t_g^{gov} PA^g \mu_G^g PUB \\
&+ \sum_s \sum_i t_{is}^{int} PA_i \alpha_i^s \beta_{vas}^s Y^s \left(\frac{P_s^{srv}}{(1+t_{is}^{int}) PA_i} \right) \left(\frac{P_s^{vas}}{P_s^{srv}} \right)^{\sigma_{vas}} \\
&+ \sum_s \sum_j t_{js}^{int} PA_j \beta_j^s Y^s \\
&+ \sum_s \sum_k t_{ks}^{int} PA_k \beta_k^s Y^s \\
&+ \sum_s \sum_f t_{fs} PF_f \alpha_f^s \beta_{vas}^s Y^s \left(\frac{P_s^{va}}{(1+t_{fs}) PF_f} \right) \left(\frac{P_s^{vas}}{P_s^{va}} \right)^{\sigma_{vas}} \\
&+ \sum_{r \neq D} \sum_g t_{gr}^{imp} (PFX) IM_r^g \\
&+ \sum_{r \neq D} \sum_i t_{ir}^{imp} (PFX) \theta_{Mr}^i Z_r^i \left(\frac{PMC_r^i}{\theta_{Dr}^i PD^i + \theta_{Mr}^i (1+t_{ir}^{imp}) PFX} \right)^{\epsilon_r^i} \\
&+ \sum_{r \neq D} \sum_i t_i^{exp} \frac{PMC_{BEL}^i}{1 - \frac{1}{\sigma_F^i}} EX_r^i \\
&+ \sum_{r \neq D} \sum_j t_j^{exp} \frac{PMC_{BEL}^j}{1 - \frac{1}{\sigma_F^j}} EX_r^j \\
&+ \sum_{r \neq D} \sum_k t_k^{exp} PX_r^k EX_r^k
\end{aligned} \tag{39}
$$

Again, the index T is adjusted endogenously to hold the real level of public spending fixed. In addition to the household and government agents we need an agent representing the foreign entrepreneurs who own the specific factors associated with cross-border Dixit-Stiglitz traded goods. The foreign entrepreneur's nominal income is FE, which is spent on foreign exchange:

$$
FE = \sum_{r \neq D} \sum_g PZ_r^g \overline{SF}_r^g \tag{40}
$$

F.4 Auxiliary Condition

In addition to the three sets of standard conditions presented above, we need to close the model with an auxiliary condition such that the real size of the government is held fixed. To do this we need to determine the index which scales direct taxes on households. Associated with the variable T is the following condition:

$$PUB \quad = \quad \overline{pub}. \tag{41}$$

F.References

Balistreri, Edward J., Thomas F. Rutherford, and David G. Tarr (2009) 'Modeling services liberalization: The case of Kenya.' *Economic Modelling* 26(3), 668–679

Appendix G:

A note on the relationship between sector specific capital and the elasticity of supply in applied general equilibrium models of imperfect competition*

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The models developed in this paper, by Balistreri et al. (2009) and by Jensen et al. (2008) to analyze services liberalization in Kenya and Tanzania utilize a specific-factor formulation. The specific-factor formulation facilitates a calibration of the FDI and domestic service responses. This is important because the empirical evidence [Hummels and Klenow (2005)] indicates that varieties expand less than proportionately to market size. The expansion of services bids up the price of the specific factor resulting in increasing costs (upward sloping supply). These increasing costs ensure that the varieties expand less than proportionately to market size. The predetermined elasticity of supply controls the magnitude of these effects. This note outlines the calibration procedure.

One can calibrate a linearly-homogeneous (constant-returns) Constant Elasticity of Substitution (CES) technology to an arbitrary price elasticity of supply if some of the input value is allocated to a specific factor. In the context of the Kenyan and Tanzania models the supply elasticity applies to the composite input that is used in both fixed and variable costs associated with the services sectors.

To simplify the presentation, consider the composite input for a single type of firm (say domestic firms) and for a single industry (say Communications). Let the quantity of this composite input be denoted y with a market price of p. Denote the associated nested

*This note is largely based on lecture notes from Thomas F. Rutherford's graduate course on Computational Economics at the University of Colorado (from the late 1990's)

CES unit cost function $c(\vec{r})$, where $\vec{r}$ is a vector of input prices. With competition for the composite input we have

$$p = c(\vec{r}) \equiv \min \{\vec{r}\,'\vec{x} \quad \text{s.t.} \quad f(\vec{x}) = 1\}, \tag{1}$$

where $\vec{x}$ is the vector of inputs and the function, $y = f(\vec{x})$, is the CES technology for aggregating inputs. Denote the fixed quantity of the sector specific input $\bar{R}$ with price r_1, and assume that all of the mobile inputs can be combined into a separable composite X with composite price r_2 (that is, $\vec{x} = \{\bar{R}, X\}$ and $\vec{r} = \{r_1, r_2\}$).[G1] We thus have the explicit expression:

$$p = c(r_1, r_2) \equiv \min \left\{ r_1\bar{R} + r_2 X \quad \text{s.t.} \quad \left[\alpha_R \bar{R}^{\rho} + \alpha_X X^{\rho}\right]^{1/\rho} = 1 \right\}, \tag{2}$$

where ρ indicates the elasticity of substitution, $\sigma = 1/(1-\rho)$, and α_R and α_X are the CES distribution parameters. Choosing units carefully (such that $p = r_1 = r_2 = 1$) at the benchmark and solving (2) we have the unit cost function:

$$c(r_1, r_2) = \left[\theta r_1^{1-\sigma} + (1-\theta) r_2^{1-\sigma}\right]^{\frac{1}{1-\sigma}}, \tag{3}$$

where θ is the benchmark value share of the sector specific input. Given that the quantity $\bar{R}$ is fixed in supply the price r_1 is a residual. The technology *de facto* exhibits decreasing returns (upward sloping supply) because the only way to increase y is to increase X at diminishing marginal product (as the $\bar{R}$ to X ratio falls).

[G1] The variable X is a nested CES subcomposite of all of the inputs excluding $\bar{R}$. Define $\vec{z}$ as the vector of all inputs other than $\bar{R}$, and define $\vec{s}$ as the vector of corresponding input prices. Let $X = g(\vec{z})$, so we have $r_2 = \min \{\vec{s}\,'\vec{z} \quad \text{s.t.} \quad g(\vec{z}) = 1\}$, where $g(\vec{z})$ is a nested CES function and the input vector $\vec{z}$ may include intermediates. The actual specification of $g(\vec{z})$ is not a concern here because the supply elasticity is inherently dependent on the concept of partial differentiation (changes in the elements in $\vec{s}$ are not considered). In fact, we are only concerned with the supply elasticity local to the benchmark equilibrium, where r_2 takes on a specific numeric value.

Using Shephard's lemma to derive demand for $\bar{R}$ we can represent the overall resource constraint on the specific factor as follows:

$$\begin{aligned} \bar{R} &= y\frac{\partial c(\vec{r})}{\partial r_1} \\ &= \theta y \left(\frac{p}{r_1}\right)^{\sigma}. \end{aligned} \tag{4}$$

Solving for the residual price

$$r_1 = p\left(\frac{\theta y}{\bar{R}}\right)^{1/\sigma}, \tag{5}$$

and then substituting this back into the unit cost function we have:

$$p^{1-\sigma} = \theta p^{1-\sigma}\left(\frac{\theta y}{\bar{R}}\right)^{\frac{1-\sigma}{\sigma}} + (1-\theta)r_2^{1-\sigma}. \tag{6}$$

Solving for y as a function of the resource constraint and the price ratio (r_2/p) we have supply:

$$y = \bar{R}\theta^{\frac{1}{\sigma-1}}\left[1-(1-\theta)\left(\frac{r_2}{p}\right)^{1-\sigma}\right]^{\frac{\sigma}{1-\sigma}}. \tag{7}$$

The supply elasticity is given by

$$\eta \equiv \frac{\partial y}{\partial p}\frac{p}{y} = \frac{\sigma(1-\theta)}{-1+\theta+\left(\frac{r_2}{p}\right)^{\sigma-1}}, \tag{8}$$

and evaluating this local to the benchmark equilibrium ($r_2 = p = 1$) we have

$$\eta = \frac{\sigma(1-\theta)}{\theta}. \tag{9}$$

This equation gives us the fundamental relationship between the local supply elasticity and the CES parameters.

Notice that there are many combinations of value shares and substitution elasticities that

yield the same local supply elasticity. If the goal is to calibrate the model to a given value of η there are a couple of options. For example, one could simply lock down the value of σ (at say $\sigma = 1$, which is Cobb-Douglas) and then calculate the appropriate overall value share of the specific factor (at $\sigma = 1$ we have $\theta = 1/(1+\eta)$). In empirical applications, however, this calibration method can be problematic, because the value of θ may be constrained by the social accounts.

In the Kenya and Tanzania models we choose a different calibration strategy. We observe the value of capital payments in the social accounts, and it is logical that these include payments to the specific factor. Denote the observed capital payments vk and the overall value of output vy. Now if we choose a share of the capital payments that should be allocated to the specific factor, call this θ_k, we can calculate the appropriate elasticity of substitution as follows:

$$\sigma = \frac{\eta\theta}{1-\theta}, \tag{10}$$

where $\theta = \theta_k(vk/vy)$.

In sensitivity analysis on the Kenya and Tanzania models we hold fixed the value of $\theta_k = 0.5$ and vary the value of η. As η increases the calibrated elasticity of substitution increases and we observe a more elastic supply response. In terms of varieties, we observe that the change in the number of varieties is closer to proportional to the change in market size as η increases.

One might consider sensitivity analysis on the value of θ_k, but this will not necessarily generate intuitive responses. In fact, as long as the counterfactual is local to the benchmark equilibrium there should be no effect of changing θ_k. As θ_k increases the value of $\theta/(1-\theta)$ falls and, according to equation (10), the calibrated value of σ falls to compensate. So larger value shares will not necessarily generate larger supply responses. In fact, by design, the local impact of a change in θ_k is zero.

G.References

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Hummels, David, and Peter Klenow (2005) 'The variety and quality of a nation's trade.' *American Economic Review* 95(3), 704–723

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