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Title: China and the Manufacturing Terms of Trade of African Exporters

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Abstract: The economic geography model of Redding and Venables (2004) is employed to decompose import growth of a large number of countries into supply and demand capacities. The results of this decomposition allow analysis of the extent to which China's export growth has altered the demand for manufactures exported by Kenya, Mauritius, and South Africa, the largest exporters of manufactured goods in Sub-Saharan Africa. Counterfactual simulations indicate that if China's supply capacity had stagnated at 1995 levels, textile exports in the selected countries would have been about 26 percent higher. In other manufacturing sectors, this study finds no evidence of African responsiveness to changes in market access conditions; hence, it is difficult to argue that China has affected non-textile exports from Africa. As a consequence of China's export growth, the selected African countries have also seen substantial reductions in their import prices. However, an estimation of their terms-of-trade suggests that the reductions in export prices outweighs the decrease in import prices.

Keywords: Export rivalry, China, Africa, Economic geography, Gravity models

JEL Codes: F12, F14

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1. Introduction

China is often viewed as a competitive threat by the exporting sectors of other developing countries. During the period 1995-2005, China's exports of merchandise, of which 90% are manufactured goods, grew on average 18.5 percent per year, increasing the Chinese share of world exports from 2.8 to 7.3 percent (WTO, 2006). This trend is especially pronounced in the largest markets in the world, where most developing countries sell their manufactures. Between 2000 and 2005, China almost doubled its share in the US import market from 8.6 to 15.0 percent, positioning itself as the third largest US supplier of merchandise, after the European Union and Canada. In the same period, China became the second largest source of EU imports, supplying 4.7 percent of total extra-EU demand, while the U.S. supplied 4.9 percent.

The concerns of developing countries about China's export growth, and its consequent depressing effects on world prices have been well documented in the literature. For instance, Kaplinsky (2006), using disaggregated import data of the European Union for 1988-2001 found that the greater the participation of China in a given market, the more likely it was to find decreases in unit prices. Furthermore, unit prices tended to be lower in sectors in which the incidence of low income exporters was highest. For the US, Kamin, Marazzi and Schindler (2006) examined the effects of China's imports on US import price inflation during the period 1993-2002. They found that a 1 percent increase in the Chinese share of total US imports lowered the US import price by 0.79 percent. Further evidence was presented by Freund and Ozden (2006), who showed that greater Chinese exports to the US were related to lower export prices in Latin America.

Several studies have examined the effects of Chinese export growth on the exports of other developing countries. The focus is mainly on Asia and Latin America. For instance, Ahearne, Fernald, Loungani and Schindler (2003; 2006), Eichengreen, Rhee and Tong (2004) and Roland-Holst and Weiss

(2004) have explored the issue of export rivalry between China and other Asian countries. All of them agreed that Asian developing countries should exploit their comparative advantages without competing directly with China, or by integrating into value-chains led by China. In Latin America, recent work includes Freund and Ozden (2006) and Hanson and Robertson (2006). These studies found that China's increased presence in the US market had negative effects on Mexico's exports, and to a lesser extent on exports from other countries in the region.

Empirical evidence of China's effects on African exports of manufactures is more scarce. This is probably because African countries export few manufactured goods. However, in some countries, export diversification efforts combined with trade preferences in the U.S. (through the African Growth and Opportunity Act, AGOA) and in the European Union (through the African Caribbean and Pacific Group of States – ACP, and more recently the Everything but Arms – EBA agreement) have had some degree of success in promoting export industries. One example is the textile and apparel sector, which constitutes most of the manufactured exports of Kenya and Mauritius. Yet the evidence about competition between China and Africa in third world markets for manufactured goods is anecdotal (Kaplinsky, McCormick and Morris, 2006), based on ad-hoc measures such as Export Similarity and Revealed Comparative Advantage indices (Goldstein, Pinaud, Reisen and Chen, 2005), or in comparisons between changes in the export growth of aggregated sectors in China and Africa (Edwards and Jenkins, 2005; Kennan and Stevens, 2005). All these studies indicated that the competition effects are non-trivial, and that more efforts are needed to understand how China's export growth affects export industries in Africa.

In this context, the present paper seeks to contribute to a better understanding of the effects of Chinese competition with African countries in third world markets for manufactured goods. Previous works studying the relationship between Africa and China have been conceived either as research-agenda setting (Kaplinsky et al. 2006, Edward and Jenkins, 2005; Kennan and Stevens, 2005.) or surveys (Goldstein et al. Zafar), hence they consider a large number of countries and their conclusions are

inherently general; in contrast this paper focuses on three key countries, Kenya, Mauritius, and South Africa. These countries have large export values relative to other African countries and high shares of manufactured goods in their total export of merchandise. By dealing with fewer countries, it is possible to better understand the way that China affects their manufacturing sectors. The analysis also allows for a general assessment of the aggregate terms of trade effects induced by China's export growth.

Complementing, previous work, this paper offers an econometric analysis of the trade data for the period 1995-2004. Thus it offers an ex-post analysis that should shed light on the difficulties facing non-traditional exports from Africa. The econometric analysis is derived from a theoretical model, following Redding and Venables (2004). The idea, fully explained in Section 3, is to decompose export growth into supply and demand capacities, exploring to what extent China has altered the demand for African products. Methodologically, this work is close to that of Hanson and Robertson (2006). Before discussing the model and its empirical implementation, the next section briefly summarizes the characteristics of manufacturing exports in China, Kenya, Mauritius, and South Africa.

2. Characteristics of manufacturing exports in the focus countries

South Africa's economy accounts for 39 percent of Sub-Saharan Africa's GDP. Furthermore almost 60% of its exports (80% when processed foods are added in) are manufactures. Although Kenya and Mauritius are smaller countries (accounting just 4 and 1 percent of Sub-Saharan Africa's GDP, respectively) Kenya has one the broadest manufacturing sectors in the region (Goldstein, et al., 2005), while Mauritius has the largest proportion of manufactures in total exports (71 percent without food manufactures and 98 percent when including them)[1]. For these reasons, this group of focus countries is highly relevant to the question of export competition

[1] A difficulty with South Africa's trade data is that until the year 2000, Botswana, Lesotho, Swaziland, Namibia, and South Africa, members of the South African Customs Union (SACU), reported trade statistics as a

Exports are as reported by the importers[2], as obtained from United Nations COMTRADE and aggregated to the second revision of the International Standard Industrial Classification (ISIC rev. 2). This aggregation encompasses all the manufacturing sectors. The ISIC sectors are: 31 - Manufacturing of Food, Beverages, and Tobacco; 32 - Textile, Wearing Apparel and Leather Industries; 33 - Manufacture of Wood and Wood Products, Including Furniture; 34 - Manufacture of Paper and Paper Products, Printing and Publishing; 35 - Manufacture of Chemicals and Chemical, Petroleum, Coal, Rubber, and Plastic Products; 36 - Manufacture of Non-Metallic Mineral Products, except Products of Petroleum and Coal; 37 - Basic Metal Industries; 38 - Manufacture of Fabricated Metal Products, Machinery, and Equipment; 39 - Other Manufacturing Industries. This level of aggregation keeps the estimation and interpretation of results at a manageable level.

The first four columns of Table 1 show, for the focus countries, exports in each sector as percentage of the total. For example, 18.5% of China's exports are textiles and apparel (ISIC 32), 8.1% are manufactures of chemicals (ISIC 35) and 52.6% are fabricated metal manufactures (sector 38) – these three sectors account for almost 80% of total China's exports. The textiles and apparel sector is also important in Kenya, Mauritius, and South Africa, where it accounts for 14, 54, and 3 percent of total exports respectively. Manufacturing of chemicals are important for Kenya and South Africa representing 14 and 7 percent of their total exports. In South Africa 53 percent of exports are manufacturing of metal products, machinery and equipment.. The next fourth columns of table 1 show the percentage of exports, by sector, destined to OECD and non-OECD high income countries. For all the countries the main export destination of textiles and apparel are High Income countries (OECD and non-OECD). High income countries are also important destinations for fabricated metal products, In principle, competition is likely

single entity. South Africa is the largest exporter of the SACU (in 2004, its exports represented 86% of all SACU's exports) Because SACU's exports are indistinguishable from South Africa's for half of the years, it was necessary to keep them together after the year 2000.

[2] Kenya did not report imports in 1995 and 1996; because Kenya's imports are important for the terms of trade estimations, we resorted to mirror statistics and complemented the data with the exports reported by Kenya's partners.

to be more intensive in these products. This contrasts sharply with the manufacturing of chemicals, in which the African countries ship between 50 percent (in Mauritius and South Africa) and 95 percent (in Kenya) of their total exports to non-high income countries.

The argument that motivates this study is the possibility that increases in China's market shares exert downward pressure on prices and divert demand away from African manufactured goods. The last four columns of Table 1 show the difference between global market shares in 1995 and in 2004 at the product category level. For example, the market share of food manufactured goods for China increased between 1995 and 2004 by 0.26 percentage points. Meanwhile, Kenya's share did not change, Mauritius' share fell by 0.06 percentage points, and South Africa's increased by 0.07 percentage points. China increased its participation in all the sectors, in particular in textiles, wood products furniture, non-metallic mineral products, and fabricated metal products. Meanwhile, the African countries have kept their shares constant throughout the last decade.

It is worth noting that increases in China's market share in the ISIC 32 (textiles) came despite the quantitative restrictions under the Agreement on Textiles and Clothing (ATC) of the WTO for several of the products included in the category. The ATC was progressively phased out in four stages, starting in 1995 and ending in 2005; however, the most binding quotas were only eliminated towards the end of this period (Goldstein, et al., 2005). This implies that in much of the analysis, the role of progressive quota elimination is confounded with export performance, an issue to which we return below.

3. Modeling Framework

Following Redding and Venables (2004), divide the world into R countries. In each country, there are w sectors producing n_w varieties. All consumers are identical and demand equal quantities x of each produced variety such that an individual's utility from consumption of varieties in sector w can be represented by a Constant Elasticity of Substitution (CES) function:

$$U_{wj} = \left[\sum_{i}^{R} n_{wi} x_{wij}^{\frac{(\sigma_w - 1)}{\sigma_w}} \right]^{\frac{\sigma_w}{(\sigma_w - 1)}}, \ (\sigma_w > 1) \quad (1)$$

where σ is the elasticity of substitution, constant between varieties of the same sector, but potentially different across the w sectors. Consumers in country j face a budget constraint for sector and overall consumption:

$$\sum_{i}^{R} n_{wi} x_{wij} p_{wij} \leq E_{wj}, \ \sum_{w} E_{wj} \leq E_j \quad (2)$$

where p_{wij} is the price of each variety of sector w produced by country i and consumed in j, E_{wj} is the share of income devoted to consumption of w, and E_j is total income. Maximization of (1) subject to (2) yields demands:

$$x_{wij} = p_{wij}^{-\sigma_w} E_{wj} (G_{wj})^{\sigma_w - 1} \text{ where } G_{wj} = \left[\sum_{i}^{R} n_{wi} p_{wij}^{(1-\sigma_w)} \right]^{\frac{1}{1-\sigma_w}} \quad (3)$$

The costs of shipping one unit of any variety from i to j are represented by T_{wij}, the percentage by which observable and unobservable trade costs augment the domestic price (p_{wi}) at the destination market, formally:

$$p_{wij} = p_{wi} (T_{wij}) \quad (4)$$

In practice, trade values are more likely to be observed than quantities, therefore multiply both sides of (3) by the number n_{wi} of varieties and their price p_{wi}, and use (4) to obtain:

$$V_{wij} = n_{wi} p_{wi}^{1-\sigma_w} (T_{wij})^{1-\sigma_w} E_{wj} (G_{wj})^{\sigma_w - 1} \quad (5)$$

which is a standard gravity equation explaining the sector-specific export value of product w from exporter i to importer j: V_{wij}.

Redding and Venables define the supply (*s*) and market capacity (*m*) coefficients as:

$$s_{wi} \equiv n_{wi}\, p_{wi}^{1-\sigma} \quad \text{and} \quad m_{wj} \equiv E_{wj}\,(G_{wj})^{\sigma_w - 1} \tag{6}$$

where s_{wi} indicates that the ability of a country to increase its exports is given by its marginal costs (price before mark up), the substitutability among varieties (mark up size), and the number of varieties supplied. Market capacity m_{wj}, indicates the position of the demand curve faced by country *i* when exporting to *j*. This depends on total expenditures in *w*, on the number of competing firms, and on the prices they charge, summarized in the price index *G*. The supply and demand capacities in (6) are weighted by trade costs to construct measures of Market Access (*MA*) and Supply Access (*SA*):

$$SA_{wj} = \sum_{i \neq j} (T_{wij})^{1-\sigma_n} s_{wi} \quad \text{and} \quad MA_{wi} = \sum_{j \neq i} (T_{wij})^{1-\sigma_n} m_{wj}, \tag{7}$$

Combining Equations (5) and (6), the exports of *w* from *i* to *j* can be written as:

$$V_{wij} = s_{wi}\,(T_{wij})^{1-\sigma_w} m_{wj} \tag{8}$$

Using the definition of market access (*MA)* given by expression (7), and introducing *t* as a subscript for time, total exports in sector *w* by country *i* at time *t* can be expressed as:

$$V_{wit} = s_{wit}\, MA_{wit} \tag{9}$$

Equation (9) permits a decomposition of total exports into internal supply capacity and foreign market access components. Empirical estimation of Equation (5) at different points in time allows identification of changes in selected countries' supply capacities and market access conditions. The empirical section employs this decomposition to explore the export performance of the selected countries and the role of China in affecting such performance.

In order to implement this approach, we must obtain a measure of how much China's price effects ($s_{china,t}$) influence market conditions. Recall from (6) that individual market conditions m_{wj} facing

country *i*, are a function of the importer's expenditure in *w* and a sector-specific CES price index, which in turn is the trade cost weighted sum of individual supply capacities, s_i. To see this more clearly, substitute into (6) the definition of price index from (3), and use (7) to rewrite market capacities as follows:

$$m_{wjt} \equiv \frac{E_{wjt}}{G_{wjt}^{1-\sigma_w}} = \frac{E_{wjt}}{\sum_i^R n_{wit} p_{wijt}^{(1-\sigma_w)}} = \frac{E_{wjt}}{\sum_i^R (T_{wijt})^{1-\sigma_n} s_{wit}} = \frac{E_{wjt}}{SA_{wjt}} \qquad (10)$$

Equation (10) suggests that the effect of China on the market conditions facing country *i* can be estimated by adjusting the price index in the denominator by changes in China's supply capacity. It will represent shifts in the demand curve facing the African exporters. For a given elasticity of substitution, a decrease in Chinese prices will result in a larger denominator, thus lowering total market capacity m_{wjt} from the viewpoint of China's competitors. This is good for the importing country, because it represents a decrease in the real price of their consumption. For China, this is also positive because it will encourage more demand for its products. However, for countries competing with China, a lower market capacity in the importing country will lower the total demand for its exports, as can be seen in Equations (8) and (9).

In order to examine how China's growth has influenced market capacity over time, we need to create a counterfactual scenario. Hanson and Robertson (2006) propose a method for doing so. They keep the evolution of China's supply capacity fixed at some point in the past (*t=0*) and estimate what would have been the market conditions faced by exporter *i* at time *t*, in the absence of China's improvements in supply capacity:

$$m_{wjt}^0 = \frac{E_{wjt}}{\sum_{i \neq chn}^R (T_{wijt})^{1-\sigma_n} s_{wit} + (T_{w,chn,j,t=0})^{1-\sigma_n} s_{w,chn,t=0}} = \frac{E_{wjt}}{SA_{wjt}^0} \qquad (11)$$

The ratio of (11) to (10) indicates how much larger the market faced by an exporter would have been if China's supply capacity had not grown at the pace it did. In the empirical section, this ratio is combined

with an estimate of the market access elasticities of exports in the selected countries in order to obtain an idea of how much different African exports would have been if China had not grown over this period.

4. Empirical implementation

The empirical strategy consists of identifying China's supply capacity by taking advantage of the differences in China's export values across importers. In turn, the year-to year variability of China's supply capacity can be combined with the year-to-year variability of market access to identify the effects of China's export growth on the exports of the African countries. Start by taking natural logarithms of Equation (8):

$$\ln(V_{wij}) = \ln(s_{wi}) + \ln(m_{wj}) + (1-\sigma_w)\ln(T_{wij}) \qquad (12)$$

where all the variables are defined as before. Ideally, data on trade frictions (T) would be available at the product level; however, we do not have access to a time series of applied tariffs for the time span analyzed (1995-2005). Therefore, following the standard practice in the literature (Anderson and Wincoop, 2003), unobservable trade costs T are modeled as an exponential function of distance ($DIST_{ij}$), borders ($BORD_{ij}$), language ($LANG_{ij}$), and preferential trade agreements (FTA_{ij}) as a proxy for tariffs (Hanson and Robertson, 2006):

$$T_{wij} = \mathrm{DIST}_{ij}^{\delta_1} e^{\delta_2 BORD_{ij} + \delta_3 LANG_{ij} + \delta_4 FTA_{ij}} \qquad (13)$$

The supply (s_{wi}) and market (m_{wj}) capacities in equation (12) are unobservable. Therefore following Redding and Venables (2004), they are approximated by using exporter (EXP_i) and importer (IMP_j) specific dummy variables. The estimating equation is therefore:

$$\ln(V_{ij}) = \beta_0 + \alpha_i EXP_i + \alpha_j IMP_j + \beta_1 \ln(\mathrm{DIST}_{ij}) + \beta_2 (BORD_{ij}) + \beta_3 (LANG_{ij}) + \sum_p \beta_{4p} (FTA_{p_{ij}}) + \varepsilon_{ij} \quad (14)$$

Where $\beta_i = (1-\sigma)\delta_i$ and ε_{ij} is an stochastic error.

The trade data V_{ij} on the left hand side of Equation 14 are the imports described in Section 2, deflated by the US GDP implicit price deflator. Distance between exporter and importer is measured in kilometers, according to the great circle formula. Border, language, and FTA are measured with dummy variables that take the value of one when a pair of countries share a border, speak the same language, or belong in the same Free Trade Area, and zero otherwise. There are 65 FTAs, hence *p*=1,..,65. The data on distance, border, and languages come from Mayer and Zignago (2006). Information on FTAs was obtained from Fontagné and Zignago (2007).

Comparing the exporter and importer fixed effects across different equations, requires to use the same set of country pairs each year, that is, no new exporters or importers are allowed through time. The number of country pairs varies across ISIC categories: in average there are 74 importers and 165 exporters. The average trade (over ISIC sectors) between these countries accounted for 97 percent of world trade in 1995 and 87 percent of world trade in 2004. The final dataset consists of 363,530 observations. These observations consists of only positive trade flows, however, in Section 6 we discuss the robustness of our results when zero trade flows are considered.

5. Results and Discussion

Equation 14 is fitted using Ordinary Least Squares, sector by sector, and year by year during the period 1995-2004. The reference group for both exporter and importer fixed effects is the U.S. There are 90 regressions (9 sectors * 10 years). Each one has more than 200 fixed effects coefficients, plus distance,

language, border and 65 FTAs coefficients. Due to this large amount of output, the most important results are summarized and briefly discussed in the Appendix.

Figure 1 shows, for selected ISIC sectors, the changes in supply capacity (exporter fixed effects from equation 14) between 1995 and 2004. The selected sectors are those that, in accordance with the discussion in section 2, concentrate a sizeable share of total African exports and compete with China for the same markets (ISIC 31, 32 for Kenya and Mauritius and South Africa, and 35 to 38 for South Africa). The larger bars represent China, while the darker smaller bars are the African countries. Note that gains in supply capacities are larger in China than in the African countries, although all the African countries have had relative improvements in their supply capacities. The exception is Kenya, a country that has a decline in the coefficient for manufacturing of chemicals (Sector 35).

Export Decomposition

To understand whether China's improvements in supply capacity can reduce the exports of the selected African countries, it is useful to separate the relative roles of supply capacity and demand conditions in determining total exports. Let lowercase Roman letters denote the estimated coefficients from Equation (14), then the empirical counterpart of Equation (9) is:

$$v_{it} = e^{(\exp_{it})} ma_{it} \qquad (9')$$

And the market access (from Equation 7) is given by:

$$ma_{it} = \sum_j e^{(imp_{jt})} \mathrm{t}_{\mathrm{ijt}} \quad \text{where } t_{ijt} = (\mathrm{DIST}^{b_1} e^{b_2 BORD + b_3 LANG + b_4 FTA})_{ijt} \qquad (7`)$$

where b_4 represents all the coefficients on FTAs. Equation (9') offers a direct decomposition of total exports. However, it has the disadvantage that it is not exact: the product of the estimated supply capacity

and market conditions will not be equal to the observed trade flows[3]. The consequence is that it becomes difficult to evaluate gains in supply capacity (or market conditions) relative to changes in actual export values. There are several ways of getting an exact decomposition. For example, Redding and Venables (2003) employ a system of equations in which supply and market coefficients are determined using estimated trade costs and are constrained to match observed imports and exports. The disadvantage is that it does not use the estimated supply and market coefficients, which are the main objects of interest in the present case.

Hanson and Robertson (2006) use another decomposition, expressing an equation like (14) as the product of the exponentials of the constant, exporter and importer dummies, trade cost, and residuals. The problem with decomposing changes in expressions that are multiplicative is that the decompositions are not unique. Hanson and Robertson deal with this by averaging all the possible combinations of the factors making up the gravity equation.

This paper takes a middle ground and decomposes the exports of the selected countries by first obtaining the exact export value based on estimated parameters (including the constant term b_o) and residuals by calculating:

$$v_{it} = e^{(b_{0t})} e^{(\exp_{it})} ma_{it} \qquad (9'')$$

with market access given by:

$$ma_{it} = \sum_j e^{(imp_{jt})} t_{ijt} e^{(\hat{\varepsilon}_{ijt})} \qquad (7'')$$

[3] In the present case, the differences are sizeable resulting in changes through time, opposite to the observed ones This problem would be solved by considering the constant terms and residuals, as explained below.

Notice that the information on trade costs and residuals should be extracted from $ma_{it.}$ This is done by decomposing (7'') in the following way:

$$ma_{it} = \left[\frac{\sum_j e^{(imp_{jt})} t_{ijt} e^{(\hat{\varepsilon}_{ijt})}}{\sum_j e^{(imp_{jt})} t_{ijt}} \right] \left[\frac{\sum_j e^{(imp_{jt})} t_{ijt}}{\sum_j e^{(imp_{jt})}} \right] \left[\sum_j e^{(imp_{jt})} \right] \quad (15)$$

The first bracketed term on the right hand side of (15) gives an approximation of the contribution of the sum of residuals for the constructed market access. The second term approximates the effects of trade costs. The accuracy of the approximation of residuals and trade costs will depend on the numerical values involved. One could also treat both terms as an aggregate of trade cost and residuals; it is not critical here. More important for the purpose of this paper, is the last term, which isolates the sum of market capacities facing exporter *i*. Substituting 15 into 9'' and taking logs yields:

$$\ln(v_{it}) = b_{ot} + \exp_{it} + \ln(ma^*_{it}) + \ln(t_{it}) + \ln(R_{it}) \quad (16)$$

where *ma** denotes market conditions purged from trade costs (*t*) and residual noise (*R*).

Table 2 shows the results of implementing Equation 16 using the estimates of Equation 14. It reports changes in individual components between 1995 and 2000, 2000 and 2004, and 1995 and 2004 using:

$$\Delta \ln(v_i) = \Delta b_o + \Delta \exp_i + \Delta \ln(ma^*_i) + \Delta \ln(t_t) + \Delta \ln(R_t) \quad (17)$$

where $\Delta N = N_{t+s} - N_t$. The changes given by Equation 17 are interpreted as percentage changes, (relative to the initial period) of the variable in levels.

Consider the case of Kenya as reported in the upper panel of table 2. In sector 31 (food), the last column ($\Delta \ln(v_i)$) indicates that exports declined by 19 percent during 1995-2000 (first row) and increased by 46 percent during 2000-2004 (second row). The net result is an increase of 27 percent for 1995-2004 (third row). Starting from the left hand side of the table, the column labeled "Δb_o" indicates changes in the constant of Equation 14, or changes in a country's level of trade due to changes in average US. trade. For Kenya, changes in average trade levels negatively affected food manufactured exports during 1995-2000 (by -53 percent), and positively during 2000-2004 (by 34 percent).

The next column in Table 5 shows the changes in supply capacity ($\Delta \exp_i$). During 1995-2004, Kenya increased its supply capacity in Sector 31 (food) by 129 percent. Out of this total, 87 percent was during 2000-2004, and the rest in the earlier period. The next column reveals that market access $\Delta \ln(ma^*_i)$ for Kenyan foods has worsened throughout the decade, although the effects are stronger in the period 1995-2000. Trade costs (t) had a negative contribution to Kenyan food exports during 2000-2004 (of - 30 percent). The last term is the contribution of the residuals, summed across partners, which takes into account a myriad of unobserved aspects. Their contribution is negative in the Kenyan case.

Four general patterns are identified in Table 2. First, the only exports that have not grown between 1995 and 2004 are Kenya's and Mauritius' textiles (sector 32); most of the decline was during 2000-2004. Second, in most cases, supply capacity changes have contributed positively to export growth. Again, the main exceptions are the textile sectors in both Kenya and Mauritius, and most of the fall is explained by the change in 2000-2004. This behavior in the supply and exports of the textile sector likely captures the elimination of quotas under ATC. Third, demand conditions have deteriorated for all the products. Except for sector 35 (manufactures of chemicals), the effect is more pronounced in 1995-2000 than in 2000-2004. Possible explanations of the negative evolution of the demand component are related to the Asian Financial Crisis in 1997, the slowdown of the US economy in the early 2000s (see Hanson

and Robertson (2006) for a discussion in the Latin American context) and China's export growth, an issue that we explore in detail below. In general, trade costs seem to be more favorable during 2000-2004 than before, with the exceptions of food (sector 31) and chemicals (sector 35). This probably reflects the implementation of the AGOA and EBA preference schemes in 2000 and 2001. Notice that demand and trade cost components are remarkably homogeneous across the three countries.

China and the exports of Kenya, Mauritius, and South Africa

The task now is to determine whether China's gains in the market shares of individual sectors bear any relationship to the deterioration of the market access conditions experienced by the African countries. To assess the responsiveness of the selected countries' exports to market access, export behavior is modeled as a function of the exporters' relative prices, foreign market access, and previous exports[4]. The measure of market access is *ma**, as discussed in the first part of this section. The inclusion of previous exports allows for partial adjustments due to, for example, past established trade connections, trade agreements, or delays arising from contracts and delivery lags.

With regard to relative prices, most studies use relevant price indices or unit prices as surrogates. In our case, the coefficients on exporters' fixed effects – or supply capacities (*s*) - are also useful in constructing a measure of relative prices. This is done by dividing the supply capacity of *each* focus country by the average supply capacity of all the other countries, using export values as weights. Recall from the decomposition in (9) that exports and supply capacity *s* are directly proportional. This is because *s* increases when either the number of varieties (*n*) increases, or the export price (*p*) decreases (see expression 6). In the case of an export function, we would expect a negative relationship between

[4] Redding and Venables (2003) derive an expression for the determinants of exports consistent with general equilibrium in their basic model. This explains exports as a function of country size, institutional costs, internal geography costs, and the estimated market access coefficients. The interest here is only on the selected African countries; hence, variation in the proxies for geographical and institutional characteristics costs is not likely to explain the differences in export behavior. The framework employed in this paper is somehow standard and has been used by Marquez and Mcneilly (1988), and Senhadji and Montenegro (1999), among others.

quantities exported and increases in prices relative to other exporters; thus, the inverse of the relative supply capacity is used in the estimation. Formally, the relative export price of each country *i* and product at time *t* (P_{it}) is given by:

$$P_{it} = \left(\frac{s_{it}}{\sum_j (s_{jt} * (V_{jt} / \sum_j V_{jt}))} \right)^{-1}$$

where $s_{it} = e^{(\exp_{it})}$. Using the same notation as before, and adding exporter fixed effects (D_i,) for capturing unobserved heterogeneity across the exporters, the export equation to be estimated (sector by sector) is:

$$\ln(V_{it}) = \alpha_o + \alpha_1 \ln(ma^*_{it}) + \alpha_2 \ln(P_{it}) + \alpha_3 \ln(V_{it-1}) + \delta_i D_i + \mu_{it} \qquad (18)$$

Where μ_{it} is an stochastic error term assumed to be normally distributed, homokedastic and uncorrelated across time and countries.

The results for estimating Equation 18 using OLS are shown in Table A.2, in the Appendix. The logarithmic specification of (18) allows us to interpret the parameter estimates as elasticities. As expected, the coefficient on relative prices is negative, although for most products this is not statistically significant. Market access is positive and significant in textiles (sector 32), negative and significant in chemicals (sector 35), and statistically zero in the rest of the sectors.

Recall that the effects of China are measured by estimating how much larger the market conditions faced by an exporter would have been if China's supply capacity had not grown at the pace it did. To obtain an estimate of China's net effect on the market access conditions faced by the exporters, note that the individual components of market capacities *m* (i.e. expenditure and price index) are not

observable. However, assuming that expenditures (E_{jt}) would have been the same whether China's supply capacity improved or not, an estimated effect of changes in *m* is obtained by taking the ratio of Equations 11 to 10, getting:

$$\Omega_{j0} = \frac{m_{jt}^{0}}{m_{jt}} = \frac{SA_{jt}}{SA_{jt}^{0}} \tag{19}$$

Equation (19) is a measure of how much larger market conditions would have been if China's growth had stagnated at a *t=0* level. By canceling the expenditure terms, the changes in market conditions are a function now of the supply access coefficients defined in (7), whose empirical counterpart is:

$$sa_{jt} = \sum_{i} e^{(\exp_{it})}(t)_{ijt} \text{ where } t_{ijt} = (\text{DIST}^{b_1} e^{b_2 BORD + b_3 LANG + b_4 FTA})_{ijt} \tag{7''}$$

And the empirical counterpart of 19 is given by::

$$\omega_{jo} = \frac{sa_{jt}}{sa_{j\neq chn,t} + e^{(\exp_{chn,0})}(t)_{j,chn,t}} \tag{19'}$$

where China's supply capacity coefficient is fixed at 1995 levels in the denominator. Figure 2 shows the evolution of ω_{jo}, averaged over all the countries *j*, for the different ISIC categories. The vertical axis in Figure 2 indicates the percentage by which actual average market conditions differ from the hypothetical market conditions in which China did not grow. For instance, in the ISIC 32 (textiles), if China had not grown since 1995, by year 2004 the average market capacity of the countries included in the regressions would have been over 30 percent larger. For other sectors relevant to the African countries, the effect is between 5 and 10 percent. The effects are lowest in Sector 31(food manufacturing).

The combination of market capacities, adjusted by ω_{jo} [5], with the market access elasticities estimated using (19), approximates the effect of China on the exports of the selected countries. The estimated adjusted market access faced by country i (m_{it}^0) is simply the sum of each exporter market capacity market capacities times the corresponding China effect, ω_{jo} :

$$ma_{it}^0 = \sum_j e^{(\hat{m}_{jt})} \omega_{j0}(t)_{ijt} \qquad (20)$$

The first three columns of Table 3 show the actual and simulated market access in 2004 for each country and the selected sectors, as well as the difference between these two terms in proportional terms. Multiplying this proportional changes by the long run market access elasticities[6] (fourth column) gives an estimate of how much higher the exports would have been if China had not evolved in the way it did. In the food sector (ISIC 31), the results are small, less than 1.5 percentage points on average. In the ISIC 32 (textiles), China's improvements in supply capacity implied considerably restricted market access for the African exporters. For instance, if China had maintained its supply capacity at 1995 levels during the decade 1995-2004, market access for Kenyan textiles would have been 33 percent higher. With an elasticity that is relatively high (and statistically significant), this results in counterfactual export values 22.63% percent higher than observed export values. In sector 38 (manufacturing of metals), the changes are also large. The changes in sectors 35 and 37 are negative due to the negative elasticities; however, these are not statistically different from zero.

[5] From Equation 19 these are $m_{jt}^0 = m_{jt} * \Omega_{j0}$

[6] $\eta = \alpha_1 / (1 - \alpha_3)$ using the notation of Equation 19. See Table A.2 in the Appendix for values of individual coefficients.

Price effects of China on Kenya, Mauritius and South Africa

The information produced by the gravity model is also useful for investigating the effects of China's supply capacity growth on the prices paid for imported goods in Kenya, Mauritius and South Africa. In light of the market access results discussed above, we should expect that the African countries have benefited from Chinese cheaper imports just as most countries in the sample. Instead of looking at market conditions, the focus is now on supply access. For each sector *w*, supply access is defined in Expression (7) as $SA_j = \sum_{i \neq j} (T_{ij})^{1-\sigma} s_i$. This measure summarizes for each importing country *j* (i.e. Kenya, Mauritius and South Africa) the changes in the supply conditions in all its partners (s_i). To reiterate, $s_i \equiv n_i p^{1-\sigma_i}$. In words, s_i is a function of the prices at which *i* exports (p_i) and the number of varieties produced in each of *i*'s sector (n_i). Furthermore, as evidenced in Equation 10, the supply access coefficients are closely related to the CES price index implied by the CES utility maximization framework. The specific relationship is $G_j^{1-\sigma} = SA_j$, thus with σ greater than one, a decrease in the price at which *j* imports from *i* (p_j) would lower *j*'s CES price index G_j, driving up the supply access coefficient. The same effects are triggered by either a reduction in trade costs, or an increase in the number of varieties.

As before, the effect of China is assessed by comparing the supply access of each country in 2004 with a counterfactual value that assumes that China's supply capacity did not grow from its 1995 levels. Labeling these supply access SA_{wjt} and SA_{wjt}^0 respectively, the interest is on the percentage change $(SA_{wjt} - SA_{wjt}^0)/SA_{wjt}^0$. The results are shown in the first column of table 4; they indicate how much larger are the supply access coefficients in each selected country due to China's export growth. To illustrate, Kenya's supply access in the textile sector is 47% larger that it would had been if China had not grown the way it did. Percentage changes in *market access* are given in the following column; these are the same

discussed before, when examining China's effects on the selected countries exports. Comparisons of these two columns give an idea of which CES price indexes have fallen more during the last decade as a consequence of China's growth. For example, in Kenya, the price of imported textiles (ISIC 32) fell by 47.43% while the price of exports fell by 38.75%. A similar situation applies for other manufactures. Mauritius has seen reductions in the price of imports (relative to exports) in Wood and Wood products (ISIC 33) and non-metallic mineral products, while in the rest of the sectors export prices fell more than imports. Lastly, South Africa, has experienced greater reductions on its export prices than on its import prices.

Setting the CES price index in 1995 to one, would imply that, for Kenya, the textiles' (ISIC 32) CES price index in 2004 is just 0.53. This is shown in the third column of table 4, labeled "Import Price in 2004 (1995=1)". Likewise, the column "Export Price in 2004 (1995=1)" is one minus the proportional change in the market access (or CES price index) facing the selected countries. While the pair wise comparison of export and import prices is informative, it would be desirable to have a summary measure of whether the fall in import prices could somehow compensate for the loss of export value. The procedure used here involves weighting the import (export) prices by the corresponding import (export) values, shown in the two following columns of Table 4 show, for year 1995. The summary measure of choice is a Laspeyre's price index, whereby quantities are held constant and prices are allowed to vary. Formally, let P_m be the import price index (or P_x the export price index) of country j, then:

$$P_m = \frac{\sum_w (p_{w,2004} \times Q_{w,1995})}{\sum_w (p_{w,1995} \times Q_{w,1995})} = \frac{\sum_w (V_{w,1995} \times p_{w,1995})}{\sum_w (V_{w,1995})}$$

Where w indexes sectors, p is either an import or export price (just as shown in table 4), Q is the quantity of exports and V is the value of exports. Notice that the index is based on 1995's imports (export) values

and by normalizing prices to one in the base period, initial values are equivalent to quantities. The estimates of P_m and P_x, and their ratio (terms-of-trade) are shown in the last three columns of Table 4. The general pattern that emerges is that both export and import price indexes have fallen, however, using trade values as weights, export prices have fallen more than import prices resulting in a Terms of Trade deterioration of these countries.

As mentioned in Section 2, we considered only positive exports. Part of the reason is that the gravity equation does not predict zero trade flows[7]. Yet, in reality, most countries do not trade with each other. For example, in the textiles sector (ISIC 32), COMTRADE reports the imports of 75 Countries from 173 Exporters in year 1995. Assuming that the importers are a subset of the exporters, this implies that there are 12,900 (i.e. 75*173 – 75) possible mutual trade flows. However, only 4,949 of these trade flows actually occur. To deal with this problem, we follow standard practice and use a Tobit estimator[8]. For ease of comparison, we present the changes in terms of trade derived from the Tobit estimation in the last column of Table 4. As it can be seen, the results are similar to those of the OLS estimation considering only positive trade flows.

6. Conclusions

This paper considered the issue of export rivalry between China and Africa in third markets for manufactures. A first step of the analysis was to compare the export structure of the focus countries in terms of products and markets. Next, the gravity model of trade was used for decomposing export growth of China, Kenya, Mauritius and South Africa in supply and demand capacities. The effect of China's export growth on the focus countries was assessed by using counterfactual calculations in which China

[7] More practically, the logarithm of zero does not exist then estimation of Equation 14 is not feasible whne trade flows equal zero.

[8] Indeed, this is the preferred econometric specification of Redding and Venables (2004).

supply capacity was assumed to stagnate at 1995 levels. This method gives an estimate of the price effects associated with China's exports. Finally, the information on prices was used to estimate manufacturing terms of trade.

The comparison of export structures showed that China and the focus countries have a considerable overlapping in their export structure, both in terms of products and destination markets. Textile and apparel (ISIC 32), manufactures of chemicals (ISIC 35) and manufactures of fabricated metals (ISIC 37) account for 80% of China's exports. These products are more than 60% of Kenya's and Mauritius's exports, and almost a third of South African exports. For textiles and apparel, and for manufactures of fabricated metals, the main export markets are High Income countries.

During 1995-2004, the focus African countries have managed to increase their exports in almost all the manufactures sectors mentioned in the preceding paragraph. The exception is the textile sector where both Kenya and Mauritius have seen declines of 22% and 12% respectively. Interestingly, in South Africa has been the sector with slowest growth (12%). The econometric decomposition of export growth in supply, demand and trade cost reveals that the demand conditions facing the focus countries deteriorated during the period 1995-2004.

An additional insight from the export decomposition is that supply capacity has generally improved and that trade costs have evolved favorably, specially, during the period 200-2004, likely reflecting preferential agreements such as AGOA and EBA. In the case of textiles and apparel export decline is explained by demand conditions deteriorating at a faster rate that improvements in supply capacity or reductions in trade costs. Moreover, trade costs are more important than changes in supply capacity in counteracting the contraction of demand conditions. It reinforces the notion that African competitiveness in industries such as textiles depend to a great extent on unilateral preferences granted by rich countries. The results show that as the multilateral system evolves and trade reforms materialize, African countries may lose their competitiveness to more efficient suppliers such as China.

Third, only the textiles and apparel sector are adversely affected by China's improvements in supply capacity. To be sure, China has an important effect on reducing the market access conditions for other exporters in industries such as chemicals (sector 35), basic metals (sector 37) and metal products (sector 38). However, African exports in these sectors do not seem responsive to changes in market access. The counterfactual simulations indicate that had China's supply capacity not grown at the pace it did, textile exports in Kenya, Mauritius, and South Africa would have been around 23 percent higher. An important factor when analyzing the textile sector is the elimination of quotas under the ATC. Although the paper did not address this directly, in the absence of quotas it would be expected that there would be even larger reductions in the market access facing the selected countries. Indeed, the negative supply shocks in the textile sectors of Kenya and Mauritius are likely a consequence of greater competition as the ATC quotas came to an end.

Fourth, in the discussions about the effects of China's growth on Africa, it is often mentioned that African countries can benefit from cheaper manufactures. The econometric evidence of this paper sustains that claim: China's export growth has contributed to lower prices for African imports. However, for the focus countries, the manufacturing terms of trade effects associated with China's growth are unfavorable.

Finally, the framework employed did not take into account developments in commodity markets or natural resources. There is evidence that the effects of China on those markets are opposite to those in manufacturing. That is, China has improved the prices of commodities and boosted exports in several African countries (Goldstein, et al., 2005). The partial equilibrium nature of this work does not take into account these effects; however, the declines in supply capacity in countries such as South Africa and Kenya might be signaling some sort of reallocation of resources to the primary sectors in an effort to take advantage of booming commodity markets.

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Table 1. Export structure and of China, Kenya, Mauritius, and South Africa, by ISIC sector and destination market in the year 2004.

	Sectorial Exports as a % of Total Exports (columns add to 100%)				% of Exports in each Sector going to High Income Countries*				Difference between global market share in 1995 and 2004, by Sector.			
ISIC	China	Kenya	Mauritius	S. Africa	China	Kenya	Mauritius	S. Africa	China	Kenya	Mauritius	S. Africa
31 Food, Beverages and Tobacco	1.5	9.8	26.3	3.8	89.8	76.3	96.1	77.1	0.26	0.00	-0.06	0.07
32 Textile, Wearing Apparel and Leather	18.5	13.8	54.1	3.2	91.5	91.4	96.5	88.2	3.91	0.02	-0.03	0.06
33 Wood and Wood Products, Including Furniture	3.4	0.3	0.1	1.6	95.4	51.2	60.5	93.9	5.64	-0.01	0.00	0.06
34 Paper and Paper products, Printing and Publishing	1.0	1.4	1.3	1.8	90.9	15.1	16.9	50.4	1.33	0.00	0.00	-0.01
35 Chemicals and Chemical, Petroleum, Coal, Rubber and Plastic	8.1	14.4	2.2	7.5	79.3	4.8	49.9	50.3	0.45	0.00	0.00	0.01
36 Non-metalic Mineral Products, except Products of petroleum and Coal	1.6	1.7	0.1	0.5	83.9	31.6	65.8	71.5	3.30	-0.03	0.00	0.04
37 Basic metal industries	2.7	2.5	0.2	32.7	74.8	3.8	43.4	68.8	0.95	-0.01	0.00	0.57
38 Fabricated Metal Products, Machinery and Equipment	52.6	4.3	6.0	15.4	84.9	21.8	78.0	77.0	3.57	0.00	0.00	0.05
39 Other Manufactures	7.7	0.7	6.7	12.5	93.6	71.6	98.8	92.3	4.24	0.00	-0.01	1.14
Non-Manufacturing Exports (Only merchandise)	2.9	51.1	2.9	20.9	78.1	78.2	77.0	78.2	-	-	-	-

* OECD and non-OECD

Source: Author's elaboration using COMTRADE

Table 2. Decomposition of changes in export values in supply capacity, market access, and other components during 1995-2004 (Results are percentage changes when multiplied by 100)

Partner	ISIC	Period	$\Delta \ln(v_i)$	Δb_o	$\Delta \exp_i$	$\Delta \ln(ma^*_i)$	$\Delta \ln(t_t)$	$\Delta \ln(R)$
Kenya	31	1995-2000	-0.19	-0.53	0.42	-0.55	0.65	-0.18
		2000-2004	0.46	0.34	0.87	-0.08	-0.30	-0.37
		1995-2004	0.27	-0.19	1.29	-0.63	0.35	-0.55
	32	1995-2000	-0.59	-0.06	-0.43	-0.28	-0.12	0.30
		2000-2004	0.37	-1.13	0.50	0.08	0.80	0.12
		1995-2004	-0.22	-1.20	0.06	-0.20	0.69	0.42
	35	1995-2000	-0.26	-0.78	-0.33	-0.24	1.11	-0.02
		2000-2004	1.50	1.12	0.21	-0.40	-0.19	0.77
		1995-2004	1.24	0.34	-0.13	-0.64	0.92	0.75
	38	1995-2000	-0.67	0.77	-0.52	-0.42	-0.32	-0.18
		2000-2004	0.68	-0.55	0.74	0.29	0.23	-0.03
		1995-2004	0.01	0.22	0.22	-0.12	-0.09	-0.21
Mauritius	31	1995-2000	-0.59	-0.53	0.67	-0.54	0.73	-0.92
		2000-2004	0.50	0.34	0.13	-0.07	-0.25	0.35
		1995-2004	-0.09	-0.19	0.81	-0.62	0.48	-0.57
	32	1995-2000	0.00	-0.06	0.55	-0.29	-0.11	-0.08
		2000-2004	-0.12	-1.13	-0.04	0.05	0.83	0.17
		1995-2004	-0.12	-1.20	0.51	-0.24	0.72	0.09
	35	1995-2000	0.81	-0.78	0.58	-0.24	1.07	0.18
		2000-2004	0.47	1.12	0.19	-0.31	-0.30	-0.23
		1995-2004	1.28	0.34	0.77	-0.55	0.77	-0.05
	38	1995-2000	0.19	0.77	0.00	-0.41	-0.25	0.07
		2000-2004	0.38	-0.55	0.75	0.28	0.24	-0.34
		1995-2004	0.57	0.22	0.75	-0.13	0.00	-0.27
South Africa	31	1995-2000	0.07	-0.53	0.64	-0.51	0.68	-0.19
		2000-2004	0.38	0.34	0.63	-0.08	-0.37	-0.14
		1995-2004	0.46	-0.19	1.26	-0.59	0.31	-0.34
	32	1995-2000	0.13	-0.06	0.45	-0.27	-0.12	0.14
		2000-2004	-0.01	-1.13	0.16	0.08	0.81	0.07
		1995-2004	0.12	-1.20	0.61	-0.19	0.69	0.22
	35	1995-2000	0.04	-0.78	0.33	-0.17	0.97	-0.31
		2000-2004	0.52	1.12	-0.11	-0.25	-0.51	0.27
		1995-2004	0.56	0.34	0.22	-0.42	0.46	-0.04
	37	1995-2000	0.34	-0.10	-0.03	-0.54	0.31	0.70
		2000-2004	0.35	0.76	0.74	0.30	-1.02	-0.44
		1995-2004	0.69	0.67	0.71	-0.24	-0.71	0.26
	38	1995-2000	0.81	0.77	0.62	-0.36	-0.29	0.06
		2000-2004	0.64	-0.55	0.41	0.33	0.16	0.30
		1995-2004	1.45	0.22	1.03	-0.03	-0.13	0.36

Sectors: 31 Manufacture of Food, Beverages and Tobacco; 32 Textile, Wearing Apparel and Leather Industries; 35 Manufacture of Chemicals and Chemical, Petroleum, Coal, Rubber and Plastic Products; 37 Basic Metal Industries; 38 Manufacture of Fabricated Metal Products, Machinery and Equipment; 39 Other Manufacturing Industries.

Source: Author's elaboration based on Regression Output

Table 3. Effects of China on market access conditions and counterfactual trade values (in year 2004) using market access elasticities.

Sector	Country	Actual Market Access (in 2004)	Counterfactual Market Access (in 2004)	Proportion of Counterfactual Market Access over Actual market Access	Market Access Elasticities (η)	Percentage of Additional Exports
31	Kenya	2.04	2.13	0.05	0.36	1.60
	Mauritius	2.15	2.24	0.04	0.36	1.59
	South Africa	2.72	2.87	0.06	0.36	1.98
32	Kenya	1.04	1.45	0.39	0.68	26.83
	Mauritius	1.02	1.43	0.41	0.68	27.86
	South Africa	1.11	1.54	0.38	0.68	25.94
35	Kenya	0.91	1.01	0.12	-0.62	-7.29
	Mauritius	0.99	1.14	0.15	-0.62	-9.15
	South Africa	2.19	2.43	0.11	-0.62	-6.73
37	Kenya	0.80	1.02	0.28	-0.43	-12.13
	Mauritius	0.37	0.44	0.18	-0.43	-7.60
	South Africa	2.97	3.56	0.20	-0.43	-8.44
38	Kenya	3.50	3.98	0.14	1.92	26.79
	Mauritius	3.87	4.38	0.13	1.92	25.34
	South Africa	4.98	5.64	0.13	1.92	25.25

Sectors: 31 Manufacture of Food, Beverages and Tobacco; 32 Textile, Wearing Apparel and Leather Industries; 35 Manufacture of Chemicals and Chemical, Petroleum, Coal, Rubber and Plastic Products; 37 Basic Metal Industries; 38 Manufacture of Fabricated Metal Products, Machinery and Equipment;

Source: Author's elaboration based on Regression Output

Reading from left to right, the column "Market Access" shows the trade-cost weighted-sum of market conditions facing the focus countries (Equation 7'' in the text). Next, the Counterfactual Market Access corrects actual market access by holding China's export supply at 1995 levels (these are based in Equation 20 in the text). Next column is the proportion of counterfactual market access over actual market access, holding China's supply capacity at 1995 levels. For example, if China had not grown the way it did, market access conditions for textiles (ISIC 32) in Kenya, would have been 39% larger. Following are the Market Access Elasticities. These indicate the responsiveness of the focus countries' export supply to changes in Market Access. These are long-run elasticities obtained using $\eta = \alpha_1/(1-\alpha_3)$ in Equation 19. The last column shows the product of the market access elasticities times the proportional change in market access, this give how larger the exports of the focus countries had been if China had not grown the way it did.

Table 4. China's effect on Supply Access, Market Access and Terms of Trade of selected countries. Trade values are in US$ millions.

ISIC / Country	% Change in Supply Access	% Change in market Access	Import Price in 2004 (1995=1)	Export Price in 2004 (1995=1)	Exports 1995 ($ mill)	Imports 1995 ($ mill)	P_x (1995=1)	P_m (1995=1)	Terms of Trade
Kenya									
31	2.52	4.51	0.97	0.95	154.33	269.16	0.83	0.87	0.96
32	47.43	38.75	0.53	0.61	50.48	175.32			
33	35.82	37.13	0.64	0.63	13.17	9.35			Tobit
34	4.77	3.32	0.95	0.97	21.81	72.41			0.84
35	6.92	11.63	0.93	0.88	92.13	460.39			
36	29.37	27.78	0.71	0.72	57.57	28.89			
37	4.83	27.66	0.95	0.72	51.09	196.20			
38	13.65	13.91	0.86	0.86	87.07	1,151.28			
39	48.10	40.37	0.52	0.60	9.06	20.03			
Mauritius									
31	2.07	4.47	0.98	0.96	462.64	252.14	0.74	0.81	0.91
32	36.68	40.22	0.63	0.60	720.26	534.27			
33	29.20	7.34	0.71	0.93	0.68	33.80			Tobit
34	5.40	6.81	0.95	0.93	1.16	66.80			0.81
35	7.76	14.58	0.92	0.85	7.54	297.50			
36	28.82	10.67	0.71	0.89	0.06	74.65			
37	8.64	17.37	0.91	0.83	1.96	81.23			
38	13.69	13.15	0.86	0.87	45.46	510.72			
39	32.69	40.51	0.67	0.59	58.19	55.93			
South Africa									
31	1.64	5.56	0.98	0.94	984.28	1,328.15	0.82	0.87	0.94
32	36.01	37.47	0.64	0.63	498.00	1,262.90			
33	21.86	37.75	0.78	0.62	377.09	271.36			Tobit
34	4.42	13.17	0.96	0.87	622.75	810.90			0.91
35	7.30	10.73	0.93	0.89	1,361.38	4,245.64			
36	23.91	38.14	0.76	0.62	95.60	422.55			
37	5.79	19.16	0.94	0.81	5,781.63	767.81			
38	12.50	13.08	0.88	0.87	1,381.61	14,100.00			
39	32.61	41.22	0.67	0.59	226.76	623.76			

Sectors: 31 Manufacture of Food, Beverages and Tobacco; 32 Textile, Wearing Apparel and Leather Industries; 33 Manufacture of Wood and Wood Products, Including Furniture; 34 Manufacture of Paper and Paper Products, Printing and Publishing; 35 Manufacture of Chemicals and Chemical, Petroleum, Coal, Rubber and Plastic Products; 36 Manufacture of Non-Metallic Mineral Products, except Products of Petroleum and Coal; 37 Basic Metal Industries; 38 Manufacture of Fabricated Metal Products, Machinery and Equipment; 39 Other Manufacturing Industries.

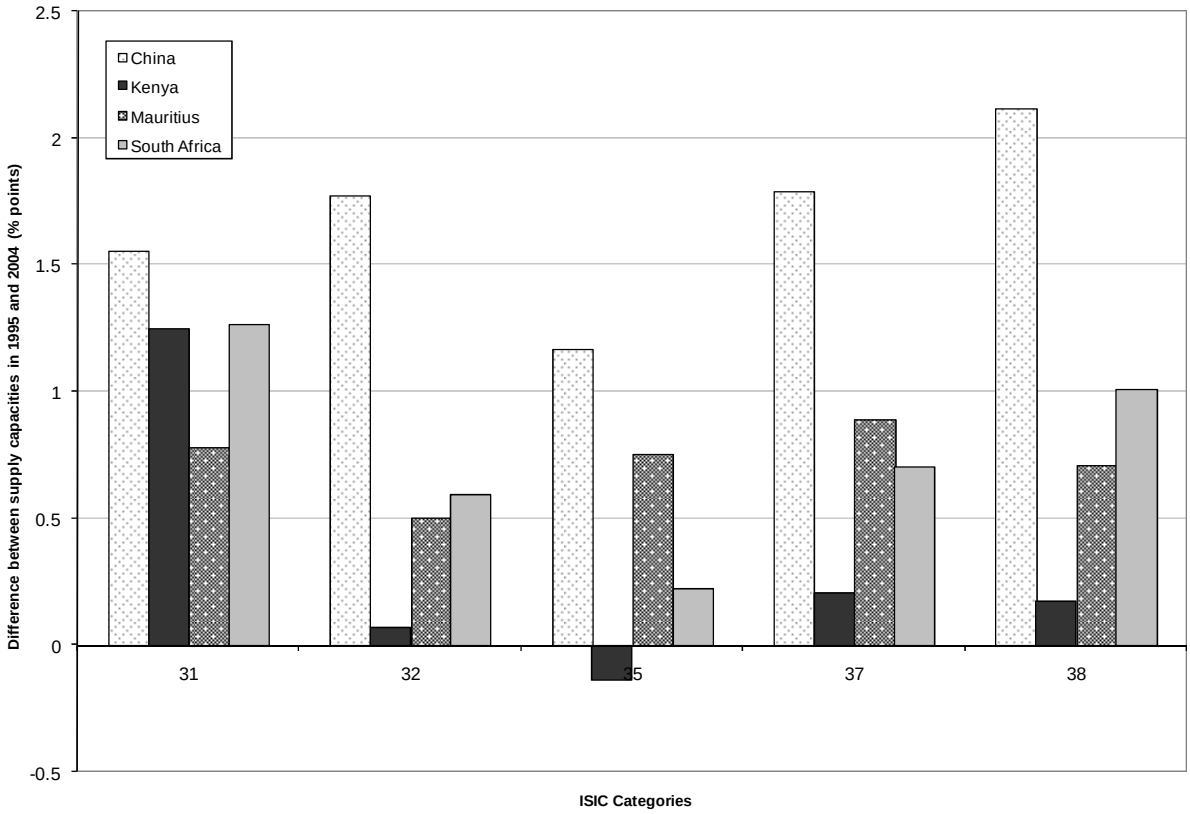
Source: Author's elaboration based on regression output

Reading from left to right, the first column indicates how much larger are the supply access coefficients in each selected country due to China's export growth, these are the import price effects. To illustrate, Kenya's supply access in the textile sector is 47% larger that it would had been if China had not grown the way it did; in other words, prices of textiles (ISIC 32) are 47% lower. Percentage changes in market access are given in the following column; these are the changes in export prices (i.e in Kenya, the price of exports fell by 38.75%.) The third and fourth columns assume that import and export prices were one in 1995, and that changed by the amounts indicated in the previous two columns. Next are export and import values in 1995. These values and the prices are used to construct P_x and P_m (export and import price indexes), using a Laspeyre's price index, whereby quantities are held constant and prices are allowed to vary. Formally, let Pm be the import price index (or Px the export price index) of country j, then:

$$P_m = \frac{\sum_w (p_{w,2004} \times Q_{w,1995})}{\sum_w (p_{w,1995} \times Q_{w,1995})} = \frac{\sum_w (V_{w,1995} \times p_{w,1995})}{\sum_w (V_{w,1995})}$$

Where w indexes sectors, p is either an import or export price (just as shown in table 4), Q is the quantity of exports and V is the value of exports. The ratio of Pm and Px, are the terms of trade are shown in the last column. As indicated in the text, the last column also shows the terms-of-trade obtained by using the Tobit estimator that take into account zero trade flows.

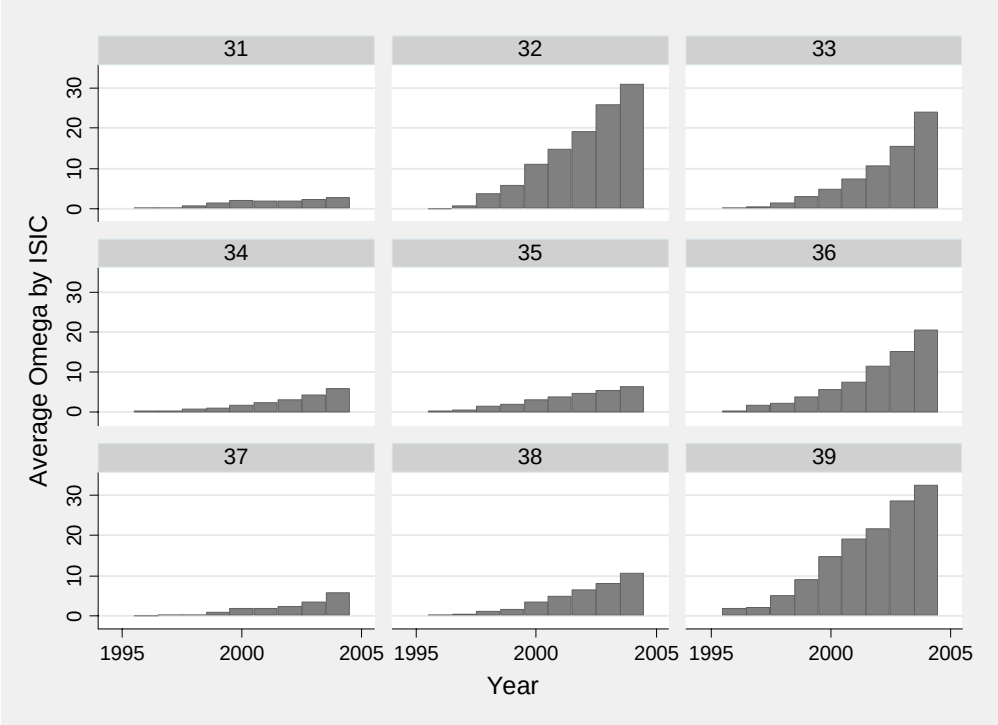
Figure 1. Change in Supply Capacities from 1995 to 2004, by sector.



Sectors: 31 Manufacture of Food, Beverages and Tobacco; 32 Textile, Wearing Apparel and Leather Industries; 35 Manufacture of Chemicals and Chemical, Petroleum, Coal, Rubber and Plastic Products; 37 Basic Metal Industries; 38 Manufacture of Fabricated Metal Products, Machinery and Equipment;

Source: Author's elaboration based on regression output

Figure 2. China effect on market access: Percentage by which actual average market conditions differ from hypothetical market conditions , by ISIC.



Sectors: 31 Manufacture of Food, Beverages and Tobacco; 32 Textile, Wearing Apparel and Leather Industries; 33 Manufacture of Wood and Wood Products, Including Furniture; 34 Manufacture of Paper and Paper Products, Printing and Publishing; 35 Manufacture of Chemicals and Chemical, Petroleum, Coal, Rubber and Plastic Products; 36 Manufacture of Non-Metallic Mineral Products, except Products of Petroleum and Coal; 37 Basic Metal Industries; 38 Manufacture of Fabricated Metal Products, Machinery and Equipment; 39 Other Manufacturing Industries.

Source: Author's elaboration based on regression output

Appendix

This Appendix provides a sample of the regression results. Additional results are available from the author upon request. Table A1 shows the coefficients for distance, border, and language along with their t-statistics, and the R-squared for the years 1995, 2000, and 2004. All the coefficients have the expected sign, are statistically different from zero, and as in most gravity equations, the R^2's are high. Table 2 shows the estimated coefficients of the export functions (Equation 19).

Figure 1 compares the distribution of supply capacity coefficients (exporter specific dummies) in 1995 and 2004 for each one of the nine ISIC sectors. Most of the coefficients are below zero, consistent with having them measured relative to the U.S., the reference group. Notice how in almost all the sectors, supply capacities have shifted to the right, suggesting an overall improvement relative to the U.S. This result is consistent with that obtained by Hanson and Robertson (2006), using a different product aggregation in an alternative gravity modeling setting. Likewise, Figure 2 shows the importer coefficients for each one of the eight sectors in 1995 and 2004. Most coefficients are below zero, indicating that most countries demand less than the U.S. For all the sectors, demand conditions have been stable relative to the US.

Table A.1. Regression Coefficients on Distance, Border, and Language (1995, 2000, 2004), by ISIC

1995	ISIC 31	ISIC 32	ISIC 33	ISIC 34	ISIC 35	ISIC 36	ISIC 37	ISIC 38	ISIC 39
Log Distance	-1.25	-1.33	-1.46	-1.68	-1.48	-1.50	-1.40	-1.24	-1.09
	(28.04)**	(29.02)**	(28.27)**	(28.44)**	(32.70)**	(29.14)**	(24.80)**	(29.95)**	(22.88)**
Border	0.65	0.71	0.87	0.48	0.71	0.79	0.40	0.93	0.32
	(4.56)**	(5.09)**	(6.06)**	(2.97)**	(5.19)**	(4.93)**	(2.97)**	(6.69)**	(1.87)
Language	0.74	0.70	0.77	1.23	0.67	0.79	0.65	0.86	0.84
	(8.00)**	(8.42)**	(7.71)**	(11.37)**	(7.49)**	(8.15)**	(5.55)**	(10.09)**	(8.58)**
Constant	25.95	27.84	26.72	29.14	29.26	27.05	26.88	28.01	25.34
	(54.90)**	(56.61)**	(50.64)**	(48.91)**	(63.28)**	(51.59)**	(46.10)**	(63.24)**	(50.57)**
Observations	4280.00	4949.00	3439.00	3355.00	4775.00	3342.00	3167.00	5619.00	3707.00
R-squared	0.68	0.76	0.72	0.77	0.76	0.74	0.72	0.81	0.77
2000	ISIC 31	ISIC 32	ISIC 33	ISIC 34	ISIC 35	ISIC 36	ISIC 37	ISIC 38	ISIC 39
Log Distance	-1.18	-1.34	-1.38	-1.59	-1.38	-1.42	-1.38	-1.26	-1.09
	(27.58)**	(29.06)**	(26.69)**	(28.60)**	(31.26)**	(28.38)**	(25.44)**	(32.65)**	(23.18)**
Border	0.65	0.54	0.62	0.39	0.69	0.74	0.40	0.54	0.20
	(4.52)**	(3.75)**	(4.58)**	(2.62)**	(5.12)**	(4.90)**	(3.03)**	(4.05)**	(1.25)
Language	0.65	0.67	0.88	1.20	0.83	0.78	0.75	0.88	1.03
	(7.37)**	(8.18)**	(9.14)**	(11.92)**	(9.95)**	(8.00)**	(7.17)**	(11.31)**	(10.73)**
Constant	25.42	27.76	26.42	28.24	28.49	26.54	26.86	28.79	25.20
	(57.01)**	(56.79)**	(51.28)**	(50.91)**	(63.49)**	(52.54)**	(48.04)**	(70.78)**	(50.99)**
Observations	4280.00	4949.00	3439.00	3355.00	4775.00	3342.00	3167.00	5619.00	3707.00
R-squared	0.70	0.78	0.74	0.78	0.78	0.76	0.74	0.83	0.78
2004	ISIC 31	ISIC 32	ISIC 33	ISIC 34	ISIC 35	ISIC 36	ISIC 37	ISIC 38	ISIC 39
Log Distance	-1.22	-1.25	-1.35	-1.52	-1.43	-1.35	-1.49	-1.24	-1.03
	(28.50)**	(27.64)**	(28.07)**	(27.54)**	(30.93)**	(27.14)**	(25.72)**	(31.83)**	(21.29)**
Border	0.72	0.64	0.68	0.39	0.71	0.93	0.36	0.61	0.48
	(5.62)**	(4.44)**	(4.81)**	(2.52)*	(4.85)**	(6.04)**	(2.84)**	(4.39)**	(2.80)**
Language	0.74	0.64	0.87	1.29	0.70	0.77	0.71	0.89	1.07
	(8.34)**	(7.40)**	(9.45)**	(12.45)**	(7.56)**	(7.94)**	(6.67)**	(11.45)**	(11.08)**
Constant	25.76	26.65	25.84	27.37	29.64	25.89	27.64	28.22	24.34
	(57.18)**	(54.20)**	(52.97)**	(49.15)**	(63.35)**	(51.25)**	(47.35)**	(68.19)**	(47.96)**
Observations	4280.00	4949.00	3439.00	3355.00	4775.00	3342.00	3167.00	5619.00	3707.00
R-squared	0.72	0.78	0.76	0.78	0.77	0.78	0.73	0.84	0.79

Notes: Results of Equation 14 in the text. Robust t statistics in parentheses. Regressand is natural log of real imports. Exporter, importer and FTA's fixed effects are omitted.
Robust t statistics in parentheses
* significant at 5%; ** significant at 1%
Sectors: 31 Manufacture of Food, Beverages and Tobacco; 32 Textile, Wearing Apparel and Leather Industries; 33 Manufacture of Wood and Wood Products, Including Furniture; 34 Manufacture of Paper and Paper Products, Printing and Publishing; 35 Manufacture of Chemicals and Chemical, Petroleum, Coal, Rubber and Plastic Products; 36 Manufacture of Non-Metallic Mineral Products, except Products of Petroleum and Coal; 37 Basic Metal Industries; 38 Manufacture of Fabricated Metal Products, Machinery and Equipment. 39 Other Manufacturing Industries.

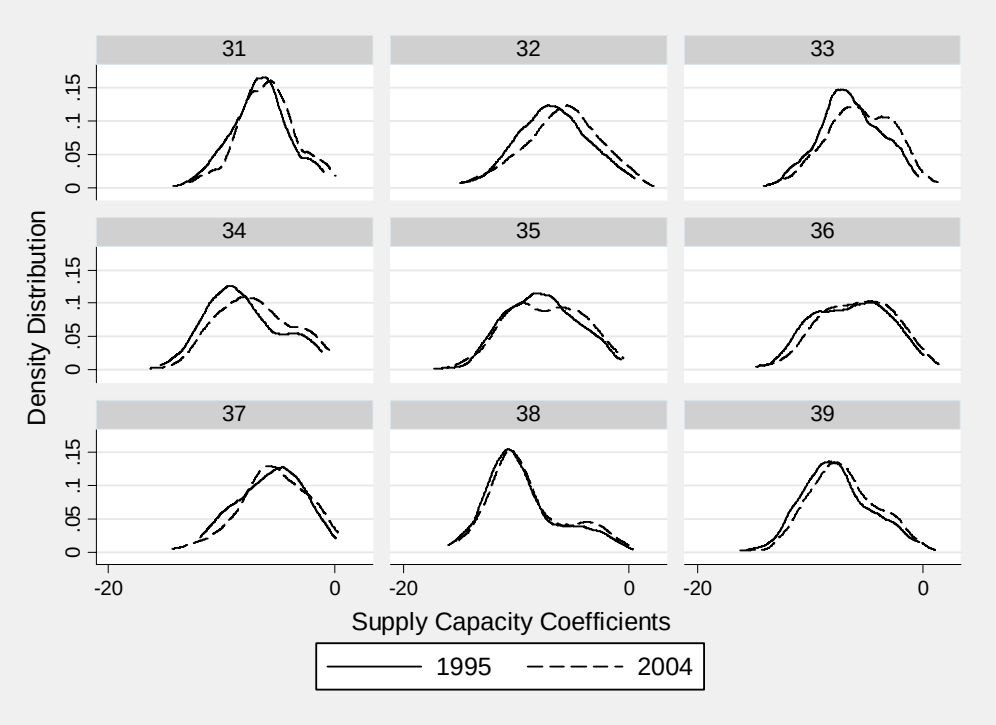
TableA.2. OLS Estimates of Export Equations.

	ISIC 31	ISIC 32	ISIC 35	ISIC 37	ISIC 38
Constant	7.735	7.941	13.090	8.875	5.111
	(3.80)**	(4.05)**	(3.93)**	(3.63)**	(1.95)
Market Access	0.202	0.488	-0.613	-0.252	0.572
	(1.13)	(2.50)*	(2.41)*	(0.74)	(1.22)
Relative Prices	-0.310	-0.081	-0.158	-0.590	-0.293
	(1.29)	(1.23)	(0.44)	(3.41)**	(1.59)
One year lagged exports	0.431	0.285	0.012	0.413	0.702
	(2.78)*	(1.75)	(0.05)	(2.55)*	(5.03)**
Fixed Effect: Mauritius	0.575	1.993	-1.987	-0.751	-0.163
	(3.54)**	(4.63)**	(2.38)*	(1.57)	(1.18)
Fixed Effect: South Africa	0.322	1.737	1.982	0.565	-0.364
	(0.48)	(4.54)**	(1.23)	(0.88)	(0.50)
Observations	27	27	27	27	27
R-squared	0.98	0.99	0.98	.99	0.99

Notes: Results of Equation 18 in the text. Robust t statistics in parentheses. Regressand is natural log of real exports.
Robust t statistics in parentheses.
* significant at 5%; ** significant at 1%

Sectors: 31 Manufacture of Food, Beverages and Tobacco; 32 Textile, Wearing Apparel and Leather Industries; 35 Manufacture of Chemicals and Chemical, Petroleum, Coal, Rubber and Plastic Products; 37 Basic Metal Industries; 38 Manufacture of Fabricated Metal Products, Machinery and Equipment;

Figure A.1. Supply Coefficients by sector in 1995 and 2004

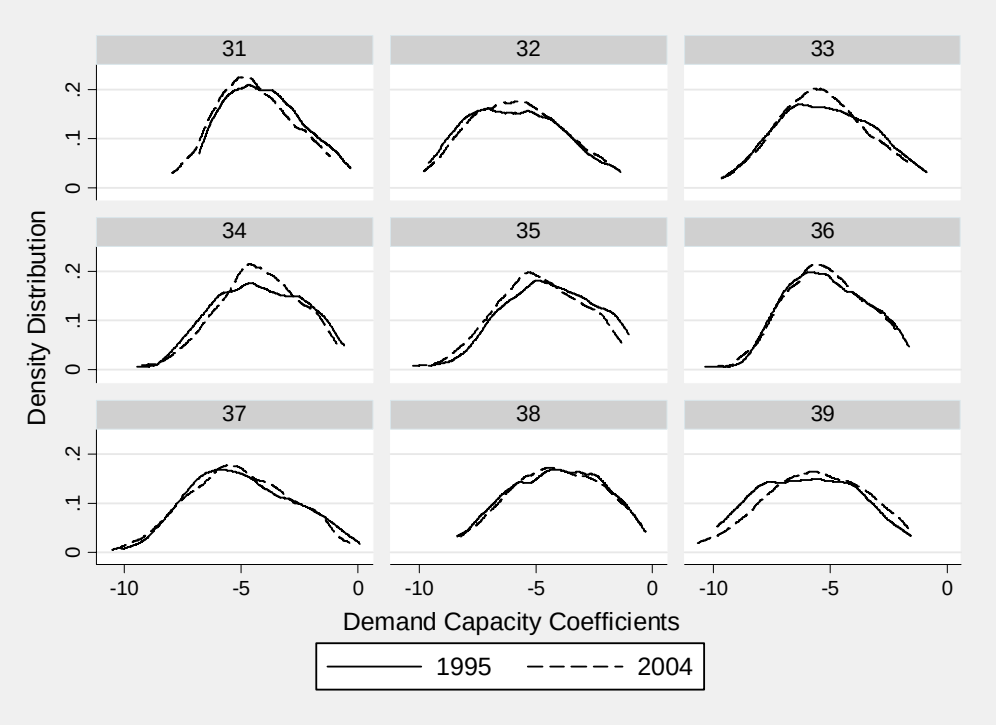


Sectors: 31 Manufacture of Food, Beverages and Tobacco; 32 Textile, Wearing Apparel and Leather Industries; 33 Manufacture of Wood and Wood Products, Including Furniture; 34 Manufacture of Paper and Paper Products, Printing and Publishing; 35 Manufacture of Chemicals and Chemical, Petroleum, Coal, Rubber and Plastic Products; 36 Manufacture of Non-Metallic Mineral Products, except Products of Petroleum and Coal; 37 Basic Metal Industries; 38 Manufacture of Fabricated Metal Products, Machinery and Equipment . 39 Other Manufacturing Industries.

This figure shows the distribution of exporter fixed effects (Supply Capacity Coefficients) from Equation 14 for the years 1995 and 2004. Notice that most supply coefficients are negative. Because the omitted category in estimating Equation 14 is the US, negative supply coefficients mean that the supply capacity of most countries is below the US supply capacity. Notice how the distribution in almost all the sectors have shifted to the right in the period considered, suggesting that most countries have caught up to some extent with the US supply capacity.

Source: Author's elaboration based on regression output

Figure A.2. Demand Coefficients by sector in 1995 and 2004



Sectors: 31 Manufacture of Food, Beverages and Tobacco; 32 Textile, Wearing Apparel and Leather Industries; 33 Manufacture of Wood and Wood Products, Including Furniture; 34 Manufacture of Paper and Paper Products, Printing and Publishing; 35 Manufacture of Chemicals and Chemical, Petroleum, Coal, Rubber and Plastic Products; 36 Manufacture of Non-Metallic Mineral Products, except Products of Petroleum and Coal; 37 Basic Metal Industries; 38 Manufacture of Fabricated Metal Products, Machinery and Equipment . 39 Other Manufacturing Industries.

This figure shows the distribution of importer fixed effects (Demand Capacity Coefficients) from Equation 14 for the years 1995 and 2004. Notice that most demand capacity coefficients are negative. Because the omitted category in estimating Equation 14 is the US, negative coefficients mean that they are below the US demand capacity.

Source: Author's elaboration based on regression output