China's Exports and Their Effects on the Intensive Margin and the Extensive Margin of its Competitors: The Case of Exports in Electronic Products

Mary E. Lovely §
Cong S. Pham †

This version: November 2015

Abstract This paper empirically looks into the effects of Chinese exports in electronic products on the intensive and extensive margins of its main competitors for the 1992-2011 period. Using China's GDP and China's bilateral distance as instruments for China's bilateral exports we find significant and robust evidence that China's exports adversely affect the intensive margin and the extensive margin of its competitors in South East Asia, East Asia, South America and India. This finding of a strong displacement effect also holds after we control for the third-country effect of China's bilateral imports in electronics. We also find strong evidence that the displacement effect on the extensive margin and the intensive margin is largest for the period following the 2007-08 global financial crisis. Last but not least, the displacement effects on the two margins are found to be largest for the group of intermediate and capital electronic goods that have high China's domestic content. This finding suggests that the displacement effects of China's electronic exports represent more a real issue for China's competitors than the existing literature on the domestic content of China's exports would suggest.

Keywords China, gravity equation, intensive margin and extensive margin, trade in electronics

---

§ Department of Economics, Syracuse University. Email: melovely@maxwell.syr.edu.
† Department of Economics, Deakin Business School, Deakin University, Geelong Victoria Australia. Email: cpham@deakin.edu.au.
Acknowledgement: We would like to thank seminar participants at Deakin University for comments. The usual disclaimer applies.

I. Introduction

China has become the world top exporter. In 2010 it surpassed Germany and the U.S. to become the leader in world exports. It will become an old story very soon that China will be the world's largest importer. According to the trade statistics of the World Bank and World Factbook in 2014 China already was the second top world importer behind only the U.S. [1]

The exceptionally rapid growth of China's economy and trade, which is believed to sustain in years to come has raised questions among policy makers and researchers about the impact that it may have on other countries. This study empirically investigates the question of whether or not China is a threat to other exporters of electronic products. The case of electronic trade is chosen because of a number of reasons. First, electronics are an important component of world trade. Today electronic exports represent more than 10% of money earned from world trade in goods. Second, it is in electronics that China exhibits an exceptional performance which parallels its performance in aggregate trade in general. In 1992 China was far behind world top exporters in electronics such as Japan, South Korea and Singapore with a total volume of electronic exports of less than US$ 5 billion. In 2010 its exports topped the world at more than US$ 400 billion.[2] Note that in 2010 Japan's electronic exports were valued at US$ 130 billion, which was one third of China's exports in electronics only. Third, since electronics are considered to be technology intensive products not only developed countries but emerging and especially developing countries always consider the expansion of their electronic exports as a major component of their trade and economic policy aimed at promote their long run economic growth. Coates, Horton and McNamee (2012) documented a shift of Chinese exports towards sophisticated products in heavy manufacturing and electronic sectors and the strong relationship between this shift and China's economic growth. Consequently the research question of whether or not China's success in electronic trade comes at the cost of other major electronic exporters is relevant and has important policy implications for a wide range of countries now and in years to come.

Unsurprisingly, the literature on the impact of China on the world trade is extensive. Yet, this paper differs from the existing literature in a number of important respects. First, it

---

[1] In 2014 according to the World Factbook the estimated volumes of imports by the U.S. and China, the two top importers are US$ 2,334 billion and US$ 1,949 billion, respectively. The estimated volumes of exports by China and the U.S are US$ 2,252 billion and US$ 2,173 billion, respectively. More details on the list of world top exporters and importers are available from the following link of the World Bank and the World Factbook: http://wits.worldbank.org/CountryProfile/Country/WLD/Year/2012/TradeFlow/Import; https://www.cia.gov/library/publications/the-world-factbook/rankorder/2087rank.html.

[2] The share of electronic trade in world trade and the volumes of China's exports in electronics in 1992 and in 2010 are computed by the authors using data available from the UN COMMTRADE database. Also see Coates, Horton and McNamee (2012) for a detailed analysis of the evolution of the patterns of Chinese exports.

is the first study that focuses on the impact of China's exports in electronics. Second, in contrast to previous studies like Eichengreen et al. (2004) and Greenaway et al. (2010) which used data at aggregate level we use data of exports at disaggregate 6-digit product level. It is our point that the use of aggregate country-level and industry-level trade data in the existing related literature make it impossible to provide convincing and sensible explanation based on the degree of complementarity or substitution between China's exports and other countries' exports. All the exported products that make up the aggregate country-level exports can be very different. Many studies such as Schott (2004), Khandelwal (2010) show that even within the same product category at disaggregate level exported products substantially differ in their quality/unit values. In other words, the degree of disaggregation of the data is of critical importance to identify the existence of the competition or substitution effects. If China's exports displace the exports of other "competing" exporters this is because China exports products/goods that are substitutes for products/goods exported by its competitors. If China's competitors however specialize in products of quality that is different from that of China's electrical products and if the love for variety characterizes the utility function of consumers of importing countries then the competition effects of China's exports are likely to be absent.[3] If this is the case the increase in China's exports are rather accompanied by an increase in exports by other countries. In brief, it is our point that the effects of China's exports on the exports of its competitors must empirically be looked at using product-level data.

Third, we empirically look into the extent to which China affects not only the intensive margin but also the extensive margin of electronic trade of other exporters. It is the study of China's displacement effect on the extensive margin of trade that is absent in the literature despite the fact that the presence of zero flows in aggregate exports and in electronic exports is very frequent. [4] This is due to the fact that a study on the displacement effects of China's exports on the extensive margin at 6-digit product level involves much more data work than studies on China's displacement effects on the intensive margin.[5]

Finally, while we follow Eichengreen et al. (2007) and Greenaway et al. (2010) to use China's GDP *and* China's bilateral distance as instruments for China's exports to a

[3] Theoretically, even if China and other exporting countries export different products China's exports still adversely influence exports of other countries via the condition of the budget constraint. Yet, we assume that this general equilibrium effect is likely to be small.

[4] Note that studies such as Baldwin and Harrigan (2011) and Martin and Pham (2015) documented the important presence of the extensive margin in the export flows especially at the product level. Helpman et al. (2008) set up a theoretical model that has both the intensive margin and the extensive margin and especially the presence of frequent and non-symmetric zero export flows. They also showed that the determinants of the extensive margin are also determinants of the intensive margin of the gravity equation.

[5] A study on the extensive margin of exports requires the creation of a dataset that also includes country pairs having zero bilateral exports. As you will see, the sample used for our analysis of the extensive margin is 2.5 times larger for the sample used for our analysis of the intensive margin.

destination in an alternative gravity specification we also control for China's bilateral imports in electronics from the exporter in order to check the robustness of our results. Given China's status as the world top importer of electronic products China's bilateral imports need to be controlled for in the second stage of the IV regression because they are a measure of the multilateral resistance of the exporter with respect to China, a major importing market *and* because they are highly correlated with one of the instruments: China's GDP.

We found strong evidence that China's exports significantly reduced exports by its South East Asian, East Asian, South American competitors and India. Specifically, a 10% increase in China's bilateral exports of a product to a foreign market caused a 4.4 % reduction in the bilateral exports of the product by China's competitors to that market. This negative effect was equivalent to the negative effect of a 3.79 % increase in the bilateral distance by 250km between China's competitors and a foreign market. Similarly, China's exports were found to significantly reduce the probability of China's competitors to sell their products in foreign markets. An increase of China's exports of a product by approximately US$ 4.7 million reduces the probability of China's competitors having positive exports of the product to a foreign destination by 7%. This effect of China's exports on the extensive margin is equivalent to the effect of an increase of bilateral distance by approximately 1570km.The displacement effect on both the extensive margin and the intensive margin was much larger in the period following the global financial crisis than in the period preceding the crisis. Importantly, compared to other studies that used more aggregate level of export data, the effect of the displacement effect of China's exports in electronics at the disaggregate level of data is much stronger, which suggests that aggregation bias might have been the reason for the finding of relatively modest displacement effect in those previous studies. Last but not least, we find that the displacement effects on both margins for electronic products used as intermediate and capital goods are twice as large as the displacement effects for electronic products used as consumption goods. Since intermediate and capital electronic products have relatively high China's domestic content this finding suggests that the displacement effects in electronic trade are more of a real issue for China's competitors than studies on the domestic content of Chinese exports suggest.

Our paper is organized as follows. The next section provides a review of the related literature. Section III discusses the data. Section IV presents a theoretical model from which both the extensive and the intensive margins are derived. Section V explains the econometrics and analyses the results. We conclude in Section VI.

II. Related Empirical Literature

The literature on the impact of China's trade on the world trade is extensive. The first group of papers such as Ianchovichina and Martin (2001) and Ianchovichina and Walmsley (2003) focused on the impact of China's accession to the WTO using the general computable equilibrium (CGE) method. They found that China's accession to the WTO was likely to increase exports of industrialized and newly industrialized East Asian economies while it reduces exports of developing East Asian economies. Explaining the difference in the impact of China joining the WTO on East Asian economies the authors argue that developed economies of East Asia benefit an increased access to China's large market due to the high complementarities of their economies and China's economy. On the contrary, China's becoming a WTO member is likely to increase competition in the third market with developing East Asian Economies.

The second major group of studies relied on the gravity equation to look into the impact of China's trade using the instrumental variable (IV) regressions. Eichengreen et al. (2004) found that the impact of China's exports varies depending on the types of goods (i.e. consumer goods or capital goods such as machinery and equipment). Geennaway et al. (2004) found evidence of the displacement effect across Asian countries but especially in developed importing markets and for high income Asian exporters. Using data at 6-digit HS classifications Giovannetti and Sanfilippo (2009) found that Chinese exports had reduced African exports for textiles and clothing, machinery and equipment. Amann et al. (2009) focused on the textile and clothing sector and documented a negative and statistically significant displacement effect for Asian exporters of low-income group. Pham et al. (2015) found that while in most high-tech sectors Chinese exports displaced the exports of developing exporters they are were associated with more high-tech exports of developed countries like OECD exporters, South Korea and Japan.

The third group of studies consist of papers that used descriptive and comparative methods to evaluate the potential impact of China on the exports of its competitors. Lall and Albaladejo (2004) looked at the evolution of China's and regional export structures and the evolution of China's shares of exports in different markets. They found that market share losses due to increased China's competition are mainly in low-technology exports while there existed evidence of complementarity rather than confrontation of international production of high technology products. Shafaeddin (2004) analysed the evolution of the revealed comparative advantage indices of exports and imports at 3-digit SITC classifications. He found evidence that the competitive effects of China's accession are exaggerated in the literature.

In summary, the empirical findings on the displacement effect of China's exports are far from being conclusive. The majority of the studies with the exception of Shafaeddin (2004) used country-level trade data. The evidence supportive of the displacement effects is far from being the rule and the existing empirical literature also suggests that the displacement effect, if any, varied depending on the characteristics of exporting countries or the importing countries or the sectors under investigation. Importantly, the displacement effect of China's exports on the extensive margin and in electronics trade is absent in the existing literature.

III. Data

The trade data are from the UN COMMTRADE database. We use trade data at 6-digit HS classifications under following category: Electrical, Electronic Equipment, which corresponds to 2-digit HS classification 85 of the 1992 version. There are in total 103 electrical products at 6-digit HS classification. Data Appendix 1 lists all the 103 6-digit products belonging to the 2-digit HS classification 85. The data are from 1992 to 2011. These are the years for which data on China's exports in this category are available. Note that we refer to China's exports in electronics as the exports by the People's Republic of China and its two special administrative regions, Hong Kong and Macau. Later we also use the electronic exports of the PRC as our main explanatory variable of interest in one of our robustness checks.

Exporting countries used in our sample are the two major developed exporters in electronics: Japan and South Korea; two major South American (SA) exporters: Brazil and Mexico and five South East Asian (SEA) exporters in electronics: Indonesia, Malaysia, Philippines, Singapore, Vietnam and Thailand. These countries are selected because either they are major exporters of electrical products or some of them are comparable to China in terms of their level of technology and labour cost. For example, Brazil, Mexico, and SEA exporters with the exception of Singapore are comparable to China and are believed to be the most likely to be affected by China's performance. While the data are available from 1992 to 2011 for all countries Philippines' and Vietnam's exports are available only from 1996 and 2000, respectively. Finally, the sample includes the top 54 importers in electronics.[6] Data on standard gravity variables are available from CEPII's gravity dataset. [7] Data on whether the

[6] See Appendix 2 for more details on the list of top 54 importers in electronics.
[7] The dataset is available from the following link: http://www.cepii.fr/CEPII/en/bdd_modele/presentation.asp?id=8.

pair of trading partners has a common currency or a common free trade agreement are from De Sousa's database. [8]

IV. The Gravity Model with the Extensive and Intensive Margin

This section briefly sets up the theoretical model by Helpman, Melitz and Rubinstein (2008) in which the intensive and the extensive margin of trade are derived.[9] Specifically, the model assumes monopolistic competition in final products and that each exporter j consists of N_j of heterogeneous firms differentiated by their productivity level. Since firms differ in their productivity level and the bilateral trade costs vary by exporter-importer pair the volume of bilateral trade is equal to the sum of the exports by the productive firms only. These firms are defined to have their productivity level high enough to obtain non-negative operating profits from their exports.

The world is assumed to consist of I countries each of which has the following CES utility function:

$$U_i = \left[\int_{l\in B_i} x_i(l)^{\alpha}\, dl\right]^{1/\alpha} \quad 0<\alpha<1 \tag{1}$$

where $x_i(l)$ is the consumption of product l and B_i is the set of products available for consumption in country i. Country i*'s* demand for product l is:

$$x_i(l) = \frac{p_i(l)^{-\varepsilon} Y_i}{P_i^{1-\varepsilon}} \tag{2}$$

where $p_i(l)$ is the price of product l in country i and P_i is country i's index price

$$P_i = \left[\int_{l\in B_i} p_i(l)^{1-\varepsilon} dl\right]^{1/(1-\varepsilon)} \tag{3}$$

Note that in the formulas above ε is the constant demand elasticity and is related to the elasticity of substitution across products α by the following condition: $\varepsilon=1/(1-\alpha)$.

It is assumed that each country i has a measure N_i of firms, each one produces a distinct product in a monopolistic competition setting. A country i firm produces one unit of output with cost-minimizing inputs equal to $c_i a$ where a is firm specific and is the number of bundles of the country's inputs used by the firm per unit output and c_i is the country-specific cost of this bundle.

[8] The link to de Sousa's gravity data on common currency and free trade agreements is the following: http://jdesousa.univ.free.fr/data.htm.

[9] Note that the focus of the thesis is empirical. The theoretical framework by Helpman et al. (2008) is set up to illustrate the determinants of the extensive margin and intensive margin of trade and consequently to provide some guide to subsequent empirical specification and analysis. It is not our purpose to estimate the effect of China on its competitors' exports in electronics strictly using the structural model by Helpman et al (2008).

A firm is assumed to only bear production costs $c_i a$ when it sells in the home market. When selling to a foreign country *i* the firms has to pay a fixed cost equal to $c_i f_{ij}$ and a melting iceberg transport cost τ_{ij}>1. [10]

The price charged by a country *i*'s producer to consumers in country i is:

$$p_i(l) = \tau_{ij} \frac{c_i a}{\alpha} \tag{4}$$

Consequently, a country *i's* firm earns the following profits when selling in country *j*:

$$\pi_{ij}(a) = (1-\alpha)\left(\frac{\tau_{ij} c_i a}{\alpha P_j}\right)^{1-\varepsilon} Y_j - c_j f_{ij} \tag{5}$$

Let a_{ij} be the measure of inputs associated with the zero profit condition of (5):

$$(1-\alpha)\left(\frac{\tau_{ij} c_i a_{ij}}{\alpha P_j}\right)^{1-\varepsilon} Y_j = c_i f_{ij} \tag{6}$$

It can be easily showed that given the CES utility function the volume of bilateral trade X_{ij} between exporter *i* and importer *j* is equal to

$$X_{ij} = \left(\frac{c_i \tau_{ij}}{\alpha P_j}\right)^{1-\varepsilon} Y_j N_i V_{ij}. \tag{7}$$

where Y_j denotes country *j*'s income. V_{ij} characterizes the fraction of exporter *i*'s N_i firms that find sales in importer *j* profitable. Specifically, V_{ij} is defined to be

$$V_{ij} = \int_{a_L}^{a_{ij}} a^{1-\varepsilon} dG(a) \quad for\ a_{ij} \geq a_L \qquad (8)$$

or V_{ij} = 0 otherwise

where a_L and *G(a)* respectively denote the number of bundles of inputs used by the most productive firm per unit of output and the cumulative distribution function of *a*, respectively.

If the measure of firm productivity (1/a) is Pareto distributed and truncated to the support [a_L, a_H] then V_{ij} can be showed to be equal to:

$$V_{ij} = \frac{k a_L^{k-\epsilon+1}}{(k-\varepsilon+1)(a_H^k - a_L^k)} w_{ij} \tag{9}$$

where $w_{ij} = max\left\{\left(\frac{a_{ij}}{a_L}\right)^{k-\epsilon+1} - 1, 0\right\}$

Note that equations (7) and (9) together shows the determinants of the *intensive* margin of trade between exporter *i* and importer *j* while zero profit condition (6) shows the determinants of the extensive margin of trade between these two countries.

[10] It means that τ_{ij} units of a product must be shipped from country *i* to country *j* for one unit to arrive. Note also that τ_{ij} is specific to exporter-importer pairs but not to exporting producer.

Importantly, Helpman et al. (2008) shows that with equality of income and expenditure, equations (6) to (9) can be used to derive the following gravity equation with *third-country* effects a la Anderson and vanWincoop:

$$\frac{X_{ij}}{Y} = s_i s_j \left(\frac{\tau_{ij}\varphi_{ij}}{Q_i Q_j}\right)^{1-\varepsilon} \qquad (10)$$

where the values of Q_j are solved from:

$$Q_j^{1-\varepsilon} = \sum_h \left(\frac{\tau_{jh}\varphi_{ij}}{Q_h}\right)^{1-\varepsilon} s_h \qquad (11)$$

In equations (10) and (11) *s* denotes the share of country *i* and *j* in world income *(Y)* while φ_{ij} is the exporter-importer specific component of the fixed costs f_{ij} that a producer has to bear when it seeks to sell its products in country *j*. Equations (10) and (11) embed the third-country effects because the summation in equation (11) is over all countries in the world including exporter *i* and importer *j*. As emphasized by Anderson and vanWincoop (2005) the third-country effects can be summarized as consisting of two components: the exporter's multilateral resistance and the importer's multilateral resistance. Specifically, the exports by exporter *i* to importer *j* does not only depend on their sizes and their bilateral trade costs but also depend on how easy it is for exporter *i* to sell its products to the rest of the world and how easy it is for importer *j* to import from the rest of the world. For our purpose, given China's status as the world top exporter and importer in electronics we empirically estimate the effects of a major component of the importer's multilateral resistance (i.e. China's exports to importer *j*) on the volume of exports by exporter *i* to importer *j*.

It is important to note that the tractability of the theoretical framework set up by Helpman et al. (2008) is useful to guide our empirical analysis and for the discussion of the third-country effects in the gravity equation in relation to both the extensive and the intensive margin. Yet, the assumption of the CES utility function and of monopolistic competition represents a major limit on a strict and structural analysis of the effect of China on its competitors' exports. The reason is that the effect, if any, of China is likely to be marginal because in presence of CES utility function and monopolistic competition every producer produces a distinct product and is of measure zero. Consequently, it is difficult to rely on the theoretical model by Helpman et al (2008) to analyse the substitution or complementarity effects of China's exports.

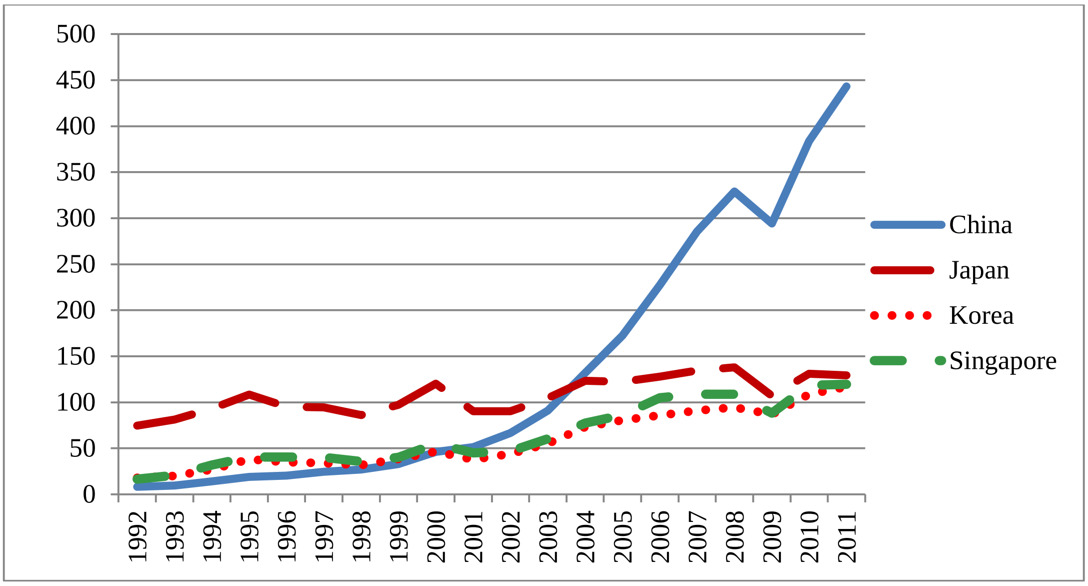
If the theoretical model no longer assumes a CES utility function the model will become less tractable but more suitable for our empirical purpose of exploring the effect of China's exports in electronics. China's exports influence the exports of its competitors via its effects on importer *j*'s budget and/or on bilateral trade costs. First, any importer *j* has a fixed budget that it can allocate between on imports from China and other high-tech exporters. If the high-tech exports of China and its competitors are substitutes Chinese high-tech exports to importer *j* will reduce the exports of its competitors. Alternatively if the high-tech exports of China and its competitors are complementary goods we expect a positive coefficient estimate of Chinese exports. It is reasonable to believe that the level of substitution or complementarity between Chinese high-tech exports and the high-tech exports of other countries depends on the extent to which they are similar or different in terms of relative factor endowments and/or technology. Second, the Chinese high-tech exports can also adversely affect high-tech exports of its competitors to the same market via its effects on the trade costs. For example, if the presence of Chinese high-tech exports in a foreign market is likely to make it more difficult for other competitors to introduce their high-tech products to the consumers of that market it will increase the search costs of these competitors. If so, Chinese high-tech exports will have an adverse effect on its competitors' high-tech exports. For our purpose the net effect of Chinese high-tech exports on the exports of its competitors is purely an empirical issue.

V. Trade in Electronics: A Preliminary Analysis

The intensive margin of electronic trade

In this section we examine the evolution of the intensive margin and the extensive margin of electronic exports and imports of countries included in our sample. Figure 1 and Figure 2 show the evolution of the value of exports by the top 4 exporters and other exporters of the sample. With the exception of the period of the Asian financial crisis China's exports in electronics have been increasing steadily over time at an increasing growth rate. Figure 1 also shows that China has largely surpassed other top exporters such as Japan, South Korea and

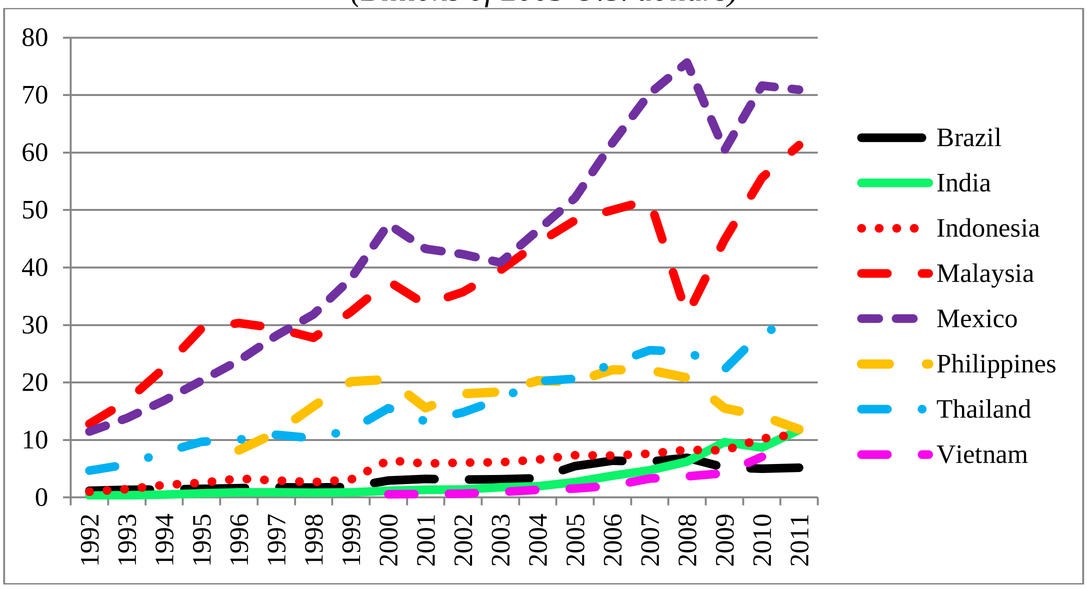
Figure 1: Value of Exports in Electronics (1992-2011) - Top 4 Exporters
(Billions of 2005 U.S. dollars)



Source: the graph is based on the authors' computation using data from the UN COMMTRADE Database.

Singapore in electrical products since 2004. In 2011 China's exports of electrical products are 450 billion US$ and equal to the sum of exports by Japan, Singapore and South Korea.

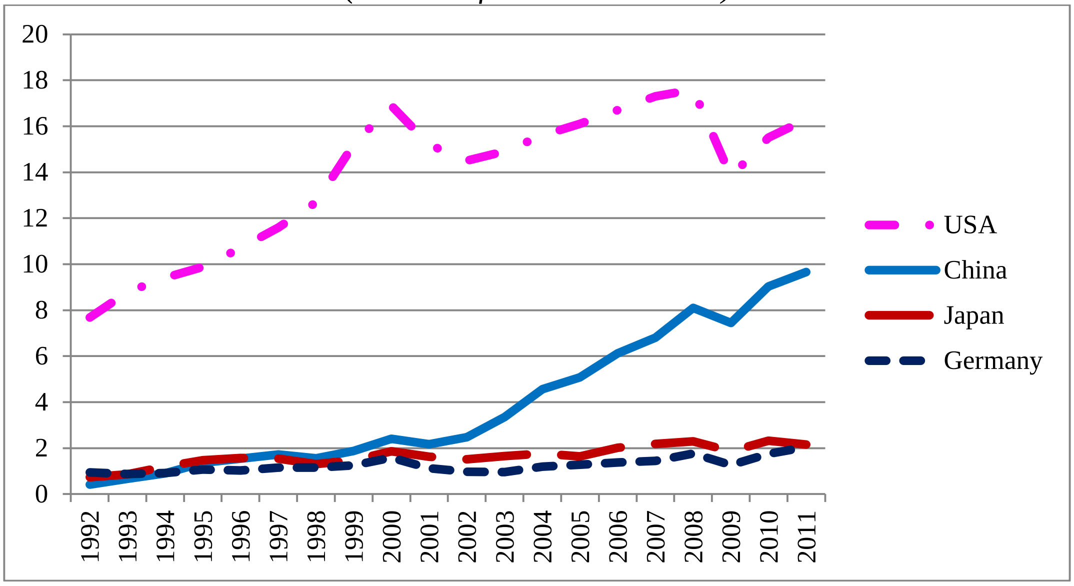
Figure 2: Value of Exports in Electronics – Other Exporters
(Billions of 2005 U.S. dollars)



Source: the graph is based on the authors' computation using data from the UN COMMTRADE Database.

Both Figure 1 and Figure 2 shows that not only China outperformed top exporters in electronics it outperformed other emerging exporters of electrical products even to a larger extent. For example in 2011 Mexico, the most important exporter of this group exported only less than one sixth of the volume of Chinese exports in electronics. In terms of the growth rate, China is also the best performer by a large margin. Both Figures 1 and 2 show that all exporting countries were negatively and substantially influenced by the 2007-08 global financial crisis. The export volume decreased substantially in 2007-08 for all the countries. Yet, it is important to note that China exhibited the fastest recovery following the crisis.

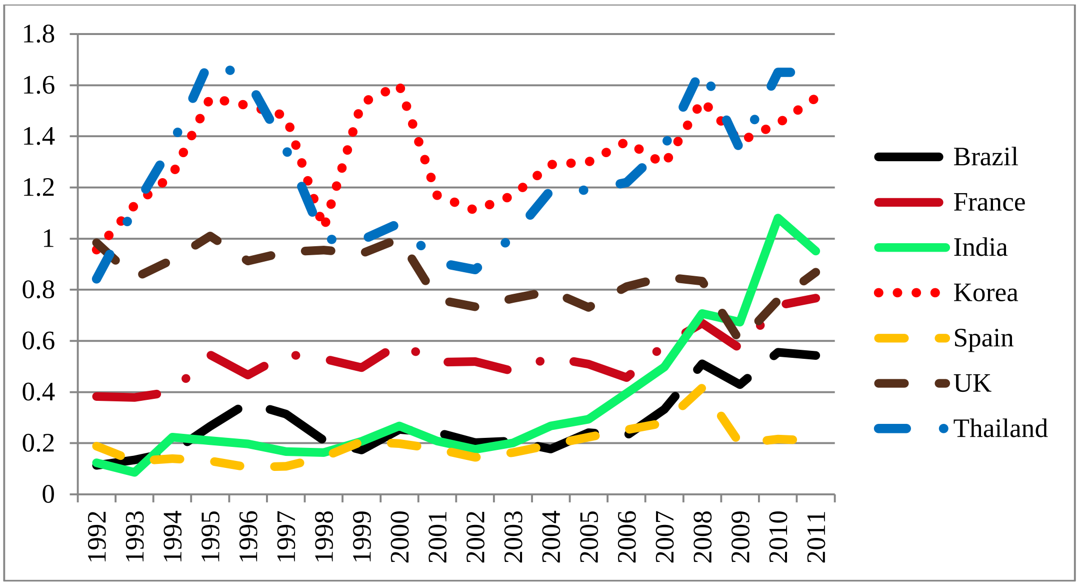
Figure 3: Value of Imports in Electronics - Top 4 Importers
(Billions of 2005 U.S. dollars)



Source: the graph is based on the authors' computation using data from the UN COMMTRADE Database.

So far the analysis is carried out with respect to the export supply of electronics. Figure 3 presents the demands for imported electronics by top four importers: the United States, China, Japan and Germany. Figure 4 presents the demands for imported electronics by other major importers. Both figures show that the demands exhibit a substantial reduction following the global crisis. Countries that exhibit the most significant reductions in demands are the U.S., and other European developed economies such as France, Spain and UK. Importantly, comparing Figure 1 and Figure 3 shows that China's exports to the world and imports from the world follow a very similar upward trend over time. Given China's status as the world top exporter and the world second largest destination in electronics China's exports and imports are considered to be two major components of the third-country effects on the foreign sales of any exporter in electronics and will need to be taken into account in our econometric gravity specification.

Figure 4: Value of Imports in Electronics – Other Importers
(Billions of 2005 U.S. dollars)



Source: the graph is based on the authors' computation using data from the UN COMMTRADE Database.

The extensive margin of electronic trade

As already emphasized in the Introduction an important aspect of the question of whether China's exports are an impediment to its competitors relates to the extensive margin of trade, i.e. the extent to which China's exports affects whether or not a country exports to a destination. This subsection is aimed at providing a preliminary analysis of the extensive margin of trade. As already mentioned in Section III, the analysis applies to a sample of 54 largest importers only.

Figure 5 shows the evolution of the shares of nonzero flows of electronic exports by top 5 exporters. They are computed as the ratio of the total number of nonzero export flows a country has to the total of all *possible* nonzero flows of exports in 103 HS 6-digit products to 56 largest importers.[11] Note that China is the best performer in terms of extensive margin since 1999. In 2011 China has positive exports in more than 80% of all possible nonzero export flows. From 1992 to 2011 China also shows a steadily increase in the number of products-destinations for which it has positive electronic exports. It also exhibits the highest growth rate in this respect. Korea and India are also found to exhibit an improvement in their extensive margin of electronic exports over time of the sample. In contrast with China, Japan exhibits a steadily decline in the number of products-destinations for which it has nonzero electronic exports.

Figure 6 shows the evolution of the same statistic for other exporters of the sample. The ranking of these exporters in terms of their performance with respect to the extensive margin

[11] For each year the number of all possible nonzero flows of exports that a country may have is 5562 (i.e. 103*54).

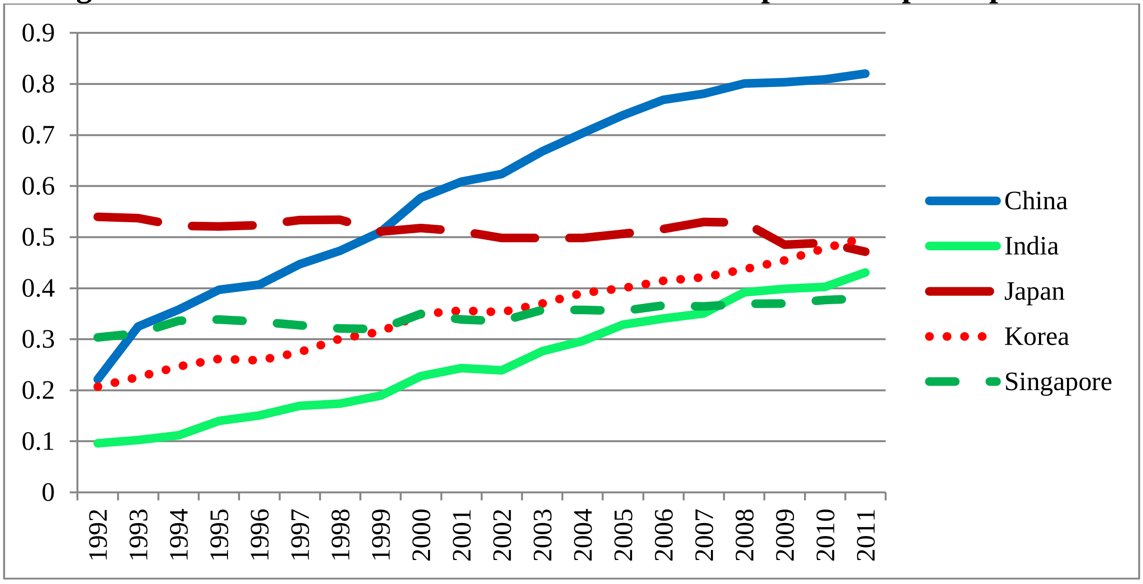
of electronic exports is in line with their economic size and level of technology. The best performers of this group are Thailand and Brazil while the worst performers are Vietnam and Philippines.

For all countries of the two groups the 2007-08 global financial crisis adversely affects them. Yet, the negative impact of the global crisis varies from one exporter to another. Countries that are the most negatively influenced are Philippines, Brazil and Japan. Following the crisis the extensive margin of electronic exports by the three countries substantially deteriorated. Figures 6 and 7 also show that countries that are the most resilient to the global crisis are China, Korea, India and Vietnam.

Appendices 3A, 3B, 4A and 4B show the average number of destinations for an exported product and the average number of products exported to a destination. All the figures exhibit the same picture as described above. China not only on average exports an electronic product to more destinations than other exporters but also exports on average more products to a destination than its competitors.

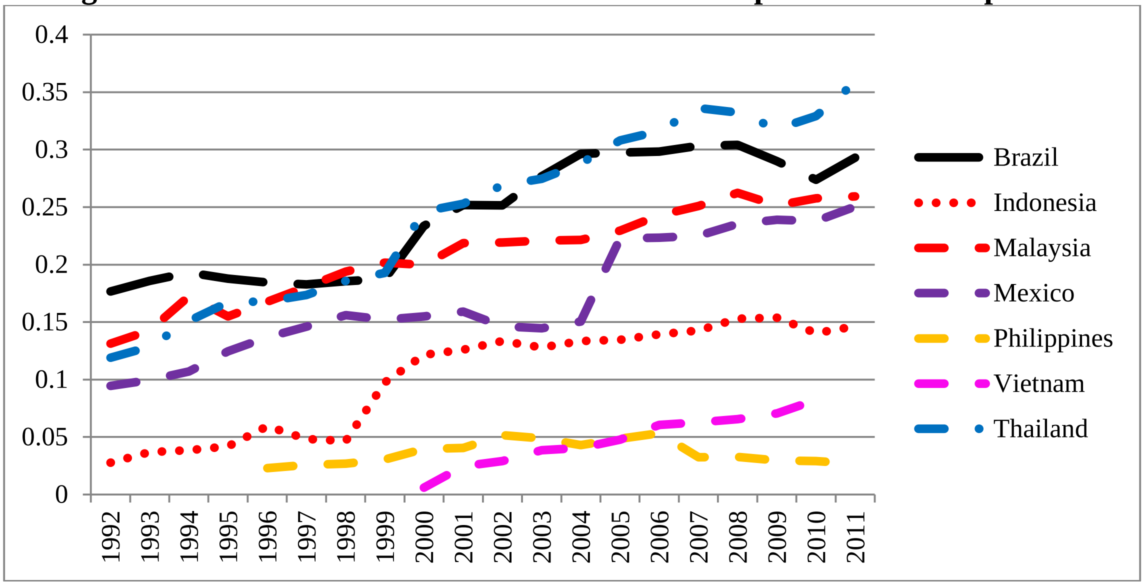
In sum, the descriptive analysis of this section show that exporters exhibit different patterns in terms of the extensive and intensive margins of their electronic exports. China performs exceptionally well in both respects. It remains however unclear at this stage if China's performance comes at the cost of other exporters in the sample. It is this question that the next section is aimed at answering.

Figure 5: Shares of Nonzero Flows of Electronics Exports – Top 5 Exporters



Source: the graph is based on the authors' computation using data from the UN COMMTRADE Database.

Figure 6: Shares of Nonzero Flows of Electronic Exports – Other Exporters



Source: the graph is based on the authors' computation using data from the UN COMMTRADE Database.

IV. Regression Results

The Econometric Methodology of the Gravity Model

We use a modified version of the gravity equation to take into account the characteristics of the product-level export data. Specifically, we use the two following versions of the gravity equation:

$$Log(Exp_{ijpt}) = \alpha_0 + \alpha_1 Log(Gdp_{it}*Gdp_{jt}) + \alpha_2 Log(Dist_{ij}) + \alpha_3 Log(Exp_{China,jpt}) + \alpha_p + \alpha_i + \boldsymbol{\delta}\times\boldsymbol{Dummies_{ijt}} + \varepsilon_{ijpt} \quad (1)$$

$$Log(Exp_{ijpt}) = \alpha_0 + \alpha_1 Log(Gdp_{it}*Gdp_{jt}) + \alpha_2 Log(Dist_{ij}) + \alpha_3 Log(Exp_{China,jpt}) + \alpha_4 Log(Exp_{i,China,pt}) + \alpha_p + \alpha_i + \boldsymbol{\delta}\times\boldsymbol{Dummies_{ijt}} + \varepsilon^*_{ijpt} \quad (2)$$

where i, j, p and t denote exporter, importer, product and year, respectively. $\boldsymbol{\delta}$ is a vector of coefficient estimates of $\boldsymbol{Dummies_{ijt}}$, which are a vector of standard bilateral dummy variables such as dummy variables on whether the two countries have common border, common language or a colonial relationship, the dummy variables on whether the two countries belong to a common free trade area. $Log(Exp_{China,jpt})$ our explanatory variable of interest, is the volume of exports of product p by China to importer j in year t.[12] In gravity regression (1) α_p,

[12] Alternatively, we can also use $China_{jh(t-1)}$, the lagged Chinese exports of product h to importer j as our explanatory variable to allow for the fact that the impact of Chinese exports on the exports of other exporters to the same destination may occur with some delay. We later use this variable in our robustness checks.

the product dummy, controls for the time-invariant product-specific factor that determines the exports of product *p* by exporter *i* to importer *j* in year *t* (i.e. Log(Exp_{ijpt})).

In order to differentiate the impact of Chinese exports by geographical group of exporters we also run the following gravity regressions:

$$Log(Exp_{ijpt}) = \alpha_0 + \alpha_1 Log(Gdp_{it}*Gdp_{jt}) + \alpha_2 Log(Dist_{ij}) + \alpha_{31} Log(Exp_{China,jpt})\_SEA + \alpha_{32} Log(Exp_{China,jpt})\_EA + \alpha_{33} Log(Exp_{China,jpt})\_SA + \alpha_{34} Log(Exp_{China,jpt})\_India + \alpha_p + \alpha_i + \boldsymbol{\delta \times Dummies_{ijt}} + \varepsilon_{ijpt} \qquad (1^*)$$

$$Log(Exp_{ijpt}) = \alpha_0 + \alpha_1 Log(Gdp_{it}*Gdp_{jt}) + \alpha_2 Log(Dist_{ij}) + \alpha_{31} Log(Exp_{China,jpt})\_SEA + \alpha_{32} Log(Exp_{China,jpt})\_EA + \alpha_{33} Log(Exp_{China,jpt})\_SA + \alpha_{34} Log(Exp_{China,jpt})\_India + \alpha_4 Log(Exp_{i,China,pt}) + \alpha_p + \alpha_i + \boldsymbol{\delta \times Dummies_{ijt}} + \varepsilon^*_{ijpt} \qquad (2^*)$$

where $Log(Exp_{China,jpt})\_SEA$, $Log(Exp_{China,jpt})\_EA$, $Log(Exp_{China,jpt})\_SA$ *and* $Log(Exp_{China,jpt})\_India$ are created as the interactions between $Log(Exp_{China,jpt})$ and geographical dummies on whether the exporter is from South East Asia, East Asia, South American and India, respectively.

Note that gravity specifications (2) and (2*) differ from gravity specifications (1) and (1*) by the inclusion of $Log(Exp_{i,China,pt})$. As emphasized in the theoretical model in Section IV in addition to the sizes of the trading partners and the bilateral trade barriers between them important determinants of a country's exports to a foreign market *j* also include the multilateral resistance associated with exporter *i and* the multilateral resistance associated with importer *j*. The former measures trade barriers that exporter *i* has with the third countries (including China as a major destination market for electronic products) relative to the trade barriers it faces in trade with importer *j*. We control for the multilateral resistance associated with exporter *i* using China's imports from exporter *i*, $Log(Exp_{i,China,pt})$.[13] Thus the specification of gravity equations (2) and (2*) are dictated both by the theoretical framework *and* the availability of the instrumental variables used to address the endogeneity associated with $Log(Exp_{China,jpt})$.

The evident problem with the OLS estimation of gravity equations (1), (1*), (2) and (2*) is that $Log(Exp_{China,jpt})$ is likely to be correlated with the error term ε_{ijpt} or ε^*_{ijpt}. An example of the correlation between $Log(Exp_{China,jpt})$ and ε_{ijpt}, which was also mentioned by

---

[13] It is important to note that the data we use are the export data at the product level. Consequently, we need to control for the multilateral resistance associated with exporter *i at the product level*. Since the bilateral tariff and especially non-tariff barriers are not available at the six-digit HS classifications we believe China's imports from exporter *i*, $Log(Exp_{i,China,pt})$ is the best available measure of the multilateral resistance associated with exporter *i*.

Eichengreen et al. (2004) and Greenaway et al. (2012), is that of an improvement in consumer sentiment worldwide in favour of electronics. Such favourable change in sentiment will result in a positive correlation between exports in electronics of China and the exports in electronics of its competitors to the same destination and consequently in an upward bias of the OLS gravity coefficient estimates vis-à-vis the IV gravity coefficient estimates. Similarly, a negative shock in the global oil market will have similar upward bias of the OLS estimates on China's displacement effect because it will result in a reduction of exports in electronics of China and its competitors.

In order to address the problem of endogeneity we instrument China's exports to a destination by using the bilateral distance between China and the importer *and* China's GDP. The first instrument is relevant because there is an established strong negative correlation between China's exports to a foreign market and the bilateral distance between them. Similarly, China's GDP has a strong positive correlation with China's exports in electronics in general independently of the importing market.

In order for the IV regression to yield consistent estimates the instruments need to be uncorrelated with the error term. In order to meet this requirement of exogeneity we need to control for China's bilateral imports in electronics in gravity specifications (2) and (2*) for two reasons. First, given China's status as the world top importer in electronics China's bilateral imports from exporter *i* (i.e. $Log(Exp_{i,China,pt})$) can be used to control for an important component of the multilateral resistance associated with exporter *i*. In other words, it controls for the extent to which exporter *i* can easily export its electronic products to third markets of which China is a top world importer. Second, both China's bilateral imports from exporter *i* (i.e. $Log(Exp_{i,China,pt})$) and our explanatory variable of interest, China's bilateral exports to importer *j* (i.e. $Log(Exp_{China,jpt})$), are strongly correlated with China's GDP. [14]

In order to empirically explore the effects of China's exports on the extensive margin of its competitors in electronics we apply the following probit regression:

$$\rho_{ijt} = \Pr\left(T_{ijpt} = 1 \middle| Observed\ variables\right)$$
$$= \emptyset\{\alpha_0 + \alpha_1 Log\left(Gdp_{it} * Gdp_{jt}\right) + \alpha_2 Log\left(Dist_{ij}\right)$$
$$+ \alpha_3 Log\left(Exp_{China,jpt}\right) + \alpha_4 Log\left(Exp_{i,China,pt}\right) + \alpha_p + \alpha_i +$$

[14] Feenstra (2002) proposed to include the exporter and importer fixed effects as a way to control for the multilateral resistances and consequently to eliminate the potential omitted variable bias due to the correlation between the explanatory variable of interest and unobservable exporter specific or unobservable importer specific factors. Note that we use as instruments for China's exports to an importer the bilateral distance between China and the importer and China's GDP. The first instrument varies from one year to anther while the second instruments is time-invariant and specific to importing destinations. Consequently, our gravity specification can only include the exporter FE but not the importer FE and the time dummies.

$$\boldsymbol{\delta} \times \boldsymbol{Dummies}_{ijt} + \varepsilon_{ijpt}\} \qquad (3)$$

where ρ_{ijt} is the probability that exporter i exports to importer j in year t, conditional on the observed variables. T_{ijpt} is the indicator variable equal to 1 when country i exports in product p to country j in year t and 0 otherwise. Following Baldwin and Harrigan (2011) the sample used in our probit regression only includes zero export flows which could have occurred but could not. In other words, zero export flows are defined only for products that an exporter could export to at least one destination but not all in year t. To address the endogeneity problem of $Log(Exp_{China,jpt})$ we estimate the probit regression (3) using as instruments China's GDP and the bilateral distance between China and the importer j.

The effects of China's exports on the intensive margin of exports of its competitors

Table 2 presents the regression results of both gravity equations (1) and (2) for comparison purposes. Note that the two specifications differ by the inclusion of China's bilateral electronic imports, which is used as a proxy for the multilateral resistance associated with exporter i. Columns 1 and 5, which present the OLS regression results shows that the gravity equation generally performs well. Standard gravity variables such as the product of GDPs of the exporter and the importer, their bilateral distances and the dummies on sharing common border and common language have a statistically significant effect on the bilateral exports with expected sign and magnitude. Our main explanatory variable of interest, China's exports, have a positive and statistically significant effect on the exports of its competitors to the same importing market. As already emphasized due to the endogeneity problem associated with $Log(Exp_{China,jpt})$ the OLS is likely to yield biased coefficient estimates of China's effects.

Contrary to the OLS regression results, the 2SLS IV and GMM regression results, which are presented in columns 2 to 4 and columns 6 to 8, show that China's electronic exports have a statistically significant and negative displacement effects. [15] Note that for the 2SLS IV estimation the results of the first stage regression in columns 2 and 6 show that the

[15] Note that Eichengreen et al (2007) who used *aggregate* bilateral trade for the period 1990-2003 and the bilateral distances between China and foreign destinations of its exports as an instruments of Chinese exports to those markets (i.e. $Log(Exp_{China,jt})$) also found a positive and statistically significant coefficient estimates of $Log(Exp_{China,jt})$ from the OLS estimator and a negative and statistically significant coefficient estimate of $Log(Exp_{China,jt})$ from their 2SLS IV estimator. The magnitude of the displacement effect at the aggregate level of data found by Eichengreen was -0.06, which is much smaller than the displacement effect we found using disaggregate product-level export data (see Table 1a in their paper).

Econometrically, the opposite sign of the IV estimate vis-a-vis the OLS estimate is straightforward. Let assume we have the following regression: $y_i=\beta_0+\beta_1 x_i+e_i$ where the endogeneity occurs if we have $Cov(x_i,e_i)\neq 0$. If z_i is a valid instrument then the IV estimate of β_1 is: $\beta_{1,IV} = \beta_1 + Cov(z_i, e_i) *\sigma_e / Cov(z_i, x_i)*\sigma_x$ while the OLS estimate of β_1 is: $\beta_{1,OLS} = \beta_1 + Cov(x_i, e_i)*\sigma_e / \sigma_x$. It is clear that $Cov(z_i, e_i) *\sigma_e / Cov(z_i, x_i)$ and $Cov(x_i, e_i)$ can have opposite signs, resulting in the OLS estimate of β_1 and the IV estimate of β_1 having opposite signs.

two instruments, China's GDP and China's bilateral distance, are important determinants of China's bilateral exports to an importing market. Both variables have statistically significant effects with expected sign on China's exports. The first stage regression also shows that a country's exports of a product to a foreign market are positively affected by its exports to China, which suggests that there is no evidence of the offsetting effect of China's imports on a country's exports in electronics at the product level. Importantly, the first-stage F-statistic values, which are reported in columns 3 and 7, are 818.58 and 793.30 and consequently establish that the instruments are relevant. The Kleibergen-Paap rank Wald F-statistics reject the null hypothesis that the equation is weakly identified. The Hansen *J* Statistics for the over-identification test for all the instruments do not reject the null hypothesis, which means that the overidentification restriction is satisfied.

As already mentioned above, given China's status not only as a top exporter but also a top importer of electronic products it is important to control for China's bilateral electronic imports in our estimation of China's displacement. The reason is that China's GDP, one of our instruments for China's exports to a destination, positively correlates with China's bilateral electronic imports, which is an important component of the multilateral resistance. The difference in the results is in line with our argument. When the gravity equation does not control for China's bilateral electronic imports the displacement effects are present but have a smaller magnitude than when China's bilateral electronic imports are included as control variables.

The regression results of our preferred gravity specification (2) in column 7 shows that a 10% increase in China's exports of product *p* to importer *j* on average causes approximately a 4.4 % reduction in the exports of product *p* by exporter *i* to importer *j*, which is equivalent to the effect of a 3.79 % increase in the bilateral distance between China and importer *j*.[16] Put it differently, the negative effect of a 10% increase in China's exports to importer *j* is equal to a negative effect of an increase of 250 km in the bilateral distance between exporter *i* and importer *j*.[17]

---

[16] Note that the coefficient of $Log(Distance_{ij})$ is -1.16, which means that a 10% increase in $Log(Distance_{ij})$ will results in 11.6% reduction in $Log(Exp_{ijpt})$. Or a 3.79 % increase in $Log(Distance_{ij})$ will results in 4.4 % (i.e. 0.1*0.044/0.116) reduction in $Log(Exp_{ijpt})$, which is equal to the effect of a 10% increase in $Log(Exp_{China,jpt})$.

[17] The effects are evaluated at the means of the explanatory variables and the dependent variable. See Tables 1 for their descriptive statistics. The regression results mean that if China's bilateral exports, $Exp_{China,jpt}$, increase by 10% from its mean of 739559 US$ (i.e. $2.71828^{13.51381}$) to 813515.4536 US$ (i.e. $2.71828^{13.51381}\times1.1$) the bilateral exports of China's competitors, Exp_{ijpt}, decrease by 4.4 % from their mean of from 96203.34 US$ (i.e. $2.71828^{11.4745}$) to 91955 US$ (i.e. $2.71828^{11.4745}\times(1-.044)$). This effect of a 10% increase in China's exports is equivalent to the effect of an increase in bilateral distance between exporter *i* and importer *j* by 250km, from 6655.9269 km (i.e. $2.71828^{8.803263}$ km) to 6908.146 km (i.e. $2.71828^{8.803263}\times1.0379$).

Table 2, which also reports in Column 8 the regression results of the GMM estimator, shows that the effect of China's bilateral exports is qualitatively and quantitatively similar. China's surge in exports is found to displace its competitors to third market, with 10% increase leading to a 4.6 % drop in exports. As expected the GMM estimator is more efficient than the 2SLS IV estimator and generally yields smaller robust standard errors of the gravity coefficient estimates.

Since the sample spans the years of the 2007-08 Global Financial Crisis it is important to investigate the sensitivity of our results to those years. Specifically, Table 3 presents the regression results of both the 2SLS IV estimator and the GMM estimator using three different subsamples: subsample without the years of 2007 and 2008, before GFC subsample (i.e. using only the years preceding 2007) and after GFC subsample (i.e. using only the years after 2008). The strong negative effect of China's exports is confirmed when the subsample excludes the years of 2007 and 2008. The coefficient estimates of $Log(Exp_{China,jpt})$ using the 2SLS IV estimator and the GMM estimator are -0.47 and -0.45, respectively. They are both statistically significant at 1% level. Importantly, columns 3, 4, 5 and 6 of Table 3 show that China's exports have a much higher negative effect for the years preceding the GFC than for the years after the GFC. Specifically, a 10% increase in China's exports causes a 10.1 % to 10.4 % reduction of exports after 2008 while it only causes a 3 % to 3.2% reduction of exports of China's competitors in the years preceding the crisis. This finding is consistent with the early analysis of the evolution of China's exports which shows that China is the country recovers the fastest among the group of world top exporters in electronics.

Given the strong evidence of export displacement it is now important to investigate to extent to which the displacement effect varies by group of exporters (i.e. South East Asia, East Asia, South America and India) and by group of importers (OECD vs non-OECD importers). The results of gravity specification (2) are presented in Table 4 for the full sample and for the sample without the years of the GFC. Note that we choose not to report the coefficient estimates of standard control variables of the gravity because they are essentially the same as in Tables 2 and 3. The displacement effect is found to be significant for all groups of exporters. China's exports reduce the exports of India and SEA exporters the most and the exports of Japan and the Republic of Korea the least. For example, a 10% increase in China's exports causes a 4.0 % reduction in the exports of India and 2.8 % reduction in the exports of Japan and South Korea. These findings of the displacement effects apply for both the full sample and the subsample regardless of the groups of importers.

The effects of Chinese exports on the extensive margin of exports of its competitors

In this section we analyse the effects of Chinese exports on the extensive margin of trade. Specifically, we look into the extent to which Chinese exports influence the likelihood of exports by other countries to the same destination by using probit regressions (2).

Table 5 presents the results of the standard probit regression, the 2SLS IV probit regression and the GMM probit regression for the 1992-2011 sample. It is important to note that since our preferred specification is the IV probit regression Table 5 only reports the marginal probability effects of the IV probit. According to the results of the standard probit regression in column 1 China's exports have a positive effect on the probability of its competitors to have positive exports of a product in the same foreign market. This is not our preferred regression results because the standard Probit regression is subject to bias due to the potential correlation between China's exports and their competitors' exports to the same destination. The results of the 2SLS IV probit in columns 2 show that the two instruments are important and statistically significant determinants of China's exports to a foreign destination. The 2SLS IV Probit regression in the second stage in column 3 yields a strong negative effect (-0.19) of China's exports on the probability of China's competitors to have positive bilateral exports of a product to a foreign destination. This effect is statistically significant at 1 %. As expected the results of the GMM probit regression in column 5 confirm the finding of the negative effect of China's exports. Column 4, which reports the marginal effect of the coefficient estimate of $Log(Exp_{China,jpt})$, allows us to have a better idea of the negative effect of China's exports on the extensive of its competitors. Specifically, an increase of $Log(Exp_{China,jpt})$ by 1 unit or equivalently an increase of China's exports of a product by approximately US$ 4.7 million reduces the probability of China's competitors having positive exports of the product to a foreign destination by 7%. [18] This effect of China's exports on the extensive margin is equivalent to the effect of an increase of $Log(Distance_{ij})$ by 0.2121 unit (i.e. 0.07/0.31), which corresponds to an increase of bilateral distance $Distance_{ij}$ by approximately 1573 km.[19]

We next carry out a number of robustness checks for our probit regressions. Table 6 reports the results when we use three subsamples: the full sample without the GFC years of 2007 and 2008, the before GFC subsample and the after GFC subsample. For all the three

[18] The effects are evaluated at the means of the explanatory variables. See Tables 1 for their descriptive statistics. An increase of 1 unit of $Log(Exp_{China,jpt})$ at its mean (i.e. 13.51381) is equivalent to an increase of $Exp_{China,jpt}$ from 739559 US$ (i.e. $e^{13.51381}$) to 5464646 US$ (i.e. $e^{14.51381}$). Thus the change in the value of China's exports is approximately 4.7 (i.e. 5464646- 739559) million US$.

[19] The coefficient estimates of $Log(Exp_{China,jpt})$ and $Log(Distance_{ij})$ are -0.07 and -0.33, respectively. It means that either an increase of $Log(Exp_{China,jpt})$ by 1 unit or an increase of $Log(Distance_{ij})$ by 0.2121 unit will reduce the probability of China's competitors to have positive exports to a foreign destination by 7 %. If $Log(Distance_{ij})$ increases by 0.2121 unit from its mean $Distance_{ij}$ increases from 6656 (i.e. $e^{8.803263}$) km to 8229 (i.e. $e^{(8.803263+0.2121)}$) km, that is an increase of $Distance_{ij}$ by 1573 (i.e. 8229-6656) km.

subsamples, China's exports are still found to have negative and statistically significant effect on the probability of having positive exports by China's competitors. Table 6 also shows that the marginal negative effect of China's exports on the extensive margin is three times higher for the before GFD period (-0.15) than for the after GFC period (-0.05).

Next we identify how the displacement effect on the extensive margin varies between groups of exporters and between groups of importer. Table 7 shows in column 1 that while the displacement effect holds for all groups of exporters the largest effect is found for South East Asian and East Asian exporters. The negative effect of China's exports on the extensive margin is found to be strongest for the group of OECD importers.

The effects of Chinese exports on the intensive and extensive margins of exports of its competitors – Additional qualifications of the results

A number of recent important studies such as Kee and Tang (2012), Koopman et al. (2008), Koopman et al. (2012) and Ma et al. (2014) empirically looked into the domestic content of Chinese exports. The point is that while China's exports have been growing exponentially over the years it represents however a real issue for China's competitors and the world trade patterns only if the domestic content of China's exports is high. Kee and Tang (2012) find that the average domestic value added ratio (DVAR) in Chinese processing exports has risen from 35% in 2000 to 49% in 2006 and that this increase is mainly driven by firms substituting imported materials with domestic materials. Koopman et al. (2008) find that the share of domestic content in exports by PRC has increased from 50% before China's WTO membership to 60% since then. They however point out that those sectors that are likely labelled as relatively sophisticated such as electronic devices have particularly low domestic content (about 30% or less).

In this section we look into extent to which the effects of China's exports in electronics vary depending on the types of goods. Specifically, we consider three types of goods defined by Broad Economic Categories (BEC) of the United Nations Statistics Division: intermediate goods, capital goods and consumption goods. The point is that the domestic content of China's exports is likely to be the least important for the consumption goods (iPads, iPhones for example) for which China's participation in the global supply chain is only in the final assembling stage with low value added. If the effects of China's exports in electronics we find early are mostly the result of China's adversely affecting the exports of its competitors in the exports of electronics as consumption goods then the threat China's exports pose to its competitors is not as serious as people think it is.

Table 8, which presents the results of the IV regression and the IV probit regression for each of the three categories, shows that for both the intensive and the extensive margins the negative and statistically significant effects of China's exports are confirmed for all the three categories. Yet, they are much larger for electronics classified as intermediate and capital goods than for electronics used as consumption goods. Specifically, for electronics used as capital and intermediate goods the magnitude of the negative effect of China's exports on the intensive margin of its competitors is twice as large as for consumption electronics goods. Similarly, the negative effect of China's exports on the extensive margin of its competitors in electronics used as capital and intermediate goods is three times larger than in electronics used as consumption goods.

Further Robustness Checks

In this section we carry out a number of additional robustness checks to investigate the sensitivity of our results. First, we restrict our sample to observations of export flows of more than US$ 1000. The idea is that export flows of small values are more likely to be subject to measurement error. The displacement effects on the extensive margin and the intensive margin still hold for all groups of exporters and importers. We also found that the displacement effect was much larger for the period before the GFC than for the period after the GFC.

We also include the product of GDPs per capita of the trading partners as an explanatory variable in our regression. In the literature using gravity equation, GDP per capita is used to control for the level of development of the trading partners that may affect their bilateral trade. The effect of China's exports still remain negative and statistically significant at 1% level and with a similar magnitude.

Finally, to account for the possibility that China's exports displace the exports of its competitors with some delay we used $Log(Exp_{China,jp(t-1)})$ and $Log(Exp_{i,China,p(t-1)})$ as our explanatory variables. The displacement effects of China's exports on both the extensive margin and the intensive margin remain still strong and statistically significant at 1% level. The lagged displacement effects are slightly smaller than the displacement effects of China's exports, which suggests that China's exports have a long lasting displacement effect on the exports of its competitors.

VI. Conclusion

Using a sample of export data at 6-digit HS classifications for the 1992-2011 period this paper empirically looks into the effects of Chinese exports in electronics on the intensive export margin and extensive export margin of Asian exporters such as India, Japan, South Korea, Malaysia, Philippines, Singapore, Thailand and Vietnam and South American exporters such as Brazil and Mexico. For our econometric methodology, we estimate a gravity equation which uses China's GDP and China's bilateral distance as instruments for our main variable of interest, China's bilateral exports and which includes China's bilateral imports to control for the multilateral resistance of the exporter. We use the same instruments in a probit regression to investigate the impact that Chinese exports have on the extensive margin of trade.

We find strong and robust evidence of displacement effect of China's exports. A 10% increase in China's bilateral exports causes a 4.4 % drop in the exports of China's competitors, which is equivalent to the effect of an increase of bilateral distance between China's competitors and the importer by 250 km. The strong displacement effect is found for each group of exporters in the sample. Finally, the negative effect of China's exports in the after GFC period is twice as large as the negative effect in the before GFC period.

As for the extensive margin of export in electronics China is found to substantially reduce the probability of having positive exports by all of its competitors. An increase of China's exports of a product by approximately US$ 4.7 million reduces the probability of China's competitors having positive exports of the product to a foreign destination by 7 %, which is equivalent to the negative effect of an increase of $Distance_{ij}$ by approximately 1570km. While the displacement effect on the extensive margin holds for all groups of exporters SEA countries are the most negatively affected by China's electronic exports. We also find that the negative impact of China on the extensive margin is the strongest after the global financial crisis. Thus, China's recovery following the GFC was carried out at the expense of its competitors to a large extent. Last but not least, the displacement effects on both margins for electronic products used as intermediate and capital goods are found to be twice as large as the displacement effects for electronic products used as consumption goods. Since electronic intermediate and capital goods are these products that have high China's value added this finding suggests that China's exports in electronics represent more of an issue for its competitors than the recent literature on the domestic content of China's exports would suggest.

REFERENCES

Ahearne, A. G., Fernald, J. G. Loungani, P. and Schindler, J. W. (2003). "China and Emerging Asia: Comrages or Competitors?". *International Finance Discussion Papers*, No. 789.

Amann, E., Lau, B. and Nixson, F. (2009) 'Did China Hurt the Textiles and Clothing Exports of Other Asian Economies, 1990-2005?', *Oxford Development Studies*, 37(4), 333-362.

Baldwin R., and Harrigan, J. (2011). "Zeros, Quality, and Space: Trade Theory and Trade Evidence". *American Economic Journal: Microeconomics*, 3: 60-88.

Coates, B., Horton Dougal and McNamee L. (2012). "China: Prospects for Export-Driven Growth". *Economic Roundup Issue 4*. (http://www.treasury.gov.au/PublicationsAndMedia/Publications/2012/Economic-Roundup-Issue-4/HTML/article4.)

Eichengreen, B., Rhee Y., and Tong H. (2007). "The Impact of China on Exports of Other Asian Countries". *Review of World Economics*, 143: 201-206.

Feenstra, R. C. (2002), 'Border Effects and the Gravity Equation: Consistent Methods for Estimation', *Scottish Journal of Political Economy*, 49(5), 491-506.

Giovannetti, G. and Sanfilippo, M. (2009), 'Do Chinese Exports Crowd-out African Goods? An Econometric Analysis by Country and Sector', *European Journal of Development Research*, 21, 506-530.

Greenaway, D., Aruneema M. and Milner C. 2012. "Has China Displaced Other Asian Countries' Exports". *China Economic Review*, 19: 152-169.

Ianchovichina, E., and Martin, W. (2001). "Trade Liberalization in China's Accession to the World Trade Organization". Policy Research Working Paper 2623, World Bank.

Kee, H. L., and Tang, H. 2012. "Domestic Value Added in Chinese Exports". *Mimeo*.

Koopman, R. Wang, Z. and Wei, S-J. 2008. "How Much of Chinese Exports is Really Made in China? Assessing Domestic Value-Added When Processing Trade is Pervasive". *NBER Working Paper 14109*.

Koopman, R. Wang, Z., and Wei, S-J. 2012. "Tracing Value-Added and Double Counting in Gross Exports". *NBER Working Paper No. 18579.* Forthcoming in *American Economic Review*.

Khandelwal, Amit. 2010. "The Long and Short (of) Quality Ladders". *Review of Economic Studies*, 77: 1450-1476.

Lall, S. and Albaladejo M. (2004). "China's Competitive Performance: A Threat to East Asian Manufactured Exports?". *World Development*, 32(9): 1441-1466.

Ma, H., Wang, Z. and Zhu K. 2014. “Domestic Content in China’s Exports and its Distribution by Firm Ownership”. *Mimeo*.

Pham Cong S., Nguyen Xuan., Sgro Pasquale and Tang Xueli. “Has China Displaced Its Competitors in High-Tech Trade?”. *Mimeo*.

Rauch, James. 1999. “Networks versus Markets in International Trade”. *Journal of International Economics*, 48: 7-35.

Shafaeddin, S. M. (2004). “Is China’s Accession to WTO Threatening Exports of Developing Countries?”. *China Economic Review*, 15: 109-144.

Schott, Peter K. 2004. “Across-Product versus Within-Product Specialization in International Trade”. *Quarterly Journal of Economics*, 119(2): 647-678.

United Nations, Department of Economic and Social Affairs, Statistics Division. 2002. “Classification by Broad Economic Categories”. *Statistical Papers Series M No. 53, Rev. 4*.

Table 1: Descriptive Statistics

Variable	Mean	Std. Dev.	Min	Max
$Log(Exp_{ijpt})$	11.4745	2.53492	6.907755	20.93987
$Log(Gdp_{it}*Gdp_{jt})$	54.2552	1.982844	48.04913	59.75689
$Log(Exp_{i,China,pt})$	13.88807	3.028923	0.661061	21.36301
$Log(Exp_{China,jpt})$	13.51381	2.648716	6.909199	21.48412
$Log(Dist_{ij})$	8.803623	0.6810602	6.748283	9.881444
$Language_{ij}$	0.108923	0.3115329	0	1
$Colony_{ij}$	0.035713	0.1855747	0	1
$Border_{ij}$	0.046218	0.209958	0	1
rta_{ij}	0.177042	0.3817053	0	1
Log(China's GDP_t)	28.395	0.6774075	27.04139	29.50261
$Log(Dist_{China,j})$	8.814695	0.6511505	7.06319	9.857974

Table 2: Chinese Exports and Their Impact on the Intensive Margin of Its Competitors

	1992-2011 Sample		1992-2011 Sample		1992-2011 Sample		1992-2011 Sample	
	OLS	2SLS IV		GMM	OLS	2SLS IV		GMM
		1st stage	2nd stage			1st stage	2nd stage	
Independent Variables	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Log(Exp$_{China,jpt}$)	0.13^{c}		-0.33^{c}	-0.29^{c}	0.11^{c}		-0.46^{c}	-0.44^{c}
	(12.29)		(-9.88)	(-10.22)	(10.59)		(-13.68)	(-15.00)
Log(Exp$_{i, China,pt}$)					0.24^{c}	0.01	0.29^{c}	0.28^{c}
					(24.75)	(0.77)	(26.62)	(26.60)
Log(Gdp$_{ijt}$)	0.47^{c}	0.82^{c}	0.90^{c}	0.85^{c}	0.49^{c}	0.82^{c}	1.04^{c}	1.01^{c}
	(11.05)	(56.58)	(14.23)	(14.43)	(11.35)	(56.68)	(15.73)	(16.36)
Log(Distance$_{ij}$)	-0.82^{c}	-0.12	-1.06^{c}	-0.99^{c}	-0.89^{c}	-0.12	-1.16^{c}	-1.13^{c}
	(-10.31)	(-1.66)	(-10.52)	(-11.23)	(-10.82)	(-1.68)	(-11.89)	(-11.95)
Language$_{ij}$	0.24^{a}	0.10	0.2	0.26^{a}	0.28^{b}	0.10	0.26	0.29^{a}
	(1.85)	(0.96)	-1.19	(1.92)	(2.11)	(0.97)	(1.66)	(1.93)
Colony$_{ij}$	-0.12	-45^{c}	-0.38	-0.37	-0.13	-0.45^{c}	-0.49^{a}	-0.48^{a}
	(-0.58)	(-3.26)	(-1.28)	(-1.55)	(-0.65)	(-3.26)	(-1.80)	(-1.80)
Border$_{ij}$	0.95^{b}	-0.06	0.52	0.61	0.95^{b}	-0.07	0.54	0.53
	(2.02)	(-0.27)	-1.12	(1.35)	(2.05)	(-0.27)	(1.26)	(1.21)
RTA$_{ijt}$	0.09	0.16^{b}	0.48^{c}	0.36^{c}	0.07	0.17^{c}	0.44^{c}	0.42^{c}
	(0.83)	(2.50)	-4.08	(3.43)	-0.58	(2.49)	(3.92)	(3.77)
Log(Gdp$_{China,t}$)		1.22^{c}				1.22^{c}		
		(12.29)				(11.70)		
Log(Distance$_{China,j}$)		-0.51^{c}				-0.51^{c}		
		(-4.68)				(-4.68)		
Product dummies	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Exporter dummies	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
First stage F-statistic			818.58				793.30	
Kleibergen-Paap rk Wald F statistics			2.3e+04				2.3e+04	
Hansen J statistic [p-value]			4.113 [0.0425]				2.038 [0.1535]	
Number of observations	182397	182397	182397	182397	182397	182397	182397	174831

Notes: (1) T-statistics computed based on the robust standard errors are in parentheses. The regression allows for the clustering of exporter pairs. (2) ^{a}, ^{b} and ^{c} denote 10%, 5% and 1% level of significance, respectively.

Table 3: Chinese Exports in Electronics and their Impact on the Intensive Margin of China's Competitors
Robustness Checks

	Sample Excluding GFC Years of 2007-08		Before GFC Sample		After GFC Sample	
	2SLS	GMM	2SLS	GMM	2SLS	GMM
Independent Variables	(1)	(2)	(3)	(4)	(5)	(6)
$Log(Exp_{China,jpt})$	-0.47[c]	-0.45[c]	-0.32[c]	-0.30[c]	-1.04[c]	-1.01[c]
	(-13.89)	(-15.46)	(-10.43)	(-11.48)	(-3.54)	(-4.99)
$Log(Exp_{i, China,pt})$	0.28[c]	0.28[c]	0.28c	0.28[c]	0.27[c]	0.27[c]
	(25.57)	(25.57)	(23.13)	(23.05)	(19.51)	(19.74)
$Log(Gdp_{ijt})$	1.05[c]	1.02[c]	0.94[c]	0.89[c]	1.60[c]	1.57[c]
	(15.99)	(16.80)	(16.19)	(17.00)	(5.46)	(7.04)
$Log(Distance_{ij})$	-1.14[c]	-1.12[c]	-1.06[c]	-1.04[c]	-1.51[c]	-1.50[c]
	(-11.64)	(-10.27)	(-10.45)	(-10.51)	(-7.04)	(-8.59)
$Language_{ij}$	0.24	0.27[a]	0.26	0.28[a]	0.12	0.12
	(1.55)	(1.74)	(1.68)	(1.91)	(0.57)	(0.59)
$Colony_{ij}$	-0.47	-0.47[a]	-0.41	-0.41	-0.81[b]	-0.79[b]
	(-1.69)	(-1.71)	(-1.44)	(-1.48)	(-2.23)	(-2.33)
$Border_{ij}$	0.52	0.50	0.58	0.59	0.13	-0.16
	(1.23)	(1.18)	(1.41)	(1.40)	(0.26)	(-0.34)
RTA_{ijt}	0.48[c]	0.45[c]	0.47[c]	0.41[c]	0.58[c]	0.58[c]
	(4.15)	(4.02)	(2.86)	(2.58)	(3.05)	(3.10)
Product dummies	Yes	Yes	Yes	Yes	Yes	Yes
Exporter dummies	Yes	Yes	Yes	Yes	Yes	Yes
First stage F-statistic	806.66		745.00		57.95	
Kleibergen-Paap rk Wald F statistics	1.9e+04		8376.19		637.362	
Hansen J statistic [p-value]	1.472		2.685		0.025	
	[0.2251]		[0.1013]		[0.8746]	
Number of observations	156163	156163	116586	116586	39577	39577

Notes: (1) T-statistics computed based on the robust standard errors are in parentheses. The regression allows for the clustering of exporter pairs. (2) [a], [b] and [c] denote 10%, 5% and 1% level of significance, respectively.

Table 4: Chinese Exports in Electronics and their Impact on the Intensive Margin of China's Competitors

(By Geographical Group of Exporters and By Group of Importers) – Robustness Checks

	2SLS IV Regressions		
	1992-2011 Sample		
	All Importers	OECD Importers	Non-OECD Importers
Independent Variables	(1)	(2)	(3)
$Log(Exp_{China,jpt})$ _SEA	-0.37[c]	-0.39[c]	-0.31[c]
	(-8.47)	(-7.00)	(-6.02)
$Log(Exp_{China,jpt})$ _EA	-0.28[c]	-0.21[c]	-0.24[c]
	(-9.26)	(-4.49)	(-5.06)
$Log(Exp_{China,jpt})$ _SA	-0.29[c]	-0.48[c]	-0.28[c]
	(-2.92)	(-5.60)	(-3.99)
$Log(Exp_{China,jpt})$ _India	-0.40[c]	-0.37[c]	-0.52[c]
	(-5.61)	(-4.85)	(-7.97)
Other control variables	Yes	Yes	Yes
Product dummies	Yes	Yes	Yes
Exporter dummies	Yes	Yes	Yes
Number of observations	182397	94520	87877

Notes: (1) All the regressions include the same set of control variables as in Table 3. We choose not to report the coefficient estimates on those variable to save space. They are available upon request by the authors. (2) T-statistics computed based on the robust standard errors are in parentheses. All regressions allow for the clustering of exporter pairs. (3) [a], [b] and [c] denote 10%, 5% and 1% level of significance, respectively.

Table 5: Chinese Exports in Electronics and their Impact on the Extensive Margin of China's Competitors

	Standard Probit	IV Probit			
	1992-2011 Sample	1992-2011 Sample			
		2SLS			ML
		1st stage	2nd stage	2nd stage	
	Coef. Est.	Coef. Est.	Coef. Est.	Marg. Effect	Coef. Est.
Independent variable	(1)	(2)	(3)	(4)	(5)
Log($Exp_{China,jpt}$)	0.06[c]		-0.19[c]	-0.07[c]	-0.17[c]
	(13.40)		(-5.99)	(-5.99)	(-7.09)
Log($Exp_{i,\ China,pt}$)	0.11[c]	0.01	0.12[c]	0.05[c]	0.10[c]
	(31.32)	(1.46)	(29.17)	(29.17)	(30.92)
Log(Gdp_{ijt})	0.30[c]	0.89[c]	0.55[c]	0.22[c]	0.50[c]
	(19.40)	(71.73)	(14.20)	(14.02)	(19.82)
Log($Distance_{ij}$)	-0.72[c]	-0.14	-0.84[c]	-0.33[c]	-0.75[c]
	(-10.94)	(-0.99)	(-10.60)	(-10.60)	(-11.74)
$Language_{ij}$	0.62[c]	0.26[c]	0.65[c]	0.25[c]	0.58[c]
	(4.97)	(4.65)	(5.29)	(5.17)	(4.87)
$Colony_{ij}$	0.04	-0.25	-0.07	-0.03	-0.08
	(0.21)	(-1.27)	(-0.34)	(-0.34)	(-0.40)
$Border_{ij}$	0.24	0.33	0.18	0.07	0.17
	(0.63)	(1.38)	(0.49)	(0.49)	(0.50)
RTA_{ijt}	0.39[c]	0.29	0.50[c]	0.20[c]	0.46[c]
	(3.98)	(1.62)	(4.79)	(4.79)	(4.85)
Log($Gdp_{China,t}$)		1.00[c]			
		(13.64)			
Log($Distance_{China,j}$)		-0.59[c]			
		(-3.59)			
Products dummies	Yes	Yes	Yes	Yes	Yes
Exporter dummies	Yes	Yes	Yes	Yes	Yes
First stage F-statistic			8743.24		
Wald test of exogeneity			7404.97		
Number of observations	469464	469464	469464	469464	469464

Notes: (1) T-statistics or Z-statistics computed using the robust standard errors are in parentheses. All regressions allow for the clustering of exporter pairs. (3) [a], [b] and [c] denote 10%, 5% and 1% level of significance, respectively.

Table 6: Chinese Exports in Electronics and their Impact on the Extensive Margin of China's Competitors

Robustness Checks

	IV Probit					
	Sample Excluding GFC Years of 2007-08		Before GFC		After GFC	
	2SLS	ML	2SLS	ML	2SLS	ML
	Coef. Est.	Coef. Est.	Coef. Est.	Coef. Est.	Coef. Est.	Coef. Est.
Independent variable	(1)	(2)	(3)	(4)	(5)	(6)
Log($Exp_{China,jpt}$)	-0.19[c]	-0.17[c]	-0.05	-0.05	-0.39[c]	-0.30[c]
	(-5.46)	(-6.55)	(-1.29)	(-1.31)	(-3.63)	(-6.68)
Log($Exp_{i, China,pt}$)	0.11[c]	0.11[c]	0.12[c]	0.12[c]	0.10[c]	0.13[c]
	(27.45)	(30.48)	(27.01)	(31.35)	(26.48)	-14.66
Log(Gdp_{ijt})	0.54[c]	0.49[c]	0.42[c]	0.41[c]	0.82[c]	0.51[c]
	(13.20)	(18.46)	(9.63)	(11.27)	(7.37)	-41.61
Log($Distance_{ij}$)	-0.82[c]	-0.73[c]	-0.73[c]	-0.71[c]	-1.02[c]	-0.60[c]
	(-9.66)	(-10.89)	(-7.78)	(-8.46)	(-11.72)	(-9.37)
$Language_{ij}$	0.64[c]	0.58[c]	0.60[c]	0.59[c]	0.67[c]	0.35[c]
	(5.19)	(4.77)	(4.77)	(4.64)	(5.02)	-2.97
$Colony_{ij}$	-0.05	-0.06	-0.02	-0.03	-0.14	-0.09
	(-0.25)	(-0.31)	(-0.08)	(-0.14)	(-0.76)	(-0.65)
$Border_{ij}$	0.20	0.18	0.25	0.25	0.12	0.06
	(0.54)	(0.55)	(0.66)	(0.68)	(0.26)	-0.22
RTA_{ijt}	0.5[c]	0.46[c]	0.43[c]	0.42[c]	0.59[c]	0.34[c]
	(4.44)	(4.61)	(2.68)	(2.77)	(6.61)	-4.32
Product dummies	Yes	Yes	Yes	Yes	Yes	Yes
Exporter dummies	Yes	Yes	Yes	Yes	Yes	Yes
First stage F-statistic	4012.88		2582.66		1511.41	
Wald test of exogeneity	4751.92	67.88	732.09	10.94	504.01	19.35
Number of observations	399845	399845	295530	295530	104315	104315

Notes: (1) Z-statistics computed using the bootstrapped robust standard errors are in parentheses. All regressions allow for the clustering of exporter pairs. (3) [a], [b] and [c] denote 10%, 5% and 1% level of significance, respectively.

Table 7: Chinese Exports in Electronics and their Impact on the Extensive Margin of China's Competitors

(By Geographical Group of Exporters and By Group of Importers)

	2SLS IV Probit Regression Second-Stage Results		
	1992-2011 Sample		
	All Importers	OECD importers	Non-OECD Importers
	Marg. Effect	Marg. Effect	Marg. Effect
Independent variable	(1)	(2)	(3)
Log($Exp_{China,jpt}$) _SEA	-0.05[c]	-0.06[c]	-0.04[b]
	(-4.52)	(-6.08)	(-2.17)
Log($Exp_{China,jpt}$) _EA	-0.05[c]	-0.06[c]	-0.03[a]
	(-4.85)	(-4.88)	(-1.61)

Log($Exp_{China,jpt}$) _SA	-0.03[a]	-0.01	-0.01
	(-1.64)	(-0.47)	(-0.54)
Log($Exp_{China,jpt}$) _India	-0.03[b]	-0.02[a]	-0.02
	(-2.02)	(-1.53)	(-1.13)
Other control variables	Yes	Yes	Yes
Product dummies	Yes	Yes	Yes
Exporter dummies	Yes	Yes	Yes
Number of observations	469464	211564	257250

Notes: (1) All the regressions include the same set of control variables as in Table 2. We choose not to report the coefficient estimates on those variable to save space. They are available upon request by the authors. (2) Z-statistics computed based on the robust standard errors are in parentheses. All regressions allow for the clustering of exporter pairs. (3) [a], [b] and [c] denote 10%, 5% and 1% level of significance, respectively.

Table 8: Chinese Exports in Electronics and their Impact on the Intensive and Extensive Margins of China's Competitors
(By Category of Goods)

	2SLS IV Regression			2SLS IV Probit Regression		
	Intermediate Goods (1)	Capital Goods (2)	Consumption Goods (3)	Intermediate Goods (4)	Capital Goods (5)	Consumption Goods (6)
Log($Exp_{China,jpt}$)	-0.43[c]	-0.45[c]	-0.27[c]	-0.20[c]	-0.15[c]	-0.11[c]
	(-11.97)	(-11.42)	(-5.98)	(-7.57)	(-3.93)	(-4.34)
Log($Exp_{i, China,pt}$)	0.24[c]	0.30[c]	0.30[c]	0.10[c]	0.11[c]	0.14[c]
	(18.28)	(19.57)	(16.65)	(22.39)	(22.35)	(23.89)
Log(Gdp_{ijt})	1.08[c]	1.04[c]	0.78[c]	0.59[c]	0.53[c]	0.45[c]
	(14.72)	(15.56)	(8.45)	(16.63)	(11.30)	(11.68)
Log($Distance_{ij}$)	-1.12[c]	-1.45[c]	-0.48[c]	-0.78[c]	-0.94[c]	-0.74[c]
	(-10.06)	(-12.45)	(-4.06)	(-10.56)	(-9.74)	(-10.57)
$Language_{ij}$	0.38[c]	0.30	-0.29	0.65[c]	0.61[c]	0.81[c]
	(2.67)	(1.66)	(-1.19)	(5.23)	(4.50)	(6.01)
$Colony_{ij}$	-0.46	-0.74[c]	0.21	-0.08	-0.04	-0.11
	(-1.64)	(-2.31)	(0.93)	(-0.35)	(-0.38)	(-0.47)
$Border_{ij}$	0.75	0.30	0.44	0.28	0.06	0.36
	(1.59)	(0.76)	(0.94)	(0.67)	(0.15)	(1.23)
RTA_{ijt}	0.61[c]	0.34[c]	0.23	0.58[c]	0.49[c]	0.30[c]
	(4.78)	(2.68)	(1.25)	(5.42)	(3.93)	(2.97)
Product dummies	Yes	Yes	Yes	Yes	Yes	Yes
Exporter dummies	Yes	Yes	Yes	Yes	Yes	Yes
Number of observations	70516	82149	22167	171729	205527	73419

Notes: (1) T-statistics or Z-statistics computed using the bootstrapped robust standard errors are in parentheses. All regressions allow for the clustering of exporter pairs. (3) [a], [b] and [c] denote 10%, 5% and 1% level of significance, respectively.

Appendix 1: List of Electronic Products at 6-Digit HS Classifications

850110: Electric motors of an output < 37.5 watts; 850120: Universal AC/DC motors of an output < 37.5 watts; 850131: DC motors, DC generators, of an output < 750 watts; 850132: DC motors, DC generators, of an output 0.75-75 kW; 850133: DC motors, DC generators, of an output 75-375 kW; 850134: DC motors, DC generators, of an output >375 kW; 850140: AC motors, single-phase, nes; 850151: AC motors, multi-phase, of an output < 750 Watts; 850152: AC motors, multi-phase, of an output 0.75-75 kW; 850153: AC motors, multi-phase, of an output > 75 kW; 850161: AC generators, of an output < 75 kVA; 850162: AC generators, of an output 75-375 kVA; 850163: AC generators, of an output 375-750 kVA; 850164: AC generators, of an output > 750 kVA; 850211: Generating sets, diesel, output < 75 kVA; 850212: Generating sets, diesel, output 75-375 kVA; 850213: Generating sets, diesel, output > 375 kVA; 850220: Generating sets, with spark ignition engines; 850230: Electric generating sets, nes; 850240: Electric rotary converters; 850300: Parts for electric motors and generators; 850410: Ballasts for discharge lamps or tubes; 850421: Liquid dielectric transformers < 650 KVA; 850422: Liquid dielectric transformers 650-10,000KVA; 850423: Liquid dielectric transformers > 10,000 KVA; 850431: Transformers electric, power capacity < 1 KVA, nes; 850432: Transformers electric, power capacity 1-16 KVA, nes; 850433: Transformers electric, power capacity 16-500 KVA; 850434: Transformers electric, power capacity > 500 KVA, nes; 850440: Static converters, nes; 850450: Inductors, electric; 850490: Parts of electrical transformers and inductors; 850511: Metal permanent magnets, articles intended as magnets; 850519: Permanent magnets & articles intended as magnets, nes; 850520: Electro-magnetic couplings, clutches and brakes; 850530: Electro-magnetic lifting heads; 850590: Electro-magnets nes and parts of magnetic devices; 850611: Manganese dioxide primary cell/battery volume < 300 c; 850612: Mercuric oxide primary cell, battery, volume < 300 cc; 850613: Silver oxide primary cells, batteries volume < 300 cc; 850619: Primary cells, primary batteries nes, volume < 300 cc; 850620: Primary cells, primary batteries nes, volume > 300 cc; 850690: Parts of primary cells and primary batteries; 850710: Lead-acid electric accumulators (vehicle); 850720: Lead-acid electric accumulators except for vehicles; 850730 : Nickel-cadmium electric accumulators; 850740: Nickel-iron electric accumulators; 850780: Electric accumulators, nes; 850790: Parts of electric accumulators, including separators; 850810: Drills, hand-held, with self-contained electric motor; 850820: Saws, hand-held, with self-contained electric motor; 850880: Tools, hand-held, with electric motor, not drills/saw; 850890: Parts, hand tools with self-contained electric motor; 850910: Domestic vacuum cleaners; 850920: Domestic floor polishers; 850930: Domestic kitchen waste disposers; 850940: Domestic food grinders, mixers, juice extractors; 850980: Domestic appliances, with electric motor, nes; 850990: Parts of domestic appliances with electric motor; 851010: Shavers, with self-contained electric motor; 851020: Hair clippers, with self-contained electric motor;

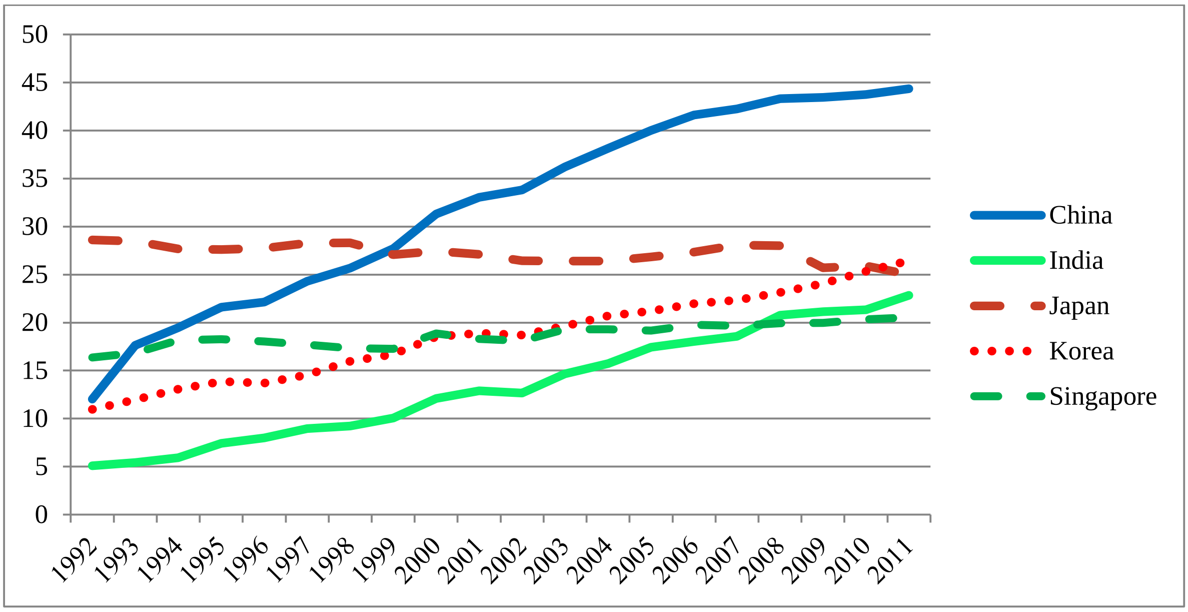
851090: Parts of shavers/hair clippers, electric; 851110: Spark plugs; 851120: Ignition magnetos, magneto-generators and flywheels; 851130: Distributors and ignition coils; 851140: Starter motors; 851150: Generators and alternators; 851180: Glow plugs & other ignition or starting equipment nes; 851190: Parts of electrical ignition or starting equipment; 851210: Lighting/signalling equipment as used on bicycles; 851220: Lighting/visual signalling equipment nes; 851230: Sound signalling equipment; 851240: Windscreen wipers/defrosters/demisters; 851290: Parts of cycle & vehicle light, signal, etc equipment; 851310: Portable battery and magneto-electric lamps; 851390: Parts for portable battery & magneto electric lamps; 851410: Industrial electric resistance heated furnaces & oven; 851420: Industrial electric induction, dielectric furnace/oven; 851430: Industrial/laboratory electric furnaces and ovens nes; 851440: Industrial induction/dielectric heating equipment nes; 851490: Parts of industrial/etc electric furnaces/ovens nes; 851511: Electric soldering irons and guns; 851519: Electric brazing, soldering machines and apparatus nes; 851521: Electric resistance welding equipment, automatic; 851529: Electric resistance welding equipment, non-automatic; 851531: Automatic electric plasma, other arc welding equipment; 851539: Non-automatic electric plasma and other arc welders; 851580: Electric, laser and ultrasonic welding equipment nes; 851590: Parts of electric solder, weld or braze equipment; 851610: Electric instant, storage and immersion water heaters; 851621: Electric storage heating radiators; 851629: Electric space heating nes and soil heating apparatus; 851631: Electric hair dryers; 851632: Electro-thermic hairdressing apparatus, nes; 851633: Electro-thermic hand drying apparatus; 851640: Electric smoothing irons; 851650: Microwave ovens; 851660: Electric cooking, grilling & roasting equipment nes; 851671: Electric coffee or tea makers, domestic; 851672: Electric toasters, domestic; 851679: Electro-thermic appliances, domestic, nes; 851680: Electric heating resistors; 851690: Parts of electro-thermic apparatus, domestic, etc.

Notes: (1) nes is short for not elsewhere classified.

Appendix 2: List of Top Importers in Electronics

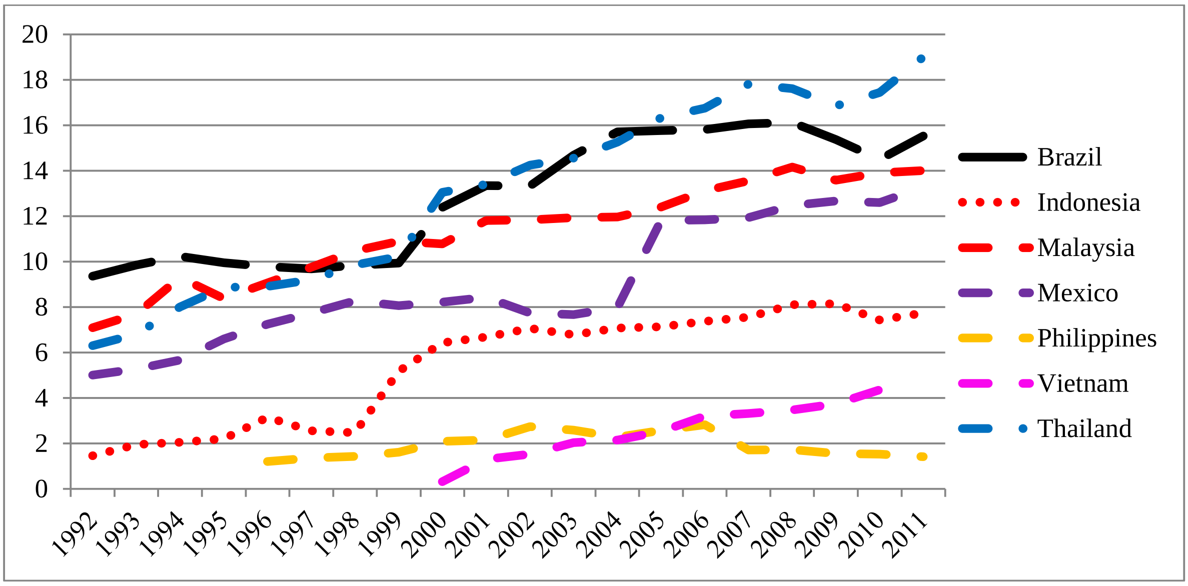
Argentina, Australia, Austria, Bangladesh, Algeria, Belgium, Belgium-Luxembourg, Bolivia, Brazil, Bulgaria, Cameroon, Canada, Chile, Colombia, Cyprus, Czech Republic, Denmark, Egypt, Finland, France, Germany, Greece, Hungary, Iceland, India, Indonesia, Ireland, Israel, Italy, Japan, Mexico, Netherlands, New Zealand, Nigeria, Norway, Pakistan, Philippines, Poland, Portugal, Republic of Korea, Romania, Russian Federation, Slovakia, South Africa, Spain, Sweden, Switzerland, Thailand, Turkey, USA, Ukraine, United Kingdom, Uruguay, Venezuela, Viet Nam.

Appendix 3A: The Average Number of Destinations for an Exported Product – Top 5 Exporters



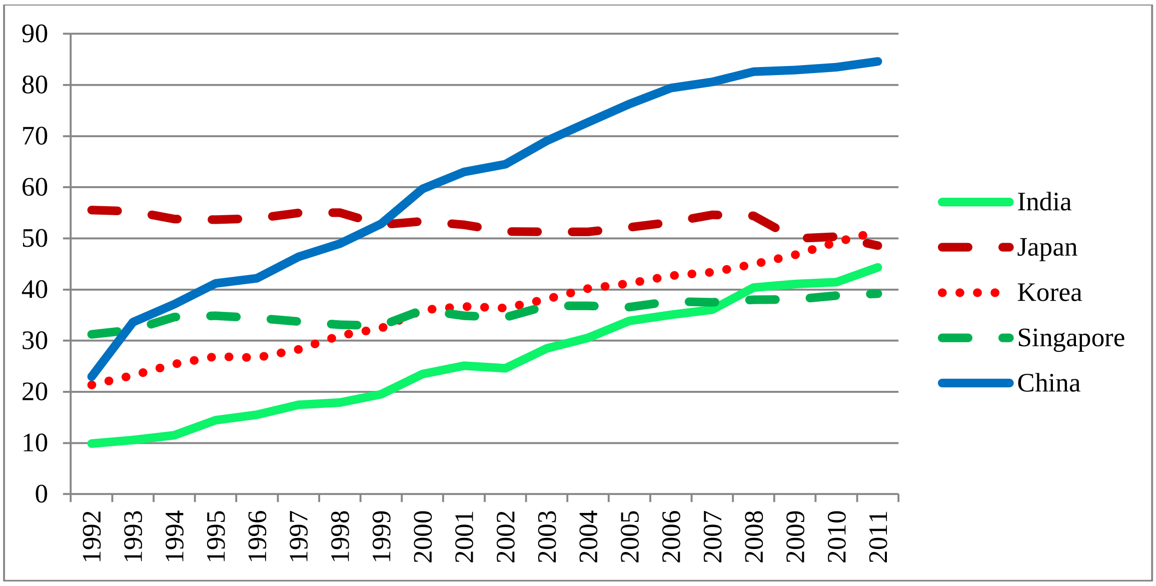
Source: the graph is based on the authors' computation using data from the UN COMMTRADE Database.

Appendix 3B: The Average Number of Destinations for an Exported Product – Other Exporters



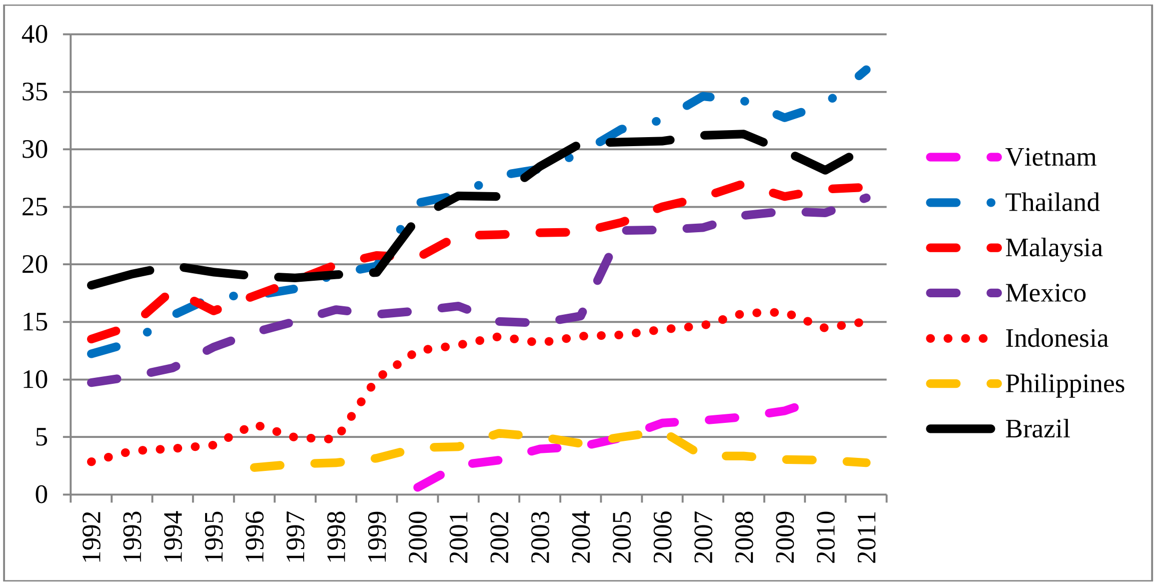
Source: the graph is based on the authors' computation using data from the UN COMMTRADE Database.

Appendix 4A: The Average Number of Products Exported to a Destination – Top 5 Exporters



Source: the graph is based on the authors' computation using data from the UN COMMTRADE Database.

Appendix 4B: The Average Number of Products Exported to a Destination – Other Exporters



Source: the graph is based on the authors' computation using data from the UN COMMTRADE Database.