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DOI: 10.1111/dpr.12290

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Received: May 2014 | Accepted: February 2016

DOI: 10.1111/dpr.12290

ORIGINAL ARTICLE

The impact of Chinese competition on third markets: An analysis by region and technological category

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Abstract

This article seeks, through the use of a gravity model, to verify if in the 2000-2009 years Chinese exports have displaced exports from other countries in third markets. The contribution of this article is to provide an overview of Chinese competition, covering different regions and technology categories in a comparative way. The evidence shows that the effect of Chinese exports on global exports is mainly negative. The medium technology manufacturing sector is the segment most affected by Chinese competition. The results also indicate that developing economies are experiencing the most negative effect of Chinese competition, especially the emerging Asian countries.

KEYWORDS

Asia, China, Chinese exports, international trade, Latin America

1 | INTRODUCTION

The prominent position achieved by the Chinese economy in the global economy in the last few years has received considerable international attention. This is mostly a reflection of Chinese gross domestic product (GDP) growth of approximately 10% per year in the last few decades, followed by the country's rapid integration into international trade flows. From 1980 to 2009, Chinese participation in global trade increased from 1% to approximately 10%, enabling China to consolidate itself in 2009 as the major global exporter and the second largest global importer (UN Statistics Division, 2010).

According to Winters and Yusuf (2007), Chinese economic expansion affects other countries around the world in a number of ways, but the most direct and intensive impact on other economies is through international trade. Four main areas of impact can be identified in the literature on China's emergence as a trading giant (Jenkins, Peters, & Moreira, 2008; Ianchovichina, Ivanic, & Martin, 2009). This emergence also influences several other countries' national development and economic growth, which underlines the importance of assessing and identifying the resulting opportunities or threats.

The first impact is related to opportunities of export to China, thanks to the growing Chinese demand for primary commodities, components and capital goods. The second concerns opportunities to import Chinese products, especially labour-intensive manufactured goods and, increasingly, electronic, computer and telecommunications manufactured products. The third type of impact corresponds to the Chinese export competition with exports from other countries in third markets. Lastly, the fourth modality encompasses indirect trade impacts, such as the global price expansion of primary agricultural, mineral, metal and energy commodities, and the decrease in price of labour-intensive manufacturing in the global market.

This work focuses on the analysis of the third type of impact. The hypothesis to be tested is that the expansion of Chinese manufacturing exports may cause displacement of exports from other countries, which target the same market. According to this hypothesis, import countries would be replacing their previous suppliers by products from China. Unlike other works, this study aims to identify which types of products—ranked according to technological intensity—have been most affected by Chinese commercial expansion in third markets, and also at checking which global regions have experienced the greatest threat from facing this competition. This study also intends to contribute to the literature that uses the analysis of direct trade indicators to assess Chinese competition. Most frequent indicators analyze the similarity of exports structures and market share variations. Thus, an econometric test is conducted from a gravitational model application, adequately controlling the wide set of variables which affect the bilateral trade.

The article is divided into five sections, in addition to this introduction and the final considerations. In the second section, an overview of the Chinese trade expansion is presented. In the third, a literature review on the Chinese competition in third markets is conducted. The fourth section details the methodology used on this work, specifying the estimate equations. In the fifth and sixth sections, the results of the model's estimates are presented, finally leading to the presentation of the conclusions.

2 | THE CHINESE TRADE EXPANSION AND ITS GLOBAL EFFECTS

This section aims to briefly characterize the vaulting Chinese trade performance in the last few years, pointing to the potential effects of this expansion. While the Chinese GDP was able to grow around 10% per year on average from 1980 to 2010, Chinese exports increased from $18 billion in 1980 to $1.6 trillion in 2010, representing an average expansion of 16% per year.[1] As a result, exports account for an increased share of the Chinese GDP, ending 2010 in 29% of the GDP, compared to 11% in 1980. The Chinese share of global exports grew from 0.9% in 1980 to 10.6% in 2010.

The extent of Chinese trade expansion becomes more evident when compared to global export growth, according to Figure 1. It is observed that, by 2000, although the growth accumulated by Chinese exports had been greater than that accumulated in the rest of the world, the difference was not

[1]The growth rate was calculated based on exports in current dollars, according to UN Comtrade data (United Nations Statistics Division, 2010).

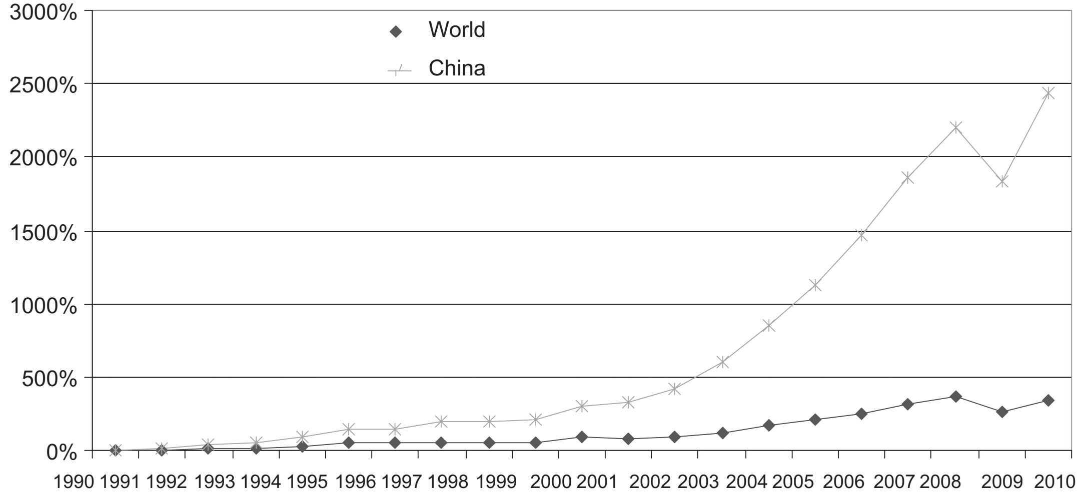

FIGURE 1 Cumulative growth of Chinese and global exports, 1990 to 2010
Source: The authors, using UN Comtrade data (United Nations Statistics Division, 2010).
Note: Cumulative growth based on exports data in current dollars.

as great as it was after 2000. Between 2000 and 2008,[2] global exports more than doubled, while Chinese exports increased sixfold. Thus, if in the 1990s the Chinese export performance already stood out, in the 2000s it became even more prominent, and that is why the focus of this impact analysis of Chinese exports on global exports will start from 2000.[3]

As well as the extraordinary growth in volume of Chinese exports, it is also important to highlight major changes in the exports pattern. The fact that the Chinese export basket contained products which were significantly more sophisticated than expected for its per capita income level is emphasized as an important determinant of the Chinese economic growth by Rodrik (2006).[4] According to him, the Chinese exports basket is commensurate with a country with three times its per capita income.

For Hanson and Robertson (2008), high manufacturing specialization led to the Chinese emergence to become a global disruptive phenomenon. However, as well as China's extraordinary increased role in the global manufacturing trade, its still superior performance in high-technology products also stands out. This phenomenon is shown in Figure 2, which shows the market share evolution of Chinese exports in terms of technological intensity, according to the classification suggested by Lall (2000). This classification translates trade data (Harmonized System—HS—at six digits) for primary and manufacturing products with degrees of different intensity and technological sophistication (manufacturing based on natural resources, and low-, medium- and high-technology manufacturing).

The Chinese export' market share in high-technology products more than quadrupled from 2000 to 2009. Medium-technology exports more than tripled and low-technology exports doubled during the period. It is noteworthy that, although the largest market share expansion had been experienced

[2]It is worth noting the exports reduction from 2008 to 2009 due to the global crisis. In spite of this turbulence, the trend of Chinese trade growth rates remained strong, leading to its position as the largest global exporter in 2009 (United Nations Statistics Division, 2010).

[3]It is noteworthy that the period covered by econometric tests runs until 2009, due to the incomplete database at the time of data collection in 2010. Even though 2009 was a global crisis year, it was decided that it would be included in the analysis, using annual dummies on the estimates to control the crisis effects, among other factors.

[4]Rodrik (2006) observes that there is a positive and statically significant correlation between the per capita income level and the productivity level associated with a country's exports basket. As he states, rich countries tend to export the same products as other rich countries.

by Chinese high-technology exports, the market share in low-technology products is the highest of all segments, representing more than 20% of the segment's global exports.

Thus, in contradiction of the theory of comparative advantages, according to which China should specialize in labour-intensive products (typical of low-income economies), the country has been exporting sophisticated products, which are normally exported by richer economies. It is worth mentioning that the evolution of trade structure based on this classification, as well as from any other product classification of technological intensity, should be carefully analyzed. This is due to the fact that, in the current context, countries exporting products rated as high-tech do not necessarily mean their companies master technological principles and hold the knowledge associated with the products' development and competitive production.

As outlined by Hiratuka (2010), WTO and IDE-JETRO (2011) and UNCTAD (2013), international trade flows went through a profound changing process due to outsourcing and value chain fragmentation strategies taken by major transnational corporations. With this process, value chains have become more geographically scattered, incorporating different countries in several steps of the chain which had previously been vertically integrated. Therefore, analysis of trade flow and its composition should be carefully conducted, since it requires understanding of the countries' insertion in these global networks.

The very beginning of the expansion process of Chinese manufactured exports was highly associated with outsourcing strategies in the most labour-intensive activities on low-tech sectors, such as textile, clothing and shoes. Multinational companies from Japan, South Korea, Hong Kong and Taiwan began the relocation process of their traditional industries in the 1980s, transforming China into the Asian companies' productive base (Gaulier, Lemoine, & Ünal-Kesenci, 2004). Throughout the 1990s, many major companies, particularly from the US, transferred a great part of their productive activity to Asia, especially China. While initially quite concentrated on traditional sectors, China's development strategy went through a constant search for upgrade with the growing incorporation of capital, technology and scale-intensive sectors, rapidly diversifying its export structure to a wide range of industries, particularly the electronic and machinery sectors. It is also important to point out the major upgrade that occurred among and within the stages of the value chains from different sectors,

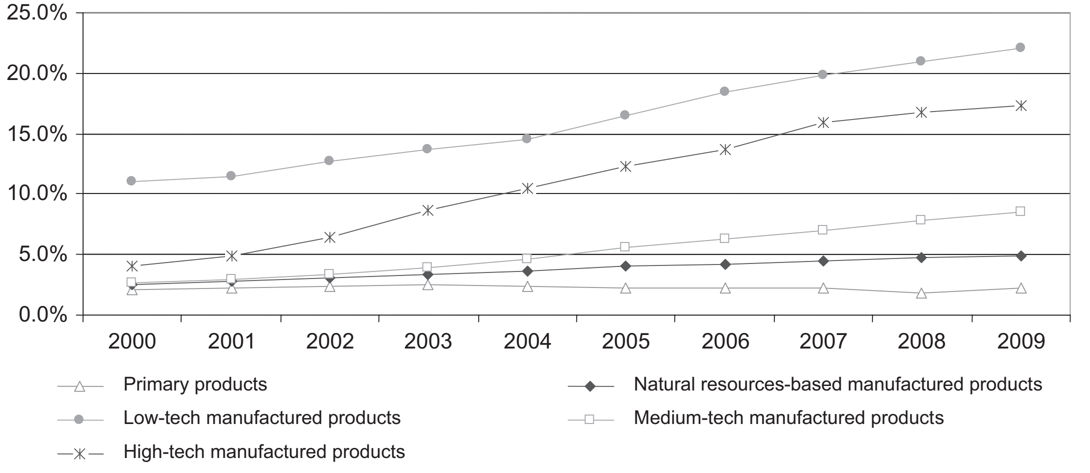

FIGURE 2 Evolution of Chinese export share of total global exports by technological segment, 2000 to 2009
Source: The authors, using UN Comtrade data (UN Statistics Division, 2010).

aimed at embedding greater technological content into activities and corporate functions, not limited to labour-intensive activities.

Thus, the scale and the speed of Chinese industrial growth throughout the 2000s began to have increasing impacts on international trade flows in different ways, not least on raw material prices. Meanwhile, WTO and IDE-JETRO (2011) outline China's role supporting developed countries exports, such as Japan and Korea, since Chinese economy is now a major importer of parts and components, as well as capital goods. Apart from China being an important consumer market for Japanese and Korean industries, a great part of the investment in China from these countries was intended to build an intra-Asian trade and production network. Thereby, China's trade structure is strongly connected to shared intra-Asian production network, and also associated to direct foreign investment flows and the decision of major corporations to consolidate a global manufacturing base in China, especially of electronic consumer goods.

For Chinese exports, developing countries represented the main target in the 1980s. From 1993 on, however, the participation of these economies on Chinese exports was overcome by the participation of developed countries. This change was mainly due to the fact that the US considerably increased the volume of imports from China, and to a lesser extent, to the Chinese trade strengthening with the European Union. However, in the last few years, due to the effects of the international crisis, exports to developing countries have become more important, increasing the potential impacts of Chinese competition.

Therefore, the analysis of the impact of Chinese competition should be conducted with these transformations in the global trade in mind, with shared production as an important element and China playing an increasingly prominent role, with different impacts on several regions around the world.

In the next section, a brief analysis of the studies which tried to establish the extent to which the Chinese trade expansion offset competitors in third markets is conducted.

3 | TRADE IMPACTS OF CHINESE EXPANSION ON GLOBAL COMPETITORS

The astonishing growth of the Chinese economy and its increasing impact on global markets has led to great international attention. The inclusion of China in the World Trade Organization (WTO) in 2001, and the subsequent elimination in 2005 of the imports quota for textile and clothing products,[5] saw Chinese expansion and its integration in international trade begin to generate more concern (Jenkins, 2008a). Thus, the 2000s saw several studies of the impact of Chinese competition on third markets, both for developed and developing countries (Jenkins & Peters, 2009).

In that sense, Husted and Nishioka (2010) investigated which developed and developing countries experienced loss due to Chinese trade expansion. Applying the constant market share method[6] in export data of manufacturing products (SITC Rev. 3, industries from 5 to 8)[7] and using a sample of 24 countries, from 1995 to 2005, the authors found evidence that developing countries did not face falling market share as a consequence of China's gains. Developing countries, such as Malaysia and Mexico, that specialized in manufacturing products similar to those of China, presented market share

[5]Upon the termination of the Textiles and Clothing Agreement.

[6]There are different approaches and ways of calculating the constant market share method, but the basic idea is that a country's market share should remain constant over time. If there are market share variations, they are attributed to competitive or global demand changes at large or in specific markets (Husted & Nishioka, 2010).

[7]SITC (Standard International Trade Classification) Rev. 3 corresponds to the third review of the product classification system, published by the United Nations for trade statistics. Industrial products are rated by the initial digits 5 to 8.

variations during this period, which were positively related to changes to the Chinese market share in third markets, suggesting that those countries do not significantly compete with China. Rather, Husted and Nishioka's (2010) results suggest that China's market share growth was related to reduction in developed countries' market share, such as Japan and the United States.

Dimaranan, Ianchovichina, and Martin (2009) also assess Chinese competition in third markets. These authors noted that, while China's growth creates opportunities to its trade partners, it produces strong competition in internal and external markets. Thus, they tried to identify which countries and industries faced the most severe competition from China, and which would be the biggest opportunities found. They used a modified version of the Global Trade Analysis Project (GTAP) standard model,[8] conducting simulations for the 2005 to 2020 period. These simulations revealed that China's growth boosts competition in manufacturing product markets, especially in the textile and clothing industries, and that manufacturing industries in several countries are negatively affected by Chinese competition, particularly from low- and average-income countries in South and South-East Asia. They have also verified that the greater variety and higher quality of Chinese exports can potentially be of benefit to the world. Nonetheless, countries that do not make an effort to engage with China's growth rate will suffer market share erosion of their exports and of high-tech manufacturing products.

Most studies of the impact of Chinese trade expansion focus on Asia, since China's exports tend to offset exports from other Asian countries more intensely (Blázquez-Lidoy, Rodríguez, & Santiso, 2006). Ahearne, Fernald, Loungani, and Schindler (2003), for instance, conducted a study for the following Asian regions and countries: the so-called Asian newly industrialized economies (NIEs) (South Korea, Singapore, Taiwan) and ASEAN-4 (Indonesia, Malaysia, Philippines and Thailand). The authors have found an often positive correlation (although rarely statistically significant) between Chinese exports growth and NIEs and ASEAN-4 exports growth, from 1981 to 2001, suggesting complementarity. On the other hand, when analyzing the market share evolution of Asian and Chinese economies to the US market, from 1989 to 2002, divided by type of industry, the authors found that China gained market share in the US in almost all industries,[9] while NIEs' market share declined and ASEAN-4 market share experienced gains only in about half of industries, showing evidence of the competition between China and the Asian countries, especially NIEs.

Eichengreen, Rhee, and Tong (2007), who were also concerned with the competitiveness of Asian countries in the face of Chinese emergence in the global market, conducted a study to estimate the impacts of Chinese exports on Asian exports, from 1990 to 2002. The authors generated, through gravitational models, the implications of Chinese expansion over the Asian countries' exports to China, and also obtained the effects of the Chinese export growth over the other Asian countries' exports to third markets. Their conclusion was that, in general, Chinese exports displaced the exports of other Asian countries. But China's economic growth had a positive impact on exports of high-income countries, like Japan, Singapore and South Korea, which are relevant exporters of capital goods. For average-income countries, like Malaysia and the Philippines, which export a great variety of products, the effect of the Chinese expansion was inconclusive. For low-income Asian countries, on the other hand, like Bangladesh, Sri Lanka, Pakistan and Vietnam, whose exports are mainly based on labour-intensive goods, the trade impact of the Chinese economic expansion was negative and more intense.

[8]GTAP corresponds to a general computable equilibrium model. The GTAP model is a multi-regional and multi-sectoral model of general computable balance used as software and fed by the GTAP Database. Besides these data resources and general computable balance programs, the GTAP project involves courses, conferences and research projects co-ordinated by the Center for Global Trade Analysis.

[9]The Chinese computer, accessories and semi-conductor industry stand out for its rapid gains in market share in the US since 1998.

Therefore, the authors have confirmed that Chinese exports tend to compete especially with traditional consumer goods' exports from other Asian countries. Greenaway, Mahabir and Milner (2008), using a methodology similar to Eichengreen et al. (2007), also found evidence that Chinese exports displaced Asian neighbour exports in the global market between 1990 and 2003. This effect intensified in the latter half of the period and, in particular, in developed country markets. But in contrast to the results of Eichengreen et al. (2007) the high-income Asian countries were the most adversely affected by the rapid rise of China.

In another way, two other analyses using gravity models revealed different results. Athukorala (2009) for the period 1992 to 2004, found evidence that Chinese competition does not crowd out other countries' exports. After controlling for other relevant variables, a one percentage point increase in exports from China was associated with a 0.54% increase in exports from other countries. He also found that the coefficient is smaller for miscellaneous manufacturing which encompasses various labour-intensive products, such as clothing and footwear, and larger for machinery products. For the author, the result could be explained by the increasing complementarity in export performance between China and the other Asian countries, especially in industries marked by cross-border production networks. In the same direction, Devadason (2010), analyzing intra-ASEAN trade, concluded that there is no evidence of diversion away from intra-ASEAN trade to ASEAN–China trade, since the coefficient that represents China's competition was negative, but statically insignificant. Besides, the studies that investigated the implications of industrial exporting power recently achieved by China on Asian countries, there is research that covers other global locations, such as Africa (Broadman, 2007; Giovanetti & Sanfilippo, 2009; Edwards & Jenkins, 2014), Europe (Martin, Ianchovichina, & Dimaranan, 2008), Russia (Ianchovichina, Ivanic, & Martin, 2009), Mexico (Gallagher, Moreno-Brid, & Porzecanski, 2008), among other countries and continents. In that sense, Ianchovichina and Martin (2006) point out that Chinese competition is important not only to South and South-East Asian countries, but also to Latin America, with the possibility of relevant losses to these countries.

In the case of Latin America, much of the discussion of these issues has found indications that China represents a threat to Latin American exports, even if, for some, this threat is more restricted, affecting only a few countries and/or sectors, and for others, it is more intense and comprehensive. Jenkins (2008b) identifies a single study (Lederman, Olarreaga, & Soloaga, 2007), that concludes there was no evidence of substitution of Latin American exports by Chinese in third markets. All other studies of this subject found at least one negative impact of the Chinese expansion on Latin American exports.

Among the works which considered the Chinese threat to Latin America are Freund and Özden (2009), Lederman, Olarreaga, and Perry (2006), Devlin, Estevadeordal, and Rodríguez-Clare (2006). Freund and Özden (2009) and Lederman, Olarreaga, and Perry (2006) showed that only exports from a few Latin American countries were negatively affected by Chinese competition; namely Mexican exports and, to a lesser extent, those from some Central American countries. According to Freund and Özden (2009), those negative impacts were restricted to some manufacturing sectors: among 97 industries (HS2),[10] only 16 experienced a statistically significant decline concomitant with Chinese export expansion. For Devlin et al. (2006), the impact is also more focused on Central America and Mexico, while acknowledging that competition between China and Latin America has intensified. According to them, Mexico, Central American countries and the Caribbean, with exporting structures specialized in light manufacturing products, are the most affected by the negative impact of competition with Chinese exports, especially in the US market.

[10]The acronym HS2 stands for Harmonized Commodity Description and Coding System, and corresponds to product classification naming in a common coding system made up of six digits. Number 2 means the classification used only considers the two first digits of the code.

On the other hand, studies by Lall and Weiss (2007), Moreira (2007) and Jenkins (2008a) showed that the negative impact of Chinese exports on Latin American exports was broader in terms of affected sectors and/or countries. Lall and Weiss (2007) rated Latin America's market share behaviour when compared to China's as falling into two types of threat: direct threat, representing the situation in which China experiences market share gains, while the country being analyzed presents a fall in market share; and partial threat, when both China and the country being analyzed have market share gains, but China's is bigger. The authors concluded that the countries most affected in general (considering direct and partial threats) were: Costa Rica, El Salvador and Chile. In 2002, in the first two countries the share of exports under Chinese threat from the total exported to the world represented more than 70%, and in Chile, around 60%. When considering only the direct threat, the countries which were most affected were, in descending order, Bolivia, Chile, Brazil, Colombia and Uruguay, all with more than 20% of their world exports under Chinese threat, in 2002.[11]

For Moreira (2007), while Central American countries and Mexico are more exposed to Chinese competition due to the similarity of exports patterns, South American countries experienced higher losses in the face of Chinese competition of manufactured products in the global market, from 1990 to 2004. This result was obtained through the constant market share methodology. The rationale the author finds to explain why Central American countries and Mexico were less affected by Chinese competition is that preference agreements and trade protection were used.

Jenkins (2008a), in turn, uses an extension of the constant market share model to measure China's competitive threat to Latin America. Among the 18 countries which were analyzed, all suffered market share loss in their exports to the US due to Chinese competition from 1996 to 2006, except Nicaragua and Peru. The author concludes that the major part of Latin America significantly lost market share to China during the same period, especially after 2001, indicating a trend of increasing competition. By calculating market share losses in exports of only manufactured products, the authors concluded that, as expected, negative impacts are more severe than the total of exports indicates.

Therefore, we maintain that Chinese competition in third markets is an important aspect for consideration in the economic literature. While most studies point to the important effects of Chinese competition, evidence, in general, is very segmented by methodology and geographic region, and, sometimes, contradictory. Thus, this work aims to contribute to the debate, using a consistent database and methodology to analyze the impact of Chinese competition in third markets comparatively in different geographic regions, and at same time trying to differentiate the impacts by technological category.

4 | METHODOLOGICAL ASPECTS AND GRAVITATIONAL MODEL SPECIFICATION

Most of the studies that analyze the impact of Chinese competition in third markets employ trade indicator analysis, measuring the similarity of the export structures of the affected country and China (Lall & Weiss, 2007; Moreira, 2007), or studying the market share evolution of the country being compared to China, and eventually other countries (Jenkins, 2008a; Jenkins & Peters, 2009; Husted & Nishioka, 2010; Hiratuka et al., 2012). This set of techniques, although useful to suggest the orientation of the

[11]Nevertheless, the authors consider that the direct threat of Chinese exports to Latin America at large seems relatively small when compared to the Chinese threat to East Asia.

impact of Chinese exports on other countries' exports, lacks tools to control other factors which affect trade among countries, as well as being incapable of capturing general equilibrium effects. Studies which use general equilibrium techniques to simulate the effects of Chinese competition employing the GTAP model specify all economic relations in order to forecast changes in interest variables, such as price, product and economic well-being (Dimaranan et al., 2009; Ianchovichina et al., 2009). However, the GTAP model depends on a large set of parameters to simulate forecasts for the desired period, and is very responsive to the adopted parameters, which can significantly alter results, as seen in Dimaranan et al. (2009). In this study, an extension of the gravitational model capable of controlling several effects that impact bilateral trade, without depending on constraints presented by the GTAP model, was used. The gravitational model does not make predictions (which depend on parameters defined ex ante), but, by using a sequence of annual series data, it can capture the trend of a specific period.

The gravitational model represents one of the most frequently used methods in international economics to explain several issues related to trade flow among countries. The first applications of the gravitational model in international trade were developed by Tinbergen (1962) and Pöyhönen (1963), aiming to explain the amount of trade between two countries, assuming that the trade volume is positively related to the 'size' of the countries, measured by GDP, and negatively related to the transportation cost between both countries, measured by the distance between its economic centres (Cheng & Wall, 1999). Even in the face of criticism over the theoretical basis of the gravitational models, these lost momentum in that many authors contributed to justifying the model (Frankel, 1997; Sá Porto, 2002), showing its compatibility with several international trade theories.[12] In this study, the gravitational model is used as a tool to analyze an empirical problem, and not to test a specific trade theory.

Thus, the gravitational model is employed to estimate the impact of Chinese exports on exports from other countries with similar destinations, just like Eichengreen et al. (2007), Greenaway et al. (2008), Athukorala (2009) and Giovanetti and Sanfilippo (2009). Hence, we have the following specification:[13]

$$\begin{aligned} \ln X_{ij,t} =& \beta_0 + \beta_1 \ln CX_{j,t} + \beta_2 \ln Y_{i,t} + \beta_3 \ln Y_{j,t} + \beta_4 \ln R_{i,t} + \beta_5 \ln R_{j,t} \\ &+ \beta_6 \ln D_{ij} + \beta_7 F_{ij} + \beta_8 L_{ij} + \beta_9 P_{ij} + \ln \varepsilon_{ij,t} \\ & i = 1, \ldots, N; j = 1, \ldots, N; t = 1, \ldots, T, \end{aligned} \tag{1}$$

in which β_0 to β_9 are the parameters to be estimated; $X_{ij,t}$ represents the exports from country i to country j throughout year t; $CX_{j,t}$ refers to Chinese exports to country j throughout year t; $Y_{i,t}$ and $Y_{j,t}$ correspond to GDP of the exporter and importer countries, respectively, at time t; $R_{i,t}$ and $R_{j,t}$ represent the per capita income of the exporter and importer countries, respectively, throughout year t; D_{ij} is the distance between the exporter country i and the importer j; F_{ij} refers to the binary variable that takes value 1 if the exporter country i and the importer j share a common border; L_{ij} corresponds to the binary variable that presents value 1 when the exporter and importer countries have a common official

[12]Frankel (1997) states that the gravitational model may be derived from the monopolistic competition models presented by Helpman and Krugman (1985), and by Heckscher-Ohlin's models derived by Deardorff (1998). Deardorff shows that the gravitational equation may be derived from Ricardian trade models, imperfect competition models and increasing scale returns.

[13]It is worth noting that, in this work, just like in the international trade's literature tradition, the gravitational equation is logarithmically estimated. This, however, results in a problem when considering the records in which a country's trade flow to another is zero in the estimation, given the impossibility of obtaining a null logarithm. Since there is no consensus on the best way to estimate the gravitational equation taking into consideration the null trade flows, in this study, we chose to perform estimates not considering the null trade flow notes, for it corresponds to the most frequent practice in literature (Cheng & Wall, 1999; Eichengreen et al., 2007).

language; P_{ij} is the binary variable that has value 1 when the exporter and importer countries have a past colonial relationship; and, lastly, $\varepsilon_{ij,t}$ represents the random error term.[14] Export variables, GDP and per capita income are in current dollars,[15] and the distance variable between two countries is measured in kilometres, from latitude and longitude of each country's most important cities or agglomerations in terms of population.

The $CX_{j,t}$ variable, which refers to Chinese exports to country j in the period t, is the key variable, because it indicates the competition level of global exports in the face of Chinese exports to the same destination. When this variable's coefficient is negative, it may be concluded that Chinese exports to country j are displacing exports from country i in the same target country j. Therefore, interpretation of the negative coefficient Chinese exports means the increasing competition of Chinese exports is causing importing countries to replace their existing suppliers with Chinese suppliers. Alternatively, a positive sign represents a complementarity situation, since the increase in Chinese exports would be related to an increase in global exports to same destination.

It is important to recognize that Chinese exports' explanatory variable ($CX_{j,t}$) is potentially an endogenous variable to the model, because global factors present in the error term[16] which were not noted may all the same affect exports from country i to country j, and Chinese exports to country j. The common solution offered by the literature is the estimation by the instrumental variables method. As pointed out by Eichengreen et al. (2007), the distance variable between China and the export target country j (CD_j) may be introduced as a valid instrumental variable of Chinese exports ($CX_{j,t}$), because it is plausible to consider it exogenous (hypothesis that may not be tested (Wooldridge, 2002, p. 86)), as well as significantly correlated to the endogenous $CX_{j,t}$ variable (hypothesis tested and corroborated by the regressions results of the first stage).

Thus, equation (1) estimation is conducted by the least squares method with two stages,[17] using a robust estimation to the presence of heteroskedasticity, according to the technique proposed by White (1980). When considering the heterogeneity problem in the gravitational model sample, the solution that is often adopted by the literature is the estimation by the fixed effects method for the countries pair, as Cheng and Wall (1999) did. However, in this study, an intercept was estimated for each exporting region as a way of incorporating a type of fixed effect,[18] since the estimation by fixed effects method for the countries pair, considering the endogeneity of Chinese exports variable, becomes unfeasible due to the fact that the instrumental variable (CD_j) found to estimate the first regression stage (in two stages) is constant in time.

Also, the gravitational model presented in this work includes explanatory variables that try to capture historical, cultural, ethical and geographical effects that affect trade between two countries as a way of complementing the heterogeneity control of observations. Thus, equation (1) specification incorporates, besides the global market supply and demand factors, resistance to trade relations, which

[14]To reach the specification of equation (1), tests were performed starting from a simple gravity equation, exposed as the basic model in Cheng and Wall (1999), adding variables like per capita income, and dummy to colonial relationship in the past, year and fixed effect. It was decided not to include dummies for trade agreements, since their effects can be captured by the variables of bilateral distance, common border, common language and colonial relationship in the past. Also, in Cheng and Wall (1999), the inclusion of dummies of trade agreements did not change the results presented by the authors.

[15]We chose to use the GDP and the per capita income in current dollars, instead of variables in purchase power parity, just like Frankel (1997) and Sá Porto (2002) did. According to Srinivasan (1995, as cited in Frankel (1997)), variables in purchase power parity are subject to large measure errors.

[16]For example, credit to trade, transportation cost influenced by oil price, and others.

[17]The first stage consists in estimating the endogenous variable related to the exogenous variables and the instrumental variable by ordinary least squares. The second stage consists in estimating equation (1) by ordinary least squares, using the estimated values of ln $CX_{j,t}$ obtained in the first stage as an explanatory variable, instead of the ln $CX_{j,t}$ variable itself.

[18]Incorporation of an intercept to each importing region was also tested, however, since the instrumental variable is defined as the distance between China and the importer country, a high multi-collinearity was verified

are represented by geographic distance (D_{ij}), presence/absence of a common boundary between two countries (F_{ij}), and historical-cultural gap, the proxy variables of which correspond to the common language (L_{ij}), and to the past colonial relationship (P_{ij}) between two countries. The expectation is that the distance between the exporter and importer countries is negatively related to the trade volume between them, and that the presence of a common boundary, the presence of a common language and the existence of a past colonial relationship become positively related to the trade amount between both countries. Annual dummies were included to control the time effect as well. This is a frequent practice in estimations with data on a panel, which enable the incorporation of changes which are common to all countries and which have occurred throughout time (e.g. an international downturn) in the analysis of the impact of Chinese exports on global exports.

It is important to highlight that equation (1) is used to estimate the uniform impact of Chinese exports on global exports. However, later in this work, we aim to identify the differentiated impact of Chinese exports to each exporting region, based on the idea that Chinese exports do not equally affect all exporting countries. Given this, a different coefficient of the effect of Chinese exports was estimated to each exporting region. Based on equation (1), but now interacting the Chinese exports variable ($CX_{j,t}$) with dummies of exporting region G_k, it is possible to obtain an inclination coefficient of the Chinese exports variable to each region, according to the following model:

$$\begin{aligned} \ln X_{ij,t} =& \beta_0 + \sum_{k-1} \delta_0 G_k + \beta_1 \ln CX_{j,t} + \sum_{k-1} \delta_1 G_k \ln CX_{j,t} + \beta_2 \ln Y_{i,t} + \beta_3 \ln Y_{j,t} \\ &+ \beta_4 \ln R_{i,t} + \beta_5 \ln R_{j,t} + \beta_6 \ln D_{ij} + \beta_7 F_{ij} + \beta_8 L_{ij} + \beta_9 P_{ij} + \ln \varepsilon_{ij,t} \\ & k = 1, \dots, K \end{aligned} \tag{2}$$

in which k corresponds to the k^{th} exporting region considered in the analysis; β_0 represents the estimate intercept of the base group (or reference group);[19] δ_0 corresponds to the estimate difference between the exporting region's (G_k) intercept and that of the base group; β_1 refers to the estimate coefficient of Chinese exports on exports of the region adopted as the base group; δ_1 represents the difference between the estimate coefficient of the effect of Chinese exports on the base group and the effect of Chinese exports on the exporting region G_k. Thus, the exporting region's G_k intercept (when the region dummy has value 1) is given by $\beta_0 + \delta_0$ and the inclination that measures the impact of Chinese exports on the exporting region G_k is given by $\beta_1 + \delta_1$.

As already mentioned, the Chinese exports variable presents an endogeneity problem. If the distance variable between China and the exports target country ($\ln CD_j$) is considered a valid instrumental variable to the endogenous Chinese exports variable ($\ln CX_{j,t}$), thus endogenous variables $G_k \ln CX_{j,t}$ use $G_k \ln CD_j$ as instrumental variables, according to Wooldridge (2002, pp. 121–122). The estimation method that employs instrumental variables are again the two-stage ordinary least squares, but in this case, there are k endogenous variables, k instrumental variables, and k estimate equations in the first stage, in order to estimate equation (2).

The division of exporting regions aims to separate the groups of countries mentioned by the literature as those which would be most affected by Chinese exports, especially Asian and Latin American countries, separating them from the group of developed countries. Thus, the regions analyzed were classified according to the following groups of source countries:[20]

[19]Base group refers to the group against which comparisons are made.

[20]Only countries which are considered most relevant in international trade were selected for the sample. The criteria used for the selection of countries was the requirement that the country should present the available data (non-zero) from a total of exports to the world, in each year from 2000 to 2009, except those which do not present enough data for the equation's explanatory variables. The list of countries in each region is in the Appendix Table.

1. Developing Asia.
2. Developed Asia.
3. Hong Kong and Macao.[21]
4. Europe.[22]
5. North America.
6. Central America and Mexico.
7. South America.
8. Countries from the Rest of the World.[23]

Both equation (1) and equation (2) gravitational models are estimated for the period from 2000 and 2009, taking into consideration the classification introduced by Lall (2000), which categorizes products by technological intensity. Thus, this work's estimations are first directed at manufacturing products. Eventually, the following categories are used: (1) Primary products; (2) Natural resources-based manufacturing, (3) Low-tech manufacturing, (4) Medium-tech manufacturing, and (5) High-tech manufacturing.[24]

Exports data were taken from the United Nations Commodity Trade Statistics Database (UN Comtrade) and were aggregated according to Lall's (2000) classification, based on Marconi and Rolli's (2007) work. Data on GDP, per capita income and population were obtained from the World Bank via the World Development Indicators. Distance data between exporter and importer countries and binary variables data of common boundary, common official language and common colonial past were collected from Centre d'Études Prospectives et d'Informations Internationales (CEPII) database.

5 | THE IMPACT OF CHINESE EXPORTS ON GLOBAL EXPORTS

In this section, the results of the gravitational model's estimates are presented for analysis of the impact of Chinese exports on global exports, assuming a uniform effect on exporting countries. In the next section, the impact on different regions will be analyzed, but it is important to have first the average impact to have a general standard as a comparative basis. Due to the strong concentration of manufacturing products in the Chinese exports structure, firstly, the impact of Chinese exports on global exports of manufacturing products is estimated. Secondly, the results of impact estimates of Chinese exports are presented to each product technological category.

The equation estimated in Table 1 corresponds to equation (1), including time and exporting region dummies. The first column presents the coefficient obtained through estimation of ordinary least

[21]Since Hong Kong and Macao are special administrative regions of China, they were isolated from the other Asian countries so as not to contaminate estimations performed in section 5, but we do not intend to analyze these two countries separately due to the difficulty in separating re-exports which occur between China and these countries.

[22]In the group of countries from Europe, only those countries which are considered developed, according to the International Monetary Fund classification of 2011, were included,.

[23]The effects of Chinese exports on the Rest of the World group are not intended for explanation, because it is a set of very heterogeneous countries, grouped as control means to isolate the effects of interest regions.

[24]It is worth noting that technological classifications, such as Lall's (2000), may overestimate high-tech exports, because technology-intensive characteristics of industrial sectors are associated with exported products. With the productive fragmentation of value chains, the country that exports high-intensity products does not necessarily master the technological grounds for its design, development and production, because it may perform only the assembly step (UNCTAD, 2013). Nevertheless, the analysis by technological category is important, since different exporting structures have different implications to the economic and development growth of the domestic industry.

TABLE 1 Estimation results: Competition of Chinese exports with global exports in the manufacturing sector

	OLS	2SLS
Chinese exports	**0.590*****	**-0.200*****
	(0.007)	(0.022)
exporter GDP	1.131***	1.240***
	(0.005)	(0.007)
importer GDP	0.222***	1.052***
	(0.008)	(0.023)
exporter per capita income	0.311***	0.355***
	(0.009)	(0.010)
importer per capita income	0.0252***	0.0155**
	(0.006)	(0.007)
bilateral distance	-1.401***	-1.413***
	(0.009)	(0.010)
common border	0.993***	1.029***
	(0.046)	(0.051)
common language	0.939***	1.290***
	(0.024)	(0.027)
past colonial relationship	0.558***	0.354***
	(0.040)	(0.043)
year 2001	-0.141***	-0.00253
	(0.031)	(0.035)
year 2002	-0.288***	-0.0377
	(0.032)	(0.036)
year 2003	-0.653***	-0.228***
	(0.032)	(0.037)
year 2004	-0.903***	-0.311***
	(0.032)	(0.039)
year 2005	-1.162***	-0.434***
	(0.033)	(0.041)
year 2006	-1.431***	-0.577***
	(0.034)	(0.043)
year 2007	-1.729***	-0.749***
	(0.034)	(0.045)
year 2008	-1.919***	-0.871***
	(0.035)	(0.047)
year 2009	-1.912***	-0.965***
	(0.034)	(0.045)
developed Asia	-0.330***	-0.524***
	(0.043)	(0.049)

Table 1 Continued

	OLS	2SLS
Hong Kong/Macao	-0.203***	-0.358***
	(0.067)	(0.071)
Europe	-1.711***	-1.855***
	(0.036)	(0.041)
North Am.	-2.626***	-3.070***
	(0.042)	(0.049)
Central Am./Mexico	-2.790***	-3.192***
	(0.043)	(0.049)
South Am.	-2.179***	-2.469***
	(0.033)	(0.038)
rest of the World	-2.025***	-2.232***
	(0.030)	(0.034)
constant (Base group: year 2000, Developing Asia - exporting region)	-18.89***	-27.15***
	(0.194)	(0.296)
Number of observations	73,918	73,918
R^2	0.759	0.698

Source: The authors.

Notes: Standard error in parenthesis.

*significant at 10%; **significant at 5%; ***significant at 1%.

squares (OLS), and the second column, by the two-stage least squares (2SLS) method.[25] It is important to note that the large difference between the coefficients estimated by OLS and 2SLS is found in the key variable coefficient, Chinese exports, because from one estimation to another, not only is magnitude changed, but also the sign. This points to the importance of considering the endogeneity of Chinese exports in the model by the 2SLS method, which is reinforced by the Hausman test,[26] that indicates rejection (to the significance level of 1%) of the hypothesis of the exogeneity of Chinese exports.

Thus, the 2SLS method has shown that global exports of manufacturing products were offset in third markets by Chinese exports from 2000 to 2009, showing that an increase of 1% in Chinese exports would reflect a reduction in global exports to the same markets in 0.2%. These results corroborate the conclusion of Dimaranan et al. (2009), whose simulations revealed that Chinese growth would intensify competition in manufacturing product markets, and that manufacturing industries from several countries would be negatively affected. Coefficients estimated by 2SLS of the other model's variables present the expected sign[27] and are statistically significant in 1%.

In order to assess Chinese competition by product technological level and verify in which categories China has demonstrated to be an important competitor, manufacturing is disintegrated in low-, medium-, and high-tech in Table 2 results. Also, the impact of Chinese exports in the group of

[25]First stage regressions were omitted here, but can be provided on demand.

[26]The Hausman test (Hausman, 1978) is based on the fact that estimation by 2SLS is consistent either in the presence or in the absence of endogeneity, and estimation by OLS is consistent only in its absence. Rejection of null hypothesis indicates endogeneity of the analyzed variable, being preferable the estimation by 2SLS.

[27]Time dummies, however, appear with a negative sign and are reduced over the years, contrary to expectations. The same is observed in Eichengreen et al. (2007).

TABLE 2 Estimation results: Competition of Chinese exports with global exports, by technological group

	Primary products		Natural resources-based industry	
	OLS	2SLS	OLS	2SLS
Chinese exports	**0.253*****	**0.203*****	**0.511*****	**0.149*****
	(0.006)	(0.012)	(0.008)	(0.018)
exporter GDP	0.993***	0.991***	0.999***	1.020***
	(0.008)	(0.008)	(0.006)	(0.007)
importer GDP	0.621***	0.680***	0.313***	0.668***
	(0.009)	(0.016)	(0.009)	(0.019)
exporter per capita income	-0.116***	-0.116***	0.251***	0.252***
	(0.012)	(0.012)	(0.011)	(0.012)
importer per capita income	0.111***	0.0949***	0.0791***	0.0570***
	(0.009)	(0.010)	(0.008)	(0.008)
bilateral distance	-1.291***	-1.280***	-1.453***	-1.379***
	(0.012)	(0.012)	(0.011)	(0.011)
common border	1.133***	1.122***	0.933***	0.995***
	(0.047)	(0.047)	(0.048)	(0.048)
common language	0.897***	0.901***	0.964***	1.110***
	(0.031)	(0.031)	(0.028)	(0.029)
past colonial relationship	0.875***	0.866***	0.958***	0.838***
	(0.045)	(0.045)	(0.049)	(0.050)
Number of oberavtions	61,362	61,362	68,106	68,106
R^2	0.537	0.536	0.64	0.626

	Low-tech industry		Medium-tech industry		High-tech industry	
	OLS	2SLS	OLS	2SLS	OLS	2SLS
Chinese exports	**0.463*****	**-0.238*****	**0.477*****	**-0.376*****	**0.396*****	**0.022**
	(0.008)	(0.024)	(0.008)	(0.027)	(0.007)	(0.019)
exporter GDP	1.158***	1.191***	1.232***	1.287***	1.036***	1.058***
	(0.006)	(0.007)	(0.006)	(0.007)	(0.007)	(0.007)
importer GDP	0.367***	1.047***	0.345***	1.193***	0.347***	0.810***
	(0.009)	(0.024)	(0.009)	(0.027)	(0.011)	(0.024)
exporter per capita income	0.0585***	0.0620***	0.327***	0.366***	0.669***	0.683***
	(0.010)	(0.011)	(0.011)	(0.012)	(0.012)	(0.013)
importer per capita income	0.101***	0.107***	-0.0333***	-0.0937***	0.0620***	0.00848
	(0.007)	(0.007)	(0.007)	(0.008)	(0.008)	(0.009)
bilateral distance	-1.568***	-1.502***	-1.429***	-1.350***	-1.356***	-1.337***
	(0.011)	(0.011)	(0.010)	(0.011)	(0.011)	(0.011)
common border	0.958***	1.006***	1.216***	1.304***	0.840***	0.889***
	(0.048)	(0.050)	(0.048)	(0.052)	(0.054)	(0.055)

Table 2 Continued

	Low-tech industry		Medium-tech industry		High-tech industry	
	OLS	**2SLS**	**OLS**	**2SLS**	**OLS**	**2SLS**
common language	1.087***	1.310***	0.801***	1.074***	1.259***	1.317***
	(0.026)	(0.029)	(0.027)	(0.030)	(0.029)	(0.030)
past colonial relationship	0.664***	0.565***	0.556***	0.323***	0.450***	0.347***
	(0.042)	(0.044)	(0.045)	(0.048)	(0.051)	(0.052)
Number of observations	68,589	68,589	65,802	65,802	60,803	60,803
R^2	0.695	0.647	0.711	0.645	0.681	0.664

Source: The authors.

Notes: a) In order to simplify the view, the estimate coefficient results of time and exporting region dummies were omitted.

b) Standard error in parenthesis.

*significant at 10%; **significant at 5%; ***significant at 1%.

primary products and natural resources-based manufacturing is presented. It can be verified that, in the estimation by 2SLS of Table 2, the impact of Chinese exports on global exports is negative and significant in low- and medium-tech groups, compared to the positive effect on the estimation by OLS. Since the application of the Hausman test to the estimations of each technological group indicated rejection of the hypothesis of the exogeneity of Chinese exports,[28] the estimation by 2SLS was proven more appropriate; in the next estimations, only the results of estimate regressions by 2SLS are presented.

The negative and significant sign of Chinese exports from the low-tech group indicates Chinese competition in this segment, which is consistent with the traditional view that China's comparative advantages are found in labour-intensive products. The Chinese exports sign is also negative and significant in the regression of medium-tech manufacturing products, with a greater magnitude in module than the low-tech coefficient. This indicates that Chinese competition in third markets is fiercer in the medium-tech segment, emphasizing the hypothesis that China is becoming more competitive in medium- and high-tech products, as well as the low-tech products segment, where China was already competitive in previous years (Rodrik, 2006; Lall & Weiss, 2007; Jenkins et al., 2008).

Regression results for primary products and natural resources-based goods highlight that, in these segments, China is not a competitive threat in third markets. This contributes to strengthening the results presented by the model, since it coincides with what was expected, that China is not internationally competitive in these categories. As to the estimate coefficient of Chinese exports in the high-tech group, it can be noted that, although positive, it consists in a next-to-zero and non-significant value, indicating Chinese exports of high-tech products have a small effect on exports from other countries in this group. However, the next section will show that this almost null coefficient reflects the different results in different regions in the world, with opposed magnitudes and directions in the Chinese exports effect.

[28]The Hausman test was not only significant in the primary products group in the rejection of the exonegeity hypothesis of the Chinese exports variable, however, via Wu-Hausman and Durbin-Wu-Hausman tests, the hypothesis of exogeneity of this variable at 1% of significance was rejected.

6 | THE IMPACT OF CHINESE EXPORTS ON EXPORTS FROM DIFFERENT REGIONS OF THE WORLD

The development of this section is analogous to the previous one, except that, in that section, the impact of Chinese exports was estimated as being the same for all countries, and in this section, it is assumed that the impact of Chinese competition in third markets affects each exporting region differently. Thus, a different inclination coefficient of Chinese exports is estimated to each exporting region.

Table 3 shows the result of equation (2) estimation by 2SLS. Coefficients estimated by column '2SLS' of Chinese exports' variable interactions with exporting region dummies are exposed as differences compared to the base group, Developing Asia. To obtain the estimate coefficient of the effect of Chinese exports on each region, it is necessary to sum the coefficient of column '2SLS' with the 'CX' coefficient of the base group (Developing Asia), according to the 'Inclination Coefficient'[29] column from Tables 3 and 4.

TABLE 3 Estimation results: Competition of Chinese exports with global exports from different regions in the manufacturing sector

	2SLS	**Inclination Coefficient**
CX - Chinese exports (Base Group: Developing Asia)	**-0.483*****	**-0.483**
	(0.036)	
Developed Asia * CX	0.182***	**-0.301**
	(0.053)	
Hong Kong/Macao * CX	-0.351***	**-0.834**
	(0.090)	
Europe * CX	0.471***	**-0.012**
	(0.033)	
North Am. * CX	0.626***	**0.143**
	(0.038)	
Central Am./Mexico * CX	0.116**	**-0.367**
	(0.051)	
South Am. * CX	0.267***	**-0.216**
	(0.043)	
Rest of the World * CX	0.263***	**-0.220**
	(0.035)	
Number of observations	73,918	
R^2	0.686	

Source: The authors.

Notes: a) Coefficients of the other explanatory variables of the model appear with the expected sign and are statistically significant, but are omitted from Table 3, since its regression corresponds to the same as in Table 1, except that it estimates the impact of Chinese exports on each exporting region.

b) Standard error in parenthesis.

*significant at 10%; **significant at 5%; ***significant at 1%.

[29] As Developing Asia corresponds to the base group, the coefficient estimated by column '2SLS' coincides with the inclination coefficient.

TABLE 4 Estimation results: Competition of Chinese exports with global exports from different regions, by technological group

	Primary products		Natural resources-based industry	
	2SLS	**Inclination Coefficient**	**2SLS**	**Inclination Coefficient**
CX - Chinese exports (Base Group: Developing Asia)	**0.212***** (0.026)	**0.212**	**-0.0761**** (0.038)	**-0.076**
Developed Asia * CX	0.114*** (0.044)	**0.326**	0.0442 (0.059)	**-0.032**
Hong Kong/Macao * CX	-0.255*** (0.069)	**-0.043**	-0.355*** (0.102)	**-0.431**
Europe * CX	-0.0206 (0.028)	**0.191**	0.217*** (0.037)	**0.141**
North Am. * CX	0.0057 (0.038)	**0.218**	0.393*** (0.046)	**0.317**
Central Am./Mexico * CX	-0.0679* (0.037)	**0.144**	0.181*** (0.051)	**0.105**
South Am. * CX	0.0265 (0.033)	**0.239**	0.420*** (0.043)	**0.344**
Rest of the World * CX	-0.00118 (0.030)	**0.211**	0.246*** (0.039)	**0.170**
Number of observations	61,362		68,106	
R^2	0.538		0.617	

	Low-tech industry		Medium-tech industry		High-tech industry	
	2SLS	**Inclination Coefficient**	**2SLS**	**Inclination Coefficient**	**2SLS**	**Inclination Coefficient**
CX - Chinese exports (Base Group: Developing Asia)	**-0.702***** (0.041)	**-0.702**	**-0.629***** (0.045)	**-0.629**	**-0.0655*** (0.038)	**-0.066**
Developed Asia * CX	0.403*** (0.061)	**-0.299**	0.0824 (0.064)	**-0.547**	0.363*** (0.047)	**0.298**
Hong Kong/Macao * CX	-0.560*** (0.112)	**-1.262**	-0.478*** (0.118)	**-1.107**	-0.277*** (0.083)	**-0.343**
Europe * CX	0.726*** (0.037)	**0.024**	0.479*** (0.041)	**-0.150**	0.283*** (0.036)	**0.218**
North Am. * CX	0.717*** (0.044)	**0.015**	0.683*** (0.047)	**0.054**	0.360*** (0.040)	**0.295**

Table 4 Continued

	Low-tech industry		Medium-tech industry		High-tech industry	
	2SLS	Inclination Coefficient	2SLS	Inclination Coefficient	2SLS	Inclination Coefficient
Central Am./ Mexico * CX	0.287***	**-0.415**	0.113*	**-0.516**	-0.0665	**-0.132**
	(0.054)		(0.058)		(0.054)	
South Am. * CX	0.532***	**-0.170**	0.0763	**-0.553**	-0.308***	**-0.374**
	(0.049)		(0.057)		(0.046)	
Rest of the World * CX	0.420***	**-0.282**	0.250***	**-0.379**	0.0857**	**0.020**
	(0.041)		(0.045)		(0.038)	
Number of observations	68,589		65,802		60,803	
R^2	0.627		0.635		0.662	

Source: The authors.

Notes: a) Standard error in parenthesis.

*significant at 10%; **significant at 5%; ***significant at 1%.

We can observe from the note in Table 3 that all exporting regions, except North America, are negatively affected by Chinese competition in the manufacturing sector. The group of countries which was most affected by Chinese exports was Developing Asia. This result coincides with the bulk of the literature, identifying South and South-East Asia (medium- and low-income Asian economies) as the group of countries most affected by Chinese competition of manufacturing products (Gaulier et al., 2004; Dimaranan et al., 2009). According to Eichengreen et al. (2007), the effects of the Chinese trade expansion tend to be felt especially by the Asian neighbours, since these countries present economic development level, factor endowment, technological capabilities and production costs similar to those of China. Also, the overlay or similarity of the Chinese exports basket with Asia's is much greater than with other countries (Devlin, et al., 2006).

The impact of Chinese exports on other regions is statistically less intense than the impact on Developing Asia. After that, Central America and Mexico, Developed Asia, and South America were the regions which were most affected by Chinese competition. According to Devlin et al. (2006), China presents comparative advantages in product categories which are crucial to Mexico and Central American countries (textile, clothing and electronics), particularly because these countries specialize in labour-intensive steps of the global value chains, where China holds an important advantage. In this vein, Table 3 shows that, from 2001 to 2009, the Latin American regions and countries which were most affected by Chinese competition in third markets in the manufacturing products sector were Central America and Mexico, although South American countries have also faced a high level of Chinese competition, as was observed by Jenkins (2008a). The effect of Chinese exports on European exporters was negative, however, since the inclination coefficient was next to zero, the impact is less intense. On the other hand, the inclination coefficient for the North American exporting region was positive, indicating that Chinese exports do not represent a threat to this region's exports.

In Table 4, manufacturing is disaggregated into technological levels, as in the previous section. In the face of the result of primary products from Table 4, it can be noted that the effect of Chinese exports is positive on exports from all the groups of countries,[30] suggesting that Chinese trade expansion

[30]Except Hong Kong and Macao.

of primary products does not compete with exports from other countries in this segment, as expected. As to the analysis of the impact of Chinese exports of natural resources-based industry products, we can see that, for most exporting regions, the effect is also positive.

It can be observed that, in low-tech products, most groups of countries face the negative effects of competition from Chinese exports. Developing Asia corresponds to the group that suffers most with Chinese competition of low-tech products.[31] In this category, the effect of Chinese exports remains strongly negative for Central America, Mexico, and Developed Asia. For North American and European countries, the result of the effect of Chinese exports has revealed a positive sign, but next to zero, indicating exports in these countries are little affected. Among the advanced countries, the Developed Asia region was the only one to have had low-tech products displaced by Chinese exports.

In the medium-tech segment, the impact of Chinese exports is also mostly negative on exporting regions. In this case, just as in the low-tech segment, Developed Asia's exporting region faces the highest negative effect from Chinese exports.[32] However, since the estimate coefficient for Chinese exports for Developed Asian and South American regions is not statistically different from the effect coefficient of Chinese exports for Developing Asia, we can say that Chinese medium-tech exports negatively affect, to the same extent, exports from these groups of countries. However, Europe was the export region that experienced the lowest negative effect, yet at a relevant magnitude. Probably, the negative impact of Chinese exports on European exports would be less intense if it were not for the European integration agreement. North America, in turn, was shown as the only region not affected by Chinese competition in this segment.

Finally, the results of the gravitational model shown in Table 4 for the high-tech industry demonstrated that the negative effects of Chinese competition in this class of products are less intense than in low- and medium-tech segments. The group of countries most negatively affected by Chinese high-tech exports corresponds, unexpectedly, to South America. It is worth noting that exports from some groups of countries were positively related to Chinese high-tech exports in considerable and significant magnitudes, like Developed Asia, North America and Europe. On the one hand, this result is contrary to the expectations of Rodrik (2006), whose opinion was that developed countries were potentially the most affected by Chinese exports of sophisticated products. On the other hand, as products classified in the high-tech group do not necessarily show their technological sophistication, it makes sense that developed economies present competitive advantages regarding Chinese exports in this segment. Production and exports, which are more knowledge-intense in some aspects associated with high-tech products, may be complementary to other products, which are also classified in the high-tech products category, but which may involve processes with lower levels of technological knowledge incorporation.

Specifically, in Developed Asia, the positive coefficient of the Chinese effect in the high-tech sector points to the same direction as Gaulier et al. (2004) and Athukorala (2009), where Chinese expansion may have a positive impact on developed Asian countries as a reflect of the production network involving these countries. A plausible hypothesis is that the model is indirectly capturing a possible overflow of the effect of export expansion from Developed Asia to China to beyond the Chinese market supply, increasing competition in other markets.

[31]In fact, Hong Kong and Macao show the greatest negative impact, however, for the reasons mentioned previously, such results are not interpreted here.

[32]See previous note.

7 | CONCLUSION

China's rise as an emerging power, especially considering its scale and speed, has had increasing impact on the global economy. This study aims to evaluate the impact of Chinese export growth on exports from other countries, trying to test the hypothesis that China would be displacing exports from other economies in third markets. The analysis included all countries which are relevant to international trade, from 2000 to 2009, enabling a wide evaluation of Chinese competition to global exports, by region and technological category.

Evidence was found to confirm the hypothesis that Chinese exports have displaced global exports as a whole in third markets in manufacturing products—where China concentrates most of its exports. Results showed that, although the global effect is negative, there are important differences among the analyzed regions (Developing Asia, Developed Asia, North America, Central America and Mexico, and South America). All exporting regions experienced negative impact from Chinese competition, except North America. The group of countries that was most negatively affected by Chinese manufacturing products competition was Developing Asia, followed by Central America and Mexico, in accordance with the literature that identifies the largest labour-intensive goods producers as the most threatened by Chinese competition.

For the purpose of separating the product segments which suffer the most from Chinese competition, the impact of Chinese exports in each category (primary products, natural resources-based, low-, medium- and high-tech manufacturing) was estimated. The segments which most felt the threat of Chinese competition were low- and medium-tech manufacturing classes. Considering global exports, the medium-tech category was the most negatively affected by Chinese competition. It is important to remember that, from 2000 to 2009, China expanded its medium-tech exports more than it did its low-tech exports.

In these low- and medium-tech segments, the impacts of Chinese exports tended to be negative in all exporting regions analyzed. Developing Asia was the most negatively affected region, in both the low- and medium-tech products. In the primary products and natural resources-based categories, the effect of Chinese exports on global exports was mainly positive, coherent to the fact that China is considered non-competitive in those sectors. In the high-tech exports, on the other hand, we saw that countries are affected in opposite directions by Chinese competition. While developed countries were positively affected, developing countries were negatively affected.

North America was the only region that was not impacted by Chinese competition in any of the technological segments. This result may be related to the hypothesis that US companies have specialized in segments—within the technological categories which were analyzed—which do not directly compete with China. This rearrangement may even be associated with the structural fragmentation of international production that often ties North American companies to Asian companies in several global productive chains. European exports were also, in general, little affected by Chinese competition in third markets, probably due to the intra-European trade prevalence resulting from better intra-block trade conditions. Europe was not immune to Chinese competition only in the medium-tech segment, having faced a negative impact which was relevant to third markets.

Among the export regions of developed countries, Developed Asia experienced the greatest threat from China, especially in the medium- and low-tech products category. In the high-tech manufacturing products class, the positive effect of Chinese exports on exports from this region is possibly related to the fact that China imports a great quantity of parts and components from the high-tech industries of these countries, generating an indirect benefit to Developed Asia through international production channels.

Developing countries, in turn, tend to experience a steeper negative impact of Chinese competition, compared to developed countries. Developing nations were intensely affected in a negative way by Chinese export competition in the three manufacturing products segments: low-, medium- and high-tech. It is worth highlighting the difference among developing regions, especially between Developing Asia and Latin American countries. Even though the impact of Chinese competition has been more intense to Developing Asia, this result is not enough to conclude if these countries had gains or losses in net trade terms. As Developing Asia is inserted in the Asian production network, this region eventually benefits from exports of parts and components to China, which could mitigate or even overcome the negative effect of Chinese competition in third markets. Latin American countries also experience a steep negative impact of Chinese competition, however, here the effect is not compensated by Chinese demand for Latin American manufacturing products. In countries that export commodities, there is an effect on exports of primary products, but in the others, especially Mexico and the Caribbean, the net negative effect is predominant.

It should be remembered that export opportunities to China were not estimated in this work, nor were the competition effects among domestic and Chinese products to importing countries. The study of Chinese competition, as well as the effects of its expansion, is a big subject that will continue to generate international debate, since China is likely to remain a large competitor in the global market, influencing trade flows in the following years. It is to be hoped that the contribution made here may stimulate future research exploring further effects.

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How to cite this article: Módolo DB, Hiratuka C. The impact of Chinese competition on third markets: An analysis by region and technological category. *Dev Policy Rev*. 2017;35:797–821. https://doi.org/10.1111/dpr.12290

APPENDIX

Table – Country Groups

Group	Countries
Developing Asia	Philippines, India, Indonesia, Malaysia, Pakistan and Thailand
Developed Asia	Japan, South Korea and Singapore
Hong Kong/Macao	Hong Kong/Macao
Europe	Germany, Austria, Denmark, Slovakia, Slovenia, Spain, Estonia, Finland, France, Greece, Holland, Ireland, Iceland, Italy, Malta, Norway, Portugal, United Kingdom, Czech Republic, Sweden and Switzerland
North America	Canada and United States
Central America and Mexico	Aruba, Bahamas, Barbados, Costa Rica, El Salvador, Guatemala, Jamaica, Mexico, Nicaragua, Panama, Saint Vincent and Grenadines, Trinidad and Tobago
South America	Argentina, Bolivia, Brazil, Chile, Colombia, Ecuador, Guyana, Paraguay, Peru and Uruguay
Rest of the World	South Africa, Albania, Saudi Arabia, Algeria, Armenia, Australia, Azerbaijan, Belarus, Botswana, Bulgaria, Burundi, Kazakhstan, Cyprus, Ivory Coast, Croatia, United Arab Emirates, Ethiopia, Fiji, The Gambia, Hungary, Faroe Islands, Israel, Jordan, Latvia, Lebanon, Lithuania, Madagascar, Malawi, Morocco, Mauritania, Mozambique, Moldavia, New Zealand, Oman, French Polynesia, Poland, Kenya, Kyrgyzstan, Central African Republic, Romania, Russia, São Tomé and Príncipe, Senegal, Tanzania, Tunisia, Turkey, Ukraine and Zambia