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The effects of Chinese competition and demand on Peruvian Exporters

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Abstract

China's role in the global economy has grown tremendously over the past two decades, significantly altering the nature of world markets. In this paper, we study the impact of Chinese supply and demand shocks to the international markets on Peruvian firm-product exports across destinations from 2000 to 2011. In particular, the demand shock has been notably absent from literature on the recent impact of China. We present evidence using both channels, focusing primarily on within firm-product and across destinations specification. The results indicate that for most part, an increase in Chinese supply and demand has had a significant and positive effect on Peruvian firm exports. From the supply side, this suggests that firms are either (i) concentrating on markets where competition is tougher, (ii) increasing R&D efforts to enhance the productivity as well as the competitiveness, (iii) benefiting from a comparative advantage in certain sectors that helps mitigate the competition presented by Chinese exporters, or (iv) a combination of these three explanations. From the demand side, this indicates that firms are possibly redirecting their exports from other markets to China.

Keywords: Competition, Demand, Trade, Firm-heterogeneity, Peru, China
JEL codes: F14, F61, L25

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1 Introduction

China's economic growth over the past three decades has been nothing short of impressive, averaging just under 10 percent annually (World Bank Group, n.d.). A couple of events in particular helped China gain greater access to world markets: (i) in 2001 China joined the WTO and (ii) in 2005 the textile quota on products destined for the European Union and the United States was removed. Consequently, the last ten years have been instrumental in solidifying China's role as a key exporter as well as an important export market.

According to Autor, Dorn and Hanson (2013), U.S. manufacturing imports from low income countries grew from 2.9 percent in 1991 to 11.7 percent in 2007, with China responsible for 91.5 percent of this growth. Although this is an example of one market, clearly, China's role as an exporter has grown. The rise of China as a serious competitor in the world market appears to have altered the composition of exports from developed and developing countries.

China's tremendous GDP growth, fueled by its export sector, has contributed to a substantial increase in income of many Chinese households. According to Kharas and Gertz (2010), by 2021 China will have over 670 million middle class consumers, compared to 150 million in 2010. Thus, despite mainly being known as a strong competitor, China is also becoming an important export destination market for a number of countries. To take advantage of this growing consumer market, many countries have been negotiating and implementing free trade agreements (FTAs) with China in recent years.[1] For example, EFIC, Australia's credit agency, hopes that the FTA, whose negotiations have been finalized November 2014, will "assist Australia to broaden its export performance and provide new opportunities".[2]

Clearly, China's emergence on global markets occurs via two primary channels: (i) the ability of China to supply the world market at competitive prices and (ii) an increase in Chinese demand for foreign goods. Most of previous literature has studied the Chinese impact solely from the supply side, analyzing the effect of Chinese competition. Such an approach may be incomplete since it fails to account for both supply and demand channels.

In this paper, we aim to study the impact of China's demand and supply shocks on Peru using firm level annual data from 2000 to 2011. While there have been many studies analyzing the effect of Chinese entry on Latin American countries, most of those papers were either performed at the sector level, concentrated on a time period marked by substantial trade and political reform, or failed to consider the dual channel impact of China's growth. Further, Peru is an excellent choice to study the impact of China because not only

[1] China currently has 19 FTA agreements that either in effect or under negotiation. Refer to http://fta.mofcom.gov.cn/english/index.shtml for more details.

[2] http://www.efic.gov.au/news-room/latest-news/2014/november/australia-china-free-trade-agreement/

is China one of Peru's main export markets, but it is also a competitor for one of its major industries, textiles.

Perhaps one of the closest studies to our paper is by Iacovone, Rauch and Winters (2013), who evaluate the effect of Chinese competition on Mexican manufacturing firms using plant and product level data from 1994 to 2004. They use the surge[3] in Chinese exports to Mexico to provide a quasi-natural experiment. Their findings suggest that competition caused selection and reallocation at both the firm and product levels. However, this study analyzes only one impact channel (competition). Furthermore, according to the World Bank definitions, Mexico has been an upper middle income country since 1999, while Peru achieved that status ten years later in 2009.[4]

We seek to fill the gap in the literature by analyzing the two possible channels through which China's export growth might have affected a developing country. We measure China's supply shock or competition as the exports of China to the World (except Peru) at HS-6 digit level and China's demand shock as the lag of firm-product exports to China. Our main specification also includes a set of macro variables commonly used in the trade literature.

Our results indicate that indeed, the rise of China had a two-fold effect on Peru, via supply and demand shocks. We find that the proxy for Chinese competition indicates a significant positive effect on firm-product export growth for a destination, after including fixed effects at the firm-product level. That is, firms might concentrate on markets in which they face tougher competition from China, differentiate themselves from Chinese products to avoid competition and/or enhance their productivity.

The proxy for Chinese demand indicates a significant positive effect on firm exports. This effect is much smaller relative to the Chinese competition. Interestingly, focusing on particular sectors, we find evidence of reallocation of mineral products from other destinations to China. This result is consistent with the surge of Chinese products in the international market which require different materials in their manufacturing process. We complement our main analysis by also studying the variation across products. This approach serves to compare our results to previous literature that use sector level data. In this case, we find that China's competition dampens Peruvian products performance, as suggested by other studies focusing on Latin America.

The rest of the paper is organized as follows: section 2 reviews relevant literature, section 3 provides the economic context and describes the data, section 4 presents the empirical strategy and section 5 follows with a discussion of the results. Lastly, section 6

[3]Chinese exports to Mexico and the United States increased substantially in terms of share and value. According to the authors China's share of Mexican imports grew by a factor of 16 during the time period considered.

[4]The country must have per capita GNI in the range of $4,086 to $12,615 to be considered upper middle income. The classifications can be found at http://data.worldbank.org/about/country-classifications.

concludes with a brief summary and suggestions for further research.

2 Related Literature

We begin by examining the effect of the supply shock. In this case, the supply shock refers to a situation where a firm is faced with an increase in competition in the international market. It is intuitive to assume that less productive firms in the presence of increased competition may be forced to leave the market. Furthermore, it is quite likely that this would apply to a developing country like Peru, which may be less prepared to profitably compete with new firms. The supply shock might also have a positive effect on the surviving firms. For example, Bloom, Draca, Van Reenen (2012) find that an increase in competition spurs innovative activity for 12 European countries.[5] Similarly, Aghion et al. (2005) using firms listed on London Stock Exchange for the period 1973-1994, find that the response to competition varies across firms as well, with strong firms more likely to survive and respond positively to a competition shock. The response of Peruvian firms may not necessarily be the same. One possible obstacle that may impede innovation and survival for firms in developing countries is easy access to credit (liquidity constraints).

The seminal work of Melitz (2003) offers a more rigorous approach to the allocation of exports among firms once an economy opens up to trade and experiences outside supply and demand shocks. According to Melitz, less productive firms are forced out of the export market and produce only domestically. More productive firms, on the other hand, can supply both domestic and foreign markets, and should therefore experience an increase in market share, which positively affects the overall productivity in the economy. In a related paper, Melitz and Ottaviano (2008) study how trade and market size affect the "toughness" of the competition. They find that in large markets, competition is tougher, forcing firms to charge low mark-ups, thus ensuring that aggregate productivity is higher. This finding could be especially useful when considering the impact of China, who is known to be a strong competitor, and the response of those competing with Chinese products.

Chinese competition has also been examined in terms of how it affects local U.S, labor markets and changes in innovation. Autor, Dorn and Hanson (2013) analyze data from 1990 to 2007 using UN Comtrade Database on U.S. imports at the HS-6 digit level and find that rising exposure to Chinese imports increases unemployment, lowers labor force participation and reduces wages in local markets. Further, the same sectors that face greater competition from China show an increase in transfer payments for unemployment, disability, retirement, etc. Similarly, Mion and Zhu (2013) find that import competition

[5] A number of studies find increased innovation/skills upgrading in response to competition. See Bartel, Ichinowski, and Shaw (2007), Freeman and Kleiner (2005), and Bugamelli, Schivardi and Zizza (2008), Mion, Vandenbussch, Zhu (2010).

from China negatively and significantly affects within-firm employment growth in Belgium, spurring some reallocation across firms.

Consequently, a supply shock may lead not only to a change in the number of exisiting exporters, but also to a restructuring of the exporting sector and firms. For example, firms may leave a sector that is more competitive, thus decreasing the importance of this sector in the economy, as new firms join a different, more “profitable" sector, thereby increasing the importance of a different industry. Such restructuring may be amplified if firms encounter not only competition from China, but also increasing demand. In the following section, Table 1, provides a breakdown of the composition of Peruvian export growth over time, by sector. It is evident that as some sectors grew, others shrank.

Notice that all these studies focuses on a single impact channel —the competition— and they concentrate on countries that are classified as middle or high income. The effects on the developing world may not necessarily be the same. In the next section, we discuss what other literature found on the impact of China on Latin America.

2.1 China and Latin America

According to Cesa-Bianchi et al. (2012), who use Global Vector Autoregressive (GVAR) model for Argentina, Brazil, Chile, Mexico and Peru, the long-term impact of Chinese GDP shock —which may capture both demand and supply shocks— on a typical Latin America economy has increased threefold since mid 1990s. Despite the significant impact of China on Latin America, the existing literature is rather scant. In this section, we look at previous work that examined Chinese impact on Latin American and Caribbean countries (LAC).

From the supply perspective, Freund and Ozden (2006) test whether exports of China affect LAC exports to a greater extent than exports from other countries using 4-digit SITC bilateral trade from 1985 to 2004. Their findings suggest that China has a negative impact on LAC countries.

Alternatively, one can study China’s supply effect using firm-specific data. Iacovone, Rauch and Winters (2013) study the impact of Chinese competition on the intensive and extensive margins of Mexican manufacturing firms using plant and product level data from 1994 to 2004. The authors find that a shock in competition causes selection and reallocation at both firm and product level. Sales and output variety in smaller firms are found to be more susceptible to competition, while larger firms were less likely to be affected. Although some of questions we hope to answer are similar, the impact study on Peru is ultimately different for three reasons: (i) Mexico is a middle income country unlike most LAC countries, (ii) the study only considers on the supply side, and (iii) the period under study includes the 90s, when Mexico underwent a devaluation of the peso, among other

reforms.

To our knowledge, the only study to find a positive effect on exports from Chinese competition is by Athukorala (2009). The author studies the impact of Chinese competition on the exports of East Asian countries from 1992 to 2005, using a bilateral country gravity equation, and then compares the East Asian group against other country groups. The results indicate that Chinese competition positively affects LAC region exports, which the author notes may be due to small initial export values.

In one of the few works to explore the demand channel, Lederman, Olarreaga and Soloaga (2007) estimate a gravity model focusing on LAC. They incorporate Chinese demand through an interaction between a dummy and the GDP variable. They find this interaction to be positive and conclude that the growth of China and India has actually produced large opportunities for LAC exporters, which have yet to be fully exploited. To the extent of our knowledge, Lederman et al. are the first to consider the Chinese demand component. However, it should be noted that our empirical approach is different. We expand on our empirical strategy in Section 4.

The impact of China on Latin America can also be studied using information on capital flows between countries. The next paper uses FDI to study the effect of Chinese competition. Garcia-Herrero and Santabarbara (2007) examine how the emergence of China as an FDI recipient affects the flow of FDI to LAC countries. The authors find that China negatively affects FDI in Mexico prior to China's WTO accession and that of Colombia following 2001 (note that the period spans from 1993 to 2003). However, for LAC as a whole, the effect of Chinese competition on FDI is not significant. Since findings are country specific, it may indicate that we cannot detemine the impact of China for the whole region.[6]

In general, it appears that studies on LAC countries use data from the 1990s, which was a period of radical reform throughout most of the region. Therefore conclusions drawn from that data set may be tied to political and economic reform. Similarly, the same decade for Peru saw an end to price controls, protectionism and restrictions on FDI. Most state companies became private. Such reforms in turn led to sustained economic growth. In order to avoid confounding the impact of Chinese supply and demand shocks with the growing pains due to reforms, the present study uses data from the previous decade (2002-2011).

[6]Similarly, Jenkins, Dussel and Mesquita (2008) focus on FDI and trade flows and highlight a positive impact of China on Brazil's commodity exports. However, the authors do not include any econometric evidence for their conclusions.

3 Data and composition of trade

3.1 Data

The data used in this study is obtained form the Peruvian Ministry of Trade (Mincetur), which aggregates monthly data from tax and customs revenue authority (SUNAT). The information available includes the following variables: (a) firm tax ID, (b) export destination, (c) product code —-reported in accordance with the Harmonized standard (HS) code at 10 digit level— (d) the revised HS codes —- to account for changes to HS system in 2002 and 2007—- and (e) export freight-on-board (FOB) values in USD. The conversion table used for consolidation between the revised HS codes was obtained from UN Comtrade.

The Chinese import and export data was collected from the online database maintained by UN Comtrade. The variables included in the dataset are (a) imports of the World (which should be equivalent to Chinese exports), less Peru, from China —which captures the Chinese competition effect or the supply shock— (b) a set of macro variables: gross domestic product (GDP), exchange rates, consumer price indices and global exports, and (c) other variables generally used in estimating gravity equations. The products available in UN Comtrade database are reported at a HS6 digit level. Thus, Peruvian products are aggregated from HS10 digit level of differentiation to HS6 digit level to make the two data sets comparable. The time period of the dataset spans from 2000 to 2011.

The other variable of interest is China's demand, which is approximated by the exports of Peruvian firms to China. The section on empirical strategy examines the proper specification of this variable in greater detail.

All nominal export data is converted to real terms by using China's export prices as a deflator. This deflator is constructed following Cheung, et al. (2010). In that paper, the authors use the aggregate export/import price index published by the Bureau of Labor Statistics (BLS). For the years prior to 2004, data for China is not available and is instead replaced by East Asian newly industrialized countries (NICs) by BLS. The GDP (in real terms) is obtained from the International Financial Statistics (IFS). The prices used are the CPIs which together with the nominal exchange rate are also drawn from the IFS. The dataset also includes variables typically used in estimating gravity equations. We use the variables regarding common border, common (official) language and distance.[7]

3.2 Trade patterns

In order to assess the impact of China on Peruvian firm level exports, it is important to first analyze the evolution of trade between China and Peru over the past decade. To enhance

[7]We use the complete gravity dataset provided by Thierry Mayer at http://econ.sciences-po.fr/node/131.

the comparison, we also examine the trading history of United States as it is an important trading partner for both countries and is the world's biggest economy.

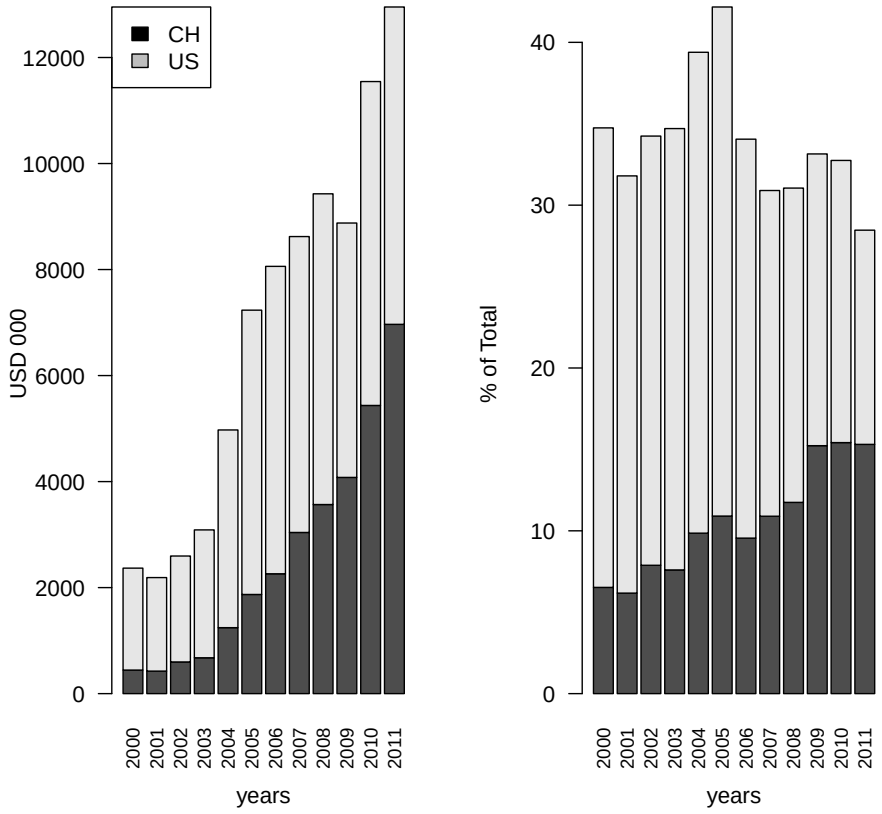

Figure 1: Peruvian exports to the United States (US) and China (CH): 2000 to 2011

In recent years, China surpassed the United States as Peru's primary trading partner. Figure 1 highlights this change by comparing the relative importance of each destination market over the period of 2000 to 2011. It is quite evident that as exports destined for China have increased (right panel), those destined for the United States have decreased. Further, according to the left panel, Peruvian exports to China (dark grey) have grown significantly. This may indicate that in addition to typical export growth, consumption patterns from the demand side (China) have changed and should therefore be included in the analysis. The following tables provide an overview of these changes by sectors, countries and bilateral flows.

Table 1 provides a breakdown of Peru's annual real export growth from 2000 to 2011. We rank the sectors according to the average annual growth, which is presented in the first column of the table. The subsequent columns provide annual real growth for 2004, 2006, 2008 and 2011. According to the table, it appears that Peru's most dynamics ex-

ports, or those with the highest growth (on average), consist of minerals (27.2 percent), gas/petroleum (23.4 percent), agriculture (18.5 percent) and chemicals (18.3 percent). Therefore, an increase in demand for commodities is likely to have a significant effect on Peruvian exports. At the other end of the spectrum, we have sectors such as food products and textiles that have exhibited the least amount of growth, at 10.2 and 10.1 percent respectively. Interestingly, the textile sector, ranked last, is also the one that is likely to face the strongest competition from China.

Table 1: Peruvian exports by sectors (annual real percentage change)

	2000-11	2004	2006	2008	2011
Mineral	27.2	72.6	50.5	-14.4	23.3
Gas/Petroleum	23.4	4.8	18.5	9.8	39.1
Others	18.7	28.1	18.6	8.6	26.5
Agricultural and Livestock	18.5	41.5	29.7	25.6	35.1
Chemicals	18.3	28.8	9.0	25.0	27.8
Basic metals and jewelry	16.2	29.5	37.3	9.5	15.5
Non-metalic minerals	16.1	29.6	24.7	9.1	19.8
Fishing	15.6	32.0	16.0	10.3	35.5
Machinery	14.7	28.7	-18.0	30.3	16.7
Timber/Papers	11.8	24.1	27.0	13.9	7.8
Food products	10.2	24.2	13.0	14.4	14.5
Textiles	10.1	30.9	15.6	10.5	22.2

Source: Mincetur-Sunat, BLS.

Next, Table 2 presents China's annual real export growth, following the same format. Overall, Chinese exports have significantly increased across all sectors. The most dynamic sectors (in terms of average real growth) are chemicals (20.2 percent), machinery (20.1 percent), basic metals (18.3 percent), non-metallic minerals (15.3 percent) and timber/papers (15.3 percent). Note that the sectors in which Peru had the most significant changes are the sectors that grew the least for China. Similarly, sectors which grew the least in Peru (timber/papers and textiles) appear to be the more (though not the most) dynamic in China. Presumably, the lack in growth in textiles and timber exports from Peru may be due to increased Chinese presence in international markets. However, in order to obtain a more complete picture on the nature of these patterns, we also examine U.S. demand from these countries, as well as the imports of Peru from China.

The last table in this section (Table 3) summarizes exports from Peru to the United States (see column PE→USA) and China (PE→CH), and from China to the United States (CH→USA) and Peru (CH→PE). It appears that overall, Peruvian exports to China grew faster relative to Peruvian exports to the United States. For example, mineral exports destined for the United States grew 27 percent on average and those destined for China grew 38 percent on average over the time period considered. Similarly, gas and petroleum

Table 2: Chinese exports by sectors (annual real percentage change)

	2000-11	2004	2006	2008	2011
Chemicals	20.2	28.1	20.7	28.4	24.1
Machinery	20.1	37.3	22.6	9.0	9.4
Basic metals and jewelry	18.3	46.8	32.5	17.8	18.6
Non-metalic minerals	15.3	24.0	19.3	8.5	7.1
Timber/Papers	15.3	27.9	22.6	2.1	10.0
Textiles	13.8	20.8	15.0	8.6	10.4
Food products	12.7	21.9	15.71	1.7	14.8
Others	12.3	17.4	15.0	6.5	5. 6
Fishing	11.6	19.1	20.8	1.5	20.6
Mineral	9.5	34.3	16.1	11.0	11.5
Agricultural and Livestock	8.9	-4.4	7.2	1.1	15.6
Gas/Petroleum	7.7	36.2	-3.5	31.3	4.9

Source: UN Comtrade, BLS

exports destined for the Unites States were lower than those destined for China (20.2 percent and 59 percent, respectively).

This is also true for other sectors, such as metals, chemicals, machinery and timber/paper, among others. This apparent divergence in growth trajectories could be a sign of reallocation between destinations by Peruvian exporters. If China has indeed become a much more important export market for Peru, it is possible that exporters are redirecting goods from other markets to China.

Furthermore, when comparing U.S. demand for Peruvian and Chinese goods, we see that the Peruvian exports that outperformed Chinese products come from minerals, gas /petroleum, fishing and agriculture and food products sectors. Therefore, Peruvian commodity exports may have a comparative advantage against China. As for sectors that might be directly competing with Chinese suppliers, such as textiles and machinery, those exhibited a relatively small average growth over the time considered (about 5.8 percent) when compared to China's exports of these products to the United States.

After closely looking at sector level data for Peru and China, we can conclude that the supply shock from China (or competition effect) is likely to be more relevant within the textiles industry. The demand shock, on the other hand, should affect minerals, gas/petroleum and basic metals the most. In the next section, we provide more definitive evidence on the impact of China on Peruvian firms using regression analysis.

4 Empirical strategy

Our goal is to estimate the impact of China's supply and demand shocks on Peruvian exports. The main specification used in our analysis is represented by equation (1). The

Table 3: Bilateral trade between Peru, China and United States by sectors

	PE→USA		PE→CH		CH→USA		CH→PE	
	Average	2011	Average	2011	Average	2011	Average	2011
Minerals	27.0	49.7	37.9	24.8	3.4	18.0	46.9	47.2
Gas/Petroleum	20.2	-3.3	58.8	-2.3	-6.7	-36.5	-1.8	-30.8
Fishing	18.1	25.3	38.3	42.6	12.7	7.9	67.4	-4.8
Food products	18.0	12.8	12.1	22.6	18.2	12.1	29.0	21.7
Agri. and Livestock	16.8	32.3	25.6	18.6	11.4	8.21	32.5	87.4
Others	11.6	24.7	34.1	42.6	8.0	-0.9	22.6	22.9
Chemicals	11.3	-18.1	31.8	-38.0	17.4	21.7	26.1	-4.8
Non-metalic minerals	10.0	6.9	-16.2	-189.2	9.2	7.7	28.7	-1.2
Basic metals and jewelry	6.2	-36.3	38.0	14.6	13.3	8.9	35.8	10.9
Textiles	5.9	3.7	0.0	-17.8	14.9	1.8	25.0	30.3
Machinery	5.8	13.2	24.1	67.0	15.8	8.1	31.9	18.0
Timber/Papers	-3.5	5.7	39.5	-39.4	12.2	-0.9	35.8	26.4

Note: $\rightarrow$ indicates direction of the trade flow. *Source:* Mincetur, UN Comtrade, BLS

variable of interest, $Y_{ipc,t}$, denotes the firm's (i) real exports (Y) to a particular destination (c) of a specific product (p) across time (t). Using this approach, we are able to answer whether an increase in China's exports (also known as Chinese competition or CHC) will affect a Peruvian firm i's exports to destination c. For example, we can study whether a supply shock of textiles from China to the United States will decrease firm i's textile exports to the United States. The actual effect (captured by the coefficient β_1) is difficult to assess beforehand.

The direction of the impact depends heavily on whether tough competition will force firms to concentrate on other markets and/or goods due to lower profitability, or if the competition will serve as an incentive for innovation and specialization of Peruvian firms. In case of the former, the resulting coefficient will be less than zero ($\beta_1 < 0$). In case of the latter, the resulting coefficient will be greater than zero ($\beta_1 > 0$). Similarly, if Peruvian firms posses certain competitive advantage that could help them avoid or bypass competition from Chinese exporters, the coefficient will be greater than zero. It is not quite evident which effect should prevail.

Further, we also measure the impact of a demand shock (CHD) on firm exports (captured by the coefficient β_2). As a response to a growing demand from China, a firm may decrease exports to other countries, in which case the coefficient will be less than zero ($\beta_2 < 0$), thus effectively shifting exports from one market to another (reallocation of exports). Alternatively, an increase in Chinese demand can positively affect the firm's exports to other markets, in which case the coefficient will be greater than zero ($\beta_2 > 0$). If the effect is positive, then it may indicate that a firm is taking advantage of the economies of scale, or simply becoming better/more efficient in supplying its product to a number of markets.

Using Peruvian firm level data, we analyze how these two shocks (CHC and CHD)

affect firm i's exports. Notice that aside from the two variables representing the supply and demand shocks, our specification also includes other important variables that we discuss in greater detail below.

$$Y_{ipc,t} = \beta_1 CHC_{pc,t} + \beta_2 CHD_{ip,t-1} + \beta_3 GDP_{c,t} + \beta_4 RER_{c,t} + \beta_5 RER^*_{c,t} + \beta_6 Vol_{c,t} ... \\ ... + \beta_7 WX_{p,t} + \beta_8 Border_c + \beta_9 Lang_c + \beta_{10} Dist_c + \alpha_{ip} + \psi_t + \gamma_c + \varepsilon_{ipc,t} \quad (1)$$

The dependent variable $Y_{ipc,t}$ denotes the real export value in log terms of firm i for product p (at HS6 digit level of aggregation) to country c at time t. Recall that CHC denotes the Chinese supply shock or competition (in real terms), otherwise compiled as Chinese exports to the World less Peru. The second component, CHD, denotes Chinese demand and is calculated as firm specific real export values to China (in log terms). Notice that working with contemporaneous variables might lead to serious identification problems since current factors can affect the performance of firm export behavior to a number of destinations. To overcome this problem, we use lagged $(t-1)$ firm exports to China.

Since it is not possible to take logs of zeros, we add one where either of the variables, CHC or CHD, is valued at zero. The corresponding coefficients should then reflect the percentage change in the dependent variable given a percentage change in one of the right-hand side variables. A possible problem of adding one to a real variable and then taking logs is that we might alter the monotonicity of real variables that are smaller than one (recall that the log of a number less than one is negative). To avoid altering monotonicity, we first rescale the deflator by dividing all values by small number such that all real variables greater than zero are bigger than one. Following that, we add one where values are zero (since zero values cannot be rescaled with a deflator). Thus, the final logarithmic values of all real variables are either positive or equal to zero when we do not observe any exports.

We believe that growth of Chinese exports and imports is largely exogenous to our dependent variable, the Peruvian firm level exports. China's export strategy to global markets has been to produce similar goods but at more competitive prices (Broda and Romalis, 2009). Thus, the main factor driving Chinese exports is structural reform through domestic policy, which promotes high investment rates, mobility of factors of production, including labor and FDI, and partnerships with key foreign firms (Huang, 2003). These factors are generally independent of strategic decisions of Peruvian firms.

Our main specification also includes other variables which are standard in estimating trade equations (see Head and Mayer, 2014). GDP is the real Gross Domestic Product (in log terms) of the trading partner. The real exchange rate (RER, in logs) is constructed in European fashion, such that an increase in RER indicates a depreciation of the local currency (Nuevos Soles for Peru). Our other exchange rate variable, RER^*, denotes the

real exchange rate between China and the trading partner (in logs). We also include the volatility of the exchange rate (Vol) of each country with respect to the U.S. dollar, which is computed as the annual standard deviation of the year-on-year change of the monthly real exchange rate.

Additionally, we include a global sector trend (WX) in order to capture global events that may affect the performance of both Peruvian and Chinese exports in foreign markets. This variable is constructed using world real exports (in log terms) for a particular sector (at HS2 digit level of aggregation), excluding China and Peru. Without the omission, Peruvian exports would appear on both the left and right-hand side of the equation, leading to serious identification problems because (i) the error term would then be possibly correlated with the explanatory variables and (ii) the explanatory variables would have strong collinearity since Chinese exports are also present in the proxy for competition (CHC).

We also include destination specific variables commonly used in estimating trade equations. We include distance ($Dist$) between Peru and the destination country and two binary variables. $Border$ takes the value of one when Peru and the destination share a border and zero otherwise, and $Lang$ similarly takes the value of one when Peru and the destination have the same official language and zero otherwise.

Finally, we also control for invariant firm-product characteristics by including firm-product fixed effects (α_{ip}), destination fixed effects (γ_c) and the time specific factor captured by the time fixed effect (ψ_t). Incorporating time fixed effects, we control for any possible trends or important events such as the global financial crisis of 2008.

The estimation sample consists of annual firm-level data at HS6 digit level from 2000 to 2011. We consider that it is important to work at this level of aggregation to properly identify China's competition and demand shocks. Working at a more aggregated level (HS1 or HS2 digit level), may lead to measurement errors that alter the significance of our results. We believe that while at highly aggregated levels (such as HS2 digit levels) we may observe competition, analyzing the data at a more disaggregated level, or at a higher product differentiation (such as HS6 digit level) could show that this competition actually occurs in different product categories. Therefore, competition observed may not be for the same product, as would be identified by HS2 digit level, but for different products, when identified by HS6 digit level of differentiation.

It is also worth noticing that our identification of demand and supply shocks only considers the intensive margin of trade. In particular, we focus only on the firm-products that appear for at least two years in the sample period. In our specification, the demand shock is the lag of exports and therefore includes products that were exported the previous year.

5 Estimation results

Equation (1) is estimated using an OLS approach. The first column of Table 4 summarizes the results for the sample that considers all product categories (defined at HS6 digit level) and all countries that observe positive trade flows with Peruvian firms without incorporating time and destination fixed effects. The second column adds the time fixed effects and the third column considers both time and destination fixed effects. The last column alters the fixed effects present in specification (1) by excluding the firm-product fixed effects. The main reason to perform this last regression is to analyze the supply and demand shocks across products. We begin by turning our attention to the first three columns of Table 4, which represent three different specifications of equation (1). The last column, specification IV, will be discussed in greater detail in the following section.

In all three specifications, the sign of the coefficient for Chinese competition (or Chinese supply shock), *CHC*, is positive but small. This indicates that an increase of 10 percent in Chinese competition for a given product to some country c will result in about 0.3-0.7 percent increase in exports of a Peruvian firm i to that country. The effect is smallest when firm-product, time and destination fixed effects are included (specification III). In fact, it appears that adding the destination fixed effects tends to decrease the positive impact of Chinese competition the most. One possible interpretation for this occurence is that invariant destination characteristics, such as country size, are picked up by the competition variable, *CHC*. Therefore, in the absence of the destination fixed effects, *CHC* is overestimated.

There exist a few possible explanations for the positive effect of Chinese competition on Peruvian firm exports to foreign markets. First, there may be adjustments in the scope of the Peruvian exporters. Firms may be choosing to concentrate on their most competitive products in the face of strong competition, or they may be allocating more effort in the most competitive market. Second, firms facing strong competition may be increasing R&D efforts to enhance the productivity as well as the competitiveness in the foreign market. Lastly, Peruvian exporters may have a comparative advantage in certain sectors that helps avoid or mitigate the competition presented by Chinese exporters.

Our second variable of interest, Chinese demand or *CHD*, has a smaller (though still significant) effect on Peruvian firm level exports than *CHC*. Across all four specifications the impact is positive. For three of the four specifications (I, II and IV), Chinese demand is strongly significant ($p < 0.001$). Again, as with the Chinese competition, the impact is smallest for specification III, when we add destination fixed effects and also least significant ($p < 0.1$). This does, however, suggest that overall an increase in Chinese demand has a positive effect on Peruvian exporters.

We study these two shocks further in Table 5 by selecting particular sectors where they

Table 4: China's demand and supply impact on Peruvian firms 2000-2011

	(I)	(II)	(III)	(IV)
OLS				
$CHC_{pc,t}$	0.066***	0.068***	0.031***	-0.160***
	(0.003)	(0.003)	(0.003)	(0.014)
$CHD_{ic,t-1}$	0.008***	0.009***	0.003*	0.154***
	(0.002)	(0.002)	(0.002)	(0.001)
$GDP_{c,t}$	0.499***	0.629***	0.794***	-0.432
	(0.079)	(0.084)	(0.109)	(0.714)
$Vol_{c,t}$	-0.025***	-0.028***	0.002***	0.071
	(0.002)	(0.002)	(0.002)	(0.038)
$RER_{c,t}$	0.790***	—	—	0.419
	(0.148)			(0.312)
$RER^{*}_{c,t}$	-0.738***	0.052***	0.252***	—
	(0.147)	(0.005)	(0.049)	
$WX_{p,t}$	0.373***	0.710***	0.714***	0.071*
	(0.035)	(0.003)	(0.064)	(0.038)
$Border_c$	0.313***	0.314***	3.574***	—
	(0.040)	(0.040)	(0.722)	
$Lang_c$	-0.142***	-0.142***	-0.567***	—
	(0.035)	(0.035)	(0.767)	
$DIST_c$	-0.000***	-0.000***	0.000***	-0.000
	(0.000)	(0.000)	(0.085)	(2.000)
Firm-Product FE	YES	YES	YES	NO
Time FE	NO	YES	YES	YES
Destination FE	NO	NO	YES	YES
N	217 502	217 502	217 502	217 502
R^2	0.012	0.008	0.001	0.107

Coefficients marked — were dropped due to collinearity issues.

Robust standard errors in parentheses.

* $p < 0.1$, ** $p < 0.05$,*** $p < 0.001$

may be felt the most: Minerals (demand) and Textiles (supply).[8] Surprisingly, China's supply shock is still positive and significant ($p < 0.001$) for both industries. It is also greater then when we include all sectors. Therefore, now a 10 percent increase in Chinese competition indicates a 1.1 percent increase in Peruvian textile exports and a 0.9 percent increase in Peruvian mineral exports.

Chinese demand, *CHD* when focusing on these particular sectors, is not significant for Textiles and is negative for Minerals. The fact that it is not significant for textiles is not surprising for two reasons: (i) China is an extremely strong competitor in textiles and (ii) textile exports were ranked last in Table1. The negative and significant ($p < 0.05$) coefficient on *CHD* for minerals may indicate that there is a possibility of redirection of these products (which are used in value added goods for China's processing exports).

Furthermore, the regressions include a set of macro variables which seek to control for the overall dynamics of Peruvian exporters to different countries. Focusing on Table 4, we observe a positive and strongly significant coefficient on the income of the destination market (*GDP*) across specifications I, II and III. The coefficient for the last specification is negative, though not significant.

The exchange rate variables display mixed results once we include time and destination fixed effects. As mentioned earlier, the exchange rate variables are constructed such that an increase in the exchange rate implies a depreciation of Peruvian (or Chinese) currency. The exchange rate volatility (*Vol*) follows predictions only when we omit the destination fixed effect. Therefore, in specifications I and II, an increase in the exchange rate volatility implies a negative impact on Peruvian firm exports. The exchange rate for Peruvian currency against the foreign destination (*RER*) is dropped in specifications II and III since it has strong collinearity when we include time fixed effects. China's exchange rate, RER^*, is negative for specification I and positive for specifications II and III. In all three cases it is also strongly significant ($p < 0.001$). However, these particular interpretations of the *RER* and RER^* may be contaminated with the collinearity of exchange rates with the time fixed effects.

The global sector trend (WX) shows a positive and strongly significant coefficient, consistent with the predictions. This means that an increase world export, less China and Peru, will positively affect Peruvian firm level exports. Border, $Border_c$, also has a positive and strongly significant coefficient. This is not surprisingly, as neighboring countries are more likely to trade and to form regional trade agreements that facilitate trade. Distance, $DIST_c$, appears to have a near negligible and negative impact (at three decimal points of precision) given the fact that biggest markets are China, United States and Europe. Language, $Lang_c$, shows a negative coefficient since these three last regions

[8] We do not include the gas/petroleum sector due to a new project Camisea, which may inaccurately amplify the demand for the time period considered.

Table 5: China's demand and supply impact on Peruvian firms 2000-2011

	(I) Minerals	(II) Textiles
OLS		
$CHC_{pc,t}$	0.093***	0.111***
	(0.003)	(0.007)
$CHD_{ic,t-1}$	-0.012**	0.002
	(0.005)	(0.004)
$GDP_{c,t}$	0.956***	0.487*
	(0.365)	(0.250)
$Vol_{c,t}$	-0.036	-0.037***
	(0.022)	(0.006)
$RER^{*}_{c,t}$	0.025	0.031***
	(0.027)	(0.005)
$WX_{p,t}$	0.922***	-0.480***
	(0.400)	(0.185)
$Border_{c}$	1.003***	-0.369***
	(0.237)	(0.078)
$Lang_{c}$	0.040	-0.256***
	(0.238)	(0.064)
$DIST_{c}$	0.000	-0.000***
	(0.000)	(0.000)
Firm-Product FE	YES	YES
Time FE	YES	YES
N	3 068	21 870
R^2	0.002	0.022

Robust standard errors in parentheses

* $p < 0.1$, ** $p < 0.05$,*** $p < 0.001$

do not officially speak Spanish (except Spain).

5.1 Variation across products

We also analyze the impact of China on Peruvian firms across products within destination in the last column of Table 4 (specification IV). The main motivation for this specification is to analyze how China's presence on world markets is altering the composition of products exported by Peruvian firms. The estimated specification omits the firm-product fixed effects from equation (1). We do not further split the sample in different sectors since the main purpose of this exercise is to analyze the variation across products.

As expected, China's competition is more relevant when we focus on the variation across products. Now, a 10 percent increase in *CHC* deteriorates the exports of a Peruvian firm by -1.6 percent. China's demand, *CHD*, retains a positive coefficient under this specification. This indicates that a 10 percent increase in *CHD* should increase Peruvian firm exports by 1.5 percent. That is, Peruvian products seems to globally benefit from China's increasing demand.

For both shocks, the supply and demand, the coefficient is strongly significant with a $p < 0.001$. Further, in this last specification (IV), all macro variables other than the global sector trend are not significant. This suggests that macro variables are more relevant when studying the determinants of firm exports across destinations rather than variation across products in a destination.

The negative impact of China on exports is consistent with other sector-level studies that center on China's supply shock (e.g. see Freund and Ozden, 2006). The advantage of our approach is that we can further control for firm-products characteristics (as shown in specifications I-III in Table 4 and Table 5). When considering these characteristics, we find the opposite effect: that is, Chinese competition is beneficial for Peruvian firm level exports.

6 Discussion

In this paper, we analyze the impact of Chinese supply and demand shocks on Peruvian firm-product exports from 2000 to 2011. Peru is considered to be an emerging economy that has enjoyed tremendous growth over the past decade. Although in the early 2000s, United States was considered to be its most important export market, dynamics have been changing, with China overtaking the United States as its most important destination market (as of 2013). Currently, the primary Peruvian exports to China are mainly comprised of commodity goods (minerals, gas/petroleum, fishing, basic metals and timber).

During the sample period considered in our study, China's exports to the world have increased significantly, indicating a possible supply shock to Peruvian firm-product exports. The effect of Chinese competition has been widely studied for developed or middle-income countries. For Latin American countries, prior work has mainly considered effects at sector level. Further, most of this work found the effect of Chinese competition to be negative for this particular region.

Using a within firm-product and across destinations specification, we find that tougher competition actually increases Peruvian firm-product exports to a given destination. At first glance, this result might appear to be counterintuitive. However, there are theoretical and empirical evidence for developed countries supporting this result. For one, it is possible that Peruvian exporters have adjusted their scope and decided to focus on markets in which the competition is tougher, in particular this means large markets, such as China, United States and Europe.

In addition, in the face of greater competition, firms may be allocating more resources toward R&D in order to enhance their productivity and competitiveness in international markets. Before engaging in this exercise, it was not clear whether low-income countries such as Peru might face liquidity constraints that would prevent them from engaging in additional R&D. While we still cannot say, given the limitations of our data, whether this is what happened, we are, however, able to at least leave this factor as possibility. Lastly, Peruvian firms may possess certain comparative advantage that has helped mitigate the competition from Chinese exporters. Unfortunately, we are not able to discern which of these three possible explanations is the correct one at this point.

We also study the supply shock across products within a destination and find that products which face higher competition from China are negatively affected during the sample period. Overall, our results indicate that an effect on the composition of trade for Peruvian exporters.

Our second explanatory variable of interest in this study is China's demand shock on Peruvian firms. In our within firm-product estimation, we find that China's demand has a positive effect on firm exports. Focusing on a restricted sample of mining firms, we observe a strongly positive effect, indicating a possibility of reallocation from other markets to China. This result is consistent with the fact that Chinese manufactured goods need raw materials for the production process. This is also consistent with China's economic growth over the past decade, with China becoming one of the most important destinations for a number of products.

According to the evidence presented, China has gained a significant share of Peruvian exports over the past decade. The results of the across products and within destination specification similarly indicate that China's demand for Peruvian products positively affects Peruvian exports. This positive externality may arise either from economies of scale,

or via prices. However, we seek to mitigate the last factor by working with real variables. Recall that we divide all nominal export values by an overall export price index.

We believe that the results presented in this paper shed additional light on the role of China in the world economy. Specifically, we present evidence on how both supply and demand shocks driven by the surge in China's economy have affected Peruvian firm level exports. Further, Peru makes an interesting case study because not only is it rich in natural resources but it also has industries that could be considered susceptible to the threat of Chinese competition. While the overall size of the coefficients on the supply and demand shocks is not large, they are for the most part highly significant. Further, the time period documented in this study shows a reversal in the order of importance of the Chinese and American destination markets for Peruvian exporters. This is an important fact to consider, since the next decade may show a much larger impact, as more exports are diverted to China.

Unfortunately, given the information available, we are unable to compute neither the firm productivity nor mark-ups for various products exported by Peruvian firms. Access to such data would allow us to better understand the mechanisms through which China's demand and supply shocks affect firms in emerging economies. Although we present some evidence of China's effect on a one emerging economy via supply and demand shocks, further research is needed to gain a more complete picture of China's role, whether benevolent or not, in the emerging markets in recent years.

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