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Integration and Trade Sector

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The Impact of Import Competition from China on Firm Performance in the Peruvian Manufacturing Sector

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Abstract

This paper studies the impact that import competition from China had on firms' performance in the manufacturing sector in Peru in 2005–2015. Using a firm-level dataset that covers the universe of firms in the formal sector, our results reveal that Peruvian firms reacted to increased competition from Chinese manufacturing goods mainly by altering their factor choices. Smaller firms seem to have opted for reducing their demand for labor—following a cost-reduction approach after facing lower sales—while larger firms seem to have adapted by deepening their capital requirements. We also observe a negative cumulative impact on net sales when we account for longer timeframes. Looking at import competition from China in third markets, we find that increased competition in the Peruvian exporting firms' main export markets had a negative effect on employment growth in 2005–2010.

JEL: F14, F16, J23

Keywords: import competition, employment growth, capital intensity, export growth, productivity growth, export competition.

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1. INTRODUCTION

From the early 2000s on, most countries around the globe experienced a surge in their trade with China. In 2006, just five years after China's accession to the WTO, the participation of Chinese goods in world-wide exports increased from 4.8% to 8.9%. By 2015, China had become the world's largest exporter: its exports—which are mainly of manufacturing goods—came to represent 15.4% of the global total.

This surge has greatly impacted economies worldwide and its impact on employment and firm performance has become the subject of a fast-growing body of literature. A large proportion of this research has studied the heterogeneous impact of the shock, focusing on employment and exploiting the variation across local labor markets—see Autor, Dorn, and Hanson (2013) and (2016). Another group of studies have analyzed the impact of import competition on firm growth, firm survival, and firm input choices by exploiting variations at the industry level (Mion and Zhu, 2013; Bernard et al., 2006—although the latter studies import competition from low-wage countries in general). Both groups of studies find that the rise in import competition is detrimental to the employment growth and survival of manufacturing firms and affects their input choices.

In Latin America, several studies have documented the heterogeneous impact of the surge in competition from China on firms' performances. For instance, in Mexico, a country with a major manufacturing sector, Blyde and Fentanes (2019) find that the surge in imported manufacturing goods from China induced a decline in employment, sales, exports, and productivity. However, this impact was more severe for the smaller and less efficient firms. In Colombia, although Molina (2016) finds a detrimental impact on employment, productivity, and domestic sales growth, he also finds that the share of nonproduction workers increases. Finally, in El Salvador, Li (2019) finds a negative effect on firm employment levels, one that is particularly significant for low-capital-intensity firms, as well as a decline in the total factor productivity (TFP) and the total revenue of small firms.

The objective of this paper is to assess the impact that the surge in imports from China had on firm performance and choices in the manufacturing sector in Peru in 2005–2015.[2] Within Latin America, Peru is one of the countries to have had the largest share of manufacturing imports from China since the early 2000s. This prominent exposure to Chinese manufacturing goods poses both a challenge and an opportunity for Peruvian firms. On the one hand, firms facing tougher competition from China in both the domestic and external markets may see their revenues shrinking and thus struggle to stay afloat. On the other hand, China's presence may act as an incentive for firms to make strategic decisions that lead them not only to survive the tougher competition but to become more productive in the process, such as by buying inputs from a more cost-efficient source, investing in technology improvements, adjusting factor intensities, etc.

With that in mind, we analyze the impact of Chinese competition not only on variables that account for firm income, such as sales, but also on others that are indicative of the strategic decisions taken by firms to adjust their production—namely employment, capital depth, and productivity. Also, considering that Peruvian exports expanded remarkably during the period analyzed, we also study the impact that the increased presence of Chinese manufacturing goods in third markets had on Peruvian exporting firms' performance.

Our results show that Peruvian firms in the manufacturing sector mainly reacted to the trade shock by adjusting their factor intensities. This mechanism seems to operate differently depending on the size of the firm. While smaller firms seem to have opted for reducing their demand for labor by following a cost-reduction approach after facing lower sales, larger firms seem to have adapted by deepening their capital requirements. Also, if we take a longer time period into account or include the second half of the decade analyzed (2010–2015), the surge in competition from China had a negative impact on net sales in the long term. Investing in technological improvements does not seem to have been part of the story, as there is no significant impact on TFP, regardless of the definitions used for firm size, the timeframe, and the instrument used. The evidence of the impact of Chinese competition in third markets indicates that tougher

[2] Our analysis is limited to this period due to data availability that will be explained in more detail in the sections below.

competition from China in third markets had a negative impact on employment growth within exporting firms in 2005–2010.

The paper is organized as follows. Section 2 provides an overview of main trends in firm performance and the presence of China in the Peruvian manufacturing sector. Section 3 discusses the methodology used for the econometric analysis of the impact and presents the key features of the data. Section 4 reports the results from the estimations of the model. Finally, section 5 concludes.

2. FIRMS IN THE PERUVIAN MANUFACTURING SECTOR

A. The Manufacturing Sector in Peru

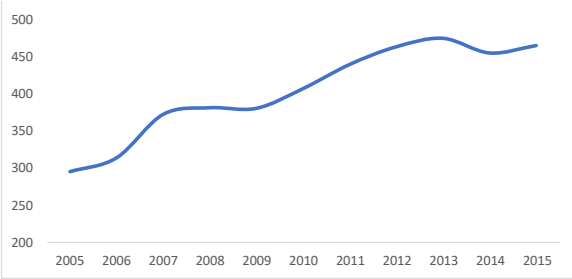
The 2000s were a decade of expansion for the Peruvian economy, and the manufacturing sector was no exception to this. Both output and labor in the sector grew steadily throughout the 2000s, and this expansion continued—albeit at a slower pace—at least until 2015.[3] Figure 1 shows the evolution of labor, sales, exports, TFP, average firm size, and the capital/labor ratio from 2005 until 2015. Except for TFP, all other variables display an upward trend throughout the period. However, there is a slowdown—and even a reversal, in some cases—during 2010–2015 relative to 2005–2010. TFP remains relatively flat with a subtle downward trend in the later years.[4]

[3] INEI (2017).

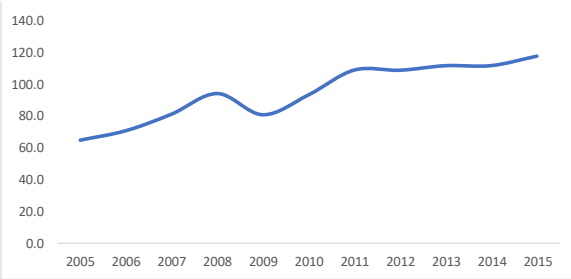
[4] The details of the TFP calculation will be explained in detail in the next section.

FIGURE 1: THE PERUVIAN MANUFACTURING SECTOR, 2005–2015

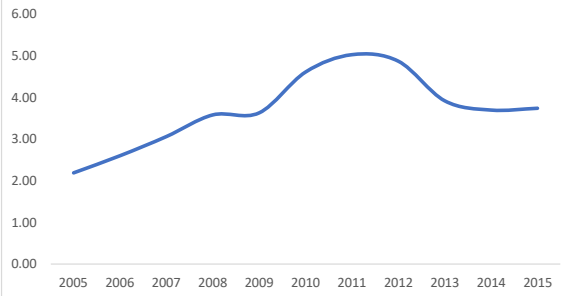
a) Number of Workers (Thousands, Sectoral Average)



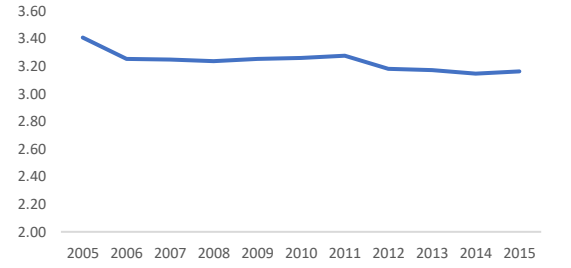
b) Total Sales (Constant Millions of Soles, Sectoral Average)



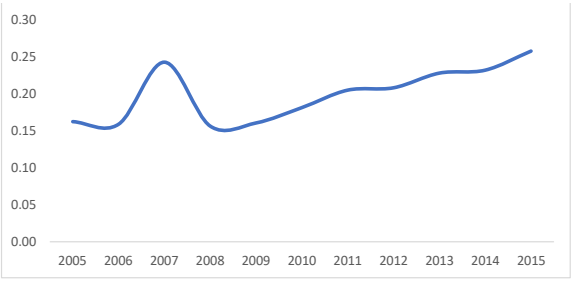
c) Total Exports (Millions of USD, Sectoral Average)



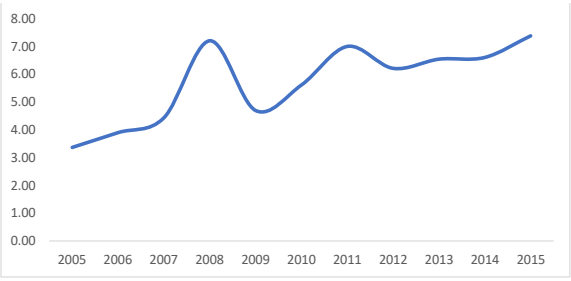
d) Total Factor Productivity (Log, Sectoral Average)[a]



e) Average K/L (Constant Millions of Soles, Sectoral Average)



f) Average Firm Size (Constant Millions of Soles, Sectoral Average)



Note: [a] The TFP is computed in logarithmic terms. The sectoral average refers to the weighted average at the firm level using the labor share as weights.

Source: Authors' calculations based on data from SUNAT.

In terms of differences across industries, table 1 shows the number of firms, labor, sales, capital, exports, and the capital-labor ratio by industry (averages for the whole period, 2005–2015). The food and beverages industry is by far the largest in the sample, reporting the largest sales, employment, capital, exports, etc. Other industries that follow in terms of representation in the sample are textiles, apparel, chemicals, and metal products.

However, in terms of growth, table 2 shows that radio, TV, and communications, computing machinery, medical and optical instruments, and chemicals are among the sectors experiencing the largest expansion in employment, sales, and exports—indeed, they saw the highest average annual growth in 2005–2015. Except for chemicals, which is among the largest industries in terms of labor and sales, the other growing sectors are among the smallest in our sample. Also, it is worth noting that industries that hold large shares of employment such as apparel and textiles either shrank or stayed almost the same in the domestic market, at least in terms of labor and sales. They seem to have done slightly better in markets abroad.

Finally, there is significant heterogeneity in firm size, with size defined by sales. Table 3 shows the value exported, the capital/labor ratio, and the productivity level of the median firm within the top and the bottom halves of the firm-size

distribution. As expected, the median firm within the group of the largest firms in the sample exports nearly 14 times more, is about 2.7 times more capital-intensive, and is on average 12% more productive than the median firm in the bottom half.

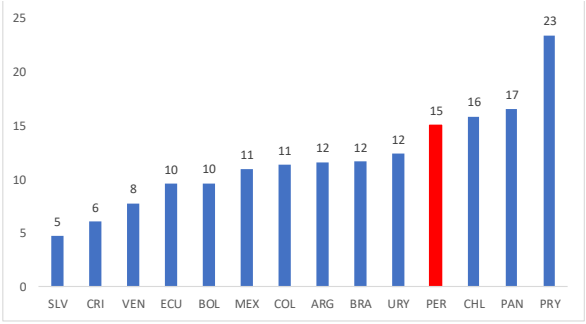
In sum, although most variables grew consistently throughout the period, the expansion observed during the first half (2005–2010) seems to have been higher than in the second half (2010–2015). Likewise, there is wide heterogeneity across industries and the industries that grew the most are not the largest. Finally, there is significant heterogeneity in terms of firm size, with the gap between the largest and the smallest firms being more pronounced in terms of exports.

B. China's Presence in the Manufacturing Sector in Peru

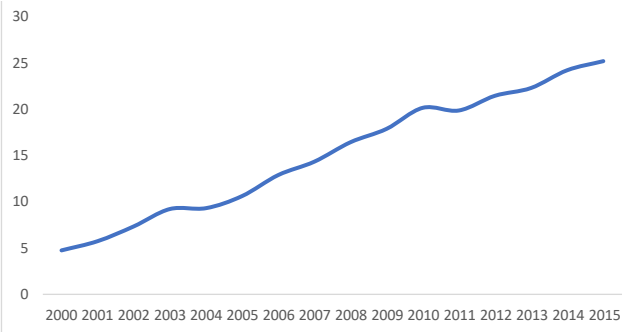
As the manufacturing sector in Peru expanded over most of 2005–2015, so did the inflow of Chinese goods in the domestic market. Peru is one of the countries in Latin America to have reached the largest shares of manufacturing imports from China since the early 2000s (figure 2a). Except for one year (2011), this presence has been growing consistently (figure 2b). In terms of the share of Chinese manufacturing goods in the domestic supply—that is, the import penetration (IP) index—figure 3a shows that Chinese exposure multiplied more than threefold between 2005 and 2015. This variation is remarkably different to the change in imports from the rest of the world. Figure 3b shows the evolution of growth in the IP index with respect to 2005, the first year in our sample. While the trend in import penetration from other countries remains relatively flat between 2005 and 2015, Chinese import penetration shows a sustained upward trend.

FIGURE 2: CHINA'S IMPORT SHARE IN LATIN AMERICA, 2000–2015

a) China's Import Share, Yearly Average 2000–2015, %



b) China's Share in Peruvian Imports

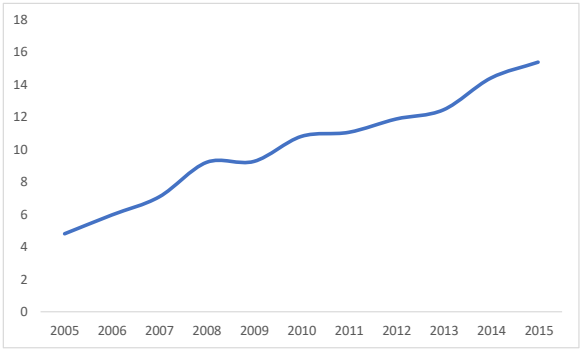


Note: Import share refers to the ratio of Chinese imports over the total imports for the respective year.

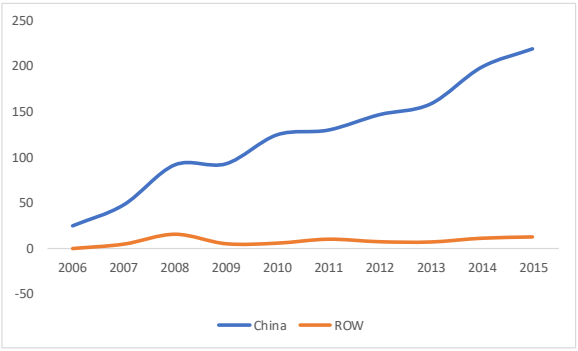
Source: Authors' calculations based on COMTRADE.

FIGURE 3. CHINA'S PRESENCE IN THE PERUVIAN MANUFACTURING SECTOR, 2006–2015

a) Import Penetration Index



b) Average Annual Growth in the Import Penetration (IP) Index: China vs. Rest of the World

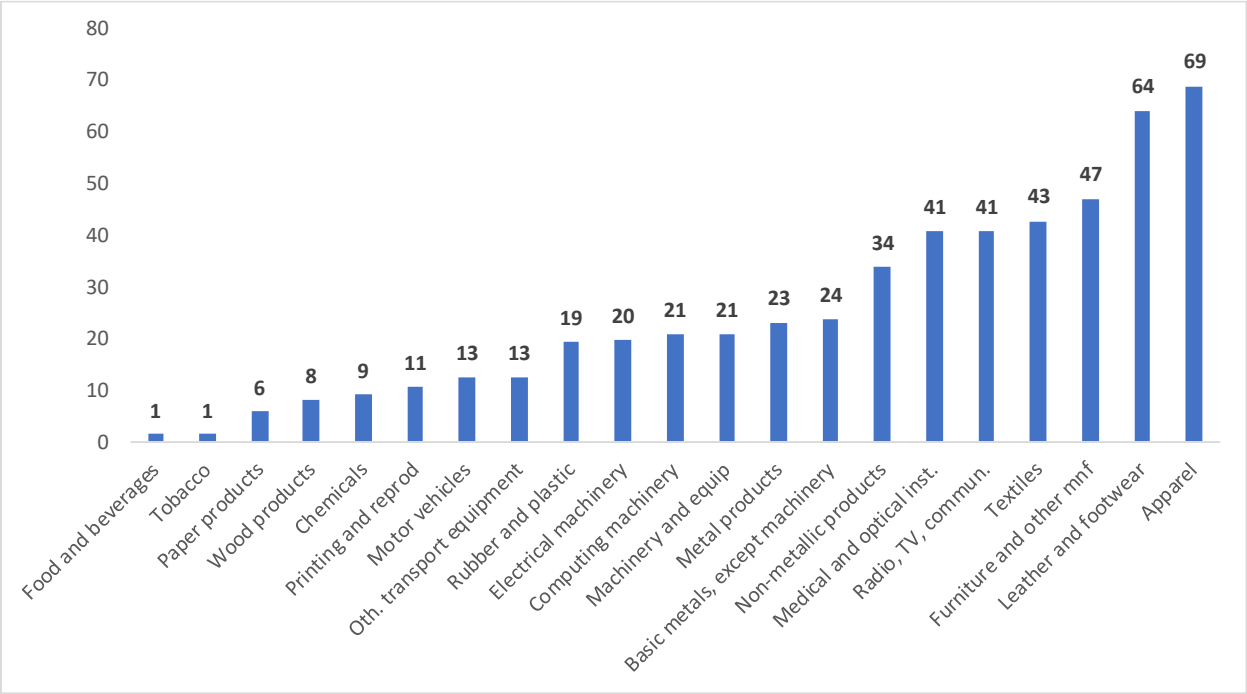


Note: Import penetration index is computed as the ratio between the Chinese imports over the total supply (domestic and foreign).

Source: Authors' calculations based on COMTRADE and INEI.

The degree of exposure varies across industries within the manufacturing sector. China's presence in manufacturing is stronger in industries such as apparel, leather, and footwear, furniture, and textiles, some of which account for a significant share of employment (figure 4). However, it is important to note that the largest sector in the sample in terms of employment, sales, and exports, which is food and beverages, is the least exposed to import competition from China.

FIGURE 4: IMPORT PENETRATION FROM CHINA BY INDUSTRY, YEARLY AVERAGE FOR 2005–2015

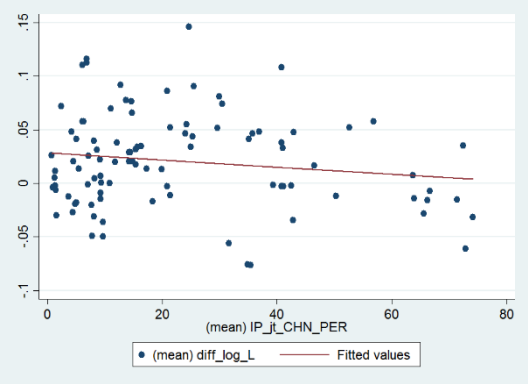


Source: Authors' calculations based on COMTRADE and INEI data.

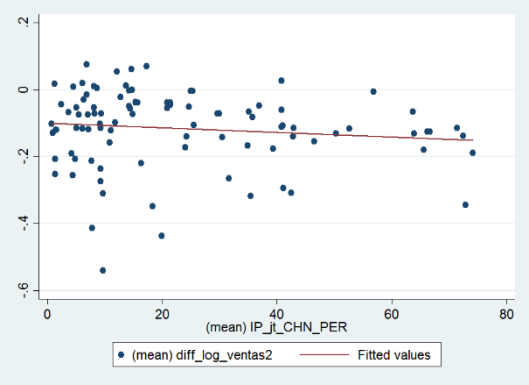
As a preliminary exercise seeking to uncover the potential links between Chinese import exposure in the domestic market and changes in employment, sales, exports, capital depth, and productivity (averaged at the sectoral level), figure 5 shows that greater exposure to competition from China is associated with lower employment growth. The relationship between Chinese import penetration and exports and sales is also negative but less pronounced than for employment. The evidence of a relationship with import penetration is even less clear in the case of exports and TFP growth. Finally, capital depth seems to have grown more in the industries that experienced the greatest Chinese import penetration.

FIGURE 5: CORRELATION BETWEEN EMPLOYMENT, SALES, EXPORTS, CAPITAL/LABOR RATIO, AND TFP AND CHINESE IMPORT EXPOSURE WITHIN THE MANUFACTURING SECTOR

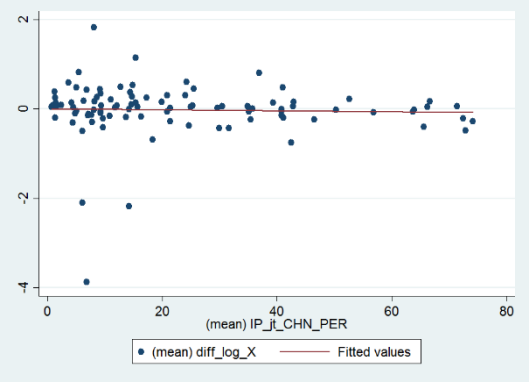
a) Employment



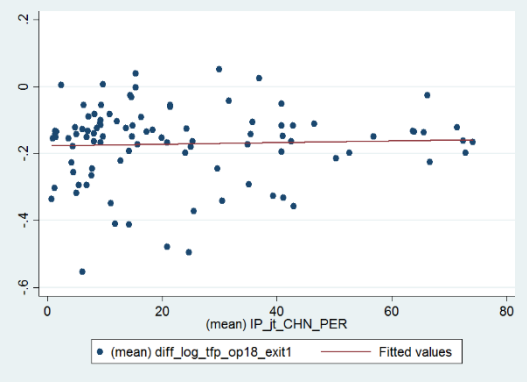
b) Sales



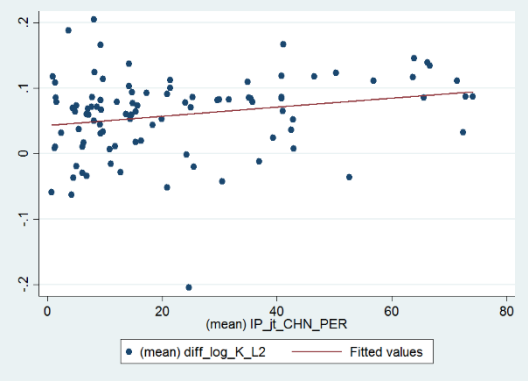
c) Exports



d) Total Factor Productivity



e) K/L ratio



Source: Authors' calculations based on COMTRADE and SUNAT data.

3. DATA AND EMPIRICAL METHODOLOGY

This section discusses the data and methodology used. The impact of more intense exposure to Chinese import goods will be analyzed for the following firm-level variables: sales, exports, employment, factor composition (capital/labor ratio) and productivity (TFP).

A. Firm-Level Data

We use firm-level data from the Peruvian Tax Authority (*Superintendencia Nacional de Aduanas y de Administración Tributaria*, SUNAT).[5] The underlying source of the information in this dataset are the financial statements reported by the firms themselves to SUNAT for taxation purposes in 2005–2015.[6] An average 14,800 firms per year are included in the dataset. The available information includes firm revenue (total and net sales) and the number of workers, inputs, and capital, among other firm characteristics.[7] The dataset also allows us to identify the main economic activity that firms state they are involved in, at the ISIC Rev 3. 4-digit level.[8] Firm-level information is reported in current prices. We deflated the information to 2007 prices employing the wholesale industrial price index reported by the National Institute of Statistics and Informatics (*Instituto Nacional de Estadística e Informática*, INEI).[9]

The firm-level balance-sheet information is merged with firm-level export data from customs and SUNAT. This merge allows us to obtain information on firms' total exports, their major export destinations, and the types of goods exported in 2005–2015.

Finally, the firm-level data from SUNAT also contains information on other firm-level characteristics such as age, activity status (whether the firm is active, has suspended activity, or exited the market), size, and geographic location, which are used as controls.[10]

B. A Note on the Total Factor Productivity Calculation

We calculate TFP using two different methodologies: Olley and Pakes (1996) and Levinsohn and Petrin (2003). Both methods control for the simultaneity bias that exists between the firm's input decisions and the observed revenue variables; however, selection bias due to firms exiting is only accounted for in the case of the Olley-Pakes estimation.[11]

To proceed with the estimation of productivity following both methods, we use total and net sales at the firm-level as our dependent variables.[12] To account for the use of factors of production, we observe the total level of employment at the firm level. We identify two potential measures of capital—total net fixed assets, and machinery and equipment. We use the log-differences of these latter two measures to generate two different investment variables that will be used as an instrument in the estimations. Finally, we deflated the sales value using the consumer price index and the capital measures using the machinery and equipment price index, both of which were taken from INEI and used 2007 as their base year.

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[5] SUNAT granted remote access to this data, but given the confidentiality restrictions surrounding it, it the estimations were calculated on-site.

[6] Although we are interested in having information for the first years of the 2000s to capture the beginning of the surge in Chinese imports, due to the changes in the questionnaires and methodological approaches in those years, the information from before 2005 cannot be compared with the information in subsequent years. Consequently, we have worked with the data from 2005 onward, recognizing that the estimations presented here might be conservative and do not include the impact of the China shock from the outset.

[7] On this point, it is important to highlight that given that firms are reporting their financial information for tax purposes, the annual PDT 684 questionnaire requests variables related to sales levels but not to production levels. Similarly, firms report the total number of employees without differentiating between types of workers.

[8] If the firm reports more than one main activity, SUNAT categorizes it under the code for the ISIC activity with the highest share in sales.

[9] Since the wholesale price index follows a different industrial classification (known as LEVEL54), we built a correspondence table between ISIC Rev. 3 and the INEI classification system (see appendix 2). Also, the data on price indexes is collected from two different sets that use different base years. We use prices from 2007, given that it is the only year that the two sets have in common and can thus be used to build a consistent price series for all years in the sample.

[10] The firm size is defined by SUNAT depending on the total sales according to four thresholds established using tax units (*unidades impositivas tributaries*, UITs). Micro-sized firms are those who reported sales of below 150 UITs, small firms are those with sales between 150 and 1700 UITs, medium firms are in the range of 1700–2300 UITs, and large firms are those that reported sales of over 2300 UITs.

[11] We acknowledge that these methodologies yield TFP estimates that are revenue-based and do not separate price from "true" productivity effects as explained in De Loecker (2011). However, data limitations prevent us from proceeding with TFP estimations that account for the latter effects.

[12] Net sales are total sales after deducting discounts, offers, and returns. In the Levinsohn-Petrin estimations, we apply both approaches (the revenue and the value-added approach) to the estimations using the two features available in Stata. In the latter case, the value-added is defined as total net sales minus sale costs. The final results do not differ substantially.

Productivity is estimated at the 2-digit ISIC level to account for technology differences across industries. Although we calculate the TFP following both methodologies, caveats in the estimation using the Levinsohn-Petrin method and advantages in the estimation using the Olley-Pakes method, both of which arise from data-related issues, led us prefer the latter method to the former. These advantages and disadvantages are as follows. First, the conventional instrumental variable employed by Levinsohn and Petrin (that is, electricity consumption) is not available in the dataset. Although we employed the intermediate inputs variable—which is made up of primary inputs, containers, and packaging, materials, and supplies—as an alternative instrument, the low quality and response rate of this variable implied a significant drop of 49% in the original number of observations.[13]

Second, the Olley-Pakes method allowed us to use the investment variable as an instrument instead of the inputs variable, as the former had a larger number of observations. In addition, it allowed us to include firm-level controls such as age, size, geographic location, year fixed effects; and two alternative exit variables to control for selection bias.[14]

We obtain results for TFP using the Olley-Pakes method for 16 industries within the manufacturing sector at the ISIC Rev. 3 2-digit level. These estimates were robust to the consideration of alternative investment and exit variables, and to the inclusion of all firm-level controls and year fixed effects. The coefficients for capital and labor obtained from both estimations are presented in table 4.[15]

The parameters estimated suggest that the capital coefficient is 0.67 on average, while the labor coefficient is 0.34 on average using both exit variables. These results are consistent with previous estimations of TFP conducted in Peru using the same dataset and the same method (Cespedes et al, 2014). Even though the authors estimate the TFP for the main economic activities at the 1-digit level and for a different period of analysis, our estimated capital and labor coefficients are comparable in magnitude.[16] The evolution of the aggregate TFP by industry using the firm-level TFP estimations can be found in appendix 1. The average TFP by industry—weighted by each firm's size—shows a downward trend in most industries with some notable exceptions such as textiles, whose TFP has been recovering since 2008, and wood products.

C. Empirical Methodology

We are interested in estimating the impact of the exposure to Chinese import competition on firm-level performance, and for that purpose, we largely follow Mion and Zhu (2013). In particular, we analyze the impact on outcome variables that reflect overall firm performance (domestic sales and exports) and factor choices (growth in employment, productivity, and capital intensity).

A priori, our expectations regarding the direction of the impact are different for each dependent variable. Regarding sales, as import competition from low-cost sources intensifies in the domestic market, sales of domestically produced goods are expected to slow, as these will arguably be offered at less competitive prices. Similarly, as imported goods flood the domestic markets and domestic sales contract, firms can be expected to adjust their labor choices, lowering demand for labor in some cases and thus slowing employment growth. In terms of capital intensity, the literature (Bernard et al., 2006) suggests that as the competition from labor-abundant (low-wage) countries increases, firms in the domestic market might alter their output mix, shifting to the production of goods that are more capital-intensive.

Finally, firm-level productivity growth could be impacted by the surge in imports from low-wage sources in either direction. On the one hand, if the more intense competition from China reduces firms' profits enough to limit their

[13] We are able to obtain TFP results for more than 157,000 observations using the Olley-Pakes method, whereas the TFP following the Levinsohn-Petrin method reported results for less than 78,900.

[14] The *firm status* variable provided by SUNAT is the main point of reference that we use to define the exit variable. This variable indicates whether the firm is in one of the following situations: active, suspended, or temporarily suspended. For our first definition of an exit variable, we consider a firm to have exited if it is suspended or temporarily suspended according to the status provided by SUNAT. For our second definition, since there are cases in which we observe data for a firm in the sample even though it is reported by SUNAT as not being active, we follow what we effectively observe in the data instead of what the SUNAT status variable establishes. The results are robust to the consideration of both exit variables.

[15] Five industries end up being excluded from the TFP calculation due to the small number of observations available for them: 16—tobacco, 23—coke and petroleum, 27—basic metals, 30—computing machinery, 31—electrical machinery, and 32—radio, TV, and communications equipment.

[16] They find that the capital and labor coefficients using the Olley-Pakes method are 0.8 and 0.4 in manufacturing sector, respectively.

options for innovation, then productivity growth may be affected negatively. However, if increased Chinese competition acts as an incentive for domestic firms to adjust their output mix and become more efficient, this implies a positive impact on productivity growth.

With all these expectations about firm-level performance in mind, we estimate the following baseline model:

$$(1)\ \Delta\, y_{ij,t+1} = \beta_0 + \beta_1 IP_{Peru,jt} + \alpha * \boldsymbol{X}_{ijt} + \delta_i + \delta_t + e_{ijt}$$

where, $\Delta\, y_{ij,t+1}$ refers to the annual rate of growth (in percentage terms) for firm i in industry j, reported between t and t+1, for the following outcome variables: employment $(\Delta Log\ (L))_{\ ij,t+1}$, net domestic sales $(\Delta Log\ (Sales))_{\ ij,t+1}$, total factor productivity $(\Delta Log\ (TFP))_{\ ij,t+1}$, and capital-labor ratio $(\Delta Log\ (K/L))_{\ ij,t+1}$.

The exposure to competition from China in industry *j* and year *t* is captured by the IP index ($IP_{Peru,jt}$) which is calculated following the expression:[17]

$$(2)\ IP_{Peru,jt} = \frac{M_{jt}^{chn}}{P_{jt} + M_{jt}^{wld}}$$

where M_{jt}^{chn} and M_{jt}^{wld} are the imports from China and the world in industry *j* and year *t*, respectively; and P_{jt} is the value-added by industry *j* in year *t*.

The vector $\boldsymbol{X}_{ijt}$ represents the set of firm-level controls in year t. These covariates include age, size, geographic location, level of employment, and capital intensity among others. δ_i is the firm fixed effect that captures time-invariant unobserved characteristics of the firm, and δ_t is the time-fixed effect that accounts for economic shocks in a given year. We also include variables such as level of employment, productivity, and capital intensity in time *t*, which allow us to control for pretrends reported in the data. Finally, e_{ijt} denotes the error term that is clustered by industry.

As suggested by Mion and Zhu (2013), the outcome variables are expressed in growth rates in *t*+1, while the regressors are reported in time *t* as a strategy to mitigate endogeneity bias. However, the estimation of equation (1) using the conventional OLS method may still raise some endogeneity issues in that the import penetration variable might be capturing not only supply-driven effects but also demand-driven components that may explain the increased presence of Chinese products in Peruvian markets. To address these potential endogeneity issues, we instrument the IP index using imports from China in Chile (mainly) and in Colombia (alternatively).

We selected Chilean imports from China as an instrument based on the following criteria: a) Chile's import structure bears a strong resemblance to that of Peru; and b) the trade relationship between the two countries was modest during the period of analysis. As a consequence, trade-related effects induced by Chinese competition on Chilean markets may be considered independently of domestic shocks that may have affected Peruvian labor outcomes.[18] Colombian imports from China were selected as an alternative instrument because both economies share other characteristics—such as size—that make them good proxies for each other. Thus, in alternative specifications, we use Colombian imports from China to assess the robustness of our results. IV quality tests, presented in the next section, indicate that both instruments have significant predictive power and satisfy the under-identifying restrictions.[19]

Firms are not equal, and we should thus not expect the impact of Chinese competition to be the same across different types of firms. To assess heterogeneity in the impact, we consider a set of specifications similar to (1) but

[17] To compute this variable, we used output by industry from INEI and the industry-level imports from UN COMTRADE. Given that INEI reports Peruvian production data at the 2-digit level for a national classification that differs from ISIC, and that the import information required to calculate this index was reported following ISIC, we created a correspondence between these two classifications to ensure they are consistent and be able to calculate the index described above. The details of the correspondence between these two classifications can be found in appendix 2.

[18] In the past decade, the average annual share of imported Chilean goods in total manufacturing imports in Peru was 5%. On the export side, Peruvian exports to Chile did not exceed 3% of Peru's total exports.

[19] We compute the Chinese import penetration index in the countries to be used as instrument according to expression (2). For this purpose, we use the Colombian production data provided by the National Planning Department (*Departamento Nacional de Planeación*), which reports production at the 2-digit ISIC level adapted for Colombia between 2005 and 2015. Meanwhile, Chilean production information is taken at the 2-digit ISIC level from the National Industrial Survey (*Encuesta Nacional Industrial Annual*, ENIA) for 2001–2010. To be consistent with the INEI classification for the industrial product information, we applied a correspondence between ISIC Rev. 3 and the INEI classification, which is presented in appendix 2.

breaking down the analysis by firm size. In particular, we split the sample of firms into two groups: one including the upper half in terms of sales (representing the larger firms) and the other with the bottom half (smaller firms).

D. Other Measures of Chinese Import Influence

The expression in (2) can help us get a sense of the overall impact of the competition from China in the domestic market. However, the competition from China is also felt in third markets that Peruvian firms export to. To study this effect, we calculate the extent of the competition from China in Peruvian firms' main export markets using exporter-level customs data.

To do so, we proceed as follows:

a) First, we identify the main three destination markets (countries) of each exporting firm per year.

b) We then use COMTRADE data to obtain China's import share by industry for each of those three main trade partners.

c) Finally, we computed a weighted average of China's import share in the main export markets by firm—using the share of each destination within the firm's total exports as weights.

In short, the export competition variable is created for each firm i, in industry *j*, year *t*, following this expression:

$$(3)\ XC_{ijt} = \sum_{d=1}^{3} X\_sh_{d,ijt} * \frac{M_{jtd}^{chn}}{M_{jtd}^{wld}}$$

where $d = 1,2,3$ denotes each of the three main export markets. The first component of expression (3) refers to the market share of each main trade partner within firm *i*, and the second part captures China's share in the total imports for industry *j*, in year *t*, in each main trade partner *d*.

Once (3) has been calculated, we proceed to estimate the model as in (1) but add export growth to the list of firm-level outcome variables and also replace the IP index for the variable capturing competition in third markets. It is important to note that in contrast to the estimation of (1) using instrumental variables for the IP index, the coefficients for the variable in (3) will be OLS estimates—we do not have the firm-level information required to build the corresponding instrument for Chile and Colombia. In this case, however, we consider OLS a valid method since the variable of interest—the presence of Chinese goods in Peruvian firms' export markets—is unlikely to be influenced by the firm-level decisions of Peruvian exporters. In this sense, the endogeneity concerns that arise when we analyze import competition in the Peruvian market are mitigated.

4. ESTIMATION RESULTS

A. Baseline Estimation and Results by Firm Size

Table 5 shows the results of the baseline estimation using imports from China in Chile from 2005 to 2010 as an instrument of $IP_{Peru,jt}$. Given the lack of available industry-level production data for Chile after 2010, the analysis using Chilean data as an instrument is limited to the 2005–2010 period. Column (1) reports the results of the impact of exposure to imports from China on employment growth. The equivalent results for net sales, capital intensity, and productivity growth are reported in columns (2), (3), and (4), respectively.

The IV results indicate that the impact of competition from Chinese imports is significant for employment and capital intensity growth. In the case of employment growth, the impact is negative. A 1-percentage-point increase in the import exposure index reduces manufacturing employment growth by 0.6 percentage points for the average firm. The same change in the Chinese IP index increases the average firm's capital depth by 0.4 percentage points. No overall

significant result is obtained for sales and productivity.[20] Considering that import penetration from China in the Peruvian manufacturing sector increased around 6 percentage points in 2005–2010, we find that the average impact on employment growth is a reduction of 3.6%, while the capital-labor ratio rises 2.4%.[21]

Even though the coefficients for sales and TFP are negative, they are not statistically significant. These results suggest that the average Peruvian manufacturing firm is adjusting its input composition in terms of labor and capital, at least in the short run, possibly leading to a more capital-intensive approach to dealing with stronger competition from Chinese imported goods, instead of bringing about short-term changes in sales. In addition, the complexity of the changes required to observe a substantial transformation in total productivity is also a possible explanation of the nonsignificant result found for TFP.

As mentioned previously, to explore possible differences in the impact across different groups of firms, we estimate (1) by breaking down the analysis by firm size, determined by net sales in a year.[22]

The results are presented in table 6. In columns (1) to (4), a firm is defined as "larger" or "smaller" depending on which half of the firm-size distribution (top or bottom) it falls within in a given year. The caveat with this categorization is that the size of a firm in each year may be influenced by the extent of import competition from China. For this reason, in columns (5) to (8), each firm is considered "larger" or "smaller" according to which half of the firm-size distribution it was placed in the first year it appears in the sample. The main difference between the two groups is that the overall share of firms that fall into the group of larger firms starts shrinking after 2005, which reflects the fact that a larger share of the entries after 2005 are of smaller firms.

Column (1) shows that the results for employment growth discussed in table 5 mainly originate in the group of larger firms. This result would be consistent with the fact that almost all the labor captured in this sample year-to-year is held among these groups of firms. However, when we control for endogeneity in the definition of firm size, the results in (5) show that the negative effect on employment is significant for both groups of firms. These results suggest that a 1-percentage-point increase in the import penetration exposure from China reduces employment growth by 0.6 percentage points in either group. The difference in these results may reflect the fact that when we use the time-invariant definition, which means that we are not allowing the firm to expand or shrink over 2005–2010, we treat 7.2% of the firms that are categorized as larger according to the time-variant definition as being smaller. The significant effect among the smaller firms found in (5) is therefore probably explained by the group of firms that are on the margin and entered as smaller firms and grew significantly over time, moving to the upper half of the distribution according to the time-variant definition.

We also find that the positive result on capital depth is also mainly explained by the group of larger firms and, in this case, the effect is robust to the consideration of both time-variant and invariant definitions. It seems to be the case that larger firms are involved in capital and labor adjustments, particularly moving toward more capital-intense structures, whereas smaller firms are mainly adapting to the higher competition through labor adjustments. In fact, figure 6 shows that the gap in the capital-labor ratio between large and small firms widened along the sample period. In the case of the smaller firms, the adjustments mainly seem to follow movements in labor, meanwhile among larger firms, the capital movements are more pronounced.

Again, no overall significant result was obtained for productivity despite the segmentation into heterogeneous sizes. We do observe, however, a negative and significant effect on sales for the smaller firms when we use the time-invariant size definition. Since segmentation by size is based on median sales per year, we consider that the time-invariant classification (t=0) is most appropriate for analyzing the effect on net sales, as it avoids synchronized movements in the dependent variable and the shifting firm-size definition. On average, column (6) indicates that a 1-percentage-point

[20] It is important to note that these results only reflect the average effects taking all industries into account. Specific industry impacts will probably differ depending on the degree of exposure to Chinese import competition.

[21] Import penetration from China increased from 4.82% to 10.84% in 2005–2010, the impact on employment growth is 6 x 0.6 = 3.6%, on average, and for capital-depth it is 6 x 0.4 = 2.4%.

[22] We split the sample based on median sales per year. If the firm reported a level of sales in a specific year that is above the median in the sample, it is considered a large firm, otherwise it is defined as a small firm.

increase in Chinese import exposure represents a slowdown in domestic sales of 0.6 percentage points among smaller firms.

In sum, firms' responses to the surge in import competition are heterogeneous in terms of labor, sales, and the capital-labor ratio. We find that smaller firms experienced a decrease in their net sales, while large firms are not significantly affected. We then observe a substantial reallocation between labor and capital in both large and small firms, which functions as a mechanism for adapting to greater competition from China although it derives from diverse responses. Smaller firms opt for adjustments in labor, probably explained by a cost-reduction approach after facing lower sales. Larger firms experience a downturn in employment growth, but unlike the case among smaller firms, there seems to have been a reallocation of resources toward capital.[23]

B. Chinese Competition in Third Markets

Table 7 presents the effects of Chinese competition in third markets. Our focus here is thus on exporting firms.[24] In columns (1) to (5), we employ export competition variables in third markets using time-variant weights for the importance of each destination. However, given that the top three destinations for each exporting firm could change from one year to the next as a response to the increased presence of Chinese products in those markets, we create an alternative competition variable using time-invariant weights, which is employed in columns (6) to (10).[25]

The results in (1) to (5) suggest a negative effect on employment growth and a positive effect on capital depth. However, when we control by time-invariant weights in columns (6) to (10), the effect only remains for employment. Column (7) indicates that an increase of 1 percentage point in the weighted share of Chinese imports in the main three export markets reduces employment growth among exporting firms by between 0.4 and 0.5 percentage points. As before, we do not find evidence of a significant effect on TFP, net sales, or exports, and the effect on the capital/labor ratio of exporter firms vanishes once we control for time-invariant destinations and weights.

C. Using Colombia to Study the Impacts Over the Full Decade

We further explore the consistency of these results by employing Colombian data as an instrument, given its availability for the full decade and the resemblance between the two economies. With the data from Chile, we truncated the regressions to only five years (2005–2010) because of the lack of industry-level data with which to compute the import penetration measure after 2010. With Colombia, we can explore five more years of data (2010–2015) and consequently account for more recent trends in the Peruvian market.

First, we compare the results of the baseline model in table 5 with the results now presented in table 8a. The results hold for all the outcome variables. The direction and magnitude of the coefficients do not vary substantially when using Chile or Colombia. Greater Chinese import penetration is associated with a lower employment growth rate and a higher capital share. The estimated effect is similar to the values obtained with Chile—the employment growth rate declines by 0.5 percentage points, and the capital depth increases 0.4 percentage points for each percentage-point increase in the Chinese import penetration measure. As before, there is no evidence of a significant effect on net sales and TFP.

We also assess the robustness of the results by breaking down the effects by firm size to verify if the heterogeneous impacts found with Chile persist when using Colombia as the IV. Interestingly, the results shown in columns (1) to (4) in table 8b confirm the presence of a negative impact on employment as well as the improvement to the capital-labor ratio among the larger firms. The direction and magnitude of the effects are largely the same for employment (0.5) and capital-labor (0.4). However, the coefficient is greater and significant for larger firms' domestic sales. This can be explained by the fact that the average firm in the sample reported a larger reduction in sales precisely between 2012–2014, a period when the positive impact of the commodity boom that favored the Peruvian economy during the 2000s

[23] The results from the OLS estimation of both the baseline model and the size model are presented in appendix 3. The direction of the impact on each outcome variable is the same.

[24] Hence, the number of observations declined since we are specifically analyzing firms with positive export transactions along the sample period.

[25] Since the import exposure in domestic markets (IP) and the presence of China in export destination markets are highly correlated, we only explore the competition variable in the main destination markets in this section to avoid multicollinearity concerns.

had faded and which we can only capture when we use Colombian data as an instrument.[26] This suggests that when we consider only 2005–2010, we are probably missing part of the effect that was significant for sales and that occurred in more recent years.

When we explore the time-invariant definition, which, as mentioned before, considers that firms do not adjust their size or scale over time, we find a significant effect on smaller firms for employment and net sales growth. However, as before, this result is due to the fact that the impact probably affects smaller firms that grew over time and would have otherwise moved to the group of larger firms. In fact, we find that this group of firms increased by up to 17% by 2015, which explains the larger coefficients found for smaller firms using this scenario.

Finally, we explore the effect of an alternative measure of exposure to import competition from China in table 8c. We do not find a significant impact on any of the outcome variables when we use the time-invariant weights. Even the significant negative effect on employment growth found using Chilean data as an instrument and time-invariant weights is lost, indicating that the inclusion of more recent years of data made a difference for the exporting firms.

D. A Study of Longer-Term Effects

In this section, we explore the impact of Chinese imports over a five-year timeframe to evaluate the persistence of the effects found in Peruvian firms' performances. So far, we have analyzed the annual change in employment, net sales, the capital-labor ratio, and TFP. Here, we explore what happens to these same aspects when we use a five-year time window. The purpose of this exercise is to move from short-term adjustments toward a longer-term perspective.

In this case, we explore changes in the five-year log difference—corresponding to $\Delta\, y_{ij,t+5}$ in equation (1) of each outcome in response to the Chinese import penetration rate reported in year t. Table 9a suggests that the impact on employment and capital-labor ratio growth persists even five years into the future. In addition, we find that there is apparently a cumulative effect, since the magnitude of both coefficients are relatively higher in absolute terms. The impact of greater Chinese competition in the current year is associated with a decrease in employment growth that persists five years later. A 1-percentage-point increase in import exposure represents a reduction of 0.9 percentage points on employment growth and sustained improvement of 0.6 percentage points in the capital-labor ratio. Moreover, we find that the effect on net sales growth, which was negative and not significant in the year-to-year estimation, now seems to be relevant for Peruvian firms over a longer time span. A possible explanation is that in the short term, firms are handling competition by adjusting inputs such as labor, modest capital investments, and possibly managing inventories and other factors to mitigate the impact on revenue generation (sales). Nonetheless, from a longer-term perspective, the increased competition from China is impacting the firm scale and its growth rate more significantly. A 1-percentage-point increase in the import exposure in a given year reduces sales growth by 1.43 percentage points five years later. Regarding TFP, even considering this longer timeframe, we observe no significant impact.

These overall results are also persistent for smaller and larger firms over a five-year timeframe. According to the estimates in table 9b, the negative impact on employment is now significant for both groups of firms using both the time-variant and time-invariant definitions. Again, the magnitude of the coefficients is relatively higher, suggesting a major cumulative effect. A similar impact is observed in sales growth among larger and smaller firms when using the time-invariant approach. The absolute value of the capital-depth coefficient is also larger compared to the year-to-year result and is only significant for larger firms. The larger firms experienced a sustained rise in capital participation that is approximately 0.15 and 0.17 percentage points larger than the changes reported yearly.

We find no evidence of changes in TFP even when we extend the timeframe over five years. Since changes to TFP normally take longer to be observed, we would have expected to find effects using this specification. However, this does not seem to be the case. Although the TFP calculations show a downward trend for some industries—as presented in appendix 1—the absence of significant effects on TFP after exploring several decompositions and time

[26] The mean value of sales for an average firm in the sample reported annual reductions of 18%, 11%, and 14% in 2012, 2013, and 2014, respectively. By the end of 2015, an upward trend is reported in sales but the average value remains below the levels observed in 2011.

windows suggests that Chinese import penetration in domestic markets does not seem to be related to the decline in productivity.

5. CONCLUSIONS

This paper documents the experience of the firms in the manufacturing sector in Peru as import competition from China surged in the country. The evidence in this paper shows that although the shock had an impact, the way in which firms reacted and adjusted to it has been heterogeneous. Overall, Peruvian firms in the manufacturing sector seem to have mainly adjusted to the shock by altering their input choices. While smaller firms seem to have opted for reducing their demand for labor by following a cost-reduction approach in response to lower sales, larger firms seem to have adapted by deepening their capital requirements. Larger firms also experienced a downturn in employment growth, but unlike the smaller firms, they seemed mainly to reallocate their resources toward more capital. The impact on net sales is only noticeable—and negative—if we take the later part of the decade into account or if we consider a longer timeframe. There seems to be no impact on TFP, regardless of firm size, the timeframe, and the instrument used.

Regarding competition in third markets, the evidence is mixed. Although greater competition from China in third markets seems to have had a negative impact on employment growth within exporting firms during the first half of the period analyzed (2005–2010), this impact fades as more recent years are accounted for (2010–2015).

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TABLES

TABLE 1: DESCRIPTIVE STATISTICS—ANNUAL AVERAGE 2005–2015

Industry	Number of firms	Number of workers	Sales (constant million soles)	Capital (constant million soles)	Exports (million USD)	Total factor productivity (log)	K/L (constant million soles)
Food and beverages	2,492	133,401	32,460	34,680	2,227	4.38	0.20
Textiles	1,018	42,684	5,438	6,318	526	4.26	0.20
Apparel	2,068	42,311	4,448	3,451	689	2.87	0.16
Leather and footwear	555	5,000	668	457	27	2.75	0.11
Wood products	609	7,587	1,048	1,115	68	4.35	0.15
Paper products	206	6,709	2,056	2,373	56	-0.11	0.16
Printing and reproduction	2,113	18,743	3,351	3,090	83	5.29	0.09
Chemicals	705	27,470	9,153	9,048	424	5.27	0.23
Rubber and plastic	630	21,513	6,459	6,271	376	0.10	0.21
Nonmetallic products	370	16,292	6,722	11,750	158	5.22	0.20
Metal products	1,965	25,939	4,234	3,563	129	3.52	0.09
Machinery and equip	483	7,670	1,387	1,383	33	2.98	0.19
Medical and optical inst.	73	1,147	194	127	4	3.80	0.09
Motor vehicles	305	4,697	875	931	38	2.68	0.12
Other transport equipment	157	3,293	533	652	9	4.46	0.11
Furniture and other mnf.	1,093	12,592	2,750	2,421	125	4.45	0.10

Source: SUNAT.

TABLE 2. FIRM-LEVEL GROWTH IN EMPLOYMENT, SALES, AND EXPORTS BY INDUSTRY (YEARLY AVERAGES)

Industry	Average annual growth		
	Employment	Sales	Exports
Radio, TV, commun.	0.18	0.31	0.31
Computing machinery	0.15	0.27	
Medical and optical inst.	0.05	0.03	0.23
Chemicals	0.05	0.08	0.10
Machinery and equip	0.05	0.09	0.11
Rubber and plastic	0.05	0.06	0.11
Electrical machinery	0.05	0.00	0.03
Food and beverages	0.04	0.07	0.10
Oth. transport equipment	0.03	0.10	-0.05
Non-metallic products	0.03	0.06	0.02
Metal products	0.03	0.08	0.07
Motor vehicles	0.03	0.07	0.05
Leather and footwear	0.02	0.09	0.08
Printing and reprod	0.02	0.06	0.03
Furniture and other mnf	0.01	0.10	0.04
Basic metals, except machinery	-0.01	0.09	-0.01
Paper products	-0.02	0.03	-0.01
Textiles	-0.04	-0.02	0.00
Wood products	-0.04	0.01	-0.04
Apparel	-0.04	0.01	0.03
Tobacco	-0.17	0.12	-0.14

Source: SUNAT.

TABLE 3: HETEROGENEITY ACROSS FIRMS

Median Firm	Bottom 50	Top 50	Ratio (Top/Bottom)
Exports in USD	19,028	264,034	13.88
K/L in soles	31,841	85,151	2.67
Productivity (log)	3.851	4.304	1.12

Source: SUNAT.

TABLE 4: OLLEY-PAKES RESULTS FOR TFP ESTIMATION BY SECTOR

Sector	Olley-Pakes—Exit 1		Olley-Pakes—Exit 2	
	Capital	Labor	Capital	Labor
Food and beverages	0.628	0.381	0.581	0.381
Textiles	0.641	0.28	0.629	0.28
Apparel	0.761	0.291	0.707	0.291
Leather	0.78	0.322	0.69	0.322
Wood	0.642	0.365	0.734	0.365
Paper products	0.976	0.328	0.748	0.328
Printing and reproduction	0.561	0.395	0.569	0.395
Chemicals	0.578	0.306	0.635	0.306
Rubber and plastics	0.97	0.246	0.754	0.246
Nonmetallic products	0.559	0.382	0.574	0.382
Fabricated metal products	0.711	0.358	0.623	0.358
Machinery and equipment	0.763	0.344	n.a	n.a
Medical and precision instruments	0.687	0.434	0.618	0.434
Motor vehicles	0.783	0.311	0.727	0.311
Other transport equipment	0.636	0.338	0.588	0.338
Furniture	0.633	0.379	0.693	0.379

Note: TFP measures are based on a value-added production function.

Source: Authors' calculations based on the SUNAT dataset.

TABLE 5: ESTIMATION RESULTS—BASELINE

Dependent variable: Annual log differences of:	(1) Employment	(2) Net sales	(3) K/L	(4) TFP
Chinese Import Exposure (%)	-0.560**	-0.388	0.378***	-0.146
	(0.221)	(0.247)	(0.113)	(0.126)
Observations	59,308	58,451	57,951	56,853
R-squared	0.491	0.452	0.491	0.461
Instrument	IP Chile	IP Chile	IP Chile	IP Chile
Method	2SLS	2SLS	2SLS	2SLS
Weak IV F-test	45.09	44.08	44.75	44.15
Underidentification p-value	0.0956	0.0964	0.0955	0.0962
Chinese Import Exposure (%) - 1st stage results	0.547***	0.546***	0.548***	0.546***
	(0.081)	(0.082)	(0.082)	(0.082)

Note: Errors are clustered at the industry level. Firm-level controls include age, size, location, capital/labor. Year and firm fixed effects are included. *** p<0.01, ** p<0.05, * p<0.1

TABLE 6: ESTIMATION RESULTS—BY SIZE

Dependent variable: Annual log differences of:	(1) Employment	(2) Net sales	(3) K/L	(4) TFP	(5) Employment	(6) Net sales	(7) K/L	(8) TFP
Chinese Import Exposure * Larger firms (defined yearly)	-0.587**	-0.406	0.400***	-0.137				
	(0.219)	(0.244)	(0.114)	(0.130)				
Chinese Import Exposure * Smaller firms (defined yearly)	-0.385	-0.235	0.224	-0.231				
	(0.233)	(0.310)	(0.136)	(0.143)				
Chinese Import Exposure * Larger firms (defined in t=0)					-0.555**	-0.359	0.396***	-0.145
					(0.218)	(0.254)	(0.107)	(0.125)
Chinese Import Exposure * Smaller firms (defined in t=0)					-0.596**	-0.585**	0.262	-0.147
					(0.256)	(0.218)	(0.201)	(0.153)
Observations	59,308	58,451	57,951	56,853	59,308	58,451	57,951	56,853
R-squared	0.491	0.452	0.491	0.461	0.491	0.452	0.491	0.461
Instrument	IP Chile	IP Chile	IP Chile	IP Chile	IP Chile	IP Chile	IP Chile	IP Chile
Method	**2SLS**	**2SLS**	**2SLS**	**2SLS**	**2SLS**	**2SLS**	**2SLS**	**2SLS**
Weak IV F-test	22.54	22.02	22.36	22.05	22.33	21.84	22.16	21.87
Underidentification p-value	0.0956	0.0963	0.0955	0.0962	0.0959	0.0967	0.0959	0.0966
Chinese Import Exposure * Larger firms (defined yearly) -1st stage	0.576***	0.572***	0.575***	0.571***				
	(0.079)	(0.080)	(0.080)	(0.081)				
Chinese Import Exposure * Smaller firms (defined yearly) -1st stage	1.158***	1.171***	1.161***	1.170***				
	(0.067)	(0.061)	(0.066)	(0.066)				
Chinese Import Exposure * Larger firms (defined in t=0) - 1st stage					0.585***	0.585***	0.586***	0.583***
					(0.081)	(0.082)	(0.081)	(0.082)
Chinese Import Exposure * Smaller firms (defined in t=0) - 1st stage					1.041***	1.040***	1.041***	1.045***
					(0.064)	(0.063)	(0.063)	(0.063)

Note: Errors are clustered at the industry level. Firm-level controls include age, size, location, capital/labor. Year and firm fixed effects are included. "Larger firms" are those in the upper half of the exporter-size distribution in a given year. "Smaller firms" are those in the bottom half. *** p<0.01, ** p<0.05, * p<0.1

TABLE 7: ESTIMATION RESULTS—CHINESE COMPETITION IN THIRD MARKETS

Dependent variable: Annual log differences of	(1) Exports	(2) Employment	(3) Net sales	(4) K/L	(5) TFP	(6) Exports	(7) Employment	(8) Net sales	(9) K/L	(10) TFP
Chinese competition in main 3rd markets (defined yearly), (%)	0.488	-0.381***	-0.150	0.260**	-0.064					
	(0.396)	(0.091)	(0.246)	(0.111)	(0.180)					
Chinese competition in main 3rd markets (defined in t=0), (%)						-0.166	-0.523**	-0.122	0.315	-0.060
						(0.618)	(0.199)	(0.256)	(0.445)	(0.372)
Observations	6,279	7,328	7,294	7,272	7,187	6,279	7,328	7,294	7,272	7,187
R-squared	0.26	0.468	0.518	0.461	0.475	0.259	0.468	0.518	0.460	0.475

Note: Errors are clustered at the industry level. Firm-level controls include age, size, location, capital/labor. Year and firm fixed effects are included.

*** p<0.01, ** p<0.05, * p<0.1

TABLE 8. ESTIMATION RESULTS USING COLOMBIA AS AN INSTRUMENT

a) Baseline Results

Dependent variable: Annual log differences of:	(1) Employment	(2) Net sales	(3) K/L	(4) TFP
Chinese Import Exposure (%)	-0.519*	-0.598	0.387*	-0.135
	(0.284)	(0.354)	(0.211)	(0.236)
Observations	112,125	110,414	109,285	107,212
R-squared	0.413	0.386	0.423	0.380
Year FE	Yes	Yes	Yes	Yes
Firm FE	Yes	Yes	Yes	Yes
Instrument	IP Colombia	IP Colombia	IP Colombia	IP Colombia
Method	2SLS	2SLS	2SLS	2SLS
Weak IV F-test	10.37	10.29	10.40	10.25
Underidentification p-value	0.0234	0.0234	0.0232	0.0237
Chinese Import Exposure (%) - 1st stage	0.899***	0.891***	0.892***	0.889***
	(0.276)	(0.278)	(0.277)	(0.278)

Note: Errors are clustered at the industry level. Firm-level controls include age, size, location, capital/labor. Year and firm fixed effects are included. *** p<0.01, ** p<0.05, * p<0.1

b) By Size

Dependent variable: Annual log differences of:	(1) Employment	(2) Net sales	(3) K/L	(4) TFP	(5) Employment	(6) Net sales	(7) K/L	(8) TFP
Chinese Import Exposure * Larger firms (defined yearly)	-0.557*	-0.632*	0.446*	-0.140				
	(0.289)	(0.353)	(0.216)	(0.233)				
Chinese Import Exposure * Smaller firms (defined yearly)	-0.358	-0.400	0.122	-0.104				
	(0.266)	(0.387)	(0.229)	(0.278)				
Chinese Import Exposure * Larger firms (defined in t=0)					-0.511	-0.561	0.453**	-0.141
					(0.296)	(0.352)	(0.211)	(0.240)
Chinese Import Exposure * Smaller firms (defined in t=0)					-0.541*	-0.697*	0.205	-0.119
					(0.258)	(0.351)	(0.240)	(0.237)
Observations	112,125	110,414	109,285	107,212	112,125	110,414	109,285	107,212
R-squared	0.414	0.386	0.423	0.380	0.414	0.386	0.423	0.380
Instrument	IP Colombia	IP Colombia	IP Colombia	IP Colombia	IP Colombia	IP Colombia	IP Colombia	IP Colombia
Method	2SLS	2SLS	2SLS	2SLS	2SLS	2SLS	2SLS	2SLS
Weak IV F-test	5.191	5.153	5.210	5.130	5.193	5.157	5.210	5.134
Underidentification p-value	0.0233	0.0233	0.0232	0.0236	0.0236	0.0235	0.0234	0.0239
Chinese Import Exposure * Larger firms (defined yearly) -1st stage	1.018***	1.013***	1.013***	1.002***				
	(0.254)	(0.257)	(0.255)	(0.258)				
Chinese Import Exposure * Smaller firms (defined yearly) -1st stage	3.110***	3.115***	3.109***	3.139***				
	(0.699)	(0.716)	(0.692)	(0.720)				
Chinese Import Exposure * Larger firms (defined in t=0) - 1st stage					1.201***	1.199***	1.197***	1.188***
					(0.242)	(0.244)	(0.243)	(0.244)
Chinese Import Exposure * Smaller firms (defined in t=0) - 1st stage					2.251***	2.265***	2.252***	2.266***
					(0.371)	(0.369)	(0.364)	(0.364)

Note: Errors are clustered at the industry level. Firm-level controls include age, size, location, capital/labor. Year and firm fixed effects are included. "Larger firms" are those in the upper half of the exporter-size distribution in a given year. "Smaller firms" are those in the bottom half. *** p<0.01, ** p<0.05, * p<0.1

c) Competition in Third Markets

Dependent variable: Annual log differences of	(1) Exports	(2) Employment	(3) Net sales	(4) K/L	(5) TFP	(6) Exports	(7) Employment	(8) Net sales	(9) K/L	(10) TFP
Chinese competition in main 3rd markets (defined yearly), (%)	-0.182	-0.287**	0.201**	0.184**	-0.0004					
	(0.198)	(0.125)	(0.087)	(0.066)	(0.059)					
Chinese competition in main 3rd markets (defined in t=0), (%)						-0.375	-0.345	-0.174	0.258	0.121
						(0.388)	(0.207)	(0.132)	(0.233)	(0.135)
Observations	11,102	13,078	12,976	12,946	12,798	11,102	13,078	12,976	12,946	12,798
R-squared	0.195	0.401	0.444	0.402	0.397	0.195	0.401	0.444	0.402	0.397

Note: Errors are clustered at the industry level. Firm-level controls include age, size, location, capital/labor. Year and firm fixed effects are included.

*** p<0.01, ** p<0.05, * p<0.1

TABLE 9. ESTIMATION RESULTS—CHANGES EVERY FIVE YEARS

a) Baseline Results

Dependent variable: 5-year log differences of:	(1) Employment	(2) Net sales	(3) K/L	(4) TFP
Chinese Import Exposure (%)	-0.910***	-1.43***	0.567***	-0.0693
	(0.283)	(0.411)	(0.109)	(0.219)
Observations	40,148	39,871	39,131	38,060
R-squared	0.821	0.743	0.791	0.733
Year FE	Yes	Yes	Yes	Yes
Firm FE	Yes	Yes	Yes	Yes
Instrument	IP Chile	IP Chile	IP Chile	IP Chile
Method	2SLS	2SLS	2SLS	2SLS
Weak IV F-test	39.73	39.23	39.10	38.72
Underidentification p-value	0.0904	0.0917	0.0901	0.0911
Chinese Import Exposure (%) - 1st stage	0.547***	0.546***	0.545***	0.544***
	(0.087)	(0.087)	(0.087)	(0.087)

Note: Errors are clustered at the industry level. Firm-level controls include age, size, location, capital/labor. Year and firm fixed effects are included. *** p<0.01, ** p<0.05, * p<0.1

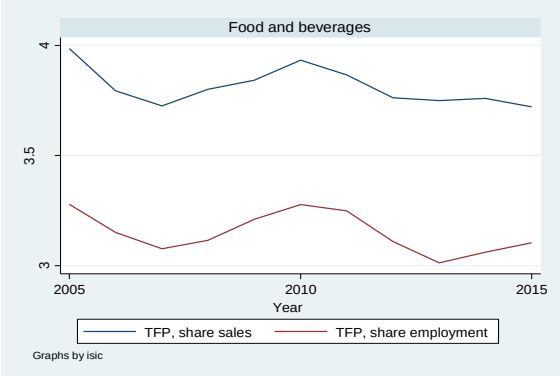
b) By Size

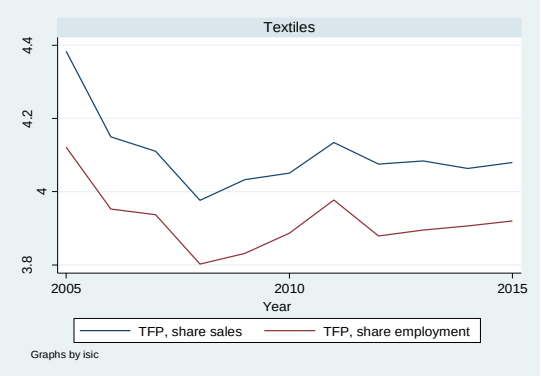
Dependent variable: 5-year log differences of:	(1) Employment	(2) Net sales	(3) K/L	(4) TFP	(5) Employment	(6) Net sales	(7) K/L	(8) TFP
Chinese Import Exposure * Larger firms (defined yearly)	-0.906***	-1.470***	0.546***	-0.072				
	(0.274)	(0.408)	(0.096)	(0.218)				
Chinese Import Exposure * Smaller firms (defined yearly)	-0.692**	-0.757	0.369**	-0.013				
	(0.250)	(0.488)	(0.156)	(0.257)				
Chinese Import Exposure * Larger firms (defined in t=0)					-0.886***	-1.411***	0.570***	-0.090
					(0.276)	(0.416)	(0.089)	(0.220)
Chinese Import Exposure * Smaller firms (defined in t=0)					-0.954***	-1.620***	0.212	0.155
					(0.257)	(0.390)	(0.180)	(0.230)
Observations	39,914	39,871	38,907	38,060	39,914	39,871	38,907	38,060
R-squared	0.818	0.743	0.791	0.733	0.817	0.743	0.791	0.733
Instrument	IP Chile	IP Chile	IP Chile	IP Chile	IP Chile	IP Chile	IP Chile	IP Chile
Method	2SLS	2SLS	2SLS	2SLS	2SLS	2SLS	2SLS	2SLS
Weak IV F-test	19.87	19.58	19.57	19.33	19.80	19.54	19.52	19.28
Underidentification p-value	0.0901	0.0916	0.0898	0.0911	0.0902	0.0918	0.0900	0.0912
Chinese Import Exposure * Larger firms (defined yearly) -1st stage	0.567***	0.564***	0.563***	0.559***				
	(0.086)	(0.087)	(0.086)	(0.087)				
Chinese Import Exposure * Smaller firms (defined yearly) -1st stage	1.164***	1.184***	1.169***	1.188***				
	(0.083)	(0.081)	(0.081)	(0.082)				
Chinese Import Exposure * Larger firms (defined in t=0) - 1st stage					0.577***	0.576***	0.573***	0.571***
					(0.085)	(0.086)	(0.086)	(0.086)
Chinese Import Exposure * Smaller firms (defined in t=0) - 1st stage					1.036***	1.044***	1.041***	1.040***
					(0.079)	(0.083)	(0.079)	(0.084)

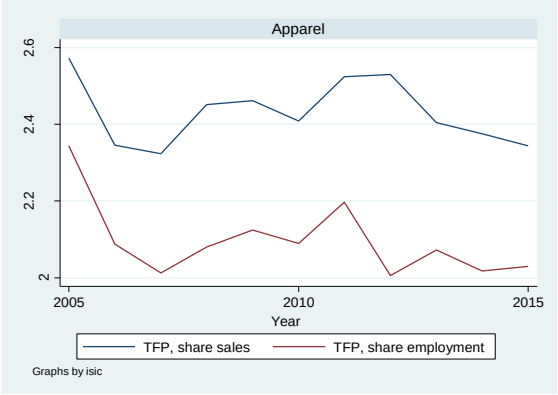
Note: Errors are clustered at the industry level. Firm-level controls include age, size, location, capital/labor. Year and firm fixed effects are included. "Larger firms" are those in the upper half of the exporter-size distribution in a given year. "Smaller firms" are those in the bottom half. *** p<0.01, ** p<0.01.

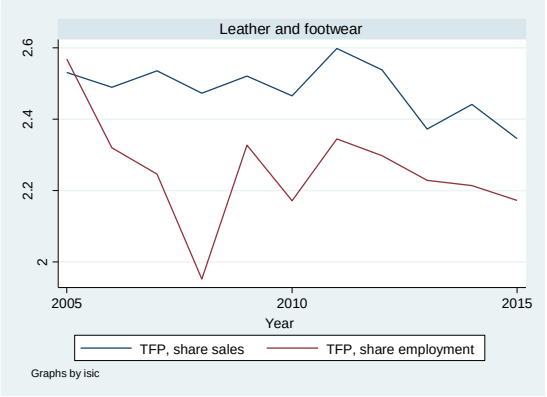
APPENDIX 1

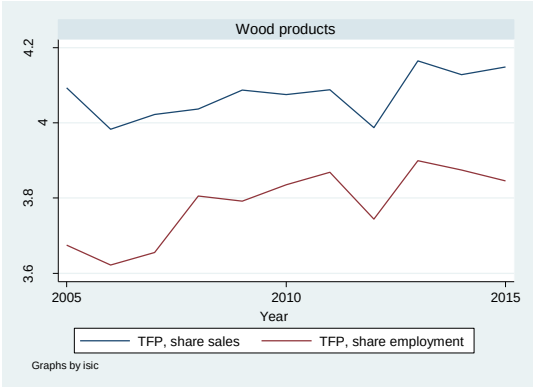
AGGREGATE TFP (IN LOGS) BY INDUSTRY, 2005–2015

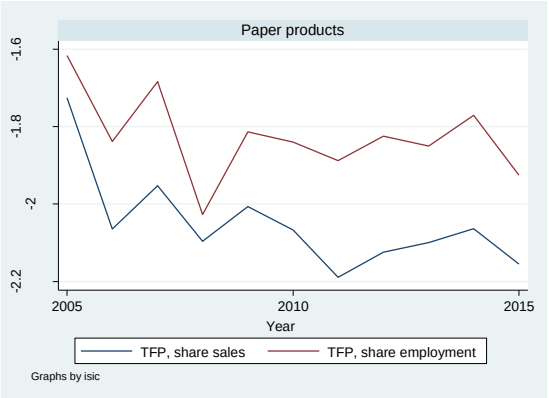


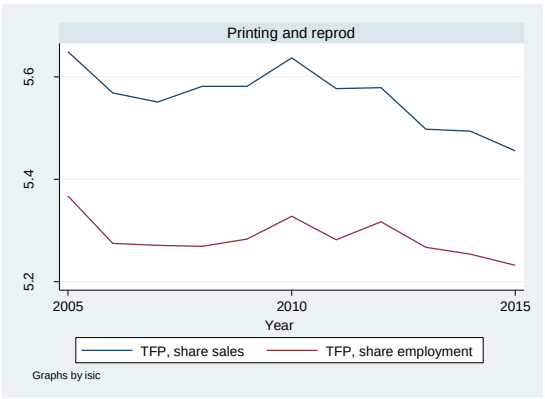


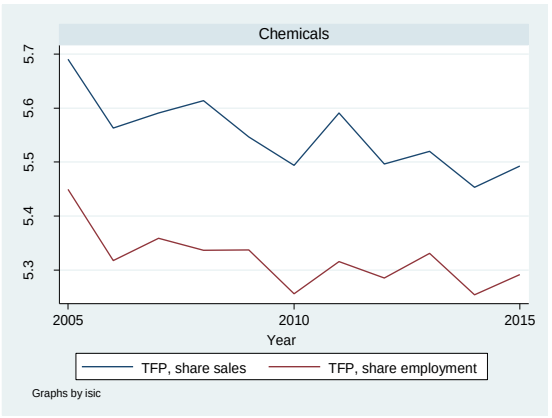


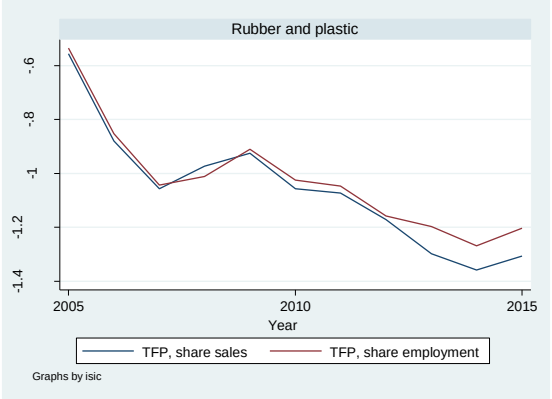


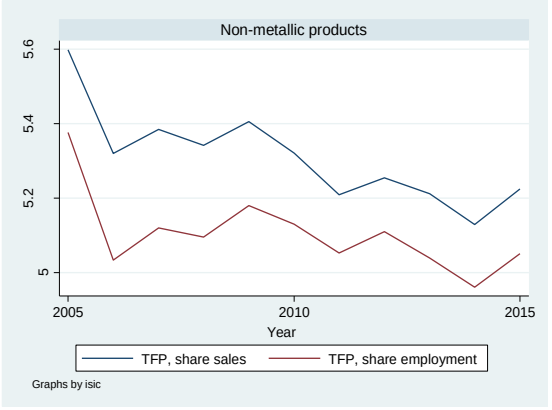


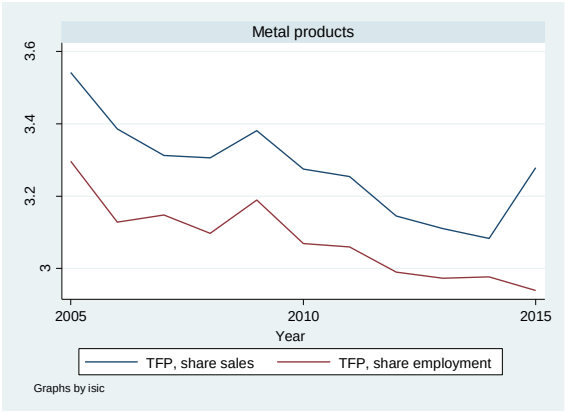


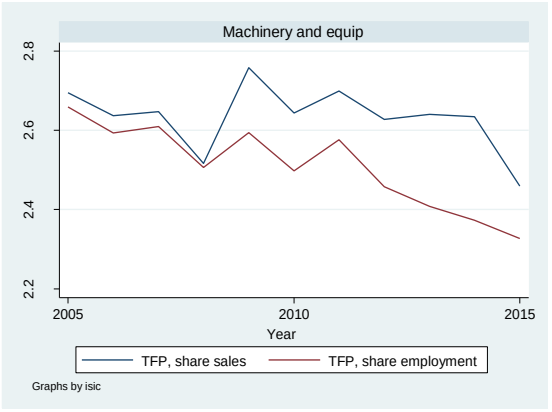

Printing and reprod
5.6
5.4
5.2
2005
2010
2015
Year
TFP, share sales
TFP, share employment
Graphs by isic

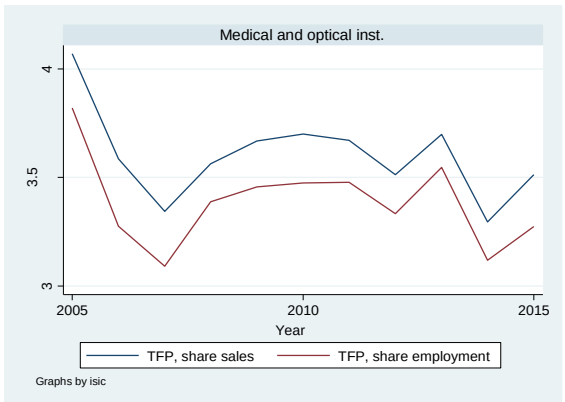

Chemicals
5.7
5.6
5.5
5.4
5.3
2005
2010
2015
Year
TFP, share sales
TFP, share employment
Graphs by isic

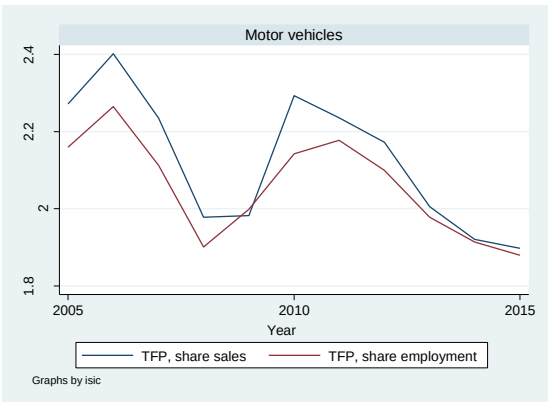

Rubber and plastic
-.6
-.8
-1
-1.2
-1.4
2005
2010
2015
Year
TFP, share sales
TFP, share employment
Graphs by isic

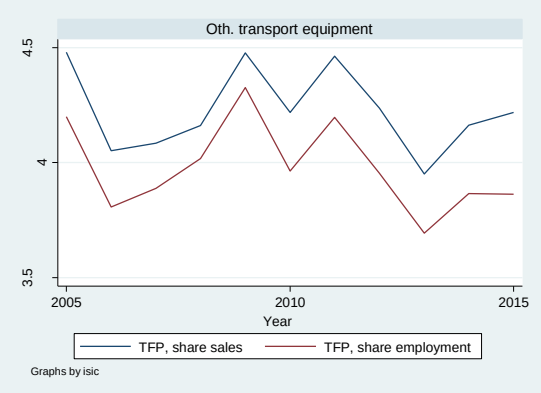

Non-metallic products
5.6
5.4
5.2
5
2005
2010
2015
Year
TFP, share sales
TFP, share employment
Graphs by isic

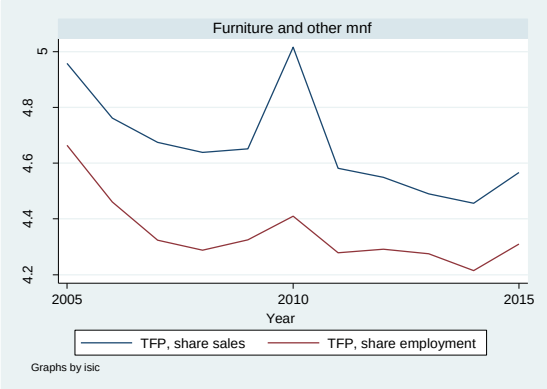

Metal products
3.6
3.4
3.2
3
2005
2010
2015
Year
TFP, share sales
TFP, share employment
Graphs by isic


Machinery and equip
2.8
2.6
2.4
2.2
2005
2010
2015
Year
TFP, share sales
TFP, share employment
Graphs by isic


Medical and optical inst.
4
3.5
3
2005
2010
2015
Year
TFP, share sales
TFP, share employment
Graphs by isic


Motor vehicles
2.4
2.2
2
1.8
2005
2010
2015
Year
TFP, share sales
TFP, share employment
Graphs by isic





Source: Authors' estimations based on SUNAT data.

APPENDIX 2

CORRESPONDENCE TABLE: ISIC AND INEI CLASSIFICATIONS

2-digit Sector	ISIC REV 3	Classification following INEI
15	Manufacture of food products and beverages	1
16	Manufacture of tobacco products	
17	Manufacture of textiles	2
18	Manufacture of wearing apparel; dressing and dyeing of fur	3
19	Tanning and dressing of leather; manufacture of luggage, handbags, saddlery, harness and footwear	4
20	Manufacture of wood and of products of wood and cork, except furniture; manufacture of articles of straw and plaiting materials	5
21	Manufacture of paper and paper products	6
22	Publishing, printing and reproduction of recorded media	7
23	Manufacture of coke, refined petroleum products and nuclear fuel	8
24	Manufacture of chemicals and chemical products	9
25	Manufacture of rubber and plastics products	10
26	Manufacture of other non-metallic mineral products	11
27	Manufacture of basic metals	12
28	Manufacture of fabricated metal products, except machinery and equipment	13
29	Manufacture of machinery and equipment n.e.c.	14
30	Manufacture of office, accounting and computing machinery	14
31	Manufacture of electrical machinery and apparatus n.e.c.	15
32	Manufacture of radio, television and communication equipment and apparatus	16
33	Manufacture of medical, precision and optical instruments, watches and clocks	
34	Manufacture of motor vehicles, trailers and semi-trailers	17
35	Manufacture of other transport equipment	
36	Manufacture of furniture; manufacturing n.e.c.	18

Source: INEI and UN ISIC Rev. 3.

APPENDIX 3

OLS RESULTS FOR BASELINE AND BY SIZE ESTIMATIONS

a) Baseline

Dependent variable: Annual log differences of:	(1) Employment	(2) Net sales	(3) K/L	(4) TFP
Chinese Import Exposure (%)	-0.159	-0.015	0.213***	-0.018
	(0.106)	(0.189)	(0.032)	(0.106)
Observations	59,308	58,451	57,951	56,853
R-squared	0.492	0.453	0.491	0.461

b) By Size

Dependent variable: Annual log differences of:	(1) Employment	(2) Net sales	(3) K/L	(4) TFP	(5) Employment	(6) Net sales	(7) K/L	(8) TFP
Chinese Import Exposure * Larger firms (defined yearly)	-0.174	-0.027	0.227***	-0.012				
	(0.106)	(0.184)	(0.033)	(0.105)				
Chinese Import Exposure * Smaller firms (defined yearly)	0.039	0.168	0.028	-0.115				
	(0.103)	(0.277)	(0.061)	(0.166)				
Chinese Import Exposure * Larger firms (defined in t=0)					-0.153	-0.006	0.224***	-0.022
					(0.112)	(0.192)	(0.036)	(0.104)
Chinese Import Exposure * Smaller firms (defined in t=0)					-0.210***	-0.113	0.100	0.024
					(0.066)	(0.184)	(0.093)	(0.147)
Observations	59,308	58,451	57,951	56,853	59,308	58,451	57,951	56,853
R-squared	0.492	0.453	0.491	0.461	0.492	0.453	0.491	0.461