# Does competition from China raise the probability of becoming unemployed? An analysis using Spanish workers' micro-data

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**Abstract**

In the period 1997-2011, import competition from China multiplied by five in the Spanish manufacturing sector. In this paper we analyze whether this severe increase in import competition from China is associated with a higher probability of becoming unemployed in the Spanish manufacturing sector. Linking industry-level data on imports with the working histories of 141,000 manufacturing workers, we show that import competition from China is positively associated with the probability of becoming unemployed. In particular, a standard deviation increase in import competition from China raises the probability of becoming unemployed between 0.8 and 3.5 percentage points, which represents between a 9% and a 44% increase relative to the unconditional probability of becoming unemployed. In contrast, we do not find any effect of import competition from China on manufacturing wages. Also, our estimations show that there is weak evidence of a positive association between a higher import competition from China and the probability of switching to an employment outside the manufacturing sector.

Keywords: imports, China, Spain, unemployment, skills, manufacturing

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## 1. Introduction

One of the salient features of the current globalization process is the emergence of China as a major exporter. During the period 1997-2011 the share of Chinese exports in total world merchandise exports multiplied by more than three (from 3.3% to 11.1%). The increase in Chinese exports was particularly intense in manufacturing, where the share rose from 3.7% in 1997 to 14.4% in 2011.[1]

This large increase in import competition from China has aroused concerns regarding its impact on the demand for labor in high-wage countries' manufacturing industries. These concerns are not new. During the 1990s, different studies started to analyze the impact of low-wage countries' exports on high-wage countries' labor markets (Krugman and Lawrence, 1994; Wood, 1994). They used aggregated data at the industry level and differentiated between broad labor categories, such as skilled and unskilled workers. These studies, with few exceptions, concluded that import competition from low-wage countries had a tiny contribution to the decline in the share of unskilled workers in manufacturing; in contrast, technological change, biased against unskilled workers, seemed to play a much larger role in this process (Berman et al. 1998).

However, the surge of Chinese exports during the 2000s motivated a series of analyses aiming to assess the robustness of the conclusions reached by the first generation of studies (Krugman, 2008). This reassessment coincided with the access to datasets that provide rich micro-level data on firms and workers. Studies using these new datasets show that import competition from China had a sizable negative effect on high-wage countries' manufacturing firm survival and on worker labor market outcomes. However, they also conclude that there is heterogeneity in how firms and workers respond to this competition. Using US firm-level data, Bernard et al. (2006) show that plant survival and growth are negatively associated with industry exposure to low-wage country exports. Nevertheless, these authors also show that within an industry the impact of competition from low-wage countries has a lower impact on capital-intensive and skill-intensive plants. Regarding heterogeneity across workers, Ebenstein et al. (2012a) show that occupation characteristics, such as routineness, play a decisive role in determining the impact of Chinese competition on individual wages, even for workers with the same educational level.

[1] The figures were calculated from the World Trade Organization database, available from www.wto.org.

The contribution of this paper is to provide new evidence on the still limited literature that analyzes the impact of Chinese import competition on high-wage countries' labor market outcomes, controlling for heterogeneity both at the firm and the individual worker level. Taking Spain as a case study, this paper provides evidence on the effect of Chinese import competition on a European country characterized by a rigid labor market, where demand shocks are mostly absorbed by changes in the quantity of workers, rather than wages. Moreover, the wage level in Spain is lower than in countries such as the US, leading to a productive specialization which is more intensive in unskilled labor than in the US, and hence, at a higher risk of being negatively influenced by a surge of imports from China.

To perform this study, we link industry-level data on imports with a dataset that comprises the working histories of around 141,000 Spanish manufacturing workers. The database identifies the worker and the firm in which the worker is employed, which allows to control for observed, and non-observed, heterogeneity both at the firm and the individual worker level. We show that during the period 1997-2011, a larger import competition from China is positively associated with a higher probability of becoming unemployed. In particular, a standard deviation increase in import competition from China raises the probability of becoming unemployed between 0.8 and 3.5 percentage points, which represents between a 9% and 44% increase relative to the unconditional probability of becoming unemployed. In contrast, we do not find any impact of import competition from China on manufacturing wages, while the evidence of a positive association between a higher import competition from China and the probability of switching to an employment outside the manufacturing sector is weak.

This paper is related to a large literature that has analyzed the impact of low-wage countries' import competition on high-wage countries' labor markets. As mentioned above, during the 1990s, different studies used aggregated industry-level data to assess the impact of low-wage countries' imports on the demand for labor in high-wage countries (Krugman and Lawrence, 1994; Wood, 1995; Leamer, 1998). During this decade we also find the first studies that analyzed the impact of offshoring to low-wage countries on high-wage countries' labor-market outcomes (Feenstra and Hanson, 1996 and 1999).

In the next decade, the access to detailed firm-level and worker-level data has allowed a finer analysis on the impact of low-wage countries' import competition on high-wage countries' labor market outcomes. As mentioned before, Bernard et al.

(2006) find that US manufacturing plant survival and growth are negatively associated with exposure to low-wage countries' imports, although the impact differed across firms. Mion and Zhu (2013) show that import competition from China had a large negative impact on the employment of Belgium low-tech firms. They also find that competition from China induces a skill-upgrading among Belgian firms. Bloom et al. (2012) find that import competition from China induces technical change in high-wage countries.

Harrison and McMillan (2011) find that, in general, offshoring to low-wage countries substitute for domestic employment in US manufacturing firms. Using data on Danish firms and workers, Hummels et al. (2011) find that offshoring tends to increase the high-skilled wage and decrease the low-skilled wage. They also find that low-skill workers suffer more from the displacement effects of offshoring. Using a similar dataset as the one used in this paper, Ebenstein et al. (2012a) find that import competition and offshoring to China is associated with wage declines, especially for workers performing routine tasks in the US. Iacovone et al. (2013) analyze the impact of import competition from China on a middle-income country labor market. Using detailed plant-level data from Mexican manufacturing firms, they conclude that import competition from China raises the probability to exit the market for small firms but has no significant effect on large firms.[2]

Rather than using firm-level or individual worker data, Autor et al. (2013) exploit the differences in manufacturing specialization across US local labor markets to analyze the impact of import competition from China. They find that local labor markets specialized in industries where the increase in Chinese imports was large experienced a stronger decline in labor force participation, higher unemployment levels, and reduced wages. Using a similar methodology, Donoso et al. (2013) show that Spanish provinces specialized in industries with higher exposure to Chinese imports also experienced large declines in manufacturing employment.

[2] Some studies using workers flows data analyze the impact of total imports, rather than imports from China, on employment and wages. Using German workers flow data, Görg and Görlich (2012) do not find any significant effect of imports on manufacturing employment and wages; however, Lurweg and Udhe (2010) show that trade has a negative, although small, effect on employment and wages in trade-sensitive manufacturing industries. Geishecker and Görg (2008) find that outsourcing reduces the wage for low-skill workers but increases the wage of high-skill workers; Bachmann and Braun (2011) find that the hazard of transitioning to unemployment rises with international outsourcing for medium-skilled and older workers. Using Austrian workers' flows data, Egger et al. (2007) find that an increase in outsourcing reduces the probability of staying in, or changing into, the manufacturing sector.

This paper is also related to the literature that uses longitudinal data on workers' labor-history to analyze the factors that determine the transition from employment to unemployment. For Spain, during the last year, different studies have shown that having a short-term contract, being a young foreign female worker and commanding a low education level increase the probability of transitioning from employment to unemployment (Medina et al., 2010; Montero and Regil, 2011; Díez-Catalán and Villanueva, 2012).

The rest of the paper is organized as follows. Section 2 presents the database and some descriptive statistics. Section 3 presents the results of the econometric estimations on the relationship between import competition from China and the probability of becoming unemployed. Section 4 analyzes the effect of Chinese competition on other labor market variables such as wages and sectoral reallocation. Section 5 concludes and provides some policy implications.

## 2. Database and descriptive analyses

The main dataset used for our empirical analysis comes from the Continuous Sample of Working Lives (*Muestra Continua de Vidas Laborales*, hereinafter MCVL), provided by the Spanish Ministry of Labor and Social Security. MCVL is a micro-level dataset built upon Spanish administrative records. By means of a simple random sampling system, it consists of a representative sample (4% - 1.2 million individuals) of the population registered with the Social Security administration over the sampling year. The sample includes workers, but also pension earners and recipients of unemployment benefits. The first MCVL wave was carried out in 2004. Since this year the MVCL has a proper longitudinal design. Once a worker is randomly selected by a MVCL wave, she will be included in subsequent waves as long as she remains registered in the Social Security. To ensure representativeness, the individuals that cease their relationship with the Social Security are substituted by new members. The MVCL contains the work histories of all individuals in the sample back to 1967.

The MCVL provides several pieces of information suited for our research. Some information is related to individual characteristics, such as age, gender, and nationality; other information is related to the job-contract and the nature of the job, such as occupation, experience in the firm, whether the worker has a full-time or a part-time job, and whether the contract has discounts regarding social security costs; contract

information also documents the cause, if any, for the termination of the contract. Finally, the dataset also provides information of employers' characteristics, such as economic activity, firm size and location.

We pool data from the MVCL 2004, 2005, 2006, 2007, 2008, 2009, 2010 and 2011 waves. We select individuals, aged between 16-65 years, with at least one record as employees with a permanent, or an open-ended, contract along the period 1997-2011 in the manufacturing sector. We exclude self-employed workers and salaried workers with a temporary contract due to the difficulty in determining the real cause of the termination of their job records. In any case, employees with permanent contracts represent almost 70% of total employment in the manufacturing sector. Workers should be enrolled in the general regime of the social security administration to be included in the sample.[3]

The selection of the period 1997-2011 is determined by two reasons. First, trade and production data to measure the competitive pressure from Chinese imports is only available from the mid-1990s onwards. Second, as mentioned before, the MVCL is only representative of the population registered with the Social Security administration for the sampling year. Although the MVCL has retrospective information, the representativeness of this information declines as we go back in time. Bearing this limitation in mind, we only step back until 1997. From 2008 onwards, the Spanish economy suffered a strong negative shock due to the financial crisis and the burst of the housing bubble. We include the first four years of the great recession period in our analysis (2008-2011). However, in the sensitivity section, we show that our results are not driven by the effects of the Great Recession on the Spanish labor market.

For each year, we classify work spells into two distinct categories: work spells that finish and the worker becomes unemployed; and work spells that remain alive. The first category excludes situations in which the contract ends due to the choice of the worker, retirement, sick leave or maternity leave. We do not consider that a contract ceases if the worker becomes unemployed, but she is employed by the same firm in a period no longer than 15 days.[4]

[3] More than 80% of workers in Spain are enrolled in the general regime. Some workers, due to their occupation, are enrolled in different regimes, such as agricultural workers, fishermen, miners, or self-employed workers.

[4] In our sample, there are workers that have more than one labor contract alive. They represent 2.2% of the individuals included in the sample.

After applying all the above mentioned filters, and deleting records with missing data, our sample consists of a total of 1,031,275 observations from 140,647 individuals. The number of observations by year and the distribution of individuals by personal characteristics are presented in Table 1. It shows that most individuals in the sample are males (76%), have an age between 30 and 44 years (45%), and are occupied in activities that demand few skills (67%).

[Table 1 around here]

Table 2 shows the unconditional probabilities of becoming unemployed. As average, the probability of becoming unemployed for a salaried worker with a permanent contract in the manufacturing sector during the period 1997-2011 is 8.1 percent. Since the start of the Great Recession there is an increase in the unconditional probability of becoming unemployed. In particular, in 2008 the probability rises to 10.1%, in 2009 to 12.6%, and then declines to 9.5% in 2010 and 9.1% in 2011. Table 2 also shows that during the period of analysis the probability of becoming unemployed is larger for females, older workers and workers performing tasks that require low or medium skills.

[Table 2 around here]

Previous studies have analyzed the probability of transitioning from employment to unemployment in Spain using longitudinal data (Medina et al., 2010; Montero and Regil, 2012). These studies also find that males have a lower probability of becoming unemployed than women. However, contrary to our results, they find that young people have a higher probability of becoming unemployed than older people. This difference is explained because these studies include workers with temporary contracts, which are widely used when hiring young people. As the cost of firing is much lower in temporary than open-ended contracts, the probability of becoming unemployed is much larger for younger workers. As in our study, Díez-Catalán and Villanueva (2012) also find that workers performing high-skill tasks have a lower probability of becoming unemployed.

The competitive pressure of Chinese import is proxied by the share of Chinese imports in apparent consumption (Bernard et al., 2006). Analytically,

$$CP_{China,k} = \frac{M_{China,k}}{P_k - X_k + M_k} \quad (1)$$

where $M_{China,k}$ are Chinese imports in industry $k$, $P_k$ is the Spanish production in industry $k$, $X_k$ are Spanish exports in industry $k$, and $M_k$ are total Spanish imports in industry $k$.[5] Spanish exports and imports data come from the Agencia Tributaria Trade database and production data come from the Spanish Statistical Institute Industrial Survey database.

Figure 1 presents the evolution of Chinese imports' competitive pressure on the Spanish manufacturing sector during the period 1997-2011. As shown in the figure, there has been a very large increase in competitive pressure from Chinese imports. In the year 1997 the share of Chinese imports only represented 0.96% of Spanish manufacturing apparent consumption; in 15 years this share had multiplied by almost five, reaching the 4.70% of Spanish manufacturing apparent consumption. If we only consider those industries where Chinese imports represented at least 1% of apparent consumption in 1997, Figure 2 shows that the competitive pressure of Chinese imports has increased in all industries. However, the increase in the competitive pressure from Chinese imports has been very different across industries. For example, in dressing and dyeing of fur (NACE 183) competitive pressure has increased in 32 percentage points, and in manufacture of office machinery and computers (NACE 300) in 31 percentage points. In contrast, in plastic products (NACE 252) and basic chemicals (NACE 241) the competitive pressure has increased only in 2 percentage points.

[Figure 1 & 2 around here]

Our expectation is that workers occupied in industries that experienced a larger increase in the competitive pressure from Chinese imports had a larger increase in the probability of becoming unemployed than workers occupied in industries where the increase of competitive pressure from Chinese imports was lower. The next section will test the validity of this expectation.

[5] We repeated all econometric estimations using a measure of import competition that does not include exports in the denominator, as in Mion and Zhu (2013). Results were not altered.

## 3. Econometric analysis

### 3.1 Imports from China and the probability of becoming unemployed

As our benchmark analysis we estimate the following econometric equation to determine the influence of Chinese import competition on the probability of becoming unemployed:

$$U_{it} = \beta_m China_{kt-1} + \beta'_i X_i + \beta'_c X_c + \beta'_e X_e + \beta_t \qquad (2)$$

where $U_{it}$ takes the value of 1 if the worker gets unemployed at year *t*, and $China_{kt-1}$ is the share of Chinese imports in the apparent demand for industry *k* at year *t-1*. This variable is lagged one year in order to avoid the effects of shocks that can simultaneously affect the probability of becoming unemployed and the share of Chinese imports in apparent demand; moreover, firms might decide to lay-off workers once they observed an increase in import competition from China.[6]

$X_i$ is a vector of individual variables that previous studies have identified as contributing to the probability of becoming unemployed. First, we control for workers' age, creating three age categories: workers between 16 and 29 years; workers between 30 and 44 years; and workers between 45 and 65 years. The excluded category in the regression is workers between 16 and 29 years. Second, we control for the sex of the worker; we add a dummy variable that takes the value of 1 if the worker is male and zero if the worker is female. Third, we add a dummy variable to control for the nationality of the worker; the dummy variable takes the value of 1 if the worker does not have the Spanish nationality and zero otherwise. $X_c$ is a vector of work-contract related variables that might influence the probability of becoming unemployed. It includes worker's occupation, classified into three different skill-levels. Workers performing jobs that require a university degree, high-level managers, and administrative and workshop bosses are included in the high-skill group; support staff without university degree, administrative officials and auxiliaries, subordinates and 1st level officials are included in the medium-skill group; the rest of occupations are included in the low-skill group. This last skill-group is the category excluded in the regression. The vector also includes the length of the working day; the dummy variable

[6] We repeated all estimations using contemporaneous values and two-year lagged values of the share of Chinese imports in apparent demand. Results were not altered.

takes the value of 1 if the worker is employed the whole working day and zero otherwise. Another dummy controls whether the permanent (open-ended) contract has any type of discount in terms of social security costs. The dummy variable takes the value of 1 if the permanent (open-ended) contract has a discount and zero otherwise. We also include the experience of the worker in the firm, measured by number of days since her contract begun. Finally, $X_e$ is a vector of employer-related variables that might influence the probability of becoming unemployed.[7] It includes the size of firms, proxied by the number of employees, that we classify in three categories: small firms (1-49 employees), medium-sized firms (50-499 employees) and large firms (500 or more employees). The excluded category in the regression is small firms.[8] Estimations also include dummy variables for each year.

The econometric estimations are carried out pooling data for the period 1997-2011. In all regressions standard errors are clustered at 3-digit industries, the level at which we observe competition from China.[9] We estimate the equation with a logistic model. Table 3 presents the results of the econometric estimations. First, we estimate the model without the control vectors. Afterwards, one by one, we include the observable controls related to individual, contract and employer characteristics. Column (1) shows that import competition from China is positive and statistically significant. This result confirms our expectation that workers occupied in manufacturing industries with a higher exposure to Chinese import competition have a larger probability of becoming unemployed than workers occupied in industries with a lower exposure to Chinese competition. Column (2) introduces the observable individual level characteristics. The coefficient for Chinese imports remains positive and statistically significant. We observe that workers between 30-44 years have a lower probability of becoming unemployed; however, older workers have a higher probability of becoming unemployed. We also find that being male reduces the probability of becoming unemployed, whereas being foreigner increases it. In Column (3) we introduce the characteristics of the contract. The coefficient for Chinese imports remains positive and statistically significant. We find that performing tasks that require high-skills reduces

[7] In MVCL firms are identified by the code assigned by the Spanish Social Security. If a firm has plants in different Spanish provinces, the Social Security provides a code for each province. Hence, in the case of multi-plant firms, the code identifies province-level plants.
[8] Our first observation for the size of the firm is year 2004. For previous years we assume that firms do not alter their size status.
[9] There are 83 industries in the sample.

the probability of becoming unemployed; however, it is not statistically significant. We also find that working the full working-day and commanding a larger experience in the firm reduce the probability of becoming unemployed; in contrast, having a contract with discounts in social security costs increases the probability of becoming unemployed. Finally, we include the characteristics of the employer. The coefficient for import competition from China remains positive and statistically significant. We can see that the probability of becoming unemployed is lower for workers occupied in medium and large manufacturing firms. We should note that the fit of the model is very low in all estimations.

[Table 3 around here]

Results reported in Table 3 show that import competition from China increases the probability of becoming unemployed. The negative effect of Chinese competition remains once we control for observable individual, contract and employer-level characteristics. To quantify the contribution of Chinese import competition to the probability of becoming unemployed, we calculate the marginal effect of the share of Chinese imports at average values. If we multiply this marginal effect (0.001) by a standard deviation increase in import competition from China (7.4 percentage points), the probability of becoming unemployed rises in (0.001*7.4) 0.0074 percentage points. If we divide this figure by the unconditional probability of becoming unemployed (0.081), we obtain that a standard deviation increase in import competition from China raises the probability of becoming unemployed by 9% (0.0074/0.081).

The econometric estimations reported in Column (4) control for observed individual, contract and employer characteristics. However, there might be unobserved worker-level characteristics, such as the inner talent of the worker, or unobserved firm-level characteristics, such as firm's innovative capacity, that might also affect the probability of becoming unemployed. In order to identify more precisely the contribution of Chinese import competition on the probability of becoming unemployed, in Column (5) we estimate the model with worker-specific and firm-specific fixed-effects. As explained in Greene (2008) and in Cameron and Trivedi (2009), in short panels with a large number of dummy variables, non-linear models,

such as logit, might lead to biased and inconsistent estimators due to an incidental parameters problem. Hence, we use a linear probability model to perform this estimation.[10] Due to the large number of dummy variables, we estimate the model using the high-dimensional fixed-effects routine proposed by Guimarães and Portugal (2010).[11] Worker-level fixed effects absorb the worker-related variables that do not change during the period of analysis, such as sex and nationality. As shown in Table 3 - Column (4), the coefficient Imports China remains positive and statistically significant, once we control for worker-specific and firm-specific fixed effects. Results also show that workers in the 45-65 age-cohort have a lower probability of becoming unemployed. Performing tasks that require medium and high-skills, working in medium of large firms, and having a longer experience also lead to a lower probability of becoming unemployed. According to the coefficient reported in Column (5), a standard deviation increase in Chinese import competition raises the probability of becoming unemployed, relative to the unconditional probability, by 44% ((0.0048*7.4)/0.081)).

In order to improve the control of non-observable factors, in Column (6) we present the results of estimating the equation with a fixed-effects logit model. The panel estimation controls for firm-worker specific fixed-effects. The limitation of this analysis is that the sample is narrowed down to the workers that have moved to unemployment; workers that keep their work-contract with the same firm alive during the period of analysis do not experience any variation in their dependent variable and are dropped from the estimation. In particular, the sample is reduced from 1,012,035 observations to 377,441 observations. As shown in Column (6), the coefficient Imports China is positive and statistically significant, denoting that the probability of transitioning to unemployment is positively linked with the rise in competition from China.

To further analyze the effect of imports from China on the probability of becoming unemployed, we replicate the estimations on Table 3 separately for different skill-levels and age-groups. The results presented in Panel A of Table 4 confirm that workers in skill-intensive occupations have a lower probability of becoming

[10] An advantage of the linear probability model is that the estimated coefficients are easy to interpret, as they show how the probability of the event (in our case, transitioning from employment to unemployment) changes when the independent variable increases by one unit if the variable is continuous, or changes its status if the variable is dichotomic. However, the limitation of the linear probability model is that the effect of independent variables on the dependent variable is constant. In addition to that, the linear probability model can yield predicted probabilities below zero and above one. Moreover, the linear probability model is inherently heteroskedastic. In order to control for heteroskedasticity we estimate the model with clustered standard errors.

[11] We want to thank Paulo Guimarães for his help in the application of this routine to our database.

unemployed due to import competition from China. The coefficient on imports from China is not significant at conventional levels for high-skill occupations, but is positive and statistically significant for medium-skill and low-skill occupations. Moreover, the coefficient becomes larger as the skill-content of the occupation is reduced. As shown by previous studies, firms can respond to import competition from China outsourcing labor-intensive tasks to low-wage countries and raising products' technological content (Bloom et al., 2012; Ebenstein et al., 2012a). These strategies reduce demand for unskilled occupations and raise the demand for more skill-intensive occupations, explaining the lower impact of Chinese competition on occupations demanding more skills. The marginal effect of the share of Chinese imports at average values for medium-skill and low-skill occupations is 0.0007 and 0.0010 respectively. Thus, the logit model implies that a standard deviation increase in import competition from China would raise the probability of becoming unemployed by 6.3% and 9% in a medium-skill and low-skill occupation respectively. When we estimate the model with worker-specific and firm-specific fixed effects (Panel B, Table 4) the results are rather similar. The coefficient for imports from China for the high-skill occupations is now significant at the 1% level and, again, the coefficient becomes larger as the skill-content of the occupation is reduced. The coefficient estimates in the linear probability model imply that a standard deviation increase in import competition from China would raise the probability of becoming unemployed by 28.4% in a high-skill occupation, by 32.5% in a medium-skill occupation and by 49.6% in a low-skill occupation. In contrast, when we estimate the model with worker-firm specific fixed effects (Panel C, Table 4), the estimated coefficient of imports from China is larger for the high-skill occupations and becomes lower as the skill-content of the occupation is reduced. Nevertheless, this result should be interpreted with caution since the reported estimates may be influenced by the previously mentioned sample selection bias, where workers that keep their work-contract with one firm alive during the period of analysis are dropped from the sample.

[Table 4 around here]

Attending to the estimation results by age group, the coefficient on imports from China is slightly higher for workers in the younger (age 16-29) and older (age 45-65) group and lower for workers in the middle group (age 30-44). For the logit model in Panel A (Table 4), the marginal effect of the share of Chinese imports at average values

is 0.0009, 0.0008 and 0.0012 for the group of age 16-29, 30-44 and 45-65 respectively. These values imply that a standard deviation increase in import competition from China would raise the probability of becoming unemployed by 8.2% for workers with age 16-29, by 7.9% for workers with age 30-44 and by 10% for workers with age 45-65. The reported estimates when we estimate the model with worker-specific and firm-specific fixed-effects (Panel B, Table 4) imply that a standard deviation increase in import competition from China would raise the probability of becoming unemployed by 64% for workers in the 16-29 age-cohort, by 48.3% for workers in the 30-44 age-cohort and by 48.2% for workers in the 45-65 age-cohort. When estimating the model with worker+firm fixed effects import competition from China is only significant for young workers.

Overall, results confirm that import competition from China is positively associated with a higher probability of becoming unemployed, even when we control for (time-invariant) heterogeneity both at firm and worker level. Moreover, the impact of competition from China is substantial, increasing the probability of becoming unemployed, relative to the unconditional probability, between 9% and 44%. Our result are in line with the conclusions reached by recent studies that find a strong negative relationship between import competition from China and the decline of manufacturing employment in the US (Autor et al. 2013, Ebenstein et al. 2012b, and Pierce and Schott, 2012), and in Spain (Donoso et al., 2013); and with studies that find a negative relationship between imports from low-wage countries and employment growth at the firm-level in high-wage countries (Bernard et al., 2006; Mion and Zhu, 2013).

### 3.2 Technological progress, the financial crisis and alternative measures of trade exposure.

To analyze the robustness of our results, we perform some sensitivity analyses. In all sensitivity analyses we report the results of estimating a linear probabilistic model with worker-specific and firm-specific fixed effects, and a fixed-effects logit model. First, we analyze whether the negative effect of import competition from China is robust to the introduction of variables that capture technological progress in the Spanish manufacturing industries that may also increase the probability of becoming unemployed. In particular, we control for capital/labor ratio, total factor productivity,

and share of information and communication technologies (ICT) in capital services.[12] As these data are at the 2-digit industry level, we recalculate the share of Chinese imports in apparent consumption for this aggregation level. Technological data are only available until 2009, so the period of analysis is restricted to 1997-2009. Trade and technological variables are lagged one year. As shown in Column (1) and (2) of Table 5, the coefficient for import competition from China remains positive and statistically significant. The coefficients for the technology variables are statistically not significant in the linear probabilistic model estimation; however, in the fixed-effects logit estimation we find that workers employed in firms that increase total factor productivity have a lower probability of becoming unemployed.

[Table 5 around here]

Second, in order to confirm that our results are not driven by the severe negative impact that the financial crisis had on the demand for labor in the Spanish manufacturing sector, we estimated the model for the period 1997-2007. As shown in Column (3) and (4) of Table 5 the coefficient Imports China remains positive and statistically significant at the 1% level.

Lastly, we analyze the robustness of our previous results for different measures of trade exposure. First, we analyze whether import competition from China has, in fact, a higher negative impact on the demand for labor than import competition from other countries. To test this hypothesis we calculate the share of European Union 15 countries, except Spain, on the apparent consumption of Spanish manufacturing. As shown in Column (1) of Table 6, in the linear probability model, the coefficient import coefficient from China is almost four times larger than the coefficient import competition from European Union 15 countries. If we narrow down the sample to workers that transition to unemployment (Column (2) of Table 6), we also observe that this transition is more likely when there is a rise in import competition from China than when there is a rise in import competition from European Union 15 countries. These results confirm that import competition from China, being concentrated in labor-intensive products, has a much larger negative impact on the demand for labor than

[12] TFP and ICT data are obtained from the Euklems database (www.euklems.net); capital/labor ratio data are obtained from the OECD STAN database (stats.oecd.org)

imports from high-wage countries. Second, to allow for the possibility that imports from China are compensated by Spanish exports to China we calculate a net imports from China as a share of apparent consumption indicator, subtracting Spanish exports to China from Spanish imports from China in the numerator of equation 1. Since Spanish imports from China are much larger than Spanish exports to China we do not expect a great variation in our previous findings. The results for the impact of net imports from China on the probability of becoming unemployed are reported in Column (3) and (4) of Table 6. It can be appreciated that the coefficient of net imports from China is positive and statistically significant at the 1% level. The coefficient in Column (3) is about 23 percent smaller and similarly precisely estimated than the coefficient estimated with a model that uses gross imports rather than net imports (Column 5 - Table 3). Its magnitude implies that a standard deviation increase in net imports from China would raise the probability of becoming unemployed by 42%. Similarly, the coefficient of net imports from China when including worker-firm specific fixed effects (Column 4) is a 46% smaller than its homologous in Column (6) of Table 3. Third, our initial measure of import competition from China includes both final goods and intermediate goods. If imports from China increase the variety of inputs that can be used by Spanish firms, their productivity may increase along with their demand for labor. To focus on the effect of import competition in final goods, we replace the share of imports from China over apparent consumption by the share of total imports less imports of intermediate inputs over apparent consumption. Imported intermediate goods by industry were obtained by combining trade data at the 2-digit level with the Spanish input-output table database. In Column (5), the coefficient on imports from China is 0.0066, 38% higher than in Column (5) of Table 3 and similarly precisely estimated. Moreover, the estimated coefficient implies that a standard deviation increase in imports from China net of intermediate inputs would raise the probability of becoming unemployed by almost 46%.

Equation 1 might have some limitations since import competition from China might show up through other labor market outcomes. For example, if wages adjust downwards reducing costs in the manufacturing sector, there would be a lower increase in imports from China, since part of this competitive pressure would be absorbed by the fall in wages. However, as analyzed in the next section, manufacturing wages do not seem to be influenced by import competition. This result indicates that during the period

of analysis manufacturing wages were rigid, at least downwards, and demand shocks were absorbed mainly through quantities, validating the use of equation 1.

[Table 6 around here]

## 4. The impact of import competition from China on wages and sectoral reallocation

In this section we analyze the impact of import competition from China on other labor market variables such as wages and sectoral reallocation. To analyze the impact on wages we draw data from the fiscal dataset attached to the MCVL main dataset. The fiscal dataset reports the total annual taxable labor income per worker for a particular year. The limitation of this dataset is that it only provides data for the period 2004-2011. In addition to that, data is not available for all workers. Following Bonhomme and Hospido (2012), we use daily wage as our wage measure, calculated as the ratio between annual taxable income and the number of days worked in a particular year.

Table 7 displays the results of the regression analyses. In Column (1) we introduce imports from China and year dummies as the only independent variables. We can see that import competition from China is negatively associated with the wage level. In Column (2) we introduce workers' personal characteristics, such as age, sex and nationality. Import competition from China remains negative and statistically significant. We observe that workers in the 30-44 cohort and workers in the 45-65 cohort command higher wages than young workers. Males have a higher daily wage than females and foreigners have a lower daily wage than workers with the Spanish nationality. In Column (3) we introduce the characteristics of the contract. Import competition from China remains negative. We can see that workers performing high-skill and medium-skill tasks have a higher daily wage than workers performing low-skill tasks. In addition to that, workers with contracts with social security cost deductions have a lower daily wage; in contrast, a larger experience is correlated with a higher daily wage. In Column (4) we control for employer-level characteristics. We can see that import competition from China remains negative and statistically significant. The results show that workers employed in medium and large firms command a higher wage than workers employed in small firms. In Column (5) we control for worker-

specific and firm-specific fixed effects. Import competition from China becomes statistically not significant. This result shows that once we control for worker and firm-specific unobservable effects there is no longer a negative association between wages and import competition from China. This result is confirmed in Column (6), when we control for worker-firm specific fixed effects.

[Table 7 around here]

In order to analyze the impact of imports from China on sectoral reallocation, we classify workers in our sample into two distinct categories, for each year between 1997 and 2011. The first category is workers that switch to an employment outside manufacturing; this category also includes manufacturing workers that become unemployed and switch to an employment outside manufacturing if they were unemployed less than one year. The second category is workers who remain employed in the manufacturing sector. Following the same approach as in section 3.1, this classification allows us to explore the impact of import competition from China on the probability of switching to an employment outside manufacturing. Our sample consists of a total of 907,861 observations of which a 4.4% correspond to workers switching outside the manufacturing sector. The manufacturing industries recording a higher number of switches are rubber products (4.9% of total switches), furniture (4.4%), leather clothes (3.8%) and clothing apparel and accessories (3.6%). For illustration purposes, Figure 3 shows a scatter plot between the number of switching spells by industry as percentage of total switching spells and the mean lagged imports from China as percentage of apparent consumption along the 1997-2011 period. The figure does not show a clear positive relationship between switching spells and import competition from China. Among the destination industries, other entrepreneurial activities received 14.3% of total switchers from manufacturing, while 13% and 11% of workers switched out from manufacturing to an employment in construction and wholesale trade and trade intermediaries respectively.

[Figure 3 around here]

The results of the regression analyses are reported in Table 8. In Columns (1) to (4) we report the results from the logistic model for different sets of explanatory variables. When we estimate the model with no controls except year dummies, the coefficient on imports from China is positive and significant at the 5% level, indicating that import competition increases the probability of switching to an employment outside manufacturing. In Column (2) and Column (3) we introduce workers' personal characteristics and the characteristics of the contract respectively. The coefficient on imports from China remains positive and statistically significant. Moreover, the probability of switching to an employment outside manufacturing reduces with age and increases as the skill component of the occupation becomes lower. Also, those workers with larger experience have a lower probability of switching. However, when we control for the size of the firm (Column 4), the coefficient of imports from China is not significant at conventional levels. This result holds when we estimate the model with worker-specific and firm specific fixed-effects (Column 5) by means of a linear probability model. In Column (6) we present the results for the fixed-effects logit model. The parameter estimate of imports from China is now significant at the 5% level and positive.

[Table 8 around here]

Overall, the presented results show that the evidence of a positive relationship between increasing import competition from China and the probability of switching to an employment outside manufacturing is rather weak. Thus reallocation of workers from manufacturing to other sectors along the 1997-2011 period was plausibly due to causes other than increasing import competition from China like wage increase differentials, as was probably the case for those workers switching to an employment in the construction sector.

## 5. Conclusions and policy implications

During the period 1997-2011 import competition from China in the Spanish manufacturing sector multiplied by five. In this paper, we analyzed whether this severe increase in import competition from China raised the probability of becoming unemployed among Spanish manufacturing workers. To test this hypothesis we use a

dataset that comprises the working lives of 141,000 manufacturing workers. This dataset allows us to control for heterogeneity across workers and firms, enabling a better identification of the effect of Chinese import competition on the probability of becoming unemployed.

Our estimations show that there is a strong positive association between a higher import competition from China and the probability of becoming unemployed. We estimate that a standard deviation increase in import competition from China raises the probability of becoming unemployed between 0.8 and 3.5 percentage points, which represents between a 9% and a 44% increase over the unconditional probability of becoming unemployed. We do not identify any effect of import competition from China on wages. Also, our estimations show that there is weak evidence of a positive association between a higher import competition from China and the probability of switching to an employment outside the manufacturing sector.

As explained by Wood (2004) there are four different interventions that might be used to address the reduction in demand for manufacturing workers, and especially for unskilled workers, due to the increase in import competition from China. The first intervention is to raise barriers to trade against imported products from China. Although this intervention has popular appeal, it is not recommended for two reasons. On the one hand, the obligations that Spain has assumed as a member of the World Trade Organization preclude the unilateral introduction of higher barriers to trade. On the other hand, higher barriers to trade would limit the benefits from international trade, which recent studies show to be sizable (Feyrer 2009a and 2009b). Other policy interventions have a lower negative impact on efficiency and better target the collective of workers that are negatively affected by import competition from China. The second and more promising policy intervention would be to reduce the number of unskilled workers. From a wider perspective, this can be achieved rising the investment in education and focusing in the development of those skills and competences that are difficult to offshore or automate (Blinder, 2009; Autor and Dorn, 2013). From a narrower perspective, the reduction in the number of unskilled workers can be achieved upgrading their skills through training. However, this policy has limitations, since it is a long-term measures and it is not always feasible to transform an unskilled worker into a skilled worker. This limitation calls for the use of other active labor market policies, such as job-search assistance, that can be implemented in the short-run (Jansen and Lee,

2007). The last policy intervention is to support the income of the unemployed. This policy is applied in Spain and in the majority of European Union countries. However, this policy has some limitations as well. If not properly designed it might discourage the return to work.

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## References


Autor, D.H. and Dorn, D. (2013). The Growth of Low-Skill Service Jobs and the Polarization of the US Labor Market. American Economic Review, 103 (5), 1553-1597.

Autor, D.H., Dorn, D. & Hanson, G.H. (2013). The China Syndrome: Local Labor Market Effects of Import Competition in the United States. American Economic Review, 103 (6), 2121-2168.

Bachmann, R. & Braun, S. (2011). The impact of international outsourcing on labour market dynamics in Germany. Scottish Journal of Political Economy, 58 (1), 1-28.

Berman, E., Bound, J. & Machin, S. (1998). Implications of Skill-Biased Technological Change: International Evidence. Quarterly Journal of Economics, 113 (4), 1245-1280.

Bernard, A.B., Jensen, J.B. & Schott, P.K. (2006). Survival of the best fit: Exposure to low-wage countries and the (uneven) growth of U.S. manufacturing plants. Journal of International Economics, 68 (1), 219-237.

Blinder, A.S. (2009). How Many US Jobs Might be Offshorable? World Economics, 10 (2), 41-78.

Bonhomme, S. & Hospido, L. (2013). Earnings Inequality in Spain: New Evidence Using Tax Data. Applied Economics, 45 (30), 4212-4225.

Cameron, A.C. & Trivedi, P.K. (2009). Microeconomics using Stata. College Station, Texas: Stata Press.

Ebenstein, A., Harrison, A., McMillan, M. & Phillips, S. (2012). Estimating the Impact of Trade and Offshoring on American Workers Using Current Population Surveys. Review of Economics and Statistics, forthcoming.

Egger, P., Pfaffermayr, M. & Weber, A. (2007). Sectoral adjustments of employment to shifts in outsourcing and trade: Evidence from a dynamic fixed effects multinomial logit model. Journal of Applied Econometrics, 22 (3), 559-580.

Feenstra, R.C. & Hanson, G.H. (1996). Globalization, Outsourcing, and Wage Inequality. American Economic Review, 86 (2), 240-245.

Feenstra, R.C. & Hanson, G.H. (1999). The Impact of Outsourcing and High-Technology Capital on Wages: Estimates for the U.S., 1972-1990. Quarterly Journal of Economics, 114 (3), 907-940

Feyrer, J. (2009a). “Trade and Income. Exploiting Time Series in Geography”. NBER Working Paper 14910, National Bureau of Economic Research.

Feyrer, J. (2009b). “Distance, Trade, and Income – The 1967 to 1975 Closing of the Suez Canal as a Natural Experiment”. NBER Working Paper 15557**,** National Bureau of Economic Research.

Geishecker, I. & Görg, H. (2008). Winners and losers: a micro-level analysis of international outsourcing and wages. Canadian Journal of Economics, 41 (1), 243-270.

Görg, H. & Görlich, D. (2012). Trade and labour market outcomes in Germany. In Lippoldt, D. (Ed.), Policy Priorities for International Trade and Jobs (pp. 193-236). Paris: OECD.

Green, W.H. (2008). Econometric Analysis. 6th Edition. New Jersey: Pearson.

Guimarães, P. & Portugal, P. (2010). A simple feasible procedure to fit models with high-dimensional fixed effects. Stata Journal, 10 (4), 628-649.

Harrison, A. & McMillan, M. (2011). Offshoring Jobs? Multinationals and U.S. Manufacturing Employment. The Review of Economics and Statistics, 93 (3), 857-875.

Hummels, D., Jorgenssen, R., Munch, J. & Xiang, C. (2011). The Wage and Employment Effects of Outsourcing: Evidence from Danish Matched Worker-Firm Data. NBER Working Paper 17496, National Bureau of Economic Research, Cambridge, MA.

Krugman, P.R. (2008). Trade and Wages, Reconsidered. Brookings Papers on Economic Activity, 2, 103-137.

Krugman, P.R. & Lawrence, R.Z. (1994). Trade, Jobs and Wages. Scientific American, April, 22-27.

Jansen, M. and Lee, E. (2007). Trade and Employment. Challenges for Policy Research. Geneva: World Trade Organization and International Labour Office.

Leamer, E.E. (1998). In search of Stolper-Samuleson linkages between international trade and lower wages. In Collins, S. (Ed.), Imports, Exports and the American Worker (pp. 141-206). Washington DC: Brookings Institution Press.

Lurweg, M. & Uhde, N. (2010). International Trade and Individual Market Perspectives. A Micro-Level Analysis of German Manufacturing Workers. CAWM Discussion Paper No. 31.

Medina, E., Herrarte, A. & Vicéns, J. (2010). Inmigración y desempleo en España: Impacto de la crisis económica. Información Comercial Española. Revista de Economía, 854, 37-48.

Mion, G. & Zhu, L. (2013). Import competition from and offshoring to China: A curse or blessing for firms?. Journal of International Economics, 89 (1),202-215.

Montero, J.M. & Regil, A. (2012). Análisis de la evolución del desempleo desde una perspectiva de flujos laborales. Boletín Ecónomico del Banco de España, Marzo, 33-43.

Wood, A. (1994). North-South Trade, Employment and Inequality. Changing Fortunes in a Skill Driven World. IDS Development Studies Series, Oxford: Clarendon Press.

Wood, A. (1995). How Trade Hurt Unskilled Workers. Journal of Economic Perspectives, 9 (3), 57-80.

**Table 1.** Number of observations and distribution by personal and occupational characteristics.

| Year | Number of observations | Male (%) | Age (%) | | | Occup. - Skill (%) | | |
|---|---|---|---|---|---|---|---|---|
| | | | 16-29 | 30-44 | 45-65 | High | Medium | Low |
| 1997 | 51,203 | 80.3 | 19.9 | 43.8 | 36.5 | 12.9 | 20.0 | 67.1 |
| 1998 | 56,904 | 79.8 | 20.9 | 42.7 | 36.6 | 12.9 | 19.7 | 67.4 |
| 1999 | 64,709 | 78.6 | 22.8 | 42.0 | 35.3 | 12.7 | 19.7 | 67.6 |
| 2000 | 69,786 | 78.0 | 24.1 | 41.3 | 34.6 | 12.5 | 19.5 | 68.0 |
| 2001 | 73,340 | 77.2 | 24.1 | 41.7 | 34.2 | 12.5 | 19.6 | 67.9 |
| 2002 | 74,566 | 76.5 | 24.2 | 42.7 | 33.1 | 12.8 | 20.1 | 67.1 |
| 2003 | 75,121 | 76.2 | 23.4 | 43.3 | 33.3 | 12.8 | 20.2 | 67.0 |
| 2004 | 75,677 | 75.7 | 22.2 | 44.3 | 33.5 | 13.0 | 20.2 | 66.8 |
| 2005 | 76,004 | 75.4 | 21.2 | 45.3 | 33.5 | 12.8 | 20.2 | 67.0 |
| 2006 | 75,591 | 74.9 | 20.1 | 46.4 | 33.5 | 12.6 | 19.8 | 67.6 |
| 2007 | 75,747 | 74.4 | 18.8 | 47.4 | 33.8 | 12.9 | 20.0 | 67.1 |
| 2008 | 73,282 | 74.2 | 17.1 | 48.2 | 34.7 | 13.2 | 20.2 | 66.6 |
| 2009 | 68,391 | 74.3 | 14.8 | 49.1 | 36.1 | 13.6 | 20.5 | 65.9 |
| 2010 | 62,639 | 74.4 | 12.8 | 49.9 | 37.3 | 14.1 | 20.8 | 65.1 |
| 2011 | 58,148 | 74.4 | 10.7 | 50.1 | 39.2 | 14.4 | 20.9 | 64.7 |
| **Total** | **1,031,275** | **76.2** | **20.0** | **45.2** | **34.8** | **13.0** | **20.1** | **66.9** |

Source: authors' calculations based on MCVL.

**Table 2.** Unconditional probabilities of becoming unemployed.

| Year | All (%) | Gender (%) | | Age (%) | | | Skill (%) | | |
|---|---|---|---|---|---|---|---|---|---|
| | | Female | Male | 16-29 | 30-44 | 45-65 | High | Medium | Low |
| 1997 | 7.2 | 7.6 | 7.1 | 9.5 | 6.1 | 7.2 | 7.2 | 6.7 | 7.3 |
| 1998 | 7.0 | 8.1 | 6.7 | 8.4 | 6.3 | 7.0 | 6.0 | 7.4 | 7.1 |
| 1999 | 7.9 | 10.1 | 7.4 | 7.7 | 7.4 | 8.8 | 7.6 | 8.5 | 7.9 |
| 2000 | 6.1 | 6.6 | 5.9 | 5.1 | 5.5 | 7.4 | 6.6 | 6.6 | 5.8 |
| 2001 | 7.1 | 8.0 | 6.8 | 6.3 | 6.2 | 8.8 | 6.9 | 7.3 | 7.1 |
| 2002 | 7.4 | 8.9 | 7.0 | 7.0 | 6.8 | 8.6 | 7.0 | 7.8 | 7.4 |
| 2003 | 7.2 | 8.7 | 6.7 | 6.7 | 6.5 | 8.4 | 6.1 | 7.5 | 7.3 |
| 2004 | 7.5 | 9.0 | 7.0 | 7.6 | 6.8 | 8.4 | 8.0 | 7.6 | 7.3 |
| 2005 | 7.8 | 8.9 | 7.4 | 7.3 | 6.9 | 9.4 | 8.8 | 7.7 | 7.7 |
| 2006 | 7.6 | 9.5 | 7.0 | 7.4 | 7.1 | 8.4 | 7.3 | 7.8 | 7.6 |
| 2007 | 7.5 | 8.8 | 7.0 | 7.7 | 7.2 | 7.8 | 6.6 | 8.0 | 7.5 |
| 2008 | 10.1 | 11.6 | 9.6 | 12.4 | 9.4 | 9.9 | 7.5 | 9.1 | 10.9 |
| 2009 | 12.6 | 13.9 | 12.1 | 14.8 | 11.5 | 13.1 | 8.8 | 12.0 | 13.5 |
| 2010 | 9.5 | 10.1 | 9.3 | 10.0 | 8.9 | 10.1 | 8.2 | 9.9 | 9.6 |
| 2011 | 9.1 | 9.7 | 8.9 | 11.8 | 8.2 | 9.4 | 7.3 | 9.3 | 9.4 |
| **Total** | **8.1** | **9.4** | **7.7** | **8.1** | **7.5** | **8.9** | **7.3** | **8.2** | **8.2** |

Source: authors' calculations based on MCVL.

Table 3. Benchmark econometric estimations, 1997-2011.

| | (1) | (2) | (3) | (4) | (5) | (6) |
|---|---|---|---|---|---|---|
| Imports China | 0.0225*** (0.0051) | 0.0198*** (0.0042) | 0.0195*** (0.0039) | 0.0148*** (0.0034) | 0.0048*** (0.0013) | 0.0338*** (0.0090) |
| Age 30-44 | | -0.1306*** (0.0199) | 0.0087 (0.0178) | 0.0256 (0.0170) | 0.0031 (0.0023) | -0.1333** (0.0572) |
| Age 45-65 | | 0.0887** (0.0365) | 0.2977*** (0.0341) | 0.3361*** (0.0384) | -0.0335*** (0.0033) | -0.3779*** (0.0879) |
| Male | | -0.1936*** (0.0027) | -0.1571*** (0.0298) | -0.1661*** (0.0237) | | |
| Foreigner | | 0.3288*** (0.0465) | 0.1676*** (0.0468) | 0.0968*** (0.0285) | | |
| High-skill occup. | | | -0.0586 (0.0379) | 0.0502 (0.0313) | -0.0938*** (0.0088) | -7.1966*** (0.3055) |
| Medium-skill occup. | | | 0.0068 (0.0254) | 0.0068 (0.0189) | -0.0551*** (0.0062) | -2.9649*** (0.2316) |
| Whole working | | | -0.0836*** (0.0280) | 0.1537*** (0.0262) | 0.0104 (0.0104) | 2.2077*** (0.2420) |
| Discount-contract | | | 0.3655*** (0.0166) | 0.2512*** (0.0185) | 0.0041 (0.0050) | -1.7537*** (0.1493) |
| Experience | | | -0.0807*** (0.0072) | -0.0881*** (0.0073) | -0.0145*** (0.0012) | 0.4668*** (0.0139) |
| Medium firm | | | | -0.7120*** (0.0394) | -0.1748*** (0.0149) | -1.6000*** (0.0939) |
| Large firm | | | | -1.0759*** (0.0728) | -0.2448*** (0.0204) | -4.6199** (0.2544) |
| Model | Logit | Logit | Logit | Logit | Linear Probability | Logit fixed-effects |
| Observations | 1,031,275 | 1,031,275 | 1,031,275 | 1,012,035 | 1,012,035 | 377,441 |
| R-squared | 0.007 | 0.010 | 0.018 | 0.038 | 0.323 | |

Note: Imports China is lagged one year. All regressions include year-specific fixed effects. Regression in Column 5 includes worker-specific and firm-specific fixed effects. Regression in Column (6) includes worker-firm specific fixed-effects. Robust standard errors clustered by 3-digit industries in parentheses. ***, ** statistically significant at 1% and 5% respectively.

Table 4. Econometric estimations by skill-level and age-group, 1997-2011.

| | By Skill level | | | By age group | | |
|---|---|---|---|---|---|---|
| | High-Skill | Medium-Skill | Low-Skill | Age 16-29 | Age 30-44 | Age 45-65 |
| | (1) | (2) | (3) | (4) | (5) | (6) |
| | **PANEL A: Logit** | | | | | |
| Imports China | 0.0062 (0.0058) | 0.0109*** (0.0033) | 0.0160*** (0.0031) | 0.0168*** (0.0036) | 0.0153*** (0.0037) | 0.0163*** (0.0042) |
| Observations | 134,423 | 207,318 | 689,534 | 205,937 | 466,001 | 359,337 |
| R-squared | 0.002 | 0.005 | 0.010 | 0.013 | 0.008 | 0.006 |
| | **PANEL B: Linear Probability (worker-specific and firm-specific fixed effects)** | | | | | |
| Imports China | 0.0028*** (0.0009) | 0.0036*** (0.0011) | 0.0055*** (0.0015) | 0.0070** (0.0037) | 0.0049*** (0.0016) | 0.0058*** (0.0012) |
| Observations | 132,019 | 202,740 | 677,276 | 202,363 | 457,877 | 351,795 |
| R-squared | 0.35 | 0.34 | 0.32 | 0.44 | 0.39 | 0.35 |
| | **PANEL C: Logit (worker-firm specific fixed effects)** | | | | | |
| Imports China | 0.0620** (0.0305) | 0.0422* (0.0242) | 0.0367*** (0.0112) | 0.0926*** (0.0271) | 0.0218 (0.0151) | 0.0077 (0.0198) |
| Observations | 43,705 | 74,262 | 257,034 | 48,072 | 122,291 | 0.0198 |

Note: Imports China is lagged one year. All regressions include worker, contract and employer characteristics as explanatory variables and specific fixed effects. Robust standard errors clustered by 3-digit industries in parentheses. ***, ** statistically significant at 1% and 5% respectively.

Table 5. Sensitivity analyses: technological progress and time-period avoiding the financial crisis.

| | Technological progress | | Period 1997-2007 | |
|---|---|---|---|---|
| | (1) | (2) | (3) | (4) |
| Imports China | 0.0094*** (0.0013) | 0.1062*** (0.0201) | 0.0067*** (0.0013) | 0.0632*** (0.0175) |
| Age 30-44 | 0.0028 (0.0025) | -0.1719*** (0.0637) | 0.0017 (0.0025) | -0.3004*** (0.0701) |
| Age 45-65 | -0.0334*** (0.0037) | -0.3806*** (0.1008) | -0.0296*** (0.0035) | -0.3912*** (0.1159) |
| High-skill occup. | -0.0979*** (0.0134) | -7.7907*** (0.3319) | -0.0912*** (0.0079) | -8.2030*** (0.3570) |
| Medium-skill occup. | -0.0545*** (0.0083) | -3.6055*** (0.2539) | -0.0493*** (0.0060) | -3.5304*** (0.2682) |
| Whole working day | 0.0049 (0.0138) | 1.3072*** (0.3364) | 0.0015 (0.0104) | 0.5221 (0.3916) |
| Discount-contract | 0.0060 (0.0063) | -2.6324*** (0.1757) | 0.0100 (0.0048) | -2.7393*** (0.1856) |
| Experience | -0.0135*** (0.0016) | 0.3853*** (0.0151) | -0.0105*** (0.0011) | 0.3314*** (0.0161) |
| Medium firm | -0.1770*** (0.0223) | -1.7103*** (0.1222) | -0.1617*** (0.0224) | -1.6292*** (0.1781) |
| Large firm | -0.2490*** (0.0323) | -4.0895*** (0.2956) | -0.2364*** (0.0383) | -2.9289*** (0.3611) |
| K/L ratio | -0.0314 (0.0450) | 0.2579 (0.8145) | | |
| TFP | -0.0877 (0.0580) | -2.4533*** (0.4808) | | |
| ICT | 0.0206 (0.0176) | 0.2886 (0.2810) | | |
| Imports EU15 | | | | |
| Model | Linear probabilistic | Fixed-effects logit | Linear probabilistic | Fixed-effects logit |
| Observations | 879,444 | 293,019 | 750,181 | 203,811 |
| R-squared | 0.343 | | 0.368 | |

Note: All regressions include year-specific fixed effects. Linear probabilistic regressions include worker-specific and firm-specific fixed effects. Imports China and technology variables lagged one year. In Columns (1) and (2) Imports China is calculated at the 2-digit industry level and the period of analysis is 1997-2009. In Columns (3) and (4) the period of analysis is 1997-2007. Robust standard errors in parentheses, clustered by 2-digit industries in Columns (1) and (2), and clustered by 3-digit industries in Columns (3) and (4). ***, ** statistically significant at 1% and 5% respectively.

Table 6. Sensitivity analyses: alternative measures of trade exposure, 1997-2011.

| | Imports from the EU15 | | Net imports from China | | Final goods imports from China | |
|---|---|---|---|---|---|---|
| | (1) | (2) | (3) | (4) | (5) | (6) |
| Imports China | 0.0046*** (0.0012) | 0.0337*** (0.0089) | 0.0037*** (0.0014) | 0.0183*** (0.0062) | 0.0066*** (0.0013) | 0.0353*** (0.0127) |
| Age 30-44 | 0.0032 (0.0023) | -0.1313** (0.0573) | 0.0030 (0.0023) | -0.1359** (0.0572) | 0.0032 (0.0023) | -0.1353** (0.0572) |
| Age 45-65 | -0.0335*** (0.0032) | -0.3742*** (0.0979) | -0.0335*** (0.0033) | -0.3771*** (0.0879) | -0.0335*** (0.0033) | -0.3763*** (0.0879) |
| High-skill occup. | -0.0937*** (0.0088) | -7.1870*** (0.3053) | -0.0937*** (0.0088) | -7.2012*** (0.3056) | -0.0940*** (0.0089) | -7.1993*** (0.3056) |
| Medium-skill occup. | -0.0551*** (0.0062) | -2.966*** (0.2315) | -0.0548*** (0.0061) | -2.9598*** (0.2315) | -0.0550*** (0.0063) | -2.9593*** (0.2316) |
| Whole working day | 0.0105 (0.0104) | 2.2170*** (0.2420) | 0.0103 (0.0104) | 2.2043*** (0.2420) | 0.0105 (0.0104) | 2.2072*** (0.2421) |
| Discount-contract | 0.0041 (0.0050) | -1.7459*** (0.1487) | 0.0042 (0.0050) | -1.7571*** (0.1493) | 0.0039 (0.0050) | -1.7568*** (0.1493) |
| Experience | -0.0146*** (0.0012) | 0.4661*** (0.0138) | -0.0146*** (0.0012) | 0.4670*** (0.0138) | -0.0145*** (0.0012) | 0.4671*** (0.0138) |
| Medium firm | -0.1748*** (0.0149) | -1.6129*** (0.0941) | -0.1752*** (0.0149) | -1.6010*** (0.0939) | -0.1753*** (0.0150) | -1.6020*** (0.0939) |
| Large firm | -0.2466*** (0.0206) | -4.6171*** (0.2534) | -0.2458*** (0.0205) | -4.6201*** (0.2543) | -0.2454*** (0.0203) | -4.6241*** (0.2545) |
| Imports EU15 | 0.0012** (0.0005) | 0.0268** (0.0039) | | | | |
| Model | Linear probabilistic | Fixed-effects logit | Linear probabilistic | Fixed-effects logit | Linear probabilistic | Fixed-effects logit |
| Observations | 1,012,035 | 377,441 | 1,012,035 | 377,465 | 1,012,035 | 377,465 |
| R-squared | 0.32 | | 0.32 | | 0.32 | |

Note: All regressions include year-specific fixed effects. Linear probabilistic regressions also include worker-specific and firm-specific fixed effects. Imports China lagged one year. Robust standard errors in parentheses, clustered by 3-digit industries. ***, ** statistically significant at 1% and 5% respectively.

Table 7. Impact of import competition from China on wages, 2004-2011.

| | (1) | (2) | (3) | (4) | (5) | (6) |
|---|---|---|---|---|---|---|
| Imports China | -0.0100** (0.0039) | -0.0085** (0.0036) | -0.0082*** (0.0025) | -0.0063*** (0.0020) | 0.0010 (0.0097) | 0.0011 (0.0010) |
| Age 30-44 | | 0.2370*** (0.0146) | 0.1268*** (0.0095) | 0.1109*** (0.0093) | 0.0358** (0.0042) | 0.0364*** (0.0042) |
| Age 45-65 | | 0.3659*** (0.0218) | 0.2307*** (0.0157) | 0.2066*** (0.0138) | 0.0234*** (0.0053) | 0.0237*** (0.0054) |
| Male | | 0.2012*** (0.0353) | 0.2441*** (0.0205) | 0.2494*** (0.0169) | | |
| Foreigner | | -0.2161*** (0.0043) | -0.0893*** (0.0043) | -0.0544*** (0.0191) | | |
| High-skill occup. | | | 0.7160*** (0.0245) | 0.6551*** (0.0207) | 0.0797*** (0.0299) | 0.1301** (0.0646) |
| Medium-skill occup. | | | 0.2954*** (0.0274) | 0.2848*** (0.0261) | 0.0550** (0.0228) | 0.1136** (0.0493) |
| Discount-contract | | | -0.1431*** (0.0132) | -0.1013*** (0.0115) | -0.0131 (0.0136) | 0.0030 (0.0210) |
| Experience | | | 0.0219*** (0.0019) | 0.0262*** (0.0017) | 0.0385*** (0.0038) | 0.0538*** (0.0043) |
| Medium firm | | | | 0.2417*** (0.0162) | 0.0253*** (0.0083) | 0.0248*** (0.0083) |
| Large firm | | | | 0.4137*** (0.0225) | 0.0288** (0.0142) | 0.0266* (0.0147) |
| Observations | 344,194 | 344,194 | 344,194 | 344,035 | 344,035 | 343,682 |
| R-squared | 0.02 | 0.07 | 0.23 | 0.28 | 0.93 | 0.93 |

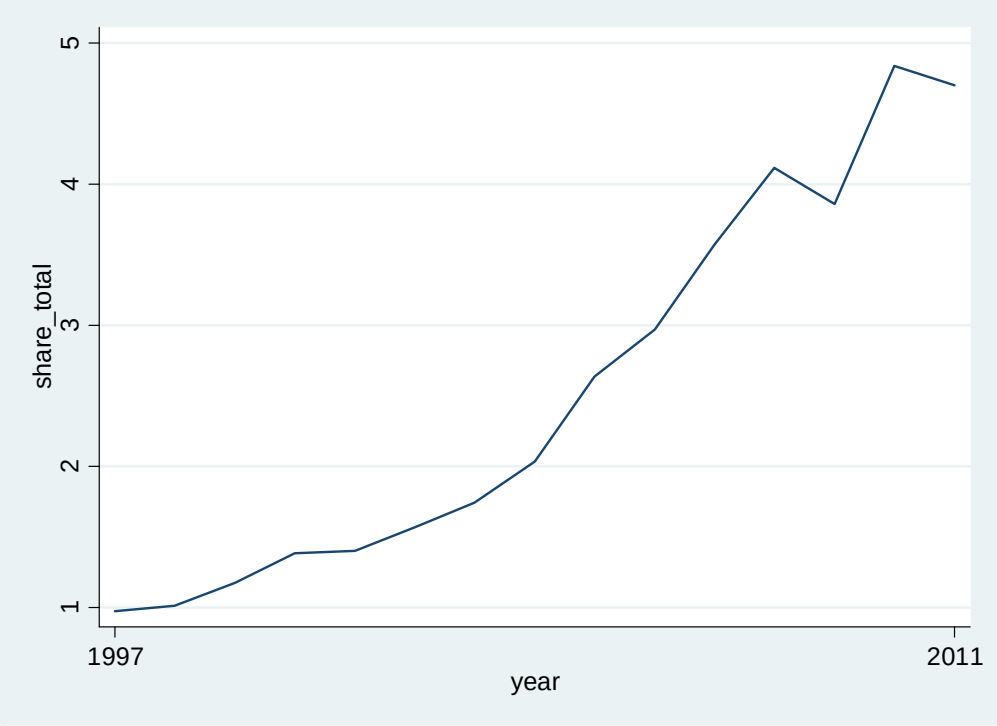
Note: The dependent variable is daily wage in logs. Imports China is lagged one year. All regressions include year-specific fixed effects. Column (5) also includes worker-specific and firm-specific fixed effects. Column (6) includes worker+firm-specific fixed effects. Robust standard errors clustered by 3-digit industries in parentheses. ***, **, * statistically significant at 1%, 5% and 10% respectively.

Table 8. Imports from China and sectoral reallocation of workers, 1997-2011.

| | (1) | (2) | (3) | (4) | (5) | (6) |
|---|---|---|---|---|---|---|
| Imports China | 0.0119** (0.0063) | 0.0105* (0.0060) | 0.0109** (0.0052) | -0.0006 (0.0051) | 0.0001 (0.0005) | 0.0280** (0.0125) |
| Age 30-44 | | -0.5650*** (0.0361) | -0.2371*** (0.0324) | -0.2562*** (0.0353) | 0.0278*** (0.0020) | 0.3921*** (0.0742) |
| Age 45-65 | | -1.2630*** (0.0360) | -0.7940*** (0.0363) | -0.9432*** (0.0421) | 0.0144*** (0.0021) | -0.1701 (0.1303) |
| Male | | -0.0502 (0.0535) | 0.0771* (0.0437) | 0.0838* (0.0522) | | |
| Foreigner | | 0.6973*** (0.0693) | 0.3546*** (0.0661) | 0.2949*** (0.0520) | | |
| High-skill occup. | | | 0.0659*** (0.0662) | 0.1994*** (0.0762) | | -7.3322*** (0.5378) |
| Medium-skill occup. | | | 0.1658*** (0.0439) | 0.1991*** (0.0483) | | -2.3929*** (0.3862) |
| Whole working | | | -0.3517*** (0.0602) | -0.2110*** (0.0661) | 0.0028 (0.0151) | 0.0270 (0.3626) |
| Discount-contract | | | 0.7654*** (0.0295) | 0.7655*** (0.0258) | 0.0131 (0.0091) | 1.4563*** (0.1576) |
| Experience | | | -0.2124*** (0.0110) | -0.2389*** (0.0154) | -0.0102** (0.0045) | 4.4370*** (0.0654) |
| Medium firm | | | | -0.4181*** (0.0402) | -0.0401 (0.0906) | 0.3919 (0.3927) |
| Large firm | | | | -0.8068*** (0.1361) | -0.0551 (0.0660) | 1.2876 (0.9988) |
| | | | | | | |
| Model | Logit | Logit | Logit | Logit | Linear Probability | Logit fixed-effects |
| Observations | 907,861 | 907,861 | 907,861 | 730,560 | 730,560 | 93,415 |
| R-squared | 0.007 | 0.035 | 0.067 | 0.086 | 0.40 | |

Note: Imports China is lagged one year. All regressions include year-specific fixed effects. Regression in Column 5 includes worker-specific and firm-specific fixed effects. Robust standard errors clustered by 3-digit industries in parentheses. ***, ** statistically significant at 1% and 5% respectively.

Figure 1. Evolution of the share of Chinese imports in Spanish manufacturing apparent consumption, 1997-2011

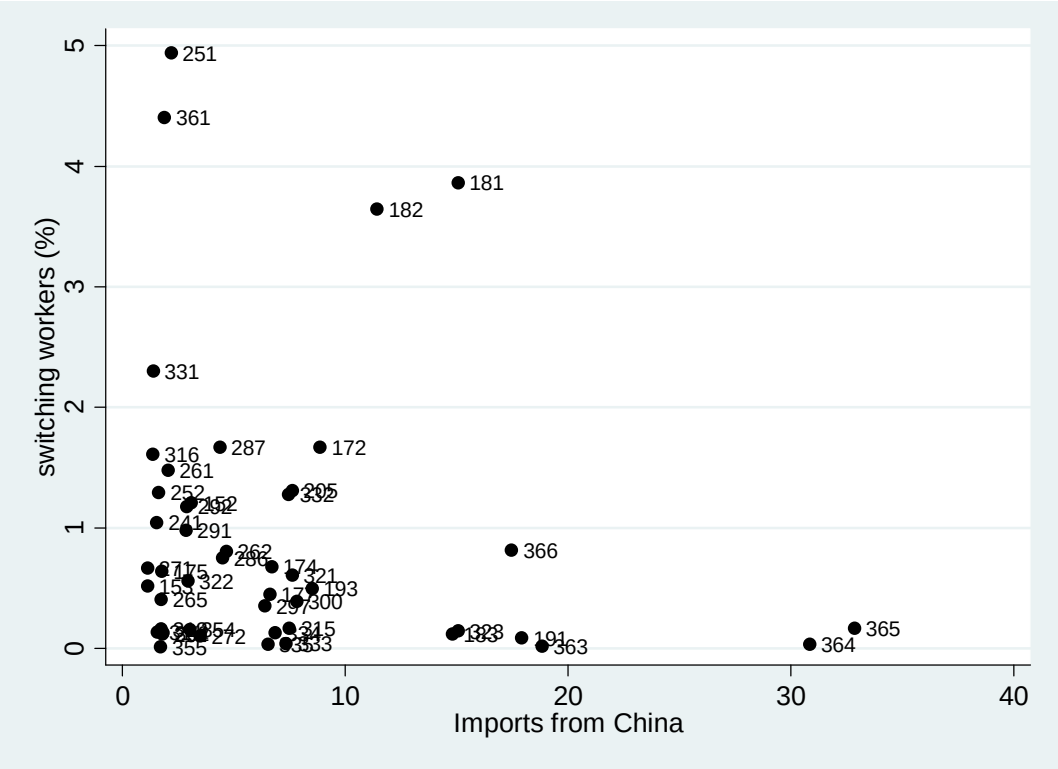



Source: authors' calculation based on Agencia Tributaria, and INE Industrial Survey databases.

Figure 2. Share of Chinese imports in apparent consumption by industry: 2011 vs. 1997.


Note: only includes industries where Chinese imports represented at least 1% of apparent consumption in 1997.
Source: authors' calculation based on Agencia Tributaria, and INE Industrial Survey databases.

Figure 3. Imports from China and switching from manufacturing industries.




Note: only includes industries where the mean Chinese imports as percentage of apparent consumption along the period 1997-2011 was at least 1%.
Source: authors' calculation based on MCVL.