Do differences in the exposure to Chinese imports lead to differences in labor-market outcomes? An analysis for Spanish provinces

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Abstract

In the period 1995-2007, Spanish imports from China have multiplied by eleven, making China the third supplier of the Spanish economy. In this paper we analyze whether this massive increase in imports had a different impact on Spanish provinces labor markets depending on their initial productive specialization. Our results show that Spanish provinces characterized by higher exposure to Chinese imports experienced higher drops in manufacturing employment and larger increases in unemployment.

Keywords: imports, China, Spain, employment, imports, provinces

JEL Classification: F16, J23

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1. Introduction.

The emergence of China as a major trader is one of the most salient features of the globalization process that the world is living at the beginning of the 21st Century. In the period 1995-2007, the share of Chinese exports in total world merchandise exports has multiplied by three (from 2.9% to 8.8%). This dramatic increase in Chinese presence in world markets has been particularly acute in the case of manufactures, where the share has increased from 3.2 % to 11.3%.[1]. The Spanish market has also experienced the massive increase in imports from China. During the period 1995-2007, the share of Chinese imports raised from 2.0% to 6.5%. At the end of the period, China was the fourth most important supplier for Spain, after Germany, France and Italy. In the case of manufactures the share of Chinese imports grows from 2.4% to 8.4%.

Since the early 1990s, scholars have pointed out that imports from developing countries in general, and from China in particular, might have disruptive effects on developed countries labor markets (Wood, 1994). Due to a higher relative endowment in unskilled labor, developing countries have comparative advantage in unskilled labor intensive goods. Moreover, the fragmentation of production processes have also allowed these countries to specialize in production stages, such as assembly tasks, which make intensive use of unskilled labor. Due to their lower costs, imports from developing countries might lead to a drop in the production of unskilled-labor intensive manufactures in developed countries, reducing the demand for low educated workers in those countries. During the 1990s, with some few exceptions (Wood, 1998; Feenstra and Hanson, 1999), most of scholars concluded that the negative impact of developing countries imports on developed countries labor markets was tiny, due to the low amount of these imports (Krugman, 1995).

However, the massive increase in amount of imports from developing countries, mostly explained by the emergence of China as a trading partner, calls for a re-assessment of the impact of these trade flows on developed countries the labor markets. The goal of this paper is to undertake this assessment for the Spanish provinces labor markets. Following the methodology developed by Autor et al. (2011), we analyze whether

[1] The figures have been calculated from World Trade Organization and World Bank databases, available from www.wto.org and www.worldbank.org respectively.

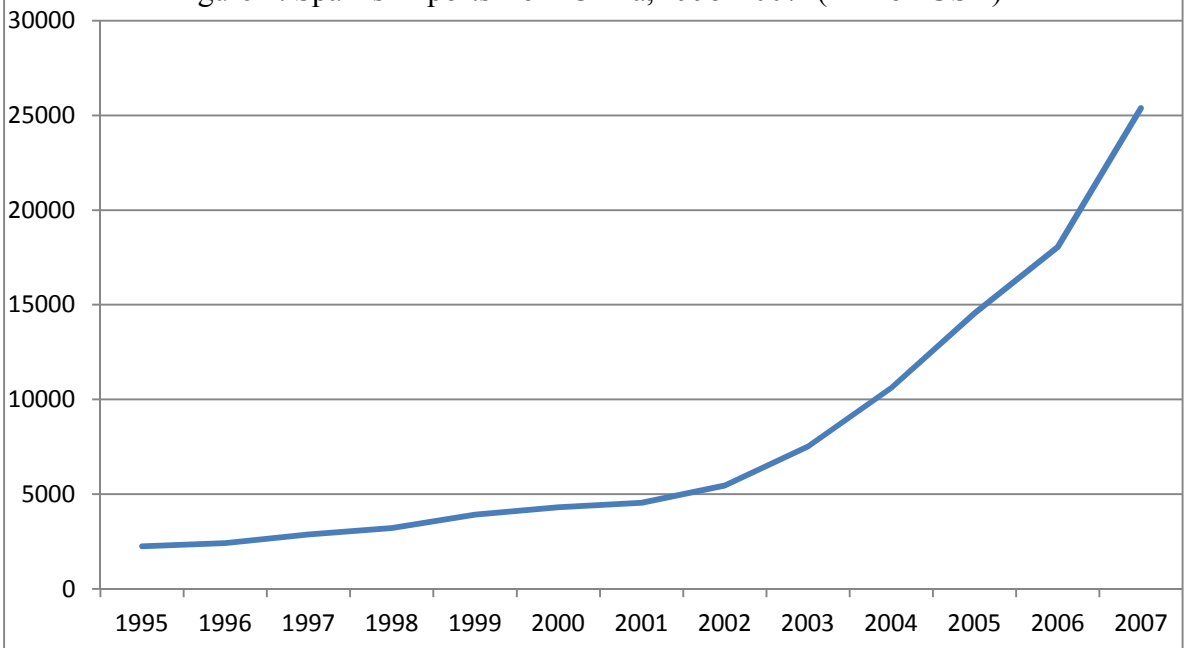
differences in provinces exposure to Chinese imports has led to differences in labor-market outcomes. We assess the exposure of Spanish provinces to Chinese imports using their initial industrial specialization. The argument is that provinces initially specialized in goods where Chinese imports growth has been very large should have had a worse evolution in manufacturing employment than those provinces specialized in manufactures than where the increase in Chinese imports has been lower. In fact, our results suggest that during the period 1999-2007, Spanish provinces more exposed to Chinese imports experience larger drops in manufacturing employment. We also find that higher exposure to Chinese imports in positively linked to higher unemployment rates.

The rest of the paper is organized as follows. Section 2 presents some stylized facts on the evolution of Spanish imports from China, and the evolution of manufacturing employment across Spanish provinces. Section 3 explains the indexes we use to measure exposure to Chinese imports and describes the data used in the empirical analyses. Section 4 presents the results of the econometric analysis. Section 5 concludes.

2. The evolution of Spanish imports from China.

Figure 1 presents the evolution of Spanish imports from China. As shown in the figure, during the period 1995-2007, the rise of Chinese imports has been impressive. In 1995 imports from China amounted for 2 billion US dollars (USD); by 2007, this amount has multiplied by more than eleven, reaching a 25 billion figure. We can observe that the increase of Chinese imports accelerated from 2001 onwards, the year in which China became a member of the World Trade Organization. Between 2001 and 2007 growth rates are always at 2 digit levels; moreover, in two years, 2004 and 2007, growth rates were larger than 40 per cent.

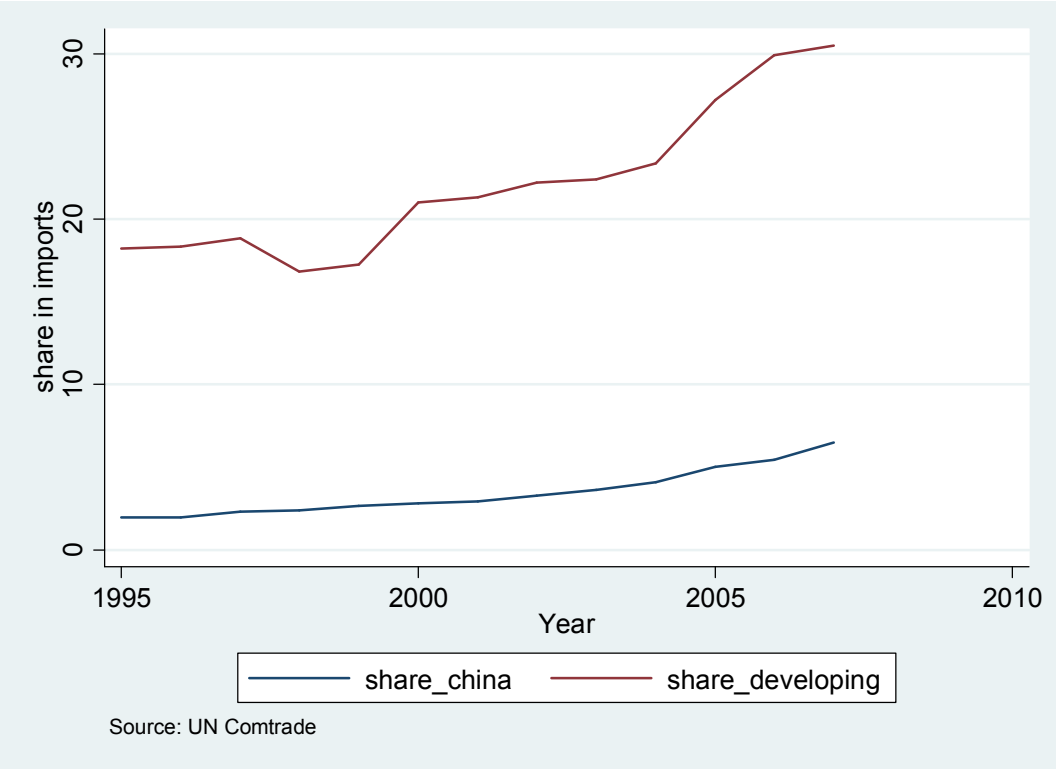
Figure 1. Spain's imports from China, 1995-2007 (million USD)



Source: UN Comtrade database.

The increase in imports from China is also important in relative terms. As shown in Figure 2, in 1995 imports from China represented 2.0% of all Spanish imports; by 2007, this share multiplied by more than three, rising to 6.5%. During the period 1995-2007, we also observe an increase in the share of developing countries in Spanish imports. We consider as developing those countries classified as low or middle-income by the World Bank in 1995. We can see that the share of these countries grows from 18.2% to 30.5%. Besides China, within developing countries the share of Latin America & Caribbean countries raises from 4.2% to 4.8% in 2007, the share of African Countries from 4.7% to 6.4%, and the share of other Asian countries from 3.1% to 3.7%; the share of Middle-East countries drops from 1.3% to 1.2%. Due to faster increase in imports from China, the share of this country in Spanish imports from developing countries almost doubles, rising from 10.9% in 1995 to 21.3% in 2007. China is also the region that contributes most to the increase in Spanish imports from developing countries in the period 1995-2009: 23.5%.

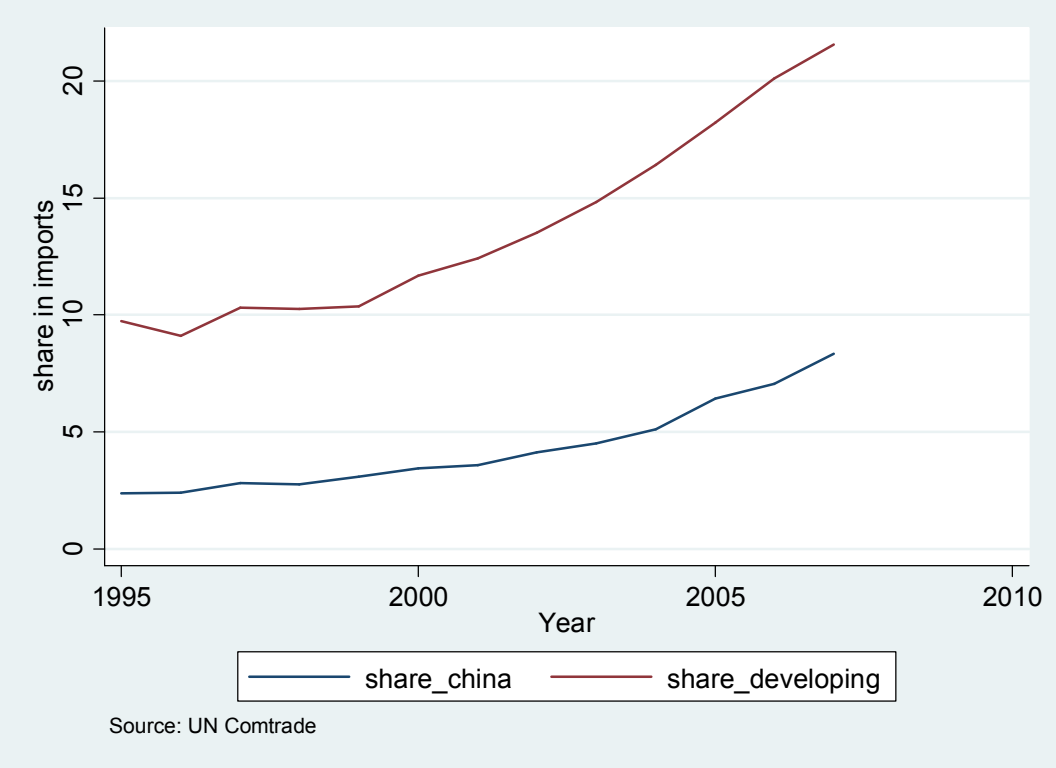
Figure 2. Share of China and developing countries in Spanish imports, 1995-2007 (%)



The increase in the weight of China in Spain's imports becomes even more impressive if we focus on manufactures. As shown in Figure 3, during the period 1995-2007, the share of imports from China multiplied by more than 3, rising from 2.4% to 8.4% of all manufactures imports. During this period, the share of manufactures from developing countries also rises from 9.7% to 21.3%. Due to the lower growth in other regions, the share of China in this group increases from 24.4% to 38.7%.[2] Moreover, imports from China explain 41% of all the increase in manufactures imports from developing countries.

[2] Latin American & Caribbean countries share grows from 1.3% to 1.5%, the share of African countries from 1.2% to 2.0%, the share of Asian countries excluding China from 2.3% to 3.1%. The share of Middle East countries remains at 0.2%.

Figure 3. Share of China and developing countries in Spanish imports of manufactures, 1995-2007 (%)



Imports from China are concentrated in four industries that account for more than three quarters of total imports: machinery and electrical equipment (33.7%), textiles and wearing apparel (15.1%), Metals (13.7%) and Other manufactures (12.1%). We can see that there has been an increase in the share of Machinery and electrical equipment and in the share of Metals in the period 1995-2007; in contrast, there has been a reduction in the share of Other Manufactures.

Table 2 summarizes employment data in manufacturing and non–manufacturing activities in Spain. It is worth noting that non-manufacturing employment experienced a much more pronounced growth than manufacturing employment during the twelve year period from 1995 to 2007. This growth differential resulted in a 4.7 percentage point decrease on manufacturing employment as a share of total employment in favor of non-manufacturing employment. If we compare the employment magnitudes as a share of working age population (age 16 and above) in manufacturing and non-manufacturing

activities, we find an increase of only one half of a percentage point in the former and an increase of 14.4 percentage points in the latter.

Table 1. Distribution of Chinese imports by industry, 1995-2007

Chapter	Share in 1995	Share in 2007
Machinery and electrical equipment	24.18	33.68
Textiles and wearing apparel	15.61	15.07
Metals	6.03	13.66
Other manufactures	16.54	12.18
Footwear	6.93	4.04
Chemicals & Allied Industries	8.32	3.95
Raw Hides, Skins, Leather, & Furs	5.34	3.20
Stone & Glass	1.97	2.83
Plastics & Rubbers	4.06	2.79
Mineral Products	3.43	2.22
Wood & Wood Products	2.38	2.08
Transport equipment	0.27	1.67
Animal & Animal Products	2.09	1.31
Foodstuffs	0.83	0.73
Vegetable Products	2.02	0.57

Source: UN Comtrade database.

Table 2. Manufacturing employment and non-manufacturing employment in Spain, 1995, 1999, 2003 and 2007.

	Manufacturing employment			Non-manufacturing employment			Working age pop. (thousands)
	thousands	Share of total employment (%)	Share of working age pop. (%)	thousands	Share of total employment (%)	Share of working age pop. (%)	
	(1)	(2)	(3)	(4)	(5)	(6)	(7)
1995	2,576	20.6	8.1	9,919	79.4	31.2	31,811
1999	2,946	20.1	8.9	11,680	79.9	35.2	33,148
2003	3,204	18.6	9.1	14,037	81.4	39.9	35,142
2007	3,244	15.9	8.6	17,123	84.1	45.6	37,592
Growth (95-07)	25.9 %	-	-	72.6 %	-	-	18.2 %

Notes: Two-digit CNAE93 activities from 10 to 41 as manufacturing activities. Working age population is population with age 16 and above.

3. Measuring import competition exposure.

In order to measure the exposure of Spanish local labor market to import competition from China we follow the methodology proposed by Autor *et al* (2011). These authors suggest that a region is more exposed to import competition from China, when it accounts for a larger share of the country sales in industries in which country imports growth from China is large. The import competition exposure index for region *i* in time *t* is obtained through,

$$IPW_{it} = \sum_{j} \frac{E_{ijt}}{E_{cjt}} \frac{\Delta M_{cjt}}{E_{it}} \tag{1.1}$$

where (E_{ijt}/E_{cjt}) is equal to start of period (year *t*) region's share of country employment in industry *j*, E_{it} is start of period total employment in region *i* and ΔM_{cjt} is equal to the observed change in country imports from China in industry *j* between the start and the end of relevant time period. It can be noticed that this measure of local labor market exposure to import competition is the average change in Chinese imports per worker in a region, weighting each industry by its share in country's total employment.

However, as Autor *et al* (2011) point out, this import exposure measure could result in endogeneity bias due to its likely positively correlation with industry labor demand shocks. To overcome this potential endogeneity, the authors propose an alternative measure to instrument IPW_{it} that is constructed using data on industry-level growth of Chinese exports to other high-income markets,

$$IPWO_{it} = \sum_{j} \frac{E_{ijt-1}}{E_{cjt-1}} \frac{\Delta M_{ojt}}{E_{it-1}} \tag{1.2}$$

Equation (1.2) makes clear that the difference between $IPWO_{it}$ and IPW_{it} is twofold. First, it substitutes country imports from China (ΔM_{ojt}), by other high-income markets imports from China (ΔM_{cjt}). In this paper, we use countries belonging to the UE-15[3] (other than Spain) as the group of other high-income markets. Second, the expression

[3] We refer to these countries as UE-14 in the rest of the paper.

uses employment levels by industry and region from the previous time period (*t-1*) rather than start of period employment levels (*t*). The use of lagged employment to apportion predicted Chinese imports to regions mitigates the potential simultaneity bias resulting from the fact that contemporaneous employment by region could be affected by anticipated China trade.

We use data on Spanish and UE-14 imports at the 3-digit HS product level from the UN Comtrade Database, for years 1995, 1999, 2003 and 2007. To concord with employment data, trade data was transformed to the Statistical Classification of Economic Activities in the European Community, rev. 1.1 (NACE rev. 1.1). Appendix figure 1 and 2 shows the dispersion graph of IPW_{it} and $IPWO_{it}$ for the two four year period 1999-2003 and 2003-2007. Both figures suggest that correlation between this two import measures is high so that $IPWO_{it}$ may be a plausible instrument for IPW_{it}.

Data on labor market for Spanish regions comes from the Survey of the Working Population[4] (*EPA*) published by the Spanish National Institute of Statistics (*INE*), for the second quarter of years 1995, 1999, 2003 and 2007.

To calculate the import exposure measures IPW_{it} and $IPWO_{it}$, the *EPA* provides data on employment by region and economic activity sector at the 3-digit level from the National Classification Activities - 1993 (*CNAE-93 and CNAE-93 rev. 1*). For illustration purposes on these two import measures, appendix table 1 presents the two variables values and the rank order for the fifteen largest Spanish provinces. For example, in Madrid and Barcelona the IPW_{it} suggest that the growth of Chinese imports amounted to 138 and 231US dollars per worker respectively during 1999 through 2003. During 2003 through 2007 the growth of Chinese imports amounted to 863 US dollars per worker in Madrid, and to 1.926 US dollars per worker in Barcelona.

[4] This database consists on a survey of the employment situation in Spain conducted quarterly by the National Institute of Statistics (INE). It provides data on the economically active and inactive population; the number of people in employment and unemployed; and the participation rate, employment rate and unemployment rate by age group, sex, educational level, region, economic sector, occupational status and length of time spent unemployed or seeking work

4. Regression analysis.

4.1 Import exposure and manufacturing employment.

Since our principle objective is to analyse the relationship between Chinese import exposure and Spanish manufacturing employment, we fit models of the following form using the full sample of 52 Spanish provinces,

$$\Delta E_{mit} = \beta_0 + \beta_1 IPW_{it} + X'_{it}\beta_2 + u_{it} \tag{1.3}$$

where ΔE_{mit} is the four-year change in the manufacturing employment share of the working age population in province i and X_{it} is a vector of control variables for start of four-year period labor force and demographic composition which might affect manufacturing employment. All models are estimated using the available data for the two four-year period 1999-2003 and 2003-2007[5].

Table 3 presents the detailed estimates of model (1.3) where import exposure is calculated with the growth of Spanish imports from China. In each case we report the parameter estimates and their corresponding standard deviation in parenthesis, the resulting R^2 and the value of the F statistic for the null hypothesis that all estimated coefficients are zero. Column 1 through 4 shows the results from Pooled OLS regression for different sets of control variables. When we estimate the model without additional dependent variables (column 1) we find no statistically significant effect on manufacturing employment from import exposure. In the second column we add a control for the share of manufacturing in province's start of four-year period employment. The estimated impact of import competition is now highly significant, indicating that a rise of 1,000 U.S. dollars per worker in a province's exposure to Chinese imports along a four-year period is associated with a decline in manufacturing employment of approximately 0.6 percentage points of working age population[6].

[5] The first four year period (1995-1999) is lost, since we instrument IPW_{it} with $IPWO_{it}$ where lagged employment data is used.

[6] For further interpretation, the mean increase in Chinese import exposure during 1999-2003 was about 110 US dollars per worker and 964 US dollars per worker during 2003-2007 (appendix table 1).

Table 3. Import exposure and change in manufacturing employment in Spain, 1999-2007:
Pooled OLS and Fixed Effects estimates
Dependent variable: change in manufacturing employment as a share of working age population (%)

Independent variable	Pooled OLS				FE			
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Import Exposure	-0.3771 (0.2610)	-0.6361† (0.2539)	-0.6659† (0.2507)	-0.9154† (0.2878)	-1.2123† (0.4042)	-0.6605** (0.3331)	-0.6844** (0.3327)	-0.8428** (0.3499)
Manufacturing empl.	-	0.0677† (0.0275)	0.0679† (0.0279)	0.0578* (0.0294)	-	-1.2685† (0.1652)	-1.2634† (0.1636)	-1.2760† (0.1706)
Work.-age pop. growth	-	-	0.0271 (0.0257)	0.0358 (0.0360)	-	-	0.0868** (0.0490)	0.1278** (0.0520)
College-educated	-	-	-	-0.0599 (0.0588)	-	-	-	0.2124 (0.2180)
Foreign-nationality	-	-	-	0.0357 (0.0545)	-	-	-	-0.0601 (0.0581)
Women	-	-	-	-0.1046 (0.1058)	-	-	-	0.0899 (0.1582)
Young	-	-	-	-0.1574† (0.0590)	-	-	-	0.0048 (0.1573)
R^2 F statistic (p-value)	0.03 2.09 (0.15)	0.08 5.20 (0.01)	0.10 3.63 (0.01)	0.21 3.82 (0.00)	0.15 5.47 (0.01)	0.61 23.74 (0.00)	0.63 20.55 (0.00)	0.64 17.66 (0.00)

Notes: N = 104 (52 provinces x 2 time periods). Fixed effects regression (FE) include a dummy for the 1999-2003 and 2003-2007 period. All regression include a constant. Robust standard errors in parentheses. Statistical significance is indicated by † at 1%, ** at 5% and * at 10%.

In column 3 we add the growth rate of the working age population as an explanatory variable. Thus we control for changes in manufacturing employment as a result of changes on working age population size itself. The effect on manufacturing employment from import exposure remains highly significant and increases moderately. Column 4 augments the regression model with four additional controls; the start of four-year period share of working age population with a college education, the share of working age population with foreign nationality[7], the share of working age women population and the share of working age young population[8]. Apart from this last variable, none of the added controls seems to have a significant effect on manufacturing employment change. The coefficient estimate indicates that a difference of a one percentage point increase in initial young working age population share is associated with a differential manufacturing employment share decline of 0.17 percentage points. This specification

[7] All individuals with nationality in high-income countries (World Bank classification) are not included as foreign nationality population.
[8] Working age population between age 16 and 24.

yields a higher coefficient estimate for the import exposure effect (0.9) than the regression models in columns 2-3.

In columns 5 to 8 we replicate all the regression models controlling for province heterogeneity through fixed effects estimation. Results show that the effect of import exposure on manufacturing employment changes is negative and highly significant in all four cases and similar in magnitude to the pooled OLS estimates.

Table 4 shows the results from IV estimation for the pooled and fixed effects models. To overcome the potential endogeneity bias, the variable *IPW* is instrumented with the variable *IPWO* that use UE-14 imports instead of Spanish imports from China. As in previous regressions, we report the parameter estimates along with their corresponding standard deviation and several instruments for model diagnostics purposes. Moreover we summarize the results from the first stage estimates of the IV two stage least square (2SLS) procedure. The new estimates for the import exposure coefficient resulted in a remarkable fall of the parameter significance. For the pooled models, the effect of import exposure is only poorly significant when controlling for the initial share of employment manufacturing and the working age population growth. For the fixed effect models the point estimates for the import coefficient is significant at the 90% of confidence level in two cases (columns 6 and 7) and at the 95% level in one case (column 5). When we include the full set of controls the coefficient significance vanishes (column 8). From estimates in columns 6 and 7 it can be noticed that a rise of 1,000 U.S. dollars per worker in a province's exposure to Chinese is associated with a decline in manufacturing employment of approximately 0.9 and 0.8 percentage points of working age population along a four year period.

Table 4. Import exposure and change in manufacturing employment in Spain, 1999-2007:
Pooled IV and Fixed Effects IV estimates
Dependent variable: change in manufacturing employment as a share of working age population (%)

Independent variable	Pooled IV				FE IV			
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Import Exposure	-0.1962 (0.4288)	-0.9920 (0.7575)	-1.2820* (0.7478)	-1.3422 (1.0465)	-2.0697** (1.0254)	-0.9023* (0.5345)	-0.8210* (0.5066)	-0.6517 (0.6680)
Manufacture empl.	-	0.0912 (0.0583)	0.1082* (0.0593)	0.0745 (0.0538)	-	-1.2378† (0.1721	-1.2460† (0.1676)	-1.3053† (0.1831)
Work.-age pop. growth	-	-	0.0332 (0.0251)	0.0363 (0.0338)	-	-	0.0888** (0.0460)	0.1225† (0.0500)
College-educated pop.	-	-	-	-0.0343 (0.0804)	-	-	-	0.1706 (0.2324)
Foreign-nationality pop	-	-	-	0.0585 (0.0890)	-	-	-	-0.0637 (0.0601)
Women population	-	-	-	-0.0763 (0.1353)	-	-	-	0.0897 (0.1521)
Young population	-	-	-	-0.1915** (0.0944)	-	-	-	0.0120 (0.1478)
R^2 F statistic (p-value)	0.03 0.21 (0.65)	0.06 1.19 (0.31)	0.03 1.55 (0.21)	0.19 2.28 (0.03)	0.08 2.54 (0.09)	0.61 22.65 (0.00)	0.63 20.43 (0.00)	0.64 14.77 (0.00)
First-stage estimates								
Import Exposure (UE)	0.1327† (0.0281)	0.1074† (0.0328)	0.1108† (0.0368)	0.0828† (0.0288)	0.1777† (0.0587)	0.1669† (0.0603)	0.1706† (0.0639)	0.1593† (0.0502)
R^2 KP statistic (p-value)	0.36 10.43 (0.00)	0.38 9.23 (0.00)	0.38 6.37 (0.01)	0.57 6.65 (0.01)	0.73 5.18 (0.02)	0.74 4.92 (0.03)	0.74 5.12 (0.02)	0.80 6.16 (0.01)

Notes: N = 104 (52 provinces x 2 time periods). Fixed effects regression (FE) include a dummy for the 2003-2007 period. All regression include a constant. Robust standard errors in parentheses. Statistical significance is indicated by † at 1%, ** at 5% and * at 10%.

Furthermore, in table 5 detailed fixed effects IV estimates of the relationship between import exposure and manufacturing employment by age group and educational level are reported. We present results for three different sets of control variables; Panel A with no controls, Panel B with the initial share of manufacturing employment, and Panel C which additionally controls for working age population growth. It is worth noting that import competition from China mostly affects non-college educated workers and young manufacturing workers (age 16 to 34). This can be explained in part by the fact that the incidence of temporary employment among young workers is remarkably higher than in the remaining groups of age. Data for year 1999 shows that the share of temporary employment among workers with age between 16 and 34 was 48.5%, while for workers

of age 35 to 49 and age above 49 the rate of temporary employment was 21% and 14.8% respectively.

Table 5. Import exposure and change in manufacturing employment in Spain by age and educational level, 1999-2007:
Fixed Effects IV estimates
Dependent variable: change in manufacturing employment as a share of working age population (%)

	Age 16-34	Age 35-49	Age ≥ 50	College	Non-college
	(1)	(2)	(3)	(4)	(5)
A. No controls					
Import Exposure	-3.9391**	-1.6097	-0.7523	-3.1107	-2.1069*
	(1.9363)	(1.5636)	(0.8942)	(3.6989)	(1.1723)
R^2	0.13	0.04	0.11	0.13	0.03
F statistic	3.91	0.52	0.35	2.26	1.72
(p-value)	(0.03)	(0.59)	(0.70)	(0.11)	(0.19)
B. ME					
Import Exposure	-3.3053†	-1.3225	-0.5291	1.4237	-1.7397†
	(1.2012)	(1.4750)	(0.8025)	(3.7875)	(0.6682)
R^2	0.57	0.35	0.36	0.59	0.48
F statistic	19.29	8.77	7.03	22.61	9.94
(p-value)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)
C. ME and WEPg					
Import Exposure	-2.4212†	-1.2668	-0.8037	1.3178	-1.5735†
	(0.8282)	(1.4447)	(0.7672)	(3.4232)	(0.5884)
R^2	0.69	0.61	0.52	0.70	0.54
F statistic	50.50	9.71	7.12	23.67	11.83
(p-value)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)

Notes: Fixed effects regression (FE) include a dummy for the 2003-2007 period. All regression include a constant. Robust standard errors in parentheses. Statistical significance is indicated by † at 1%, ** at 5% and * at 10%.

4.2 Import competition exposure and labor market outcomes.

In this section we analyze the effect of trade shocks on several local labor market outcomes other than manufacturing employment in order to detect potential indirect effects from import exposure. Specifically we focus on changes on non-manufacturing employment, working age population and unemployment.

We begin in table 6 by assessing the degree to which non-manufacturing employment may be indirectly affected by import shocks. The sign of this effect can be ambiguous.

On the one hand, an increase on import exposure could have a negative indirect effect to the degree that a reduction on manufacturing employment affects aggregate labor demand. On the other hand, it could be positive as far as an import shock may result in workers reallocation from manufacturing activity sectors to non-manufacturing sectors within provinces.

Table 6. Import exposure and change in non-manufacturing employment in Spain, 1999-2007: Pooled IV and Fixed Effects IV estimates
Dependent variable: change in non-manufacturing employment as a share of working age population (%)

Independent variable	Pooled IV				FE IV			
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Import Exposure	3.0909**	3.0922**	0.0264	-2.2917	-0.4872	-1.2330	-0.4715	-1.6748
	(1.4101)	(1.3952)	(0.6663)	(1.6808)	(1.7447)	(1.7557)	(1.2515)	(1.6359)
Non-manufacture empl.	-	0.1573*	-0.1892†	-0.3066†	-	-1.2658†	-1.1414†	-1.2902†
		(0.0823)	(0.0718)	(0.0798)		(0.2511)	(0.2200)	(0.2371)
Work.-age pop. growth	-	-	0.7211†	0.7043†	-	-	0.8312†	0.7842†
			(0.0721)	(0.0868)			(0.1657)	(0.2102)
College-educated pop.	-	-	-	0.4485**	-	-	-	0.7599
				(0.1977)				(0.6577)
Foreign-nationality pop	-	-	-	0.3974*	-	-	-	0.2578
				(0.2111)				(0.2144)
Women population	-	-	-	0.6165**	-	-	-	-0.1689
				(0.2972)				(0.5064)
Young population	-	-	-	-0.2011	-	-	-	0.1423
				(0.2221)				(0.3985)
R^2	0.01	0.05	0.62	0.58	0.08	0.38	0.59	0.56
F statistic	4.71	9.52	51.55	26.99	2.67	11.47	21.84	10.28
(p-value)	(0.03)	(0.00)	(0.00)	(0.00)	(0.08)	(0.00)	(0.00)	(0.00)
First-stage estimates								
Import Exposure (UE)	0.1327†	0.1327†	0.1485†	0.0996†	0.1777†	0.1778†	0.1819†	0.1698†
	(0.0281)	(0.0279)	(0.0283)	(0.0301)	(0.0587)	(0.0599)	(0.0638)	(0.0518)
R^2	0.36	0.39	0.43	0.57	0.73	0.73	0.74	0.80
KP statistic	10.42	10.56	9.32	7.15	5.18	5.16	5.37	6.70
(p-value)	(0.00)	(0.00)	(0.00)	(0.01)	(0.02)	(0.02)	(0.02)	(0.01)

Notes: N = 104 (52 provinces x 2 time periods). Fixed effects regression (FE) include a dummy for the 2003-2007 period. All regression include a constant. Robust standard errors in parentheses. Statistical significance is indicated by † at 1%, ** at 5% and * at 10%.

We present the pooled and fixed effects IV estimates for different sets of control variables, where our dependent variable is the change in non-manufacturing employment as a share of working age population. The included control variables are identical to those on table 3 and 4 with the only difference that we use the initial share of non-manufacturing employment instead of initial share of manufacturing

employment. We find no robust evidence that import shocks to local manufacturing leads to substantial changes in the surrounding local labor market. The estimated import exposure coefficient from pooled IV is positive and significant in two out of four specifications (column 1 and 2). Nevertheless, the coefficient significance vanishes when we include additional explanatory variable other than the start of four year period share of non-manufacturing employment. From fixed effect IV estimates, the import coefficient is always negative but not statistically significant.

In table 7 we evaluate whether import competition in local manufacturing causes reallocation of workers across provinces. For this purpose we estimate several models for the growth rate of the working age population. Now, the only included control variable is the initial working age population as a share of total population. Again, we find no robust evidence that shocks to local manufacturing lead to substantial changes in working age population. Although the effect of import exposure is positive and highly significant from the pooled data models, when we control for province heterogeneity the coefficient on import exposure is not significance in any case. Autor *et al* (2010) suggest three possible causes for this lack of significant effect of trade exposure on population flows. First, import shocks effect on manufacturing employment are too small to affect local labour outcomes along provinces. Second, if good markets are well integrated at the national level, local labor markets fully adjust to import competition increases without any mobility response. In third place, the lack of population adjustment could be due to low geographical job mobility across provinces

In appendix table 2 and table 3 we analyze the effect of import exposure on the two components of the working age population: the labour force and the non-included in the labor force (NILF) population. We are unable to find evidence of robust effect from import shocks to these two components.

Table 7. Import exposure and change of working age population in Spain, 1999-2007:
Pooled and Fixed Effects, OLS and IV estimates
Dependent variable: Working age population growth rate (%)

Independent variable	Pooled				FE			
	OLS		IV		OLS		IV	
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Import Exposure	1.0650	2.1075**	4.2478**	5.7763†	0.2496	-0.1010	-0.8281	-2.3553
	(0.8811)	(0.8647)	(2.1580)	(2.3174)	(0.5181)	(0.7788)	(1.3904)	(2.5007)
Working-age pop.	-	-0.7300†	-	-0.9135†	-	-0.8213	-	-2.2113
		(0.1762)		(0.1822)		(1.1353)		(1.8686)
N	104	104	104	104	104	104	104	104
R^2	0.01	0.18	0.11	0.03	0.24	0.25	0.19	0.10
F statistic	1.46	10.08	3.80	12.56	8.58	6.46	7.36	6.47
(p-value)	(0.23)	(0.00)	(0.05)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)
First-stage estimates								
Import Exposure (UE)	-	-	0.1327†	0.1261†	-	-	0.1777†	0.1224**
			(0.0281)	(0.0281)			(0.0587)	(0.0541)
R^2	-	-	0.36	0.39	-	-	0.73	0.77
KP statistic	-	-	10.43	9.99	-	-	5.18	3.39
(p-value)			(0.00)	(0.00)			(0.02)	(0.07)

Notes: N = 104 (52 provinces x 2 time periods). Fixed effects regression (FE) include a dummy for the 2003-2007 period. All regression include a constant. Robust standard errors in parentheses. Statistical significance is indicated by † at 1%, ** at 5% and * at 10%.

Table 8 shows the pooled and fixed effects IV estimates for different sets of control variables, where our dependent variable is the change in unemployment as a share of working age population. The included control variables are identical to those on table 4 and 3 with the only difference that we use the initial share of unemployment instead of initial share of manufacturing employment. It is clear from the pooled data models, that the effect of import competition on unemployment is far from significant. From the fixed effects models, we find that the effect on employment is positive and significant. The point estimate on column 8, where the full set of controls is included, implies that a rise of 1,000 U.S. dollars per worker in a province's exposure to Chinese imports along a four-year period is associated with an increase in unemployment of approximately 2.7 percentage points of working age population. In this model, a higher share of college educated population predict a smaller decline in unemployment, while both, a higher share of foreign nationality population and women population predict a higher increase in a province unemployment.

Lastly, fixed effects IV estimates of the relationship between import exposure and unemployment by age group and educational level are reported in table 9. We present

results for three different sets of control variables; Panel A with no controls, Panel B with the initial share of unemployment, and Panel C which additionally controls for working age population growth. It can be noticed that import competition shocks from China mainly increases unemployment among non-college educated and young population (age 16 to 34).

Table 8. Import exposure and change in unemployment in Spain, 1999-2007:
Pooled IV and Fixed Effects IV estimates
Dependent variable: change in unemployment as a share of working age population (%)

Independent variable	Pooled IV				FE IV			
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Import Exposure	0.8790 (0.6739)	-0.4209 (0.6135)	-0.8765 (0.5938)	-0.7552 (0.6929)	-1.4876 (1.5263)	2.2507** (1.1333)	2.4317** (1.1193)	2.7443† (0.9577)
Unemployemnt	-	-0.5184† (0.0994)	-0.5321† (0.0973)	-0.7058† (0.1369)	-	-1.7273† (0.2272)	-1.7638† (0.2326)	-1.8872† (0.1839)
Work.-age pop. growth	-	-	0.0992† (0.0307)	0.0688 (0.0653)	-	-	0.1230 (0.1374)	-0.1156 (0.1479)
College-educated pop.	-	-	-	0.0433 (0.1110)	-	-	-	-0.9485** (0.4001)
Foreign-nationality pop	-	-	-	-0.0272 (0.1000)	-	-	-	0.3322† (0.1176)
Women population	-	-	-	0.3009 (0.2483)	-	-	-	0.5087* (0.2976)
Young population	-	-	-	0.3037 (0.1974)	-	-	-	0.0633 (0.1843)
N	104	104	104	104	104	104	104	104
R^2	0.01	0.41	0.45	0.51	0.08	0.75	0.75	0.81
F statistic	1.67	19.53	15.84	8.88	1.67	18.72	13.75	12.14
(p-value)	(0.20)	(0.00)	(0.00)	(0.00)	(0.20)	(0.00)	(0.00)	(0.00)
First-stage estimates								
Import Exposure (UE)	0.1327† (0.0281)	0.1203† (0.0279)	0.1240† (0.0297)	0.0954† (0.0256)	0.1777† (0.0587)	0.1678† (0.0616)	0.1726† (0.0654)	0.1699† (0.0509)
R^2	0.36	0.40	0.41	0.57	0.73	0.74	0.74	0.80
KP statistic	10.43	10.15	8.73	9.22	5.18	4.48	4.78	6.39
(p-value)	(0.00)	(0.00)	(0.00)	(0.00)	(0.02)	(0.03)	(0.03)	(0.01)

Notes: Fixed effects regression (FE) include a dummy for the 2003-2007 period. All regression include a constant. Robust standard errors in parentheses. Statistical significance is indicated by † at 1%, ** at 5% and * at 10%.

Table 9. Import exposure and change in unemployment in Spain by age and educational level, 1999-2007:
Fixed Effects IV estimates
Dependent variable: change in unemployment as a share of working age population (%)

	Age 16-34	Age 35-49	Age ≥ 50	College	Non-college
	(1)	(2)	(3)	(4)	(5)
A. No controls					
Import Exposure	-2.4771	-0.7341	-0.6223	-1.8979	-1.3936
	(1.5630)	(1.9697)	(0.7471)	(3.9625)	(1.6484)
R^2	0.08	0.01	0.07	0.04	0.07
F statistic	1.84	0.21	2.06	0.48	1.82
(p-value)	(0.17)	(0.81)	(0.14)	(0.62)	(0.17)
B. Unemployment					
Import Exposure	3.4126**	2.1498	0.3678	-1.2628	2.3357**
	(1.4724)	(1.5627)	(0.4884)	(2.6960)	(1.1317)
R^2	0.79	0.66	0.53	0.70	0.76
F statistic	39.32	20.16	10.41	28.02	18.11
(p-value)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)
C. Unem. and WEPg					
Import Exposure	3.8160**	2.2457	0.2849	-1.4224	2.3430**
	(1.5630)	(1.4471)	(0.4487)	(2.2219)	(1.0700)
R^2	0.78	0.67	0.55	0.75	0.76
F statistic	30.67	13.29	7.91	23.72	19.55
(p-value)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)

Notes: Fixed effects regression (FE) include a dummy for the 2003-2007 period. All regression include a constant. Robust standard errors in parentheses. Statistical significance is indicated by † at 1%, ** at 5% and * at 10%.

4. Conclusions.

This paper analyzes whether differences in the exposure to Chinese imports explain differences in labor market outcomes across Spanish provinces. Differences in the exposure to Chinese imports arise from the specialization of Spanish provinces: those provinces specialized in goods where imports from China have grown more are more suffer an impact on the labor market than provinces specialized in goods where imports from China have barely changed. Our results show that during the period 1999-2007 period, Spanish provinces more exposed to Chinese imports experienced a larger drop in manufacturing employment, and a larger increase in total unemployment. These results are robust to controls in the endogeneity of Chinese imports growth and simultaneity in labor and trade markets.

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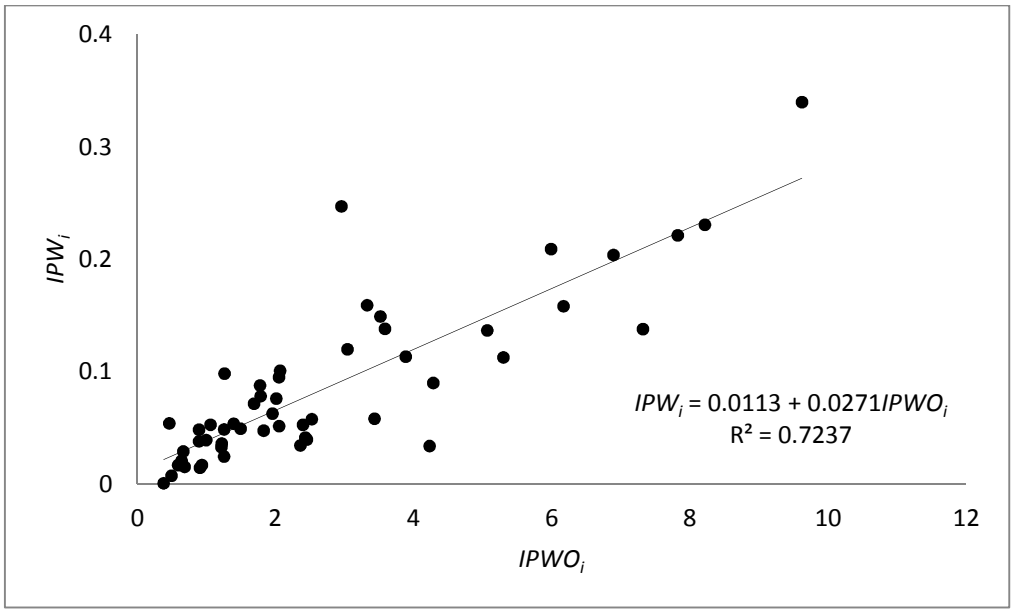
APPENDIX

Appendix Table 1. Imports exposure measures across largest Spanish provinces, 1999-2003 and 2003-2007.

	IPW_{it}				$IPWO_{it}$			
	1999-2003		2003-2007		1999-2003		2003-2007	
	value	rank	value	rank	value	rank	value	rank
Madrid	0.14	11	0.86	16	7.32	4	6.77	7
Barcelona	0.23	3	1.93	4	8.22	2	9.81	2
Valencia	0.14	12	1.05	14	5.07	9	5.04	12
Sevilla	0.04	40	0.58	29	1.22	38	1.67	37
Alicante	0.22	4	1.27	9	7.82	3	6.20	9
Málaga	0.03	42	0.36	40	4.23	11	1.53	39
Vizcaya	0.09	19	1.62	6	4.28	10	5.00	13
Cádiz	0.05	31	0.48	35	2.05	25	1.89	32
La Coruña	0.10	16	1.47	7	2.07	24	4.29	16
Asturias	0.04	36	0.86	18	2.43	21	2.72	25
Murcia	0.09	20	0.54	31	1.78	31	3.20	22
Pontevedra	0.05	35	0.78	23	1.83	29	2.67	26
Zaragoza	0.11	15	1.14	11	5.30	8	5.65	10
Granada	0.03	41	0.31	44	2.36	23	1.28	44
Las Palmas	0.02	46	0.22	47	0.64	48	1.25	45
Weighted mean	0.11	-	0.96	-	4.07	-	4.64	-

Notes: The table reports IPW_{it} and $IPWO_{it}$ values and rank order for the 15 provinces with largest population in 1995. The weighted mean is calculated for all 52 provinces using start of period population share as weights.

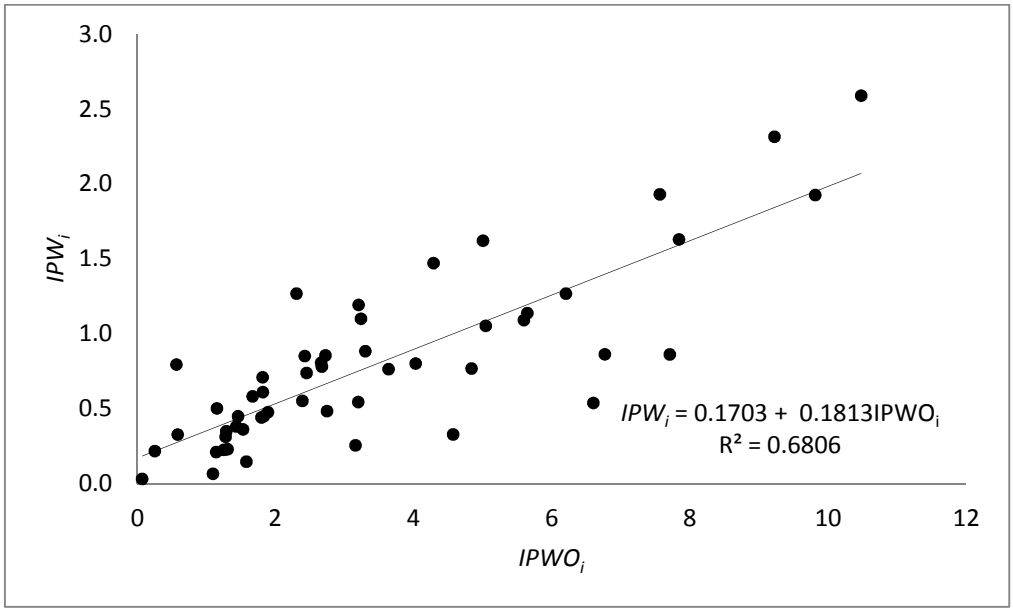
Appendix Figure 1. Dispersion graph of IPW_i and $IPWO_i$, 1999-2003.



Pearson's correlation coefficient = 0.85

Spearman's rank correlation coefficient = 0.81

Appendix Figure 2. Dispersion graph of IPW_i and $IPWO_i$, 2003-2007.



Pearson's correlation coefficient = 0.82

Spearman's rank correlation coefficient = 0.79

Appendix Table 2. Import exposure and change in labour force in Spain, 1999-2007: Pooled IV and Fixed Effects IV estimates
Dependent variable: change in labour force as a share of working age population (%)

Independent variable	Pooled IV			FE IV		
	(1)	(2)	(3)	(4)	(5)	(6)
Import Exposure	3.7737**	2.1088	1.4053	-4.0445*	-1.2046	-0.1434
	(1.7001)	(1.9410)	(1.0311)	(2.3460)	(1.9300)	(1.2369)
Labor force	-	0.2680†	-0.1970**	-	-1.1278†	-1.2412†
		(0.1065)	(0.0927)		(0.2058)	(0.1607)
Work.-age pop. growth	-	-	0.8457†	-	-	0.9366†
			(0.0730)			(0.1792)
N	104	104	104	104	104	104
R^2	0.01	0.13	0.71	0.08	0.54	0.76
F statistic	4.83	12.57	68.04	6.28	16.35	29.07
(p-value)	(0.03)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)
First-stage estimates						
Import Exposure (UE)	0.1327†	0.1187**	0.1208†	0.1777†	0.1643†	0.1683†
	(0.0281)	(0.0293)	(0.0278)	(0.0587)	(0.0601)	(0.0637)
R^2	0.36	0.38	0.40	0.73	0.74	0.74
KP statistic	10.43	10.12	10.61	5.18	4.67	4.89
(p-value)	(0.00)	(0.00)	(0.00)	(0.02)	(0.03)	(0.03)

Notes: N = 104 (42 provinces x 2 time periods). Fixed effects regression (FE) include a dummy for the 2003-2007 period. All regression include a constant. Robust standard errors in parentheses. Statistical significance is indicated by † at 1%, ** at 5% and * at 10%.

Appendix Table 3. Import exposure and change in NILF population in Spain, 1999-2007: Pooled IV and Fixed Effects IV estimates
Dependent variable: change in NILF population as a share of working age population (%)

Independent variable	Pooled IV			FE IV		
	(1)	(2)	(3)	(4)	(5)	(6)
Import Exposure	0.3334	-1.4103	-1.5411	0.4131	-1.9567	-1.9875
	(1.0285)	(1.1918)	(1.0280)	(0.9084)	(1.4067)	(1.3061)
NILF	-	-0.2872†	-0.2024**	-	-0.9108†	-0.9800†
		(0.0735)	(0.0926)		(0.3484)	(0.3161)
Work.-age pop. growth	-	-	0.1520**	-	-	-0.2307
			(0.0735)			(0.2252)
N	104	104	104	104	104	104
R^2	0.02	0.25	0.30	0.08	0.43	0.45
F statistic	0.10	10.48	10.35	6.28	6.19	4.46
(p-value)	(0.75)	(0.00)	(0.00)	(0.00)	(0.00)	(0.01)
First-stage estimates						
Import Exposure (UE)	0.1327†	0.1213*	0.1232†	0.3347†	0.2313†	0.2339†
	(0.0281)	(0.0077)	(0.0281)	(0.0730)	(0.0776)	(0.0800)
R^2	0.36	0.38	0.39	0.37	0.51	0.57
KP statistic	10.43	10.28	10.64	7.94	5.90	5.94
(p-value)	(0.00)	(0.00)	(0.00)	(0.01)	(0.01)	(0.01)

Notes: N = 104 (42 provinces x 2 time periods). Fixed effects regression (FE) include a dummy for the 2003-2007 period. All regression include a constant. Robust standard errors in parentheses. Statistical significance is indicated by † at 1%, ** at 5% and * at 10%.

Appendix Table 4. Variable description and data source.

Variable	Description	Source
Import Exposure	Index of import exposure (see section 4).	EPA (INE) Comtrade (UN)
Manufacturing employment	Manufacturing employment as a share of total employment (%). We classified two-digit CNAE93 activities from 10 to 41 as manufacturing activities.	EPA (INE)
Non-manufacturing employment	Non-manufacturing employment as a share of total employment (%).	EPA (INE)
Working age population growth	Working age population growth rate (%).	EPA (INE)
College-educated pop.	Working age population that has a college education as a share of working age population (%).	EPA (INE)
Foreign-nationality pop.	Working age population that has foreign nationality as a share of total working age population (%). All individuals with nationality in high-income countries (World Bank classification) are not included as foreign nationality population.	EPA (INE)
Women population	Working age women population as a share of working age population (%).	EPA (INE)
Young population	Working age population between age 16 and 24 as a share of total working age population (%).	EPA (INE)
Working-age population	Working age population as a share of total population (%).	EPA (INE)
Unemployment	Unemployment as a share of working age population (%).	EPA (INE)
Labor force	Population employed and unemployed as a share of working age population (%).	EPA (INE)
NILF	Not included in the labor force population as a share of working age population (%).	EPA (INE)