

Immigration and Firm Performance: a city-level approach

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ABSTRACT: This article analyses the effect of immigration flows on the growth and efficiency of manufacturing firms in Spanish cities. While most studies were focusing on the effect immigrants have on labour markets at an aggregate level, here, we argue that the impact of immigration on firm performance should not only be considered in terms of the labour market, but also in terms of how city's amenities can affect the performance of firms. Implementing a panel data methodology, we show that the immigrants' increasing pressure has a positive effect on labour productivity and wages and a negative effect on the job evolution of these manufacturing firms. In addition, both small and new firms are more sensitive to the pressures of immigrant inflow, while foreign market oriented firms report higher productivity levels and a less marked impact of immigration than their counterparts. We also present a set of instruments to control for endogeneity. It allows us to confirm the effect of local immigration flows on the performance of manufacturing firms.

JEL classification: L25, R12.

Key words: Firm growth, firm location, regional effects.

Inmigración y comportamiento empresarial: una aproximación a escala de ciudad

RESUMEN: Este artículo analiza el efecto de los flujos de la inmigración sobre el crecimiento y sobre la eficiencia de las empresas industriales en ciudades españolas. Mientras que la mayoría de los estudios se centran en el efecto de los inmigrantes sobre los mercados de trabajo a una escala agregada, aquí sostenemos que el impacto de

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la inmigración en el funcionamiento de la empresa debe ser considerado, no sólo en términos de mercado de trabajo, sino también en términos de cómo las características de la ciudad pueden afectar el funcionamiento de las empresas. A partir de una metodología de datos de panel, demostramos que la presión cada vez mayor de los inmigrantes tiene un efecto positivo sobre la productividad del trabajo y los salarios, y un efecto negativo sobre la evolución del trabajo de estas empresas industriales. Además, las pequeñas y nuevas empresas son más sensibles a las presiones de la afluencia de inmigrantes, mientras que las empresas orientadas al comercio internacional registran niveles más altos de productividad y un impacto menos profundo de la inmigración que sus contrapartes. También presentamos un conjunto de instrumentos para controlar la endogeneidad. Esto permite confirmar el efecto de los flujos locales de inmigración sobre el funcionamiento de las empresas industriales.

Clasificación JEL: L25, R12.

Palabras clave: Crecimiento empresarial, localización empresarial, efectos regionales.

1. Introduction

Massive immigration flows increase the supply of workers and alter the skill composition of local labour markets. A large body of economic literature has tried to determine the impact of immigration on the equilibrium on the labour market and, in particular, its effects on wages and employment in host countries (Borjas, 1989, 1994; Card, 2009). In general, these empirical studies conclude that immigrants are complementary to native workers and the increase in the available workforce has little effect on wages and income. Usually this literature adopts a labour market aggregate perspective, but international immigration flows are unequally distributed among countries and cities.

This paper analyses the consequences of immigrant inflows into manufacturing firms in Spanish cities. In particular, we are interested in determining the effects of immigration on jobs, wages and productivity at a firm level. Spain is an exceptional case in international immigration, since the foreign-born population has increased considerably over the last decade. However, the distribution of immigrants is not homogeneous; there is a high concentration in the most dynamic regions. These regions experience a significant transformation in the social dimension –religions, languages, cultures– which affects the local economy in terms of the diversity of skills and capabilities among its workforce. Today, many Spanish cities have a high proportion of immigrants and have become veritable ‘melting pots’ of peoples and cultures.

The increasing role of international migration in developed countries has given rise to a body of wide-ranging and interesting theoretical and empirical research (Dustman and Glitz, 2005). Economic literature has focused mainly on the analysis of the economic impact of immigration on the labour market, emphasizing the wage differential and its reduction over time (Borjas, 1989, 2006; Ottaviano and Peri,

2006). A further wave of literature analyses the human capital effect of international immigration, in particular examining its effect on the countries of origin, and portraying it as an engine that drives the leading economies (Torben, 2007). Finally, a third group of research focuses on immigration policy in host countries (Winter and Zweimüller, 1996; Lundborg and Segerstrom, 2002).

Previous empirical studies have suggested that immigrant populations generally arrive with few skills and considerable handicaps, but their economic opportunities improve rapidly over time. In general, immigrants complement native workers (Borjas, 1994, Card, 2009). As we will observe in the case of Spain, low-skilled workers predominate among the immigrant population, while only a fraction of new immigrants are skilled workers with prior experience in manufacturing industries.

In general, the empirical literature adopts an aggregate perspective. But if we observe the location patterns of immigrants we find that new immigrants are concentrated in cities with more job opportunities and more developed networks of immigrants. When this fact is included in the analysis, the need to analyse firms' responses to immigration flows becomes apparent.

How do firms respond to immigration in terms of employment, wages and productivity? Are there any differences that can be attributed to the age or size of a firm? Does external activity condition firm's response? This article aims to identify the effect of immigrant populations on growth. Our database compiles information on Spanish manufacturing firms located in cities with more than 1,000 inhabitants during the period 2001-2005. Our study emphasises the response of firms to immigration from three different dimensions (employment, wages and productivity).

There are three main contributions to consider. First, we analyse the effect of immigration flows. The arrival of new contingents has increased the labour force and firms may have modified their incentives to invest. Second, we consider the fact that the arrival of new immigrants has also put pressure on rental prices and has changed the appearance of cities. Third, our analysis adopts a city and firm approach, in contrast with previous studies on immigration that tend to adopt a macroeconomic or individual approach.

The rest of the paper is organized as follows: the second section reviews recent literature examining the impact of immigration flows. The third section presents the theoretical foundations for our analysis of the effect of immigration on firm performance with a derivation of Roback's (1982) model. This model interprets local differences in wages and rents in relation to the pressure of immigrants on the labour market and local factors. The fourth section sets out the characteristics of database. The fifth section presents our main hypothesis supporting the subsequent empirical analysis. In the sixth section, we report the main empirical results obtained and the last section presents our main conclusions.

2. Immigration and its effects on firm performance

The earth is not flat, but barriers to mobility have diminished and international immigration has appeared as one of the main characteristics of the 21st century. Until the

seventies, Spain was primarily a country of origin and recorded flows of internal migration between regions. However, in the last decade of the 20th century, Spain became one of the main host countries for international immigration. Because of this unusual circumstance, the inflow migration pattern in Spain today is clearly an interesting case to observe and study.

The available data point out the intensity of the arrival of immigrants to Spain in recent years. Immigrants were forming only 1.6% of Spanish population in 1998, but then their fraction increased to 7.0% in 2004 and rose to 11.3% in 2008¹.

In a short period, the foreign population in Spain has increased significantly. There were 637,085 immigrants in 1998 and this number increased to 5,220,577 in 2008 (see yearly evolution in Table A-1). The recent wave of international immigration in Spain is intense and has significant social and economic effects.

The literature has widely studied the impact of immigrants on the labour market of the host countries. The empirical results can be summarized as follows: flows of immigrants have a slightly negative impact on wages in the host country in the short term (Borjas, 2003)², but native workers have the same labour opportunities because '*immigrants do jobs that natives do not want to do*' (Borjas, 1994). Native workers also obtain lower salaries in labour markets with a high percentage of immigrants. However, in those markets immigrants find fewer labour opportunities than native workers (Borjas, 2006). In general, immigrants are less skilled than natives and their salaries are lower, but over time their salaries grow faster than those of native workers (Borjas, 1994). And finally, after one or two decades immigrants attain the same wage level as native workers with the same skills.

Peri and Sparber (2008) analyse the effects of immigration on the wages of native workers with low education and job training levels. They found two critical factors. The first is that immigrants choose jobs similar to those of native workers or choose different jobs due to inherent comparative advantages between native and foreign-born workers in performing particular tasks. The second is whether native workers respond to immigration and adjust their occupational choices to shield themselves from competition with immigrant labour. Immigrants with little education or job training have a comparative advantage in manual and physical tasks, while natives of similar levels of education have a comparative advantage in communication and language-intensive jobs. When immigration generates large increases in manual labour supply, the relative compensation paid for communication skills rises, thereby rewarding natives who progressively move towards language-intensive jobs.

¹ The Spanish Statistics Institute considers an immigrant to be a foreign-born person who has lived in Spain for one year or more and who intends to live in Spain for at least one year. It does not include minors of 16 years of age or younger, foreigners that were born in Spain, or Spanish citizens who were not born in Spain.

² During the period 1980-2000 in the United States, empirical evidence suggests that an increase in immigration of 10 percent had the following effects (Borjas, 2006): it reduced the wages of native workers in that same skill group by 3.5%; it reduced the wages of native workers who had the same education but who differed in their experience by 0.7%; and it increased the wages of native workers with different educational attainment by 0.5%. In the short run, immigration reduces the earnings of native workers by 3.3%; but in the long run, it increases them by 0.1%.

In general, flows of immigrants are a complement to some groups of native workers and produce an increase in low-skilled workers (Quispe and Zavodny, 2002), a moderating effect on wage growth (Borjas, 2003, 2006), an increasing asymmetry in the levels of productivity and efficiency across firms and across jobs and a positive impact on economic growth. Thus, these studies adopt an aggregate perspective from the labour market and do not approach the diversity of the reality.

In fact, the territorial dimension has been neglected by several different fields studying industrial organisation, and only in recent decades some interest in analysis of its effects appeared. On this note, the majority of studies analysing firm performance have focused almost exclusively on firm variables (Fotopoulos and Louri, 2000). This lack of interest in territory is more pronounced in the analysis of firm performance (Hoogstra and van Dijk, 2004). However, the location of a firm influences its behaviour and, as a consequence, influences post-entry firm performance and firm survival. Although interest in the effect of territorial variables on firm performance has increased over the last decade, there are still crucial aspects, which need further study such as the effect of immigration on firm performance.

The impact of the increasing number of foreign-born workers on the labour market is intense and affects firm performance. The rapid economic growth experienced in recent decades is due to an increase in the number of workers. However, productivity has remained unchanged. We wonder whether this increase in the number of workers in the labour market has affected firms' decisions regarding growth via productivity versus the employment of more workers.

3. Theoretical arguments

Recent empirical papers have observed the economic implications of immigration at the metropolitan, regional and local levels (Grossman, 1982; Borjas, 1987). Some papers report a negative correlation between the rate of immigration and wages across cities and suggest that immigrants reduce the opportunities of native workers in the labour market. However, recent research has found no correlation between immigration and wage levels in cities, evidence that immigration has no effect on local labour markets. Borjas (2006) offers two interpretations of such results. On the one hand, immigrants may not be randomly distributed across labour markets. On the other hand, the pressure of immigrants on local labour markets may produce a displacement effect for native workers, especially for natives that compete with immigrants for the same jobs.

However, the effects of immigration should not be observed only from a macroeconomic perspective but also at microeconomic level, i.e., at a firm level, so as to take into account the different pressures caused by the arrival of immigrants to the cities. Analysis of the effects of immigration acquires much more interest when a territorial, rather than a macroeconomic, approach is adopted.

In order to analyse the effects of immigration on host cities we turn to Roback's (1982) model, which explains local differences in wages and rents as a result of differences in amenities. The formalisation of the idea that local differences in wages and

rents compensate people and businesses for differences in desirable local amenities is attributable to Jennifer Roback (1982) and Rosen's (1974) seminal work. Their studies were pioneering in offering a framework to quantify hedonic prices for certain urban characteristics.

Roback's model offers a hedonic analysis of cities and several attempts to develop quality-of-life indexes for cities or metropolitan areas. Of particular note for our purposes is the analysis of the effects of immigration on wages and housing prices in host cities. Today a large body of urban literature highlights the importance of amenities in retaining workers and firms in cities (Florida, 2000a, 2000b, 2000c; Gyourko et al, 1999). In general, these studies suggest that amenities have not yet been fully capitalized into wages or rents. Here we would like to provide a simple theoretical framework for immigration flows, within which rents, wages and city population can be interpreted as implying that immigration to larger cities is driven by productive amenities (Krupka and Donaldson, 2007)³.

Suppose we have an economy with a large number of cities (M) where businesses and workers incur no costs for relocation to other cities. Workers may choose to look for work in the city with the characteristics that will provide the highest level of satisfaction for them. The vector of characteristics only varies in terms of the level of amenities (s) in a continuous manner from s , $s \in (1...n)$. The residents consume and produce a composite commodity, X , whose price is fixed by global markets.

Roback's (1982) framework presents a simple general equilibrium model in which both capital and labour are assumed to be completely mobile across cities. In this context the cost of changing residences or firm location is equal to zero, but intercity commuting costs are high and we assume that workers find jobs in their cities. In a state of equilibrium in terms of the distribution of workers among the cities and firms, wage and rent differences can be characterized as functions of the amenities in the city (s_i). Given a level of s_i in their city, workers choose quantities of X —the composite commodity consumed- and l^c —the residential land consumed- to satisfy a budget constraint,

$$\text{Max } U(x, l^c; s_i) \quad \text{subject to} \quad w + I = x + l^c r$$

Where w is an individual wage, I is a non labour income, and r is a house rent. From this equation we can easily derive the indirect utility function, V . In conditions of market equilibrium, the utility function for workers is given by the following formula,

$$V(w, r, s_i) = \alpha$$

Where α is a constant and wages and rents differ among cities in order that the workers' utility function is the same in all M cities. The implication of this adjustment is that workers have no incentive to move from one city to another. This in turn

³ The literature classifies amenities in three categories: productive, non-productive and unproductive. Productive amenities increase utility and business profits; non-productive amenities increase utility but do not affect firm profits, and unproductive amenities increase utility but reduce profits.

implies, for example, a higher level of the s_1 characteristics of the city, but also lower wages so that the level of utility remains the same. The model also assumes that partial derivatives of the utility function, as the latter relates to wages and city amenities, are positive, and that the partial derivatives related to rent are negative. So,

$$V_w \geq 0, \quad V_r \leq 0, \quad V_{s_i} \geq 0$$

Firms located in a particular city produce commodities according to a production function with constant returns to scale, $X = f(l^p, N; s_i)$, where l^p is the land used in production, N is the total number of the workers in the city and s_i is the local amenities. The problem that each firm located in city M faces is to minimize costs subject to the production function. Under these conditions, firms located in different cities are limited to adjusting real salaries to comply with this condition. So,

$$C = C(w, r, s_i) = 1, \text{ where } Cw \geq 0 \text{ and } Cr \geq 0$$

As usual the unit cost function increases in both factor prices, but the effect of local amenities is more ambiguous. Amenities can either be productive (cost reducing) or unproductive (cost enhancing), and when the nature and the dimension of local amenities change, the effect on production costs is indeterminate in sign.

In a state of equilibrium, workers and firms have no incentive to relocate to another city. A spatial equilibrium means that the workers cannot increase their utility and businesses cannot reduce costs by relocating. Equilibrium of real salaries is obtained through an equality of utility among workers and an equal per unit cost of production in firms across all cities. The real salary is determined by the interaction of the conditions for equilibrium in such way that the economic effect of the different levels of s_i in M cities is seen in the differences in real salary between the cities. In equilibrium, we have:

$$C(w, r, s_i) = 1 \quad \text{and} \quad U^0 = V^0 = V(w, r, s_i)$$

Notice that real wages and rents are determined by the interaction of the equilibrium conditions of the two sides of the market —land and labour markets—. Wages and rents can be solved as functions of city amenities, given a level of α . The result is that in cities with a higher (lower) level of the city variable s_i real wages are lower (higher). In this model the factor prices offer a balance between the location preferences of firms and those of workers. Firms prefer locations with low rent levels and low wages, while workers may accept lower real wages in cities with high rents as long as the city offers more amenities that serve to increase their welfare.

According to the model above, the impact of massive immigrant inflows on local factor prices, labour market and amenities may vary. These situations are a particular focus of the empirical work that we undertake below. In essence, massive immigration affects local prices and the evolution of the firm in three main ways,

- a) Immigration can generate productive amenities that increase utility and firm profits. Here, we expect a pressure on rents and a positive impact on real wages, which in terms of the firm dynamics, results in an increase in employ-

- ment in the location, an increase in the level of heterogeneity of efficiency between firms and an ambiguous effect on labour productivity.
- b) Immigration can generate non-productive amenities in the city that increase utility but which do not affect business profits. Here, we expect a rise in housing rents and a negative effect on wages that lead to an increase in employment and have a negative impact on labour productivity.
 - c) Finally, if immigration generates non-productive amenities in the city that increase utility but which cause business profits to fall, then we can expect an ambiguous effect on rents and a reduction in real wages that lead to a decrease in the number of local workers and which have a negative impact on labour productivity.

If a host city receives massive immigration flows, then it will be affected in several ways. On the one hand, immigration flows lead to an increase in total population, affect local factor prices related to housing rentals and produce an increase in the local labour supply. Rising immigrant populations and productive amenities that positively affect wages increase housing demand, provide incentives for the real estate sector and increase rents (Glaeser and Gyourko, 2005). On the other hand, immigration flows produce disamenities and amenities in the city. The former are related to the increasing cost of housing and changes in the composition of the population. The latter are related to linguistic and cultural diversity, which positively affects the creativity and initiative of the native population. The net effect of immigration may be ambiguous; however, the recent literature stresses that the positive aspects outweigh the negative (Ottaviano and Peri, 2005).

Intense pressure from immigrant workers on a local labour market may displace native workers with more experience, and force them to move to new areas. The presence of significantly large groups of immigrants will, in the short run, lead to salary inequalities and less pressure to acquire more efficient technologies. This results in a reduction of the capital to work ratio and in productivity in areas that demand workers with fewer qualifications. Massive immigration flows in cities tend to displace native workers to industries that need workers with more skills and inter-relational capabilities, and to displace native workers to manufacturing industries. Furthermore, technological changes in manufacturing firms tend to eliminate unskilled or semi-skilled jobs, while new jobs being created require the workers to have technological experience (Lewis, 2005). In addition, the migration of skilled workers is an important factor of generating interregional spillovers and facilitating regional learning effects (Faggian and McCann, 2006).

4. Data

4.1. The database

The database we use in our analysis is the Spanish Mercantile Registry for the years 2001 to 2006. The data include all manufacturing firms that are required to declare the number of employees on their books. What is crucial to our analysis is that we are

able to identify where firms are located and, moreover, we can obtain additional information about these firms. Since the aim of this paper is to analyse the response of firms at city and firm levels, our database constitutes a useful tool for analysing the Spanish case.

The data related to population and immigration at city level are provided by the Spanish Statistics Institute obtained from the website of the *Anuario Económico de España* (2007). This information has been cross-referenced with the information on firms.

The selection process for the information was the following. First, we considered only those firms that were in our database for at least three years, in order to avoid the appearance of firms that had entered to the market as part of a financial strategy. We considered only firms with more than three employees and we excluded all firms that were outliers. Specifically, we did not include any firms where the average wage was more than 80 thousand euros, or any with negative investment, negative productivity, or where the productivity per worker exceeded 300 thousand euros per worker. Likewise firms with excessive growth ratios in terms of employment, productivity and wages were also excluded. Finally, the total number of firms considered was 43,115 and the number of observations was 119,564.

4.2. Spanish immigration evidence

Immigrant inflows from developing countries to Spain were intense in the period from 1998 to 2008. In this decade, the majority of immigrants had few qualifications and difficulties speaking Spanish, and came from underdeveloped countries in Africa, South America, Asia and East European countries. Recently, family reunification processes have led to the migration of wives/husbands, children and, less often, parents. The main consequence of this large migration has been a rise in the population of Spain, although there is an unequal distribution across regions.

Observing the distribution of immigrants across Spanish regions, we find large differences between rural and urban regions. According to the municipal registry, as of the 1st January 2008 in Spain there was a foreign population of 5,220,577 inhabitants, or 11.3% of the total population. The distribution of immigrants is heterogeneous among Spanish regions. Regions with an immigrant share exceeding the Spanish average form two different groups. In the first group, we have two sets of islands where the presence of immigrants is high due to the fact that they are traditional destinations for retired immigrants from Northern Europe. In the Balearic Islands, immigrants make up 20.8% of the population and in the Canary Islands, 13.6%. In the second group we find regions such as Madrid, which are among the most dynamic and economically developed areas of the Spanish economy. These areas include the Mediterranean arc (Murcia - 15.7%, Valencia- 16.7%, and Catalonia - 14.9%) and the Corridor of the Ebro (La Rioja - 13.7%, and Aragón - 11.6%). In our analysis, we only considered regions on the mainland peninsula. In general, the location patterns of immigrants are related to the economic dynamism and the manufacturing specialization of the regions, with the exception of Navarra (10.4%) and the Basque Country (5.4%), which have low percentages of immigrants.

Apart from the regional distribution, another interesting way to examine the phenomenon of immigration in a territory is to analyse the location of immigrants by city size. Table 1 shows the distribution of population and immigrants according to whether the city belongs to a region with a higher or lower proportion than the average of immigrants. In order to demonstrate the large influx of immigrants in numerical terms, we show information from 2001 to 2006. We found considerable differences in immigration rates between cities located in industrialized and those in more rural regions. For example, in the first group the share of immigrants is high (Madrid, 14.0%; Barcelona, 15.2% and Valencia, 12.1%), while in less industrialized regions the presence of immigrants is more scarce (Seville, 3.5%; Valladolid, 4.3% and Vigo, 3.8%). Here, the case of the Basque Country is worth mentioning, as it is a dynamic, industrialized region with low immigration rates (Bilbao, 5.5%; Vitoria, 6.3% and Donostia, 4.5%)⁴.

Table 1 shows that of the 1,992 municipalities, the percentage of immigrants was 1.71%, while in 2006 this percentage had increased to 5.06%. The total growth of the population during this period was 5.35%, while the increase in the percentage of immigrants was 211.15%. In addition, the percentage of immigrants in 2001 was 4.64%, while in 2006 it had increased to 13.12%. The total growth rate of population during the period was 12.60% while the growth rate of immigrants was 218.14%.

Thus, three different patterns describing the flow of population to Spanish cities emerge. First, population growth in cities with fewer than 5,000 inhabitants was negative. Second, for cities with between 20,000 and 99,999 inhabitants the growth rate in terms of population and immigrants was higher than in larger or smaller cities. Third, there is an inverse U-shaped relationship between city size and percentage of immigrants. This is the result of the capacity of large metropolitan areas to attract young, highly-qualified population that can compensate for the large number of immigrants.

When immigrants settle in a country they do not distribute themselves homogeneously throughout the territory. Indeed, immigrants are heterogeneous groups made up of individuals that are motivated to uproot themselves for different reasons; some wish to leave a place behind, others wish to be somewhere new. Of particular interest here are data that distinguish between emigration flows from countries with higher or lower income levels than those of the country of destination. According to the municipal registry office, as of the 1st January 2008, 18.4% of immigrants came from countries with higher income levels (the UK, 6.7%; Germany, 3.5%; Italy, 3.0% and France, 2.2%) while the remaining 71.6% came from less developed countries (Rumania, 14.0%; Morocco, 12.3%; Ecuador, 8.0% and Colombia, 5.4%).

Of equal interest is a determination of the main sectors of activity that employ foreign-born immigrants. In general, men find largely permanent jobs in the construction, commercial and tourist sectors, while women work in domestic service, and less frequently, in the tourist and commercial sectors. The manufacturing sector is an option for a smaller number of immigrants. According to the *Encuesta de Inmigración* (immigration census) in 2007, a total of 2,269,092 foreign-born immigrants have jobs. The sectors

⁴ Anuario Económico de España, 2007.

Table 1. Immigrant location according to city population and regional rates of immigration

	Regions with low relative immigrants rate								Growth (%) Population immigration	
	2001				2006					
	N	Total Population	Total Immigrants	%	N	Total Population	Total Immigrants	%		
More than 100000 inhab.	28	6,155,386	99,485	1.62	28	6,330,312	304,294	4.81	2.84	205.87
Between 20000-99999 inhab.	119	4,752,229	107,603	2.26	136	5,507,090	363,515	6.60	15.88	237.83
Between 5000-19999 inhab.	489	4,652,386	72,267	1.55	508	4,797,373	201,328	4.20	3.12	178.59
Fewer than 5000 inhabitants	1,356	3,096,937	40,022	1.29	1,320	3,020,441	124,592	4.12	-2.47	211.31
Total	1,992	18,656,938	319,377	1.71	1,992	19,655,216	993,729	5.06	5.35	211.15
	Regions with high relative immigrants rate								Growth (%) (%) Po- pulation	
	2001				2006					
	N	Total Population	Total Immigrants	%	N	Total Population	Total Immigrants	%		
More than 100000 inhab.	24	9,412,904	421,629	4.48	27	10,462,391	1,375,075	13.14	11.15	226.13
Between 20000-99999 inhab.	116	4,461,951	222,584	4.99	138	5,413,831	760,313	14.04	21.33	241.58
Between 5000-19999 inhab.	289	2,861,338	145,147	5.07	318	3,185,158	404,158	12.69	11.32	178.45
Fewer than 5000 inhabitants	649	1,381,134	51,748	3.75	595	1,339,320	136,383	10.18	-3.03	163.55
Total	1,078	18,117,327	841,108	4.64	1,078	20,400,700	2,675,929	13.12	12.60	218.14

Note: Regions with low relative immigration rates: Andalucía, Asturias, Cantabria, Castilla y León, Castilla-La Mancha, Extremadura, Galicia, Navarra and Basque Country. Regions with high relative immigration rates: Madrid, Murcia, Valencia, Catalonia, La Rioja and Aragón.

Sources: Spanish Statistics Institute (includes those municipalities with more than 1,000 inhabitants)

with the highest percentages of immigrants are construction (19.3%), the hotel and catering industry (13.1%), the commercial sector (12.6%) and manufacturing (11.0%). In 2007, Spanish manufacturers employed 249,857 immigrants. The *Encuesta de Inmigración* offers information about the work immigrants performed in their country of origin. In Spanish manufacturing industry, 44.3% of immigrants have worked previously in manufacturing jobs in their countries of origin and 55.7% have had work experience in other sectors (agriculture - 14.1%, construction - 8.6%, the hotel and catering industry - 7.4% and the commercial sector - 6.7%). The lack of experience and qualifications of immigrant workers increases the costs of adjustment and adaptation in manufacturing jobs. This situation hinders job efficiency and lowers job productivity.

5. Econometric methodology and variables

5.1. Econometric methodology

In keeping with the main premise underlying Roback's model, we propose three equations for analysing the effects of immigration on a firm's performance. Thus, our main purpose is to analyse the impact of immigration on the dynamics of the firm. However, we also analyse this impact on levels (Tables A.2 and A.3) and we obtain similar results. Since our main purpose is to analyse the response of firms to the percentage of immigration, we use Gibrat's Law, which assumes that the firm growth ($g_{i,t}$) of firm "i" in period "t" is independent of firm size [$\ln(S_{it})$]:

$$g_{i,t} = \alpha + \beta_1 \ln(S_{i,t-1}) + u_{i,t}$$

where size is measured in number of employees. Since some firms are more likely to be efficiently organized because of industry-specific differences in fixed costs or because they are located in certain regions with access to specialised raw materials, we include firm-specific variables and territorial variables that influence firm behaviour, and obtain the following equation:

$$g_{i,t} = \alpha + \beta_1 \ln(S_{i,t-1}) + \beta_2 \ln(Age_{i,t}) + \beta_3 Dens_{i,t} + \beta_4 Immig_{i,t} + u_{i,t} \quad [1]$$

Where $g_{i,t}$ is the dependent variable calculated as the difference between firm size "i" in year t and period $t-1$, $\ln(S_{i,t-1})$ is firm size measured in number of employees, $\ln(Age_{i,t})$ is firm age, $Dens_{i,t}$ is the city density, $Immig_{i,t}$ is the share of immigrants and $u_{i,t}$ is an error term.

Departing from Gibrat's Law (Equation 1), in order to analyse whether flows of immigration in each Spanish municipality influence patterns of firm growth in terms of employees (Equation 2), wages (Equation 3) and productivity (Equation 4) we calculate the following equations:

$$\begin{aligned} growthE_{i,t} &= \ln(E_{i,t}) - \ln(E_{i,t-1}) \\ &= \alpha + \beta_1 \ln(S_{i,t-1}) + \beta_2 \ln(Age_{i,t}) + \beta_3 Dens_{i,t} + \beta_4 Immig_{i,t} + u_{i,t} \end{aligned} \quad [2]$$

$$growthW_{i,t} = \ln(W_{i,t}) - \ln(W_{i,t-1}) \quad [3]$$

$$= \alpha + \beta_1 \ln(S_{i,t-1}) + \beta_2 \ln(Age_{i,t}) + \beta_3 Dens_{i,t} + \beta_4 Im\,mig_{i,t} + u_{i,t}$$

$$growthLP_{i,t} = \ln(LP_{i,t}) - \ln(LP_{i,t-1}) \quad [4]$$

$$= \alpha + \beta_1 \ln(S_{i,t-1}) + \beta_2 \ln(Age_{i,t}) + \beta_3 Dens_{i,t} + \beta_4 Im\,mig_{i,t} + u_{i,t}$$

In addition, these equations are estimated for both small and new firms and according to the external activity of firms.

Our econometric methodology involved the application of panel data with fixed effects (GLS, Generalised Least Squares) to control for individual characteristics that may affect firm performance. Hausman tests were performed to confirm its suitability for these estimations.

The variables applied were the following:

<i>Variables</i>	<i>Description</i>
Dependent variable	
<i>growthE_{i,t}</i>	Log difference of employees (E)
<i>growthW_{i,t}</i>	Log difference of wages (W)
<i>growthLP_{i,t}</i>	Log difference of labour productivity (LP)
Explanatory variables	
$\ln(S_{i,t})$	Log firm size measured in number of employees
$\ln(Age_{i,t})$	Log firm age
Territorial variables	
<i>Dens_{i,t}</i>	Density of population where the firm locates
<i>Immigration_{i,t}</i>	Share of immigrants in the municipality

Source: authors' own.

The relationship between firm growth and firm size measured in terms of the number of workers allows us to conduct our analysis using Gibrat's Law, which assumes that firm growth follows a random path. However, a large body of empirical literature reports a negative relationship and, thus, refutes this hypothesis (for Spain, see Fariñas and Moreno, 2000; Peña, 2004; Calvo, 2006; Teruel, 2009). Two factors explain this negative relationship. First, new firms tend to be smaller than those that have been operating for a longer time, and so are unable to exploit scale economies in the sector. Second, the literature points out the existence of a minimum efficient size. Thus, firm growth should favour the likelihood of a firm's survival.

Firm age is equivalent to market experience (Jovanovic, 1982). Although, in general, there is a negative relationship between firm growth and age, a diversity of results are, in fact, to be found. On the one hand, new firms are usually small and seek to grow to achieve the minimum efficient size. On the other hand, these new firms suffer from a lack of experience in the market and are unaware of their level of efficiency. Cabral and Mata (2003) report that new firms present more asymmetric distri-

bution, which approaches normality over time. According to these authors, such differences reflect the financial restrictions which new firms have to contend with. However, Fagiolo and Luzzi (2006) failed to find empirical evidence of greater financial constraints among new firms.

Keeble and Walker (1994) argue that population density represents the existence of agglomeration economies or diseconomies. These can be related to labour costs, knowledge spillovers, market demand, accessibility and congestion. Population density can have two different effects on a firm's performance. On the one hand, it may have a positive impact thanks to the effects of a competitive environment and because of the amenities that are available in culturally diverse cities⁵. But, on the other hand, cities with high population densities may act to eliminate negative impacts on firm performance, if firms do not benefit in some other way. Higher wages, congestion problems and higher land prices are among the drawbacks a firm faces if choosing to locate in a densely populated city. Recently, Duranton and Puga (2001) reported a positive relationship between population and location when firms are knowledge intensive and use highly skilled workers, while firms which are land intensive and based on scale economies tend to locate in less densely populated cities⁶.

Here, we considered the number of immigrants as a proportion of the total population. There is a wide body of evidence suggesting that immigrants are unskilled and occupy jobs with low levels of productivity. Kim (2007) considers the share of foreign-born population $[FB/(FB+NB)]$ to be a useful measure of the relative supply of unskilled to skilled workers (L/H). Some authors, such as Salerian, (2006) propose that the arrival of immigrants has an effect on labour skills. Skilled workers are more productive and, thus, are paid higher wages than unskilled workers. As a consequence, the arrival of immigrants negatively affects average wages, productivity and skill levels. However, Ottaviano and Peri (2005, 2006) reported a positive impact of immigrants on wages and employment. This positive impact occurs via productivity, since a higher number of low-skilled immigrants implies an increase in skilled workers, which has a compensating effect on the productivity average. We should highlight that we are considering the effect of the share of immigrants in the city where the firm is, but we are not focusing in the effect of cities in the surroundings.

Whether there is labour displacement or compensation in the labour market, it is unlikely that the percentage of immigrants in this market is directly affected. However, the foreign-born population rate is subject to two significant sources of measurement error: (1) a considerable number of foreign-born workers in manufacturing in-

⁵ Agglomeration economies can have five different effects, they might: i) increase *knowledge spillovers* (Morrison and Siegel, 1999); ii) generate economies of localization because of production inputs that are shared (Quigley, 1998); iii) exploit specialisation and scale economies in local transport networks (Ciccone and Hall, 1996); iv) reduce transaction costs (Quigley, 1998); v) increase the adoption of new technologies due to the higher capacity for R&D (Keller, 2002).

⁶ Moulton (1990) noted that using a more aggregated independent variable than the dependent variable can lead to a group-effects bias. We estimate the same equations considering estimation of city fixed effects robust and find that the estimates remain unchanged. This suggests that the proxy variable is not simply picking up variation across cities but that there is substantial within-city variation as well.

dustries are skilled and (2) not all native-born workers are skilled. Due to these measurement errors, the share of foreign-born immigrants must be interpreted carefully. An additional reason for caution is the fact that not all immigrants participate in the labour market, particularly following an intense process of family regrouping in recent years. Moreover, immigrants who participate in the labour market may work in industries other than manufacturing. However, here we propose interpreting immigration from a different perspective. Foreign-born inhabitants shape cities as well as natives, so the arrival of contingents of immigrants to Spanish cities has modified the urban structure, city lifestyle and land prices. In other words, there are different amenities. According to Duranton and Storper (2006), “*a location with good amenities will be more attractive. In turn, this will raise land prices. But then higher land prices will affect the choices made by firms regarding factor usage. In turn, this can affect the local composition of economic activity (away from land intensive activities) and local wages (which will also capitalise these amenities)*”. For this reason, we propose that the share of immigration not only captures the displacement or compensation of skills in the labour market, but it also measures a type of amenity related to the city life style.

5.2. Hypotheses

Given the above interpretation of the immigration variable, this subsection presents the hypotheses that will be analysed empirically. Our hypotheses regarding the effect of immigration on firm performance are as follows:

5.2.1. For **employment growth**, we will analyse the following hypotheses:

Hypothesis 1. *In general, immigration has a negative effect on employment growth in manufacturing firms.*

We expect that firms which greatly increase their production (employing more workers) will not be so keen to be located in large cities with their similarly large proportions of immigrants, because these cities are characterised by high land prices and their labour markets for skilled workers are highly competitive. There is in fact Spanish empirical evidence that manufacturing firms have moved from metropolitan areas to nearby cities to avoid such land competition.

Hypothesis 2. *Small and new manufacturing firms are more sensitive to immigration.*

Small and new firms tend to report lower value-added and sales, and as such they usually suffer certain financial constraints. These firms may be located in economically and socially dynamic areas, which can lead to opposing effects. On the one hand, they might benefit from dynamic environments, while, on the other, the pressure of competition is higher in more dynamic cities. Small and new manufacturing firms may, therefore, be more strongly affected by immigration.

Hypothesis 3. *Manufacturing firms with external activity⁷ are more sensitive to immigration.*

Firms operating in foreign markets need to be more competitive and, as a consequence, they have to capture any kind of external spillovers. However, their impact on employment rates may be more markedly negative if immigration behaves as a non-positive amenity.

5.2.2. For wages, our proposed hypotheses are the following:

Hypothesis 4. *The effect of immigration on wage increases is undetermined.*

Given the ambiguous results in the literature, no specific result can be expected (Borjas, 1986, reports a slightly negative short-term impact, though even this disappears in subsequent time periods). A positive impact of immigration on wages can be interpreted as evidence for the existence of urban amenities. In other words, immigrants are located in dynamic urban areas where firms compete for skilled workers. Wages are the main factor attracting workers. However, a negative impact of immigration on wages can be interpreted as evidence for the existence of urban diseconomies such as high land prices. Recently, Ottaviano and Peri (2005) and Card (2009) found that a diversity of production skills, abilities and occupations enhances productive performance, which is supported by the existence of a *diversity wage premium*. According to these authors, this positive relationship can be interpreted in terms of higher productivity.

Hypothesis 5. *Small and new manufacturing firms are more sensitive to increasing wage levels in municipalities with a high share of immigrants.*

According to Jovanovic (1982), both new and small firms tend to be less efficient on average than their counterparts. As we have observed in our empirical data, small and new firms in Spain are similarly less productive. As a consequence, they are not able to raise salaries with the same degree of freedom as their more established counterparts. Furthermore, they usually face more severe financial problems and so have less capacity to increase wages.

Hypothesis 6. *Foreign market oriented firms are more sensitive to immigration.*

Depending on their key variable of competitiveness, foreign market oriented firms might have to increase wages in highly competitive environments or, alternatively, reduce them. If immigration raises the share of one skill group, then that skill group suffers short run wage falls relative to the other skill group. Fo-

⁷ Here, we classify firms between those that are “Import-export firms” (foreign-market oriented firms) when they declare to export and import simultaneously. While, “Non-Import/export firms” when they only declare import, only export or neither of both activities.

reign-market oriented firms using that skill group intensively will become relatively profitable. Accordingly, it expands, bidding the wages of that skill group back up relative to the other skill group.

5.2.3. For **labour productivity**, we propose the following hypotheses:

Hypothesis 7. *Immigration has not an effect on labour productivity in manufacturing firms.*

No specific result can be expected regarding the impact of immigration on labour productivity given that there is a wide range of possible responses. First, some theories point towards a process of displacement between unskilled labour and capital investment. Thus, immigration has negative impact on labour productivity. However, a recent line of research offers an alternative explanation. Due to skill complementarities, a higher number of unskilled workers tends to mean that more skilled workers are employed, which leads to an increase in average productivity. In fact, Ottaviano and Peri (2005) show that multicultural diversity has a positive impact on wages via higher productivity. As a consequence, a positive impact of immigration on labour productivity growth can be expected.

Hypothesis 8. *Small and new firm productivity is more sensitive to the arrival of immigrants.*

Given that small and new firms are usually less labour productive, we expect their productivity to increase more markedly when they are in local environments characterised by a large share of immigrants.

Hypothesis 9. *Immigration does not affect the productivity growth of foreign market oriented firms.*

When firms are competitive in knowledge-intensive sectors, characterised by the employment of skilled workers, they will experience a positive impact. However, when firms depend on scale economies, labour productivity growth will not be affected by staying in environments with a high share of immigrants.

6. Results

This section presents our empirical results in three stages. First, we analyse the impact of immigration on the growth of employment rates, wages and labour productivity⁸ in all the firms contained in our database. Second, we pay particular attention to

the effects of immigration flows on new and small firms. Here, we expect increased sensitivity for both new (firms operating for fewer than six years) and small (firms operating for more than three years and employing fewer than ten employees) firms in terms of their productivity due to the amenities generated by immigrants. Third, we draw a distinction between firms oriented towards foreign markets and those oriented towards the domestic market.

According with Table 2, immigrant flows have a positive (albeit not significant) impact on wage growth and labour productivity, and a negative impact on the number of workers employed by manufacturing firms. In line with previous findings, in cities with high immigrant inflows, firms come under greater pressure to increase wages, improve labour productivity and to regulate the growth of their workforce. The increase in the share of immigrants in cities leads to an increase in housing costs, a replacement effect for native workers and a positive effect for skill composition and productivity in manufacturing firms. In this causal link, immigration does not affect the labour market directly, but rather does so via a city's amenities. Immigrants produce positive and negative amenities. Thus, a multicultural environment might be positively valued by a more open-minded firm, while immigrants can produce unproductive amenities in terms of the cost of living in multicultural neighbourhoods and the pressure placed on the local housing market and public services.

Table 2. Workers, wage and productivity regressions. GLS fixed effects estimations

	Whole database			Small firms			Young firms		
	Workers	Wage	Productiv.	Workers	Wage	Productiv.	Workers	Wage	Productiv.
$\ln(S_{i,t})$	0.8010 (0.0029)*	0.1457 (0.0023)*	0.1950 (0.0044)*	-0.8486 (0.0045)*	0.2372 (0.0051)*	0.3329 (0.0094)*	-0.8536 (0.0065)*	0.1230 (0.0055)*	0.1801 (0.0105)*
$\ln(Age_{i,t})$	0.0689 (0.0048)*	-0.0927 (0.0038)*	-0.1439 (0.0071)*	0.0521 (0.0060)*	-0.1121 (0.0069)*	-0.1773 (0.0126)*	0.0678 (0.0089)*	-0.1183 (0.0075)*	-0.1711 (0.0144)*
$Dens_{i,t}$	-0.0745 (0.0116)*	0.0135 (0.0091)	-0.0225 (0.0173)	-0.0396 (0.0171)**	0.0227 (0.0195)	-0.0105 (0.0357)	-0.0536 (0.0463)	-0.0059 (0.0389)	-0.0483 (0.0745)
$Immig_{i,t}$	-0.1107 (0.0568)***	0.0337 (0.0447)	0.1818 (0.0848)**	-0.3228 (0.0884)*	0.3160 (0.1008)*	0.4667 (0.1842)**	0.2506 (0.2340)	0.9729 (0.1967)*	1.0365 (0.3769)*
Constant	2.2588 (0.0253)	-0.1919 (0.0199)*	-0.1744 (0.0378)*	1.5374 (0.0362)*	-0.2373 (0.0412)*	-0.2511 (0.0753)*	2.0541 (0.0761)*	-0.1613 (0.0640)**	-0.1963 (0.1226)
R ²	0.5086	0.0512	0.0270	0.6429	0.0924	0.0579	0.6784	0.0528	0.0328
Wald test	19776.40	1031.03	530.70	9532.23	539.42	325.57	5386.08	142.22	86.54
Hausman test	64229.87	3625.03	1705.28	30318.53	435.82	243.31	3344.40	843.68	415.69
Firms		43,115			18,514			12,355	
Obs.		119,564			39,700			22,570	

Dependent variable: yearly change in logarithm.

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

⁸ The explanatory capacity of the models is high for the estimation of the workers growth, but less significant for the wage and labour productivity growth.

Conversely, immigration may negatively affect the decision of firms to employ more workers. One hypothesis that might account for this is that firms may not value the existence of large immigrant populations in the city as a way to increase employment. However, according to Duranton and Puga (2001), a more plausible hypothesis is that firms that decide to grow significantly (using more resources) prefer environments that are less densely populated and that have less immigration. We should not overlook the fact that immigration puts housing prices under greater pressure, so firms wishing to acquire new buildings might face more difficulties, especially if they own large factories. In this sense, Spanish cities are currently witnessing the movement of large factories away from the biggest cities towards the smaller cities, which do not suffer the same problems of population density.

A further piece of evidence supporting this last hypothesis is the fact that immigration has a positive impact on wage growth. Knowledge-intensive firms with a need to attract skilled workers usually locate in large cities. A multicultural environment has a positive effect, since nowadays highly skilled workers tend to be attracted to cities. Moreover, large cities provide a pool of highly skilled native workers, and so wages must be attractive if a firm wishes to engage the most efficient workers.

As far as the other variables are concerned, previous firm size was found to present the expected negative sign, given that large firms are more productive and pay higher wages, while they tend to grow less in terms of the number of workers they employ. Conversely, firm age positively affects employment growth, but negatively affects wage and productivity growth. But, of course, old firms tend to be larger in terms of workers and sales, paying higher wages and having greater labour productivity than their counterparts. Finally, population density negatively affects employment growth (Duranton and Puga, 2001).

When considering firm size and age, we expected the effects of immigration to be more marked in small and new firms and, indeed, Table 2 shows that these firms are more sensitive to the number of immigrants. In all our estimations the coefficients of immigration are larger than they are for the whole sample. Firms with fewer than ten employees located in cities with high immigration registered a positive impact on wage growth and productivity growth and regulate increases in their employment growth compared to those of their counterparts. This evidence is particularly marked in the sample of new firms. Thus, firms that are set up in cities with proportionally higher immigrant populations are more likely to increase their wages and productivity.

In the last step, we classified the firms into two groups according to their market orientation. Firms that are oriented to foreign markets are more able to face international competitive pressures, given that they have previously improved productive technologies that require skilled and qualified workers and have obtained productivity gains. Conversely, Spanish firms oriented to the domestic market are under less competitive pressure and must overturn a large differential if they wish to change to a new technological state and improve labour productivity.

Since the advent of the euro, the Spanish economy has witnessed a continuous fall in its competitive advantages due to the negative inflation differential compared with that recorded in other countries in the Euro-zone, and this has placed Spanish

firms operating in international markets under increasing pressure. Our econometric study presents interesting findings. In relation to wage increases, one of our most notable results was that immigration has an additional and negative impact on foreign market oriented firms, while immigration has a non-significant positive impact on productivity. One explanation for this might be that large multicultural cities provide more competitive environments for firms. Thus, immigration enhances labour productivity albeit non-significantly.

Table 3. Workers, wage and productivity regressions. Geographical orientation market. GLS fixed effects estimations.

	<i>Non-export/import firms</i>			<i>Import-export firms</i>		
	<i>Workers</i>	<i>Wage</i>	<i>Productiv.</i>	<i>Workers</i>	<i>Wage</i>	<i>Productiv.</i>
$\ln(S_{i,t})$	-0.7836 (0.0033)*	-0.8676 (0.0064)*	0.1609 (0.0027)*	0.0882 (0.0045)*	0.2170 (0.0049)*	0.1109 (0.0097)*
$\ln(Age_{i,t})$	0.0592 (0.0051)*	0.1024 (0.0162)*	-0.1025 (0.0041)*	-0.0634 (0.0116)*	-0.1541 (0.0075)*	-0.1413 (0.0248)*
$Dens_{i,t}$	-0.0750 (0.0132)*	-0.0610 (0.0243)	0.0213 (0.0106)**	0.0033 (0.0173)	-0.0068 (0.0196)	-0.0600 (0.0372)
$Immig_{i,t}$	-0.0619 (0.0635)	-0.2872 (0.1312)	0.1021 (0.0510)**	-0.1948 (0.0935)**	0.2266 (0.0943)**	0.1439 (0.2007)
Constant	2.1064 (0.0271)*	2.9277 (0.0745)*	-0.2132 (0.0218)	-0.1028 (0.0531)***	-0.2268 (0.0402)*	0.1377 (0.1140)
R ²	0.4972	0.5554	0.0578	0.0283	0.0325	0.0113
Wald test	15170.39	4706.09	941.90	109.69	515.11	42.94
Hausman test	45543.79	3241.05	1598.47	17709.17	410.89	139.22
Firms		97,267			22,297	
Observations		35,892			7,223	

Dependent variable: yearly change in logarithm.

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

Finally, firm size affects non-foreign market oriented firms more positively. One hypothesis is that firms with external activity pay higher wages regardless of their size, and firm age has a more significant negative impact on wage growth on non-export/import firms. In line with our expectations, non-foreign market oriented firms are more sensitive to local population density, but import-export firms present low sensitivity to agglomeration economies. In short, migration flows increase population density, population size and domestic demand, thereby increasing the generation of external and agglomeration economies; but population density and size may be less relevant to internationally traded goods and service sectors because economies of scale can be achieved through international trade.

Endogeneity bias

In seeking to interpret the relationship between immigration and firm performance we must recognise the potential endogeneity bias. This bias is attributable to the fact

that firms might enjoy higher wage and productivity growth because of a positive economic shock, disproportionately attracting immigrants who are more productive and who have a greater capacity to grow, thus giving rise to a considerable increase in immigrants. In the event of such an economic shock, the impact of the number of immigrants on firm performance will be upwardly biased. Therefore, in order to isolate the correlation between the share of immigration and firm performance we have introduced several instrumental variables.

Table 4. Workers, wage and labour productivity regressions. IV estimation, GMM

	<i>Non-export/import firms</i>		
	<i>Workers</i>	<i>Wage</i>	<i>Productiv.</i>
Second stage			
$\ln(S_{i,t})$	-0.0445 (0.0011)*	0.0100 (0.0004)*	0.0153 (0.0009)*
$\ln(Age_{i,t})$	-0.0457 (0.0014)*	-0.0089 (0.0006)*	-0.0119 (0.0013)*
$Density_{i,t}$	-0.0037 (0.0023)**	-0.0028 (0.0012)**	-0.0066 (0.0025)*
$Immig_{i,t}$	-0.1605 (0.0388)*	0.0621 (0.0210)*	0.0174 (0.0445)
Constant	0.2814 (0.0045)*	0.0111 (0.0019)*	-0.0278 (0.0041)*
R ²	0.0670	0.0047	0.0028
Wald chi ²	3879.59	677.94	285.54
First stage			
IndexIND	-0.0035 (0.0005)*	-0.0035 (0.0005)*	-0.0035 (0.0005)*
IndexCIAL	-0.0186 (0.0006)*	-0.0186 (0.0006)*	-0.0186 (0.0006)*
IndexTUR	0.0216 (0.0005)*	0.0216 (0.0005)*	0.0216 (0.0005)*
ForeignPop	0.0347 (0.0003)*	0.0347 (0.0003)*	0.0347 (0.0003)*
Constant	0.0351 (0.0004)*	0.0351 (0.0004)*	0.0351 (0.0004)*
R ²	0.2216	0.2216	0.2216
F test	10924.74	10924.74	10924.74
Firms		43,115	
Observations		119,564	

Instruments are an index of manufacturing, commercial and tourist activity as well as the level of immigrant population in the region.

Dependent variable: yearly change in logarithm.

* significant at 1%, **significant at 5%, ***significant at 10%

Heteroskedasticity-robust standard errors are reported in parentheses.

The set of instruments we use is an index of industrial, commercial and tourist activity and an index of the level of immigration in the region⁹. The underlying idea is that over the last decade, Spain has experienced a large increase in immigration for reasons exogenous to the events of any particular firm. Thus, the existence of a region with more immigrants or one that showed itself to be more dynamic was reason enough to transfer to one particular city. Since our instrumental variables are related to the economic dynamism of the city and the social opportunities in a region, we suppose that these variables do not have such a great direct impact on workers, wages and productivity growth.

Table 4 strengthens the hypothesis that while the effect of immigration on workforce growth is negative, while it is positive on wage and productivity growth. However, the effect is not significant on productivity growth. The estimated coefficient is significant and very large for workforce growth. Furthermore, our results show that our instrumental variables can explain 22% of the share of immigrants.

7. Conclusions

In the 20th century Spain played an important role as a country of net emigration, but since the nineties it has become one of Europe's major host countries. These massive immigration flows have been largely concentrated in the most dynamic regions. These phenomena have had a major impact on the skill structure of the workforce, increasing labour supply and displacing native workers. While in 1998 the share of immigrants was just 1.6% of the Spanish population, in 2008 it has reached 11.3%. In a short period foreign population has risen considerably: in 1998 there were 637,085 immigrants and by 2008 the number has risen to 5,220,577 immigrants.

In line with recent research (Salerian, 2006; Ottaviano and Peri, 2005, 2006; Duranton and Stolper, 2006), we found that the arrival of immigrants in Spanish cities has led to a redeployment of skills, affecting local amenities and facilitating technological changes in local manufacturing firms. This positive impact has led to an increase in labour productivity, consequently reducing the number of employees needed in manufacturing firms located in cities that register high immigrant inflows. Immigrant inflows seem to affect manufacturing firms in two ways. On the one hand, such inflows have a direct impact on manufacturing jobs as they increase employment supply, especially among firms requiring unskilled or semi-skilled workers. However, immigrants finding jobs in manufacturing firms represent only a small proportion of total immigrants. On the other hand, above all in cities that have recorded a marked rise in the number of immigrants, this phenomenon increases pressure on local factor prices (rents, public services), displaces the native population to more skilled and qualified jobs, and has an indirect effect on manufacturing since it allows a better distribution of labour qualifications.

⁹ The manufacturing, commercial and tourist index is a comparative index of the importance of industry (including construction), trade (both wholesale and retail), and tourist activities.

Our empirical study draws on two sources of information. At the local level we obtained the foreign-born population in all Spanish peninsular cities with more than 1,000 inhabitants during the period 2001-2006. This information allowed us to track the evolution in the proportion of immigrants making up the population of 3,070 Spanish cities. Our database contains information at the firm level from a large sample of 43,115 manufacturing firms with more than three workers during the period 2001-2005.

Our empirical results show that local immigration flows have a positive impact in terms of increased wage and labour productivity and a negative impact on the number of employees. In line with previous theoretical findings in cities recording a high inflow of immigrants, firms were placed under greater pressure to increase wages, improve labour productivity and to regulate workforce growth. The increase of immigrants leads to a rise in rents, the displacement of native workers, and a positive effect on skill composition and productivity in manufacturing firms. When we corrected the endogeneity bias with a set of instruments, we obtained similar results, which suggest a causal link between the proportion of immigrant population at the city level and productivity gains in manufacturing firms.

Small and new firms showed themselves to be more sensitive to the proportion of immigrants making up the population of a city. Firms with fewer than ten employees located in cities with the highest immigration rates recorded a positive impact on wage and productivity growth and tend to regulate their workforce more than their counterparts do. This evidence is particularly strong in the sample of new firms. These firms that chose to set up in cities with high immigrant populations were more likely to increase wages and productivity.

Finally, we classified our sample of manufacturing firms into two groups according to their market orientation. Foreign market oriented firms are larger in terms of number of employees and sales, obtain a higher labour productivity level, and pay higher wages than firms oriented to the domestic market. However, foreign market oriented firms registered lower rates of growth size, wages and productivity than their counterparts. Immigration flows in cities presented a negative impact on wages and employment rates and a positive impact on productivity in domestic market oriented firms, while in import-export firms immigration had a negative effect on job creation and a positive effect on wages.

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Anex

Table A.1. Number of immigrants in Spain

<i>Year</i>	<i>Foreign-born population</i>	<i>Annual rate</i>	<i>Immigrants as proportion of Spanish population</i>
1998	637,085	—	1.6
1999	748,954	17.56	1.86
2000	923,879	23.36	2.28
2001	1,370,657	48.36	3.33
2002	1,977,946	44.31	4.73
2003	2,664,168	34.69	6.24
2004	3,034,326	13.89	7.02
2005	3,730,610	22.95	8.46
2006	4,144,166	11.09	9.27
2007	4,519,554	9.06	10.00
2008	5,220,577	15.50	11.30

Note: Information on the 1st of January.

Source: Padrón Municipal, Spanish Statistics Institute

Table A.2. Workers, wage and productivity regressions.
Whole database. GLS fixed effects estimations.

	<i>Workers</i>	<i>Wage</i>	<i>Productiv.</i>
$\ln(S_{i,t})$	0.1990 (0.0029)*	-0.0470 (0.0020)*	-0.0525 (0.0038)*
$\ln(Age_{i,t})$	0.0689 (0.0048)*	0.0882 (0.0033)*	0.0611 (0.0061)*
$Density_{i,t}$	-0.7450 (0.116)*	-0.136 (0.0079)***	-0.7740 (0.1480)*
$Immig_{i,t}$	-0.1107 (0.0568)***	0.8329 (0.0390)*	0.1604 (0.0726)**
Constant	2.2588 (0.0253)*	2.9425 (0.0174)*	3.4990 (0.0323)*
R ²	0.0726	0.0453	0.0039
Wald test	1495.61	906.61	74.47
Hausman test			
Firms		43,115	
Observations		119,564	

Dependent variable: logarithmic value of the variable.

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

Table A.3. Workers, wage and labour productivity regressions.
IV estimation, GMM.

	<i>Workers</i>	<i>Wage</i>	<i>Productiv.</i>
Second stage			
$\ln(S_{i,t})$	0.9555 (0.0011)*	0.0865 (0.0011)*	0.1204 (0.0017)*
$\ln(Age_{i,t})$	-0.0457 (0.0014)*	0.0782 (0.0015)*	0.1002 (0.0023)*
Density _{<i>i,t</i>}	-0.0037 (0.0023)*	0.1000 (0.0032)*	0.0682 (0.0047)*
Immig _{<i>i,t</i>}	-0.1605 (0.0388)*	1.7255 (0.0559)*	1.5815 (0.0834)*
Constant	0.2813 (0.0045)*	2.4906 (0.0046)*	2.6671 (0.0072)*
R ²	0.9329	0.1215	0.1000
Wald chi ²	780000	22016.71	13552.69
First stage			
IndexIND	-0.0035 (0.0005)*	-0.0035 (0.0005)*	-0.0035 (0.0005)*
IndexCIAL	-0.0186 (0.0006)*	-0.0186 (0.0006)*	-0.0186 (0.0006)*
IndexTUR	0.0216 (0.0005)*	0.0216 (0.0005)*	0.0216 (0.0005)*
Foreign Pop	0.0347 (0.0003)*	0.0347 (0.0003)*	0.0347 (0.0003)*
Constant	0.0351 (0.0004)*	0.0351 (0.0004)*	0.0351 (0.0004)*
R ²	0.2216	0.2216	0.2216
F test	10924.74	10924.74	10924.74
Firms		43,115	
Observations		119,564	

Instruments are index of manufacturing, commercial and tourist activity as well as the level of immigrant population in the region.

Dependent variable: logarithmic value of the variable.

* significant at 1%, **significant at 5%, ***significant at 10%

Heteroscedasticity-robust standard errors are reported in parentheses.