The Effect of Immigration on the Labor Market Performance of Native-Born Workers: Some Evidence for Spain[(*)]

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Abstract

Spain is one of the European countries where immigration flows during the last decade have increased noticeably. The Spanish labor market institutions and the Spanish immigration policy exhibit some peculiarities which may be relevant when analyzing the impact of immigration. This paper provides a first approximation to the labor market effects of immigrants in Spain during the second half of the 1990s, the period in which immigration flows to Spain have accelerated. By using alternative datasets, we estimate both the impact of legal and total immigration flows on the employment rates and wages of native workers, accounting for the possible occupational and geographical mobility of immigrants and native-born workers. Using different samples and estimation procedures, we have not found a significant negative effect of immigration on either the employment rates of native workers or on wages.

JEL Codes: J21, J11
Keywords: immigration, employment rates, wages.

1. **Introduction**

The literature that seeks to evaluate the impact of immigration on the labor market of the host country is by now very large and well-surveyed.[1] Two main conclusions can be drawn from this literature:

First, it has proven very difficult to find support for the implications of the standard-textbook model in which an increase in labor supply due to immigration ought to reduce the wages of native workers in flexible labor markets in which relative wages adjust to demand and supply factors, or to reduce their employment rates in labor markets where rigidities prevent adjustments of relative wages.

Secondly, empirical results seem to be time-dependent, with a variety of studies finding different estimates of the labor market impact of immigration depending on the episode under consideration.

In a recent influential paper, Borjas (2003) claims that this unsatisfactory state of affairs might arise from a somewhat misguided methodology. Most of the empirical studies in this strand of the literature use the so-called "area-analysis" approach which correlates wages and employment rates, on the one hand, and the fraction of immigrants, on the other hand, across local labor markets. These spatial correlations suggest that, at most, a 10 percent increase in the fraction of immigrants reduces the wages of native workers by about 1 percent. The small-sized estimates could be explained by the fact that immigrants tend to cluster in localities with thriving economies and therefore tend to cause a spurious positive correlation between immigration and local outcomes which biases downwards the parameter of interest. In order to correct for this bias, a number of studies have focused on the analysis of "natural experiments" where the increase in immigration can be considered as exogenously determined. This is the case of Card (1990) on the Mariel boatlift from Cuba to Miami, or Hunt (1992) on the repatriation from Algeria to France. However, they still get no significant effects.

Thus, as long as production factors, either capital or labor, are mobile across local labor markets, spatial correlations will fail to capture the parameter of interest,[2] namely, the degree of substitution between immigrants and native-born workers, as native workers move from those cities affected by the labor supply shock to other localities unaffected by the immigration influx, and firms may want to move into those cities where wages have fallen. Thus, Borjas (2003) advocates to replace spatial correlations by correlations across skill groups (using education and labor market experience as indicators of skills), on the grounds that these are categories from which, in the short run, it is impossible for workers to move away and therefore the degree of substitution between natives and immigrants is bound to be much better gauged. Using this approach, Borjas (2003) finds that an increase in the size of a skill group by 10 percent lowers the wage of workers in that group by about 2 to 3 percent and reduces working weeks by 2 percent. Nonetheless, Card (2001) and Card and Di Nardo (2001) find that in the US cities that have received flows of relatively unskilled immigrants, the relative size of their unskilled populations has also increased, which somewhat challenges the interpretation relying on the mobility of native workers as an explanation of the lack of spatial correlations between immigrant flows and local labor market outcomes.

[1] See, for instance, Borjas (1994, 1999) and Friedberg and Hunt (1995).
[2] For a formal proof, see Borjas (1999).

Most of the empirical studies trying to assess the impact of immigrant flows on the labor market outcomes of native workers use US data.[3] Wealth of data and the long experience with the effects of large waves of immigration since the 1840s justify this focus of attention on the US experience. However, during the last decade many European countries have become recipients of immigrants, and, thus, the demand for informed analysis of the impact of immigration into Europe has notably increased.[4] In a recent contribution, Angrist and Kugler (2003), using a panel of European countries, find that the immigration slightly reduced the employment rate of native-born workers, although this effect is larger in countries with "rigid" institutions, in particular in countries where product market competition is restricted. This finding suggests that the link between immigration and labor market outcomes of native-born workers may be more subtle than just the insight provided by the static labor demand/labor supply model of the labor market. [5]

These premises lead us to the main motivation of this paper. Spain is one of the European countries where immigration flows during the last decade have increased noticeably. As seen in Figures 1a and 1b, during the second half of the nineties the net immigration rate to Spain has reached values close to 1,5% of the population, while immigration accounts for more than 90% of total population growth. Moreover, the Spanish labor market institutions and the immigration policy exhibit some peculiarities which may be relevant when analyzing the impact of immigration. And there are very few empirical studies trying to measure this impact.[6] This makes Spain an interesting case of study of the labor market effects of an immigration boom.

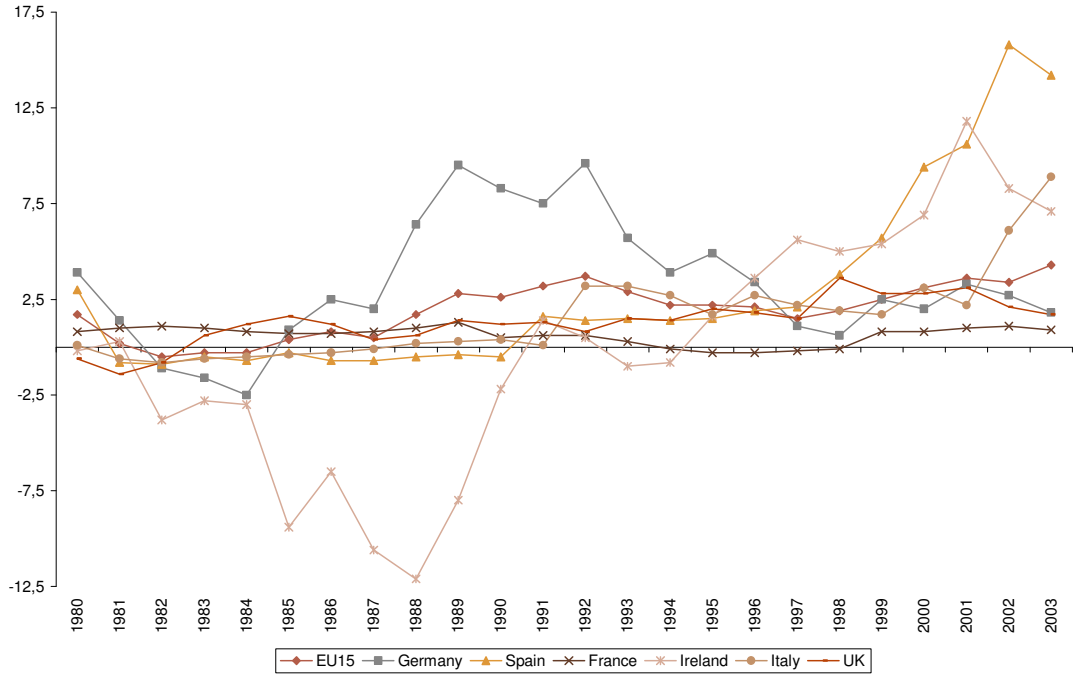
[3] There are, however, some studies which apply the "spatial correlations" approach to other host countries such as Hunt (1992) to France, Pischke and Velling (1997) to Germany, and Dolado et al. (1997) to Spain.

[4] For recent immigration trends in some European countries, see Coppel et. al (2001) and Boeri et al. (2000).

[5] The labor market impact of immigration also depends on the technological complementarities between capital and labor of each type in the production function, how wages are determined and what kind of labour market frictions are considered. For a discussion of these issues, see Section 2 in Carrasco, Jimeno and Ortega (2004).

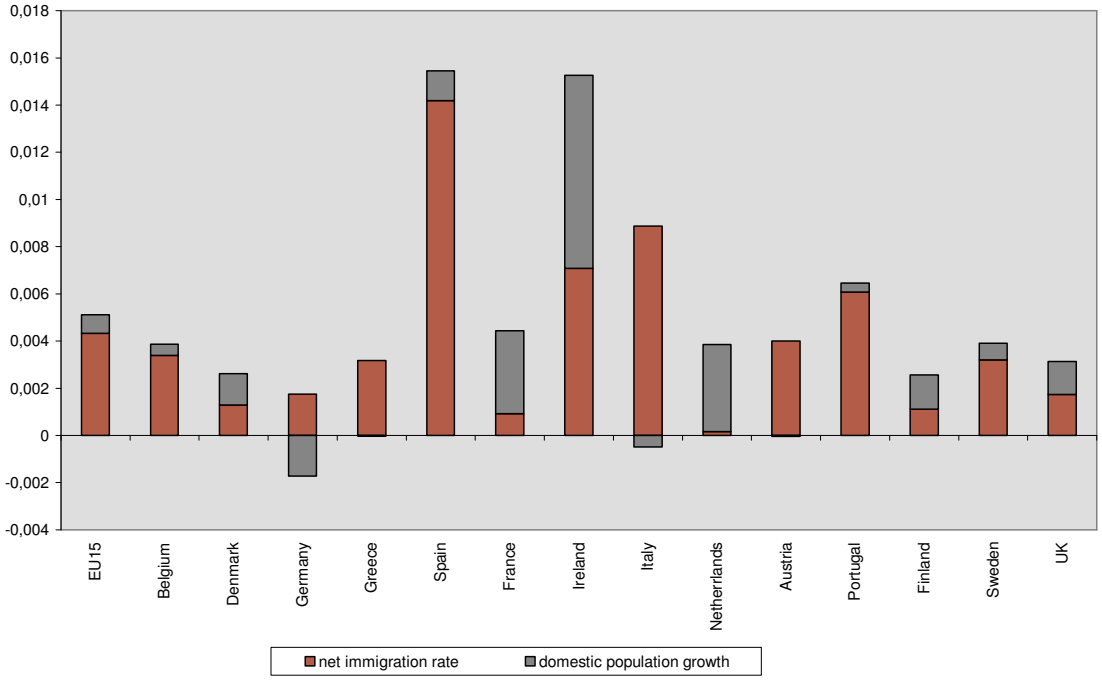
[6] Most of the research of immigration to Spain is of sociological/qualitative nature (see, for instance, Carrasco, 2002, and Izquierdo, 2002). Within the economic literature, there are some previous studies. Dolado et al. (1997) analyze the effects of an amnesty of illegal immigrants on the wages and unemployment rates of native-born workers in the late 1980s/early 1990s, while Dolado (2002) surveys the available literature related to the design of migration policies in order to shed light on the Spanish case. Collado et al. (2002) perform a generational accounting exercise to measure the impact of immigration on public budgets, and Amuedo et al. (2005) explore whether immigrants are more responsive than natives to regional labour market opportunities.

Figure 1a. Net immigration to several EU countries (per thousands of inhabitants)



Source: EUROSTAT (NEWCRONOS Database).

Figure 1b. Population growth and its components in EU15 countries, 2003



Source: EUROSTAT (NEWCRONOS Database)

Thus, the main goal of this paper is to provide a first approximation to the labor market effects of immigrants in Spain during the second half of the 1990s, the period in which immigration flows to Spain have accelerated. For this analysis, we rely on data from the last two waves of the Census of Population for the years 1991 and 2001, the register of work permits to foreigners for the period 1993-1999 and from the last available wave of the Wage Structure Survey (*Encuesta de Estructura Salarial*) for the year 2002. While the Census of Population covers, in principle, both legal and illegal immigration and offers information on the educational level and potential work experience of immigrants, the register of work permits provides an accurate measure of the incidence of legal immigration and offers information about the sector of activity where the immigrants work. In turn, the Wage Structure Survey focuses only on the formal sector of the economy and, therefore, does not account for illegal immigrants. Hence, by using alternative datasets, we estimate both the impact of legal and total immigration flows on the employment rates and wages of native workers, accounting for the possible occupational and geographical mobility of immigrants and native-born workers.[7]

The paper is organized as follows. Section 2 provides a brief description of the evolution of immigration to Spain. In Section 3 we describe the data to be used. Section 4 presents the empirical approach and Section 5 contains the estimation results. Finally, Section 6 concludes with some policy implications from our analysis.

2. Immigration to Spain: A summary of the main trends

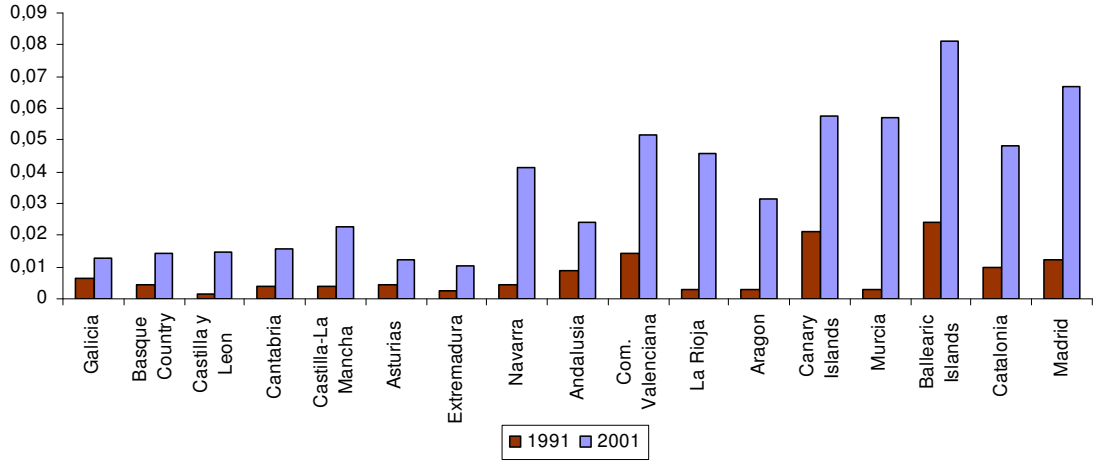
A person is defined to be an immigrant if he does not have the Spanish citizenship. All other persons, even if they were born in a different country, are classified as natives. According to this definition, during the last decade, immigrant population in Spain has surged from 0.35 million in 1991 to almost 3.69 million in 2005, that is, from about 1% to 8.4% of total population.[8] As seen in Figure 2, Census data show a clear regional concentration of immigrants in Madrid and the Eastern part of Spain. South America and Africa are the main areas of origin of the immigrants (with weights of about 30% and 20%, respectively). About 50% of the immigrants have secondary studies, while around 15% have tertiary studies and almost 60% of them arrived after 1995. Finally, immigrants are relatively young, with about 60% of the immigrants in the 20-44 age group, and men of 25-34 years of age being overrepresented.[9]

[7] A recent paper using a similar approach to ours is Cohen-Goldner and Paserman (2004), who study the Israeli case.

8 Not all available data sources (Census of Population, Labor Force Survey, administrative registers of residence and work permits, etc.) coincide in their measurement of the stock of foreign population in Spain. There are also some methodological problems caused by changing regulations which sometimes blurred the exact incidence and distribution across sectors and regions of immigrants flows to Spain.

[9] For more details on the characteristics of immigrants in Spain, see Carrasco, Jimeno and Ortega (2004).

Figure 2. Foreign population as a proportion of total population by region



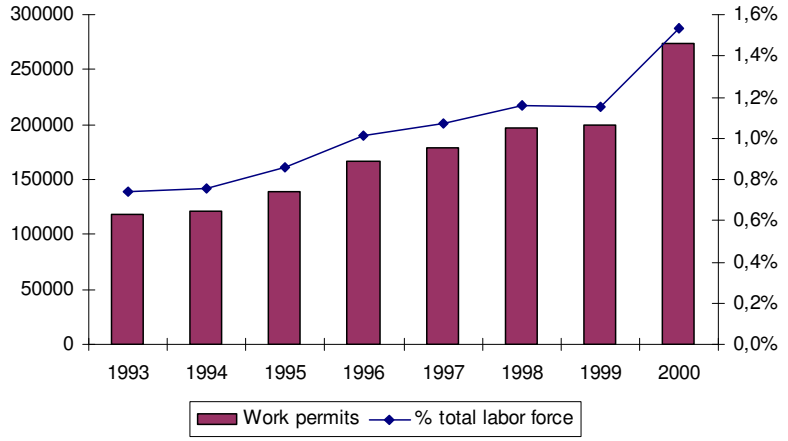
Source: Census of Population, 1991 and 2001

Immigrants are required to obtain a work permit if they intend to be either employed or self-employed. Since 1992 EU citizens are exempted from this requirement (citizens from Luxembourg since 1993, citizens from Austria, Finland, Norway and Sweden since 1994). Regarding the process that leads to awarding work permits, in the case of an initial authorization, the employer that intends to employ the immigrant should request the work permit. Among other documents, the employer has to prove that he has done a job offer in the Public Employment Services and that he has obtained negative results. In the case of renewals or self-employees, the immigrant worker should request the authorization. Finally, government authorities decide whether to grant the work permit or not. There are several types of work permits with different duration and restrictions regarding the sectoral and geographical scopes where the immigrant is allowed to work.

By comparison between the Census data and the register data, it can be concluded that about one third of the immigrants are in an "irregular situation", that is, without a residence or a work permit. According to estimates from the Spanish Ministry of Employment, shown in Figure 3, the number of work permits has increased from around 120 thousands (0.7% of the labor force) in 1993 to around 270 thousands (1.5% of the labor force) in 2000.[10] The large increase in this last year was caused by a special amnesty process which took place over 2000 and 2001. Most work permits are awarded to immigrants in the service sectors. Immigrants with work permits are also geographically concentrated in some regions, representing a high proportion of the labor force in Madrid, Catalonia, Ballearic Islands, and Murcia

[10] More recent data for 2000-2002 have not yet been made available by the Spanish Ministry of Employment. In 2000-2001 there was a special amnesty procedure, and in 2002 new immigration laws were approved after intense political discussions, which seem to be the reasons for the delay in the publication of these data.

Figure 3. Work permits (stock)



Source: Ministry of Employment and Social Affairs

3. Data

For the estimation of the labor market effects of immigration in Spain we use four different data sources. Firstly, we obtain measures of the size of the immigrant population and its composition by some personal characteristics, as well as the employment rates of native workers from the last two waves of the Census of Population (1991 and 2001). Secondly, we use detailed data on work permits for the period 1993-1999 from the register of the Spanish Ministry of Employment and Social Affairs, to better measure the incidence of legal immigration. In this case, employment rates of native individuals are obtained from the Labor Force Survey. Finally, we use the last available wave of the Wage Structure Survey (2002) to obtain measures of the size and characteristics of legal immigrants and of the wages of native workers. As EU citizens do not require a work permit, they are not included as immigrants when considering this source of data. On the contrary, when using the Census of Population and the Wage Structure Survey they are counted as immigrants.[11] In what follows we describe the construction of the variables to be used in our empirical analysis.

Our analysis relies on the correlation between the immigration supply shock and some local labor-market outcomes for native workers across several segments or cells of the labor market. Ideally, cells should be defined along dimensions across which immigrants and native workers could not relocate themselves, as stressed by Borjas (2003) who uses education and labor market experience. In our case, the definition of cells is determined by the data source being used. From the Census of Population and from the Wage Structure Survey, we can observe education and potential labor market experience of immigrants. From the register of work permits, we can only observe their age and the sector where they work. Using correlations across sectors would yield consistent estimates of the causal effect of immigration on the labor market performance of native workers only under the assumption that skills are sector-specific. However if workers, either native-born or immigrants, can move across sectors in response to sector-specific labor market conditions, our estimates will be inconsistent and subject to the same criticism as the estimates based on "spatial correlations". Although in Spain the degree of sectoral mobility of native-born workers is not high, we find this assumption unappealing and, hence, we turn to an Instrumental Variables (IV) estimation whenever the definition of cells includes the sectoral dimension.

[11] Considering EU citizens as immigrants or not does not alter the results presented below.

Thus, cells are defined along the following groups: (i) educational level (without studies, primary, secondary or tertiary education), gender, and potencial work experience (in groups of five years from 0 to 40), or alternatively (ii) age groups (20-34, 35-44, 45-54, 55-65), gender, and 44 sectors of activity.[12] The definition of the immigration supply shock, x, is

$$x_{it} = \frac{m_{it}}{(n_{it} + m_{it})}$$

where m and n stands, respectively, for the number of immigrants and the number of native employed workers. Subscripts i and t, refer, respectively, to a particular cell and period of time (year).

To capture the labor market outcomes of native workers, we compute, for each cell, the following variables: (i) the employment rate of native workers, $e_{it} = \frac{n_{it}}{p_{it}}$, where p stands for the native population[13], and; (ii) the mean annual and hourly wage of native workers, aw_{it} and hw_{it}, respectively.[14]

Summary statistics of the variables for all samples are presented in Table 1. In the sample from the Census of Population, the immigration supply shock, x, takes an average value of 5.67%, ranging from 0.30% (men with no formal studies and 36 to 40 years of work experience in 1991) to 38.27% (men without studies and 11 to 15 years of work experience in 2001). The mean of the employment rate is about 58.64%. In the sample of work permits, the immigration rate, x, is around 0.89%. The average value of the employment rate as it was constructed is around 1.2%. If we add e_{it} across sectors we obtain an average value of the employment rate of 51.96%. Finally, in the sample from the Wage Structure Survey, the mean share of immigrants, x, is about 6.87%. The mean annual wage of native workers is around 18,365 euros and the mean hourly wage is about 9.67 euros.

Figures in the Appendix present further information about the immigrant supply shock and the labor market outcomes of native workers by education-experience cells. The increase in the proportion of immigrants in the labor force has been the highest in the low education and low potential work experience groups. Native's employment rates, annual and hourly wages are increasing in potential work experience and educational levels, and are higher for men than for women.

Similarly, we also illustrate the supply shocks experienced by the groups defined in terms of sector of activity. Specifically, given the large number of cells, we have plotted the average immigrant supply shock for the period considered in each sector of activity by age for men and women separately.[15] As can be observed in Figure A6, there is some deal of variation across sectors both for males and females.[16]

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[12] The list of sectors is in the Appendix.

[13] As mentioned above, when we use work permits data, this variable is constructed using the information provided by the Labor Force Survey (LFS). Notice that since the population cannot be defined by sector, the denominator, p_{it}, does not have sectoral variation, so that the employment rate of a group defined by age and gender in each year of the sample can just be recovered by simply adding e_{it} across sectors. Given that the number of cells we are using is rather high, the LFS estimates of employment and population may be not be as accurate as, for instance, data from the Census of Population. As a result, in some cells the employment of native-born workers is underestimated.

[14] We have also estimated the effect of immigration supply shock on native's unemployment rates. The results are qualitatively similar, with the opposite sign, to those obtained for employment rates.

[15] Since the number of cells we are considering is somehow large (4x2x44x7=2,464 cells), we prefer to report the data in this fashion rather than separately for each year.

[16] In the Figures we exclude sector 44 (Domestic care) where the incidence of immigration is much higher than in the rest.

Table 1: Summary statistics

Variable	Observations	Mean	Std. Dev.	Min	Max
		Employment Rates			
		Census of Population (all immigrants)			
x	128	0.0567	0.0737	0.0030	0.3827
e	128	0.5864	0.2577	0.0823	0.9579
		Register of work permits (legal immigrants)			
x	2,395	0.0089	0.02852	0	0.5235
e	2,395	0.5196	0.2147	0.1677	0.8712
		Wages			
		Wage Structure Survey (legal immigrants)			
x	64	0.0686	0.0797	0	0.3317
aw	64	18,365	10,127	4,530	45,621
hw	64	9.6722	4.8057	4.4784	22.6598

Note: Cells are defined by labor market experience, gender and education when using data from the Census of Population and the Wage Structure Survey, and by age, gender and sector of activity when using data from the work permits register. The initial number of cells in the sample of work permits is 2,464, but we have eliminated 69 cells with zero natives. We have kept cells with zero immigrants, otherwise we would have a selection problem.

4. Empirical approach

To estimate the effect of the immigration rates, *x,* on the native labor market outcomes we perform the following regressions:

$$\log\left(\frac{y_{it}}{1+y_{it}}\right) = \beta x_{it} + \delta_{it} + \varepsilon_{it} \quad (1)$$

$$\log w_{it} = \beta x_{it} + \delta_{it} + \varepsilon_{it} \quad (2)$$

where the dependent variables are the employment rate of native workers (for equation (1)) and the mean annual and hourly wage of native workers (for equation (2)). δ is a vector of unobservable fixed effects reflecting the dimensions along which cells are defined and some interactions among them.[17] Specifically, for the sample of work permits we have included interactions between sector and year, age and year, and sector and age, while for the Census and wage data the interactions are between education and experience, education and year, and experience and year.[18]

We report both the estimates of the coefficient β and the corresponding elasticity. For this, as in Borjas (2003), we define an alternative measure of the immigration shock, $x'_{it}=m_{it}/n_{it}$, so that the corresponding elasticity of the employment rate with respect to the ratio of immigrants to native workers is

$$\left(\frac{\partial y_{it}}{\partial x'_{it}}\right)\left(\frac{x'_{it}}{y_{it}}\right) = \frac{1}{(1+x'_{it})^2}\left(\frac{\partial y_{it}}{\partial x_{it}}\right)\left(\frac{x'_{it}}{y_{it}}\right)$$

where

[17] In the case of the employment regression, since the dependent variable is within the (0,1) interval, we impose a logistic transformation. Nonetheless, results from linear regressions are similar to those reported in the text.

[18] The first two groups of interactions control for the possibility that the impact of sector, education, experience and age changed over time, and the last one controls for the fact that the experience and age profile have a different effect across schooling and sector groups, respectively.

$$\left(\frac{\partial y_{it}}{\partial x_{it}}\right) = \beta \frac{\exp(\beta x_{it} + \delta_i)}{[1 + \exp(\beta x_{it} + \delta_i)]^2}$$

is the marginal effect. Similar expressions are obtained for the wage equations. We evaluate these magnitudes at each observation and then calculate the mean.

Under the assumption of no selection bias (that is to say, if there is no correlation between the unobservable fixed effects and the variable *x*), consistent estimates of the parameter of interest, β, in equations (1) and (2) can be obtained by ordinary least squares (OLS). Nevertheless, if we think that selectivity effects are present, the fixed effects can be treated as additional parameters to be estimated, which therefore allows for correlation between them and the explanatory variable, *x*. If we assume that no selection bias is present after controlling for fixed effects, then consistent estimates of the parameters can be obtained by OLS regression on the fixed effects model. On the other hand, if selectivity effects still remain even after controlling for fixed effects, we should use an alternative strategy in order to obtain the true causal effect of *x* on the dependent variable (i.e instrumental variables or cuasi-natural experiments). These selectivity effects are more likely in the specification in which cells are defined using sector of activity than when defined using education and experience. Thus, when data availability forces us to define cells using sectors, we perform an instrumental variables estimation.

5. Results

In this section we report the estimates from the different models described in Section 4. Two sets of estimates are presented. The first one presents the effect of immigrant shock on natives' employment rates. The second set of results examines the effect of immigrant shock on natives' wages. The first row in the tables reports the results from the pooled data without including fixed effects in the regression. Row (2) presents the estimates when including fixed effects, while Row (3) presents the results when including also interactions among them. Rows (4) to (9), in turn, report the coefficients estimated for men and women separately.

5.1 Employment Rates

5.1.1 The impact of total immigration

We first present the results from estimation relying on cells being defined by gender, educational level and potential work experience. The data are from the Census of Population for 1991 and 2001. There are pros and cons from using this sample. First, in principle, the Census should provide a good measure of the total immigration to Spain, both legal and illegal. Moreover, as cells are defined along the gender, education and experience dimensions, there are no reasons to expect that mobility across cells is an issue for the estimation. On the minus side, the number of cells used in the estimation (64 per year) is significantly lower than the number of cells that could be considered when using other dimensions.

Table 2 presents the results for the employment rates. Overall, we do not find statistically significant effects of the immigration shock on the employment rates of native-born workers in any specification. When interactions of the fixed effects are included as additional regressors, the impact of immigration on the employment rate is negative. In particular, the estimated elasticity at the aggregate level is around 0.022, so

that an increase of 10% in the ratio of immigrants to native workers would decrease the employment rate of native workers by 2.2%. Separate estimations by gender shows that the impact of immigration on the employment rate turns out to be positive and smaller for men than for women, although again non significant at standard levels.[19]

Table 2. OLS estimates using education-gender-experience groups
Dependent variable transformed: log(e/(1+e))

	Coefficient β	Std Err.	Marginal Effects*	Elast.*	Fixed Effects	Interactions	Nº of obs.
			All				
(1)	0.3276	1.6733	0.0754	0.0089	NO	NO	128
(2)	-1.5432	1.8734	-0.2818	-0.0336	YES	NO	128
(3)	-1.0357	2.3738	-0.1892	-0.0219	YES	YES	128
			Males				
(4)	-1.5982	1.2027	-0.2569	-0.0225	NO	NO	64
(5)	-1.1691	1.0392	-0.1760	-0.0169	YES	NO	64
(6)	0.9662	1.8957	0.1499	0.0144	YES	YES	64
			Females				
(7)	4.2688	2.1347	1.0328	0.1603	NO	NO	64
(8)	-0.9683	1.0504	-0.1947	-0.0299	YES	NO	64
(9)	2.2576	4.4023	0.4463	0.0671	YES	YES	64

* Mean values. Regression models in rows (3), (6) and (9) include interactions between education and experience fixed effects, education and period fixed effects, and experience and period fixed effects. Standard errors are clustered by cells to adjust for possible serial correlation. All the regressions are weighted by the sample size used to calculate the dependent variable.

To get some feeling about the importance of geographical mobility when performing this kind of estimation, we also exploit the variability across 17 Spanish regions defining labor market segments as above for each of these regions. The estimates are presented in Table 3. The results show that the estimated elasticity for the employment rate is still negative but becomes statistically significant. These discrepancies with respect to the elasticities obtained when the region is not used to define cells suggest that part of the partial correlation between immigration and labor market performance of native workers found when we use geographical variation is produced by workers mobility rather than by a causal effect from immigration on labor market outcomes. One possible interpretation of this result is that immigrants tend to move to the less thriving regions of Spain, where the employment rate of native workers is lower.

Table 3. OLS estimates using education-gender-experience-regions groups

[19] Since the variable x_{it}, gives the immigrant share among labor force participants in each cell, one could think that the labor force participation decision may introduce some endogeneity in this variable. This problem can be addressed using an instrument. Following Borjas (2003), we use the proportion of immigrants in the total population as an instrument. The results from this IV estimates provide positive elasticities for the employment rate, although statistically non-significant.

Dependent variable transformed: log(e/(1-e))

	Coefficient β	Std. Err.	Marginal Effects*	Elast. *	Fixed Effects	Interactions	Obs.
(1)	1.4793	0.6329	0.3365	0.0340	NO	NO	2,167
(2)	-1.0752	0.3447	-0.1954	-0.0215	YES	NO	2,167
(3)	-2.4418	0.4196	-0.4428	-0.0479	YES	(Region x Year), (Education x Year), (Experience x Year)	2,167
(4)	-0.9381	0.3566	-0.1704	-0.0179	YES	(Region x Year), (Education x Year), (Experience x Year), (Education x Experience)	2,167

* See notes in Table 2.

On the other hand, we can think that the impact of immigration on labor market outcomes of native workers is not immediate. As Cohen *et al.* (2004) pointed out "there are reasons to believe that the effect of a given immigration wave is not uniform over time".[20] Thus, it could be relevant to distinguish between the short and long run effects of immigration on the labour market. Trying to disentangle these effects, we have separated immigrants in two groups: immigrants with less than 3 years of residence in Spain and immigrants with more than 3 years of residence in Spain.

Table 4 presents estimates for these two groups separately. The results show that the effect of immigrants with 3 or less years of residence in Spain on the employment rates of native workers is positive, while the effect of immigrants with more than 3 years of residence is negative. The same is true for men. On the contrary, for women the effect of immigration on native's employment rates is always positive, though it decreases as time goes by. Although, none of the estimated coefficients are statistically significant, the results seems to indicate that substitutability within cells increases as times goes by, which points out the existence of assimilation.

Table 4. OLS estimates using education-gender-experience groups
Dependent variable transformed: log(e/(1+e))

	Coef β (≤ 3 years)	Std Err.	Marginal Effects*	Elast.*	Coef β (> 3 years)	Std Err.	Marginal Effects*	Elast.*	Fixed Effects	Interactions	Nº of obs.
					All						
(1)	-15.5380	10.6715	-3.4945	-0.1943	14.3066	9.5191	3.2175	0.2349	NO	NO	128
(2)	9.3255	5.7612	1.7043	0.0945	-10.9951	4.9760	-2.0094	-0.1541	YES	NO	128
(3)	0.5664	5.5137	0.1035	0.0054	-2.5444	4.8320	-0.4650	-0.0347	YES	YES	128
					Males						
(4)	-28.3973	12.7966	-4.2430	-0.1832	21.5946	12.8828	3.2265	0.1688	NO	NO	64
(5)	14.9162	6.2805	2.2527	0.1083	-14.9947	5.3231	-2.2646	-0.1416	YES	NO	64
(6)	4.0230	3.7721	0.6242	0.0294	-2.2210	3.1520	-0.3446	-0.0212	YES	YES	64
					Females						
(7)	-11.5952	14.8144	-2.7902	-0.1995	18.5824	12.5545	4.4716	0.4302	NO	NO	64
(8)	4.8858	4.0032	0.9795	0.0697	-6.2567	4.2355	-1.2543	-0.1214	YES	NO	64
(9)	3.0099	8.7494	0.5950	0.0405	1.5491	7.2147	0.3062	0.0293	YES	YES	64

* See notes in Table 2.

5.1.2 The impact of legal immigration

[20] If immigrants are relatively close substitutes of native workers when they arrive in the host country we would expect to see an immediate impact on natives' labor market outcomes. However, as time goes by and capital and labour adjust, the medium and long run response will be smaller. On the contrary, if immigrants, at the time of their arrival, are poor substitutes of native workers, since their human capital is not fully transferable to the host country, the immediate impact of immigration on natives' labour market outcomes is close to zero. Nevertheless, as they acquire local labour market skills, they compete with native workers, so that the medium and long run effects on natives' outcomes might be substantial.

As for legal immigrants, we rely on data from the administrative register of work permits for the 1993-1999 period. In this data set, there is no information on the immigrant's education level, so that we have to define cells along the sectoral dimension, exploiting the fact that permits are awarded to work in some particular sector and mobility across sectors is restricted. Table 5 presents OLS estimates of equation (1) with these data, while Table 6 gives IV estimates.

Results in Table 5 shows that, when including fixed effects and interactions among them in the specification, the estimated coefficient is negative and statistically significant. In particular, the estimated elasticity is around -0.18, so that an increase of 10% in the ratio of immigrant to native workers, say, from 5% to 5.5%, would decrease the employment rate of native-born workers by 1.8%, that is from 52% (the average value in our sample) to 51.06%.

The estimates for men and women separately yield smaller elasticities in absolute values than the ones obtained at the aggregate level (-0.035 for men and -0.088 for women), but the estimated coefficients are still statistically significant at the standard levels.

Table 5: OLS estimates using the sample of work permits.
Dependent variable transformed: log(y/(1+y))

	Coefficient β	Std. Err.	Marginal Effects*	Elast.*	Fixed effects	Interactions	Obs.
			All				
(1)	0.1125	2.3744	0.0005	0.0057	NO	NO	2,395
(2)	-9.7442	1.6585	-0.1071	-0.1364	YES	NO	2,395
(3)	-15.0422	2.3176	-0.1687	-0.1823	YES	YES	2,395
			Males				
(4)	-3.4443	0.9333	-0.0268	-0.1261	NO	NO	1,231
(5)	-3.8672	1.0398	-0.0577	-0.0451	YES	NO	1,231
(6)	-3.6505	1.2259	-0.0551	-0.0349	YES	YES	1,231
			Females				
(7)	8.9504	5.5090	0.0208	0.4765	NO	NO	1,164
(8)	-12.9204	3.2577	-0.1033	-0.0995	YES	NO	1,164
(9)	-13.1792	4.9524	-0.1060	-0.0882	YES	YES	1,164

* Mean values. Regression models in rows (3), (6) and (9) include interactions between sector and age fixed effects, age and period fixed effects, and sector and period fixed effects. Standard errors are clustered by cells to adjust for possible serial correlation. All the regressions are weighted by the sample size used to calculate the dependent variable.

These results, however, could still be biased if we think that, even after controlling for sector, age, and gender fixed effects, immigrants tend to move towards those segments in the labor market where the employment rates of native-born workers are lower (or higher) or, alternatively, if native-born workers tend to move out of those segments where immigrants flow in. This problem can be addressed using an Instrumental Variables approach. Ideally we would like to use an instrument based on information about the labour market behaviour of the immigrants in their country of origin (like in Friedberg, 2001). Unfortunately, we do not have that type of information. Instead, our instrument comes from observation of the procedure for awarding work permits. We regress the probability of a work permit being awarded on immigrant characteristics and some indicators of the labor demand conditions in each particular cell of the labor market, and recover the residual as an instrument of the immigration

shock. This residual ought to capture only the discretionary and random elements introduced by the administrative procedure, not labor demand conditions.

Specifically, since the main problem to identify the parameter of interest, β, is that it is likely that most of the variation in work permits is due to demand factors, we have tried to get rid off these factors by using as instrument the residual of a probit estimate of the approval rate of work permits conditional on the lagged employment growth rate by sector and region. We only have information on the approval rate for the years 1995-1999, so the number of observations is smaller than in the OLS estimation[21]. The correlation coefficient between this instrument and x is 0.0238 (p-value : 0.34). Appendix 2 presents probit estimates of the approval rate of work permits (the first stage equation). The percentage of work permits requested which are finally awarded is about 88%. The sectors in which the number of work permits requested is higher are Domestic care, Agriculture, Hotels and restaurants, and Construction.

The 2SLS estimate of the parameter β, presented in Table 6, is positive but not statistically significant. According to these results, we cannot reject the hypothesis that immigration has no impact on native employment rate. The contrast between the OLS and IV estimates indicates that the distribution of immigrants across sectors is not independent of employment conditions in those sectors and, as a result, OLS yields overestimates of immigration's negative impact on native employment rates. These results are qualitatively similar to the ones obtained by Friedberg (2001), who uses the supply shock in a occupation to identify the labour market impact of immigration in the Israeli labour market.

Table 6: IV estimates using the sample of work permits.
Dependent variable transformed: log(y/(1+y))

	Coefficient β	Std. Err.	Marginal Effects*	Elast.*	Fixed effects	Interactions	Obs.
			All				
(1)	0.3040	0. 4216	0.00005	0.0066	NO	NO	1,714
(2)	0.2137	0.3416	0.00004	0.0028	YES	NO	1,714
(3)	0.7739	0.6281	0.00016	0.0074	YES	YES	1,714
			Males				
(4)	0.6719	1.4206	0.0005	0.0844	NO	NO	950
(5)	-0.0549	1.8457	0.00006	-0.0001	YES	NO	950
(6)	0.4434	2.9701	0.00006	0.0011	YES	YES	950
			Females				
(7)	-0.1379	0.3969	-0.00003	-0.0002	NO	NO	764
(8)	-0.3298	0.1497	-0.00005	-0.0040	YES	NO	764
(9)	-0.9247	1.3402	-0.00009	-0.0040	YES	YES	764

*Mean values of the marginal effects and elasticities. Sample period: 1995-99.

5.2 Wages

Finally, we estimate the impact of immigration on natives' annual and hourly wages. For this purpose, we use data from the Wage Survey Structure for 2002, which includes firms in the industry, construction and services sectors. There are advantages and disadvantages from using this survey. On the one hand, the survey allows us to define cells along the gender, education and experience dimensions and provides a good

[21] OLS results do not change when using the period 1995-1999.

measure of legal immigration to Spain as well as a relevant measure of spanish workers' wages. On the other hand, public administration, primary sector and domestic service, this last two with an important presence of immigrants, are excluded from the survey. Besides, it is only possible to distinguish between natives and immigrants workers in its last wave, so that the number of cells used in the estimation (64) is significantly low, reducing the precision of the estimates.[22] Finally, it only includes legal immigrants.

Table 7 presents the estimates. The results point to the inexistence of any sizeable effect of immigration on the wages of native workers. This could be possibly explained by the existence of minimum wages that prevent these to decrease below their level.

Table 7. OLS estimates using education-gender-experience groups
Dependent variable: log w

	Coefficient β	Std. Err.	Elast. *	Fixed Effects	Interactions	Nº of obs.
			Annual Wage			
(1)	-3.6420	1.3922	-0.0222	NO	NO	64
(2)	0.4174	0.6364	0.0025	YES	NO	64
(3)	1.2102	1.5738	0.0074	YES	YES	64
			Hourly Wage			
(4)	-3.6004	1.2298	-0.1079	NO	NO	64
(5)	0.0590	0.5475	0.0018	YES	NO	64
(6)	-0.7237	1.1382	-0.0217	YES	YES	64

As in the employment estimates, we also exploit the geographical variability for wage data (see Table 8). When using the geographical variation the estimated elasticities are negative and become statistically significant. As before, these discrepancies with respect to the elasticities obtained when the region is not used to define cells might suggest that part of the partial correlation between immigration and natives' wages found when we use geographical variation is produced by workers mobility rather than by a causal effect from immigration on wages. One possible interpretation of this result is that immigrants tend to move to the less thriving regions of Spain, where the wages of native workers are lower.

Table 8. OLS estimates using education-gender-experience-region groups
Dependent variable: log w

	Coefficient β	Std. Err.	Elast. *	Fixed Effects	Interactions	Nº of obs.
			Annual Wage			
(1)	-1.1703	0.2750	-0.0047	NO	NO	1,053
(2)	-0.1382	0.1043	-0.0006	YES	NO	1,053
(3)	-0.2017	0.1053	-0.0008	YES	YES	1,053
			Hourly Wage			
(4)	-1.2630	0.2435	-0.0246	NO	NO	1,053
(5)	-0.1088	0.0904	-0.0021	YES	NO	1,053
(6)	-0.1640	0.0869	-0.0032	YES	YES	1,053

* Mean values. Regression models in rows (3) and (6) include interactions between education and experience fixed effects. We have dropped 35 cases, out of 1088 observations, in which the annual and hourly wages of native workers were missing.

[22] Given the low number of cells in this case, we do not perform separate estimates for men and women.

6. Concluding remarks

The economic analysis of immigration has devoted much attention to the identification of its impact on the labor market outcomes of native-born workers. However, the empirical evidence on this matter is not totally conclusive and, to a large extent, refers to the US case, where relative wages adjust to the relative supply and demand of workers of different characteristics to a larger extent than in the "rigid" European labor markets.

In this paper we have searched for some effects of immigration on the Spanish labor market. Although still a country with a relatively low proportion of foreign population, during the period 1993-1999 the number of foreign workers with work permits increased by about 70%, and the proportion of immigrants in the total population increased by more than 5 percentage points between 1991 and 2003. This strong rise has spurred some concerns about a possible fall in the employment rates of native-born workers. To address this issue, we estimate the impact of immigrants with work permits on the employment rates of native-born workers using information on employment rates and incidence of immigration for workers of different groups of age, gender, and sectors of activity. We also use an alternative sample including illegal immigrants and searching for correlation between immigration and employment rates across workers groups defined by educational levels, gender and potential work experience.

We have found some negative effect of immigration on the employment rates of native-born workers only when considering immigrants with work permits and employment rates are defined over sectors of activity. In this case the corresponding elasticity estimated by OLS is around -0.1. In the sample with restricted work permits, where occupational mobility is less than a problem, we also found that legal immigration has a quite small effect on the employment rate of native workers. On the contrary, when considering total immigration we have found negative, but not statistically significant, effects of immigration on the employment rate of native workers.

This result has some interesting policy implications for the debate about the effects of an amnesty for illegal immigrants. Such a measure, which may cover about 500,000 illegal immigrants, is currently being discussed in Spain. This would yield a rise in the proportion of legal immigrants of about 30%. Assuming that the elasticity of the employment rates of the native-born population to legal immigration is -0.05, the amnesty would result in a fall of the employment rate of native-born workers of about 1.5%, that, from the current level of 62%, amounts to less than one percentage point.

Our results ought to be complemented by further analyses. First, given the short period span in our samples, we can only observe the short-run impact of immigration, which is conceivably very different to its long-run impact. Moreover, we have tried to measure the causal effect of immigration on the employment rates of the native-born workers. The fact that we have been unable to find any sizeable effect does not mean that the impact of immigration on the labor market outcomes of native-born workers is small, since that impact could have taken place through wages or through the total number of hours worked. Whether that happened or not remains to be investigated once adequate data on these variables are available.

Appendix 1: Sectoral classification

Work permits

1. Agriculture, cattle raising, and hunting
2. Fishing
3. Coal mining
4. Oil and gas extraction
5. Extraction of minerals (non-energy)
6. Food, beverages, and tobacco
7. Apparel and textiles
8. Leather products
9. Wood and cork products
10. Paper and printing
11. Refineries
12. Chemical products
13. Rubber and plastics
14. Fabricated Non-metallic minerals
15. Metal manufacturing
16. Fabricated metal products (excluding machinery)
17. Mechanical equipment
18. Office equipment
19. Electrical equipment
20. Precision instruments
21. Automobiles
22. Other transportation equipment
23. Furniture and other manufacturing
24. Production and distribution of electric energy, water and gas
25. Construction
26. Vehicles. Sales and repair
27. Wholesale trade
28. Retail trade
29. Hotels and restaurants
30. Transports
31. Sea transports
32. Air transports
33. Other transports and communications
34. Financial activities
35. Real estate
36. Research and Development
37. Other entrepreneurship activities
38. Public Administration
39. Education
40. Health and social services
41. Public sewerage
42. Cultural and leisure activities
43. Personal services
44. Domestic care

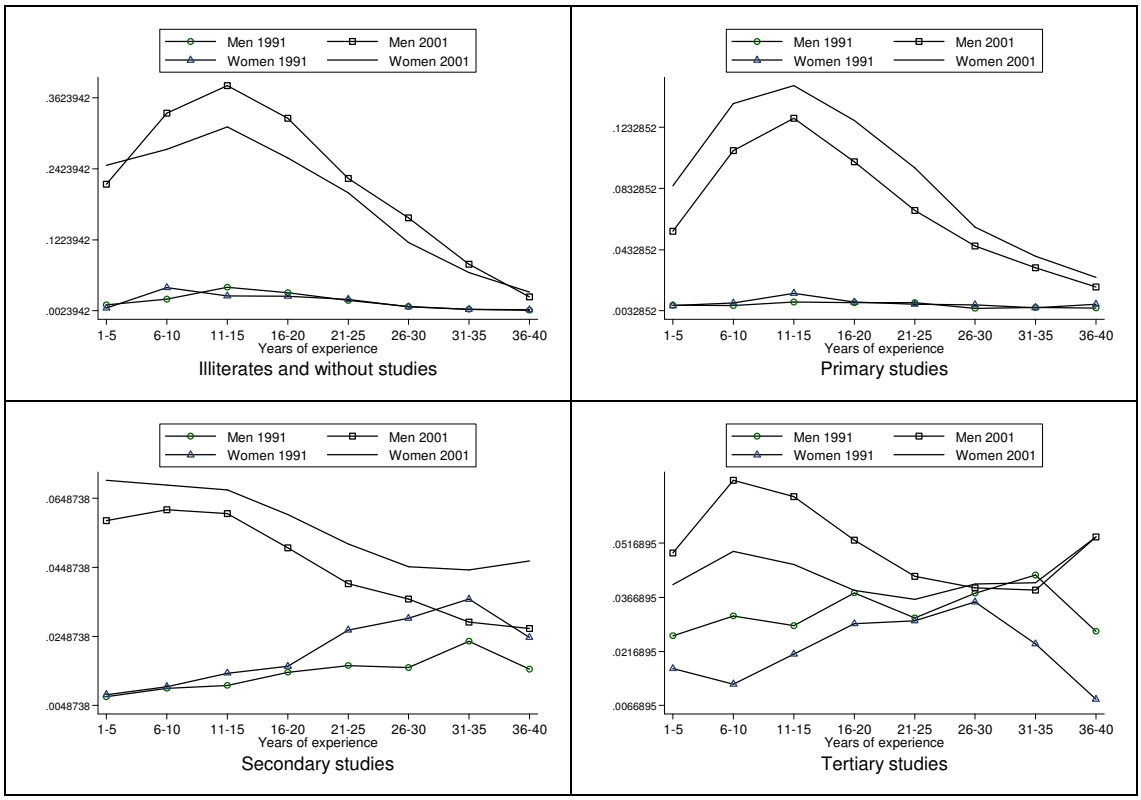
Appendix 2

Probit regression.
Dependent variable: Probability of awarding a work permit

Variable	Coeff.	St. Err.
Age	0.0662	0.0017
Age ^{2}	-0.0006	0.00002
Sex	0.0511	0.0050
Crec_9394	0.00030	0.0001
Crec_9495	-0.0009	0.0001
Crec_9596	-0.0011	0.0001
Crec_9697	0.0026	0.0001
Crec_9798	0.0048	0.0002
Constant	-0.2817	0.0301
Log-Likelihood	-194,733	
Nº Obs.	521,355	

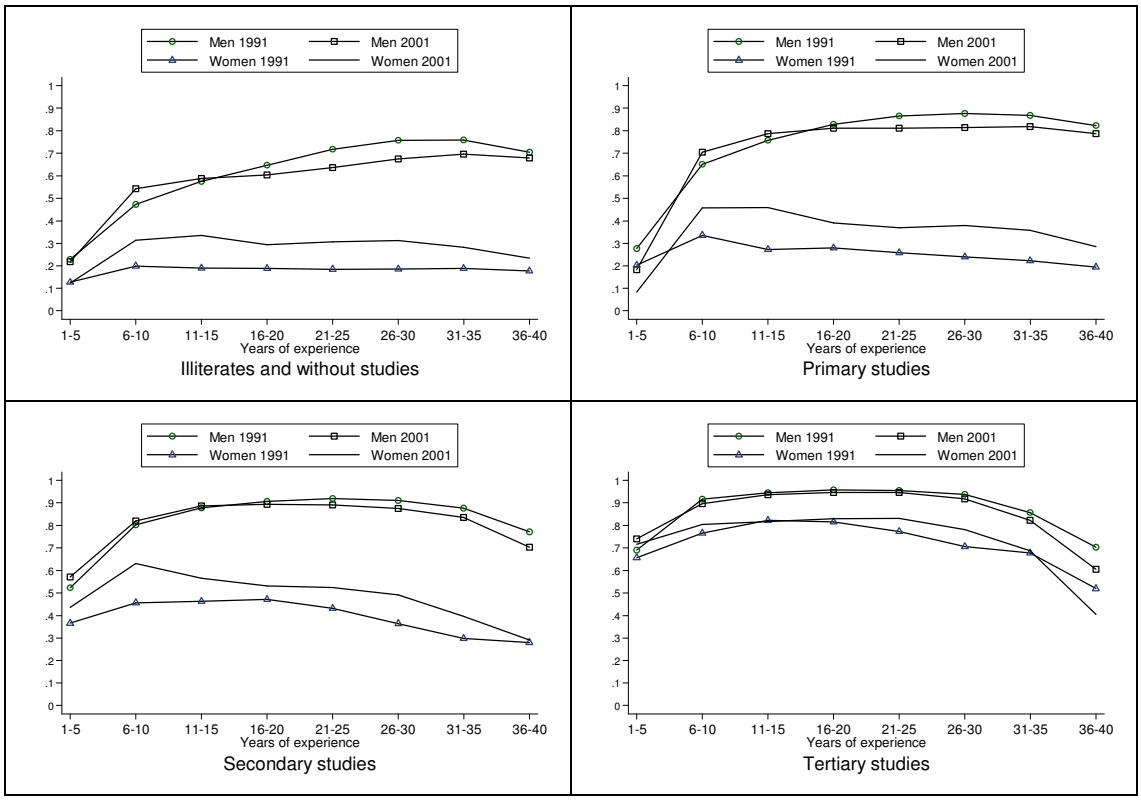
Note: The variables Crec_9394 to Crec_9798 are defined as the employment growth rate by sector and region between two consecutive years.

Figure A1. Incidence of immigration by educational level and years of experience



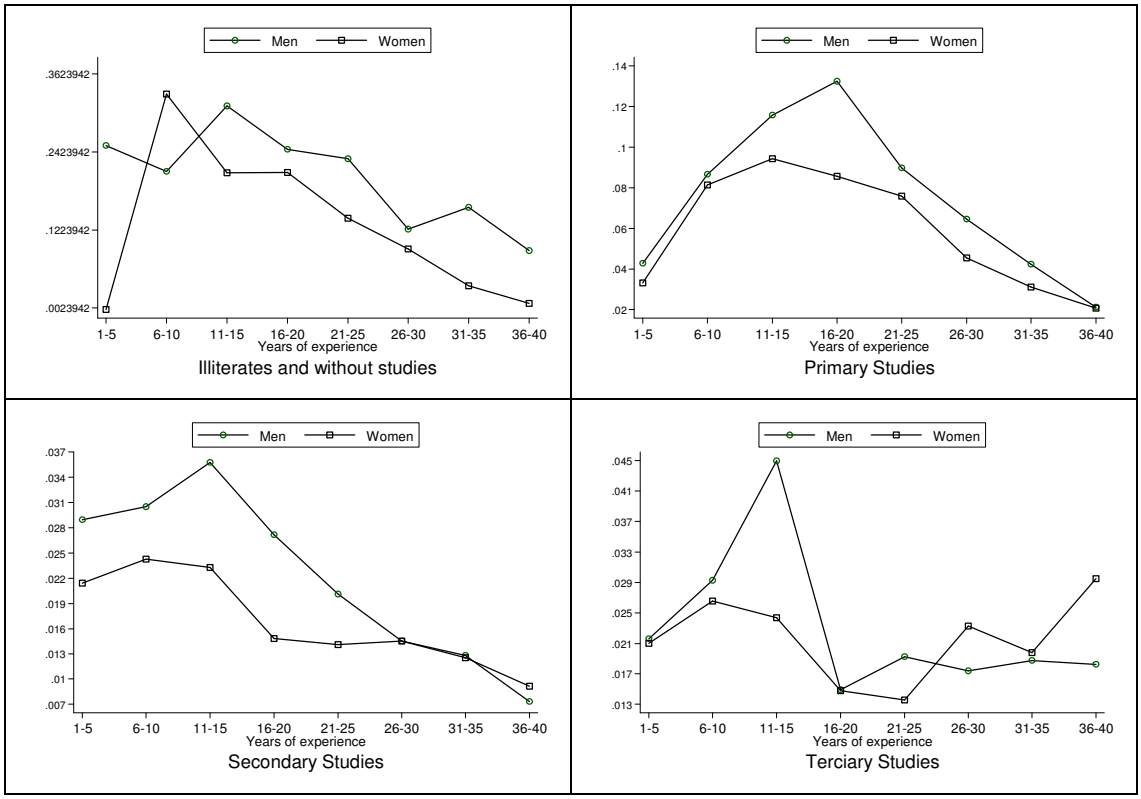
Source: Census of Population, 1991 and 2001

Figure A2. Employment rates of native workers by educational level and years of experience



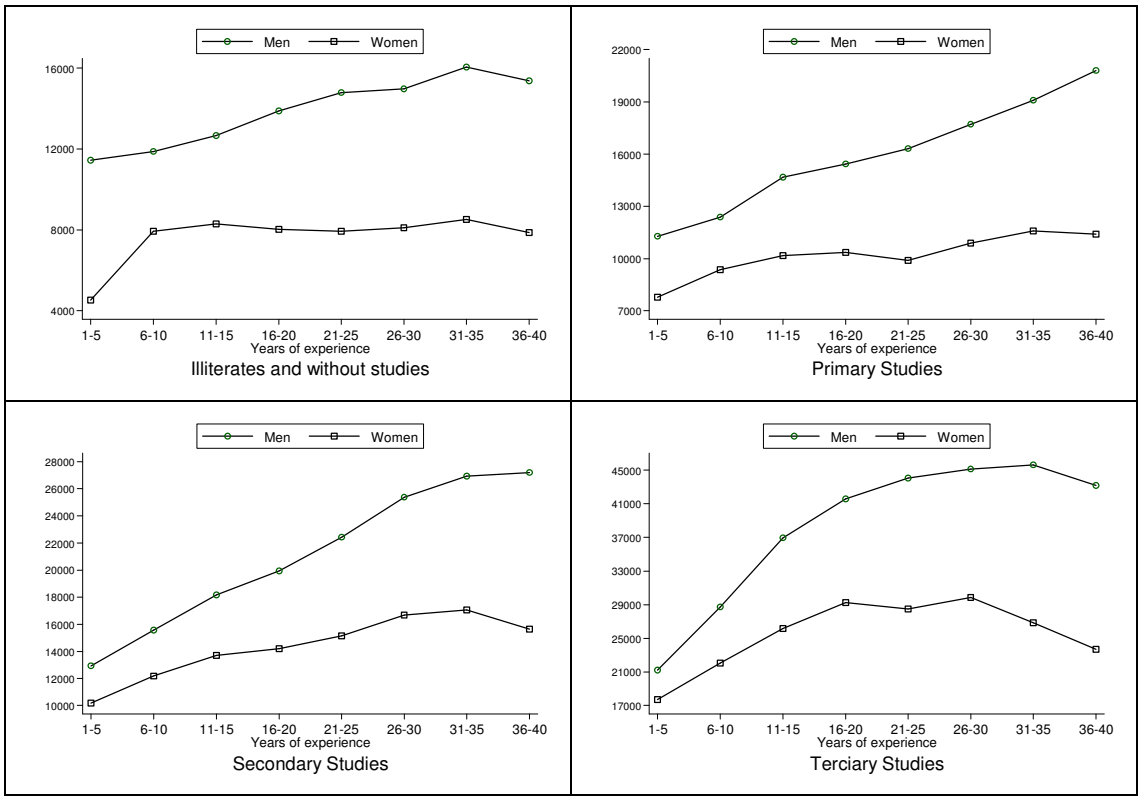
Source: Census of Population, 1991 and 2001

Figure A3. Incidence of immigration by educational level and years of experience



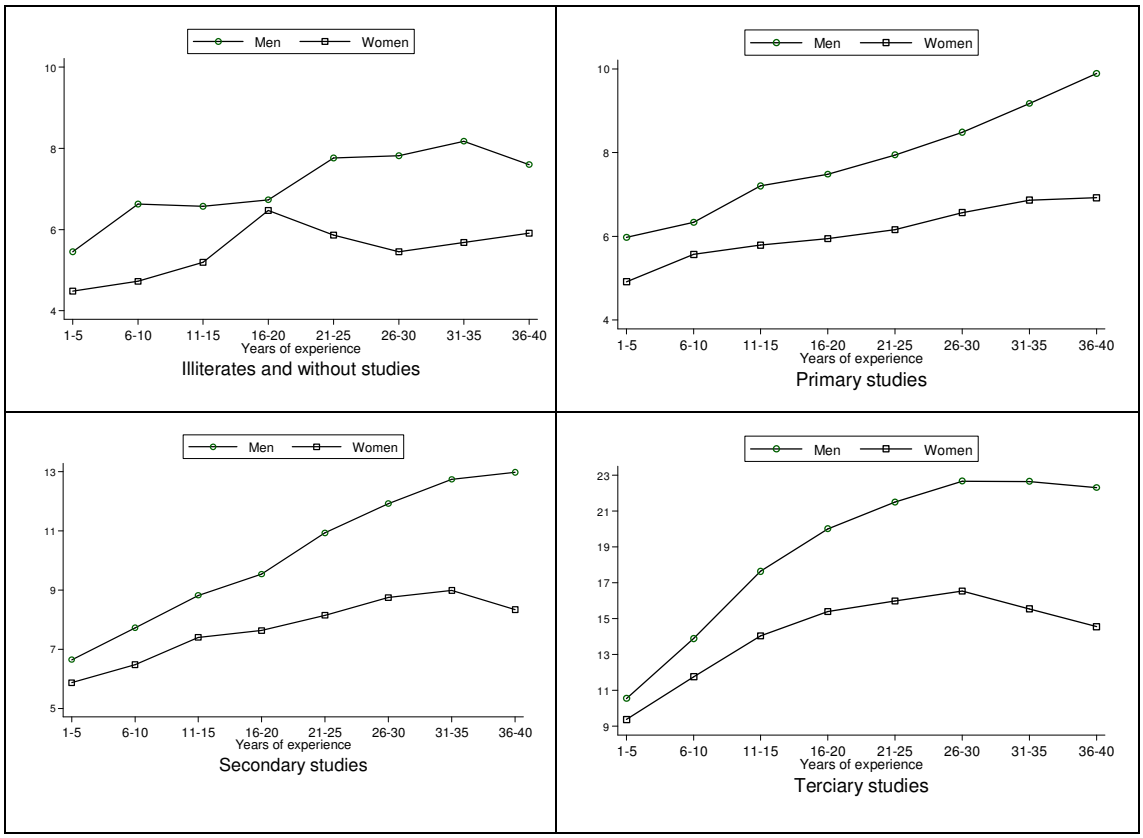
Source: Wage Structure Survey, 2002

Figure A4. Annual wages of native workers by educational level and years of experience



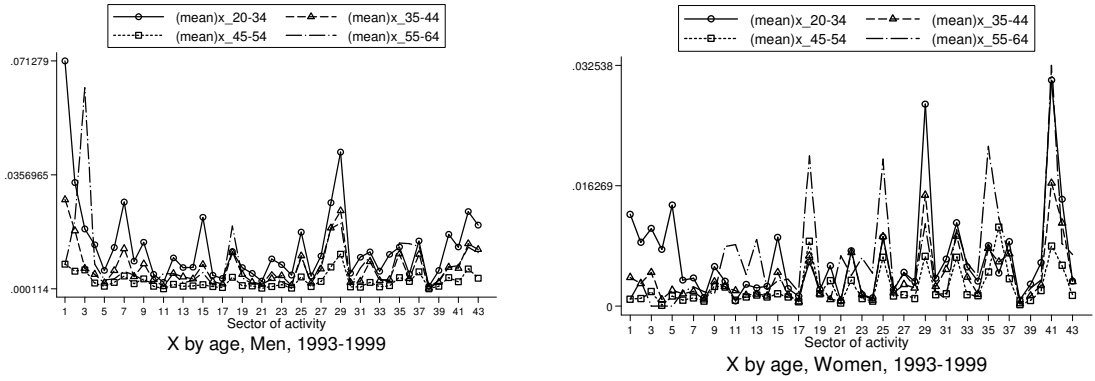
Source: Census Wage Structure Survey, 2002

Figure A5. Hourly wages of native workers by educational level and years of experience



Source: Wage Structure Survey, 2002

Figure A6. Incidence of immigration by age and sector of activity



Source: Register of Work Permits, 1993-1999

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