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The effects of immigration on the production structure of Spanish regions.

Joan Martin *, Francisco Requena**, Guadalupe Serrano+

Abstract.

Immigrants have increased their participation in Spanish labour supply from 1 percent in 1997 to 7 percent in 2004. Using the factor proportion model of production, this paper analyses the impact of this labour supply shock on the Spanish regions' industrial structure. Our best specification is a hybrid factor proportion model with time varying regional effects to capture Hicks neutral technological progress. The results show that immigration has played a substantial role in explaining the increase of construction and services in total output across Spanish provinces. Moreover foreign and native workers are complementary in the two sectors, while in other sectors there is some evidence of substitutability between foreign and native workers.

* Dept. of Economics
Universitat Jaume I de Castelló
C/ Vicente Sos Baynat, s/n
12071 Castelló. Spain
Phone. +34 964 72 86 09
Fax. +34 964 72 85 91
E-mail: jmartin@eco.uji.es

** Dept. of Applied Economics
Faculty of Economics
University of Valencia
Avda dels Tarongers sn. Campus dels Tarongers
46022 Valencia. Spain
Phone: +34 96 382 88 51.
Fax: +34 96 382 82 49.
E-mail: francisco.requena@uv.es

+ Dept. of Economic Analysis.
Faculty of Economics
University of Valencia
Avda dels Tarongers sn. Campus dels Tarongers
46022 Valencia. Spain
Phone: +34 96 382 82 47.
Fax: +34 96 382 82 49.
E-mail: guadalupe.serrano@uv.es

1. Introduction

Net flows of immigration from less developed countries have contributing significantly to the population's growth in developed countries during the nineties and first decade of this century. This large wave of immigrants can be considered as a labour supply shock which affects the relative factor endowments in the host economy, and thus its industrial composition. Moreover, since there are differences in sector specialisation patterns and differences in factor intensities, differences in immigrant skills could drive, among other factors, differences in wages of more-skilled relative to less-skilled workers, which were observed in developed countries over the nineties (Davis and Trevor, 2004).

In Spain, foreign population has shown a large increase in the last decade, being less than the 1% in 1998 in contrast to the nearly 9% in 2005. The intensity of the phenomenon in this short period of time makes Spanish economy a good “laboratory” where to analyse the economic effects of immigration. On the one hand, considering a national perspective, both the industrial structure and trade patterns will be affected over the time. On the other hand, from a spatial perspective, immigration could drive relevant industrial structure shifts across Spanish regions.

This paper analyse the role of immigration flows in the Spanish regions’ industrial structure. We focus on the impact of immigrants on local industrial composition, its measurement and the quantification of the extent to which an increase in the immigrant labour force could induce shifts in the industrial structure and specialisation patterns of regional economies. Though immigration is still ongoing process, we perform the study over the period 1995-2003 for which data are available.

Recent literature analysing the effects of skilled and unskilled immigration inflows on the industrial structure of countries has found both shifts in countries’ specialisation patterns but also relevant technological adjustments. For example, when low-skilled labour is a relative abundant factor, the adoption of new capital-intensive technologies is delayed given that labour costs are cheaper than the investment required to implement such labour-saving new technologies. (Lewis, 2004; Gandal et al., 2004). The effect of immigration on the adoption of technologies which are intensive in the relative abundant factor in the country has not been analysed up to our knowledge in Spain. The last OECD report on Spanish economy (OECD, 2005) points out the strong efforts made by both private and public agents in order to increase the level of R&D expenditures. However, the adoption of new technologies in certain manufactures and services has been slow compared to other European countries, which may be due to adoption of technologies which use more intensively immigration population.

Explaining the determinants of shifts in production and trade patterns is a key question to understand the economic performance of an economy. Specific factors in each industry can explain some aspects of those changes. Nevertheless, analysing each industry isolated from the rest of the economy does not allow considering interrelations among industries, markets and other economies. General equilibrium models demonstrate the relevance of such interrelations but very often, when empirical analyses of production shifts are the objective, those models are forgotten.

This paper adopts a general equilibrium approach –the factor proportions model of international trade- to explain up to which point changes in industrial structure of economies are driven by shifts in factor endowments, with independence of those specific changes happened in each industry or market. According to factor proportions model, countries tend to produce (and export) relatively more of those goods that intensively use their relative abundant factor of production. Thus, production in one economy is determined both by factor endowments and by the way in which those factors are combined to obtain the output. This idea is very relevant given that shifts in the relative factor endowments in the economy could imply the specialisation in those industries that intensively use the relative abundant factor, given that it is relatively cheaper; or could imply changes in the production technology towards those more intensive in the relative abundant factor. Only in the first case, the industrial composition of the economy would really considerably.

We develop our analysis in two parts. In the first part we test the adequacy of the factor proportion model to describe the Spanish regions' economies. To do it, we use data on Spanish provinces (Eurostat NUTS III) and 24 production sectors from 1975 to 1993, a period in which foreign labour force is insignificant (less than 0,75 percent of Spanish labour force). Moreover, to distinguish between the effects of factor accumulation from those of general technological changes, we implement the methodology proposed by Harrigan (1995, 1997, 1999) and recently used in Schott (2001), Trevor (2006) and Redding and Vera (2006) using country level data. After evaluating the prediction capacity of the factor endowment model using regional data, we analyse the changes in specialisation production across Spanish provinces over the period 1995-2004, when the immigration supply shock has happened.

In the second part, we estimate the Rybzcynski coefficients, i.e. what is the increase in final output due to a unitary increase in factor endowments. We specify a sector production function in which the share on industry in the region is determined by aggregate factor endowments and technology. We consider a sample of 6 sectors and 50 provinces. Now we consider foreign labour endowment separately from the native labour endowment in the production function and investigate whether native and foreign workers are complementary or substitute in each industry.

The paper concludes with some implications of political economy which arise from our results. We want to identify what type of immigration should be supported from public administration according to the productive requirements of Spanish economy to face international competition challenges in optimal conditions. Moreover, we want to discern if immigration is playing a negative role in the adoption of new technologies in any sector and/or region.

2. Immigration and the Spanish labour force.

The immigration shock began in the second half of the nineties, in 1997 and implied a substantial increase in the foreign population living in Spain as well as the stock of labour force (Figure 1). Moreover, a relevant characteristic of the foreign immigrant population in Spain is that it poses a different composition of education levels and occupation categories compared to natives. Those differences in the qualification-mix of immigrants and natives may have cause a change in skill composition in the labour force across Spanish regions. Information in Table 1 allows us to examine the changes in skill composition of immigrants and of the overall labour force for 1995 and 2004. The share of immigrants with a medium and high-educational level is higher than that of the rest of labour force. In total, the pool of immigrants is slightly more educated than the rest of labour force pointing to the fact the education can determine the emigration decision looking for better job and life conditions. In fact, skill upgrading in the immigrants group occurred only in the medium-education level in which the share of immigrants increased 12 percent from 1995 to 2004.

Table 1 also shows that the distribution of foreign labour force is more heterogeneously distributed across Spanish provinces than native labour force. While medium-educated actives are the most unequally distributed foreign actives in the territory, natives with low education are the less homogenously distributed. Those differences in the distribution of foreign active population could change the composition of labour force in the Spanish provinces, especially if we focus in the level of skills of foreign actives that arrive to each province. Figures 2 and 3 show the composition of native and foreign labour force by educational level. In native labour force, more homogenously distributed, the largest group of actives are those with medium education as it is shown in Figure 2. The same is observed in Figure 3, despite the significant differences of foreign actives endowments in Spanish provinces. Then, differences across provinces seemed to be related both to the total amount of foreign actives in the region and to their educational attainments.

From the sectors point of view, Figure 4 shows the number of workers by sector. The sectors that employ more foreign workers are building and, in market services, trade and hotels and household services. Moreover, immigration has slowed and the process of destruction of jobs in agriculture and industry in the last decades. Moreover is relevant to notice that apart from building, where the share of immigrants is larger, in the rest of sectors immigrants are more homogenously distributed. Moreover, as it is shown in Figure 5, the distribution of the immigrants by sector is very similar to those of the natives, except in building where the share of immigrants is larger, and in industry where the share of immigrants is lower that the share of native workers.

Percentage variations in sectoral output shares on the total output of each Spanish province between 1995 and 2003 are shown in Table 2. The composition of economic activity in Spanish provinces continues the trends characterising the past decades. The reduction of agriculture and industry sectors is favouring the increase of the relevance of building and services in all provinces, sectors that absorb mostly the foreign workers that are arriving over the period.

3.- Methodology

Openness to international trade in products and ideas creates mechanisms other than wage changes through which an economy can adjust to factor-supply shocks: the adoption of national-wide changes in production technology, and regional-specific changes in the mix of goods produced. The goal here is to analyse the extent to which industrial structure can be explained by aggregate factor endowments in a general equilibrium approach, that is, factor endowments themselves drive production patterns through the forces of general equilibrium. Following Reeve (2006), three of the four core theorems of the factor proportion model, those relative to production side (Stolper-Samuelson, Rybczynski and factor price equalisation), point to factor endowments as the determinants of industrial composition of economies and the source of comparative advantage.

In each province, let there be N industries and F primary factors of production. For each industry assume technology is constant returns to scale, free of externalities and identical across provinces. In each province, factor-market equilibrium at each point in time implies supply equals demand,

$$X = C'V \qquad (1)$$

where **X** is a Nx1 vector of industry value-added output, **V** is a Fx1 vector of factor-endowments, being N>=F, and C is a FxN matrix of unit factor requirements (industry production techniques) in the province, such that element c_{fi} shows the units of factor *f* required to produce one unit of real value added in industry *i*. This equality between factor supply and factor demand, together with the equality of price to average cost in each competitive market ensures that factor price equalisation holds if all provinces face the same hicks-neutral technology, face the same product prices and produce the same set of N goods

For our purposes the key implication of equation (1) is the existence of a structural relationship between outputs and factors in one economy, despite the factor proportion model has not been unaware to product indeterminacy problems[1]. If this would be the case, the relationship between outputs and factor endowments wouldn't be very useful to explain provinces' industrial composition (non significant explanatory variables, and large within-sample prediction errors). We will consider this possibility by analysing different number of industries and factors.

4.- Using the factor proportion model to evaluate the impact of an immigration shock (out-sample prediction)

To what extent does the factor proportion model allow to explain the industrial structure of the Spanish provinces? In this part we perform an analysis about the adequacy of this model explaining the economic behaviour of regions, before the wave of immigration that begun in the second half of the eighties.

We use Reeve as the reference paper we test the model performance in the period of analysis and the sources of change in industrial structure.

Adding an error term in equation (1) we have that the province z's output in industry i, is obtained by combining factor endowments in the region –physical capital, high-education, medium-education and low education actives and land-, v_{zt}, according to sector i's factor requirements, c'_{it}, in the period t.

$$x_{zit} = c'_{it} v_{zt} + \varepsilon_{zit}$$

and pooling across provinces, we have that for each industry i=1…N and time, t:

[1] See some caveats about production indeterminacy in Reeve (2006)

$$X_{it} = C'_{it} V_t + \varepsilon_{it} \qquad \text{(i)}$$

Thus for each industry i, we have T equations. Rather than estimating each equation in (i) separately, the possible existence of temporal autocorrelation and structural changes make more interesting the estimation of each sector equations model as a seemingly unrelated regression model (SUR), where the cross-section dimension is the number of observations for each temporal equation in each industry's SUR. Moreover scale problems and the possibility of heteroskedasticity are controlled for by weighting all variables by the provincial GDP. Thus it implies a GLS estimation of the SUR model. Finally and in accordance with the author, potential factor endowments endogeneity is not a major concern because industry-specific output flows are regressed on slowly moving aggregate factor stocks and it is supposed that those industry-specific output flows contemporaneously affect factor returns and nearly does not appreciably affect factor endowments.

We use data covering the period 1973-1993**.** We consider 24 Sectors and 50 Spanish provinces. Sector output is measured by means of Gross Added Value, GAV, and the capital is measured as gross capital stock. Both variables are from the BBVA Foundation and are expressed in year 2000 constant euros, see appendix for details. Labour endowments are measured by means of active population by education level (low, medium and high educated actives) from the Spanish Labour Force Survey. Finally, data on arable land are obtained from the Statistics National Institute of Spain.

The model estimates allow us to explain the industry composition of Spanish provinces over a period in which foreign immigration is not a significant phenomenon. By means of coefficient estimates we can describe the production specialisation-labour endowments relationships in each province. Then, under various economic scenarios over the period 1995-2003, we can perform an out-sample prediction exercise in order to explore what could have happened if the immigration shock never would never have taken place. Thus, comparing both predicted industry shares, with and without immigration shock, provides us with a first glance on the effect of immigration on industrial composition of Spanish provinces.

Results

Estimation exercise: R^2 very high 0,7-0,9. Thus the model performs very well. There are critics when the H-O model is applied to national data compared to international data. Among regions or provinces belonging to the same country indeterminacy of regional specialisation patterns and thus the low performance of the H-

O model occurs due to full factor mobility, the absence of barriers to trade, large scale economies and external effects Bernstein and Weinstein (2002). Reeve (2006) in a multi-country analysis, obtain a moderate performance of the H-O model, being his R^2 around 0,4 in average (see Table 8 in Reeve,2006). In our case the equivalent R^2 are between the 0,7 and 0,9 in average, pointing to the better performance of the H-O model for Spanish provinces. May be in those years our regions are very different from those characterised in critic literature and because of that the model performs well.

Labour is the main factor explaining output changes, although technological change has also been important. Land and capital endowments are very stable. Based on the explanatory power of the factor proportion model, the effects of factor endowments appear to be relevant in explaining the industrial composition of Spanish provinces. Thus is and adequate framework to analyse the impact of immigration on the industrial structure of these economies. As a first exercise, we exploit the full dimension of cross-section industry-province dimensions and the temporal dimension in a SURE estimation to obtain the Rybczynski coefficients that we will use later to do a out-sample prediction exercise.

We assume a first scenario in which there is not technological change, and migration is an insignificant proportion of the labour force in 1995. Under these conditions and the previous estimates, we obtain the industrial composition of Spanish provinces in 1995. Then, we repeat the exercise for 2003, assuming that immigration is constant over the period. Thus, by comparing the predicted shares between 1995 and 2003, we have the variation of industry shares in the absence of an immigration shock, ΔS_i . If we account for the immigration shock, we obtain an alternative industry shares in 2003, and their correspondent variation between 1995 and 2003, $\Delta S_i^{'}$. If we compare ΔS_i $\Delta S_i^{'}$ we can obtain a first glance on the effect of migration on industrial composition. (1) If we focus on the sector (not regional) perspective, considering R-24 does not add additional information compared to those from the R-6 sector disaggregation, except for the textile and hotels sector branches. We used R-24 sector classification to avoid endogeneity problems among total factor endowments and too highly aggregated sector outputs but we concentrate on R-6 for comments. (2) Immigration reduces the loose of weight of agriculture and enhances the increase of the importance of market services and building in almost all the provinces. (3) We have to add precision to our predicted shares. In fact the sum is not exactly 100. We allow prediction errors between the 1% and 10%, that make no necessary to adjust predicted shares to sum up the 100%. We think it is better to allow for those prediction errors rather than adjust the results because this s second option implies changes affecting many sectors and will distort our results. In fact, the prediction errors are not so relevant for our purposes because we are interested in the differences of industry shares' variation between 1995 and 2003 caused by the immigration shock. (4) Next we assume a second scenario in which a sort of technological change is allowed. We suppose that technological changes between 1995 and 2003 are the same than those occurred between 1985 and 1993. In fact, this assumption implies to use different values for the drift in 1995 and 2003 predictions, respectively we use 1985 and 1993 drift estimates. Again we are interested in differences in the evolution of industry shares with and without the immigration shock. (5) As a conclusion of this part the model performs well and migration is relevant to explain the evolution of industrial composition of Spanish provinces but, with the out-sample prediction we can only have a first approximation to the problem since it remains the problem of prediction errors increasing as time horizon increases.

5. Are foreign and native workers as substitute factors in the production function?

Unfortunately, information from 1995 onwards is not homogeneous with the previous one because of the change of the base year for computations, and the change in National and Regional Accounts' methodology to adapt it from the ESA-79 to the ESA-95 scope. These changes mainly affect the account criteria, information sources, computation procedures, sector branches and product classifications and production definition and valorisation and make no possible to directly compare both series. Because of that it is necessary to perform a new analysis of this period in which immigration wave began, the second half of the nineties.

To do so, we use available information for Spanish provinces. We aggregate industries from 24 to 6 sectors and remain the spatial dimension of the sample: 50 Spanish provinces. We focus on the spatial dimension because it allows us to make extreme spatial inequalities of immigration inflows, and at the same time permits a larger sample size given the information available. Moreover in this period 1995-2003 there is not a perceptible technological change. Thus if there are output shifts, they have to be due to the immigration shock.

Then we make a SUR estimation of equation (ii) but now to the period 1995-2003.

$$X_{it} = C^{*\prime}_{it} V^{*}_{t} + \varepsilon_{it} \qquad \text{(ii1)}$$

where for each industry i, we have T equations, and the cross-section dimension is the number of observations for each temporal equation in each industry's SUR. In this case, we distinguish among native and foreign actives in the consideration of factor endowments, $V*'_t$. Again, scale problems and the possibility of heteroskedasticity are controlled for by weighting all variables by the provincial GDP, implying a GLS estimation of the SUR model.

Despite the empirical advantages of H-O model, the adequacy of its assumptions on homothetic preferences, identical technologies and no barriers to trade has been questioned and used as arguments supporting the poor performance of the model to explain countries' production patterns. In our case, the use of provincial data allows us to go away from those critics. In fact infra-regional information makes more plausible the irrelevance of measurement errors and technological differences across provinces and the exogeneity of variations in relative prices. Nevertheless, and in accordance with Redding and Vera-Martin (2006) the use of regional -or provincial data in our case- implies that the exogeneity and immobility of factor endowments assumption does not stand in that sample[2]. Nevertheless, they derive and use a general equilibrium relationship between production structure and relative prices, technology and total factor endowments that "under the null hypothesis of the HO model and under more general alternatives hold irrespective of the degree of factor mobility"[3]. Following their approach, we conduct a more flexible empirical analysis by specifying the model under the HO model's assumptions about identical prices and technology among provinces, that is (ii). If cross-region differences in prices and technology are not permanent but are specific for the region R in the period t, relative to the R' reference region, the SUR model will change by the inclusion of a set of region-time dummy variables, D_{Rt}, model (ii2). If we allow for regional differences in relative prices and technology, we add to the initial SUR model a region fixed effect, D_R, model (ii3).

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[2] Juarez (2000) point to the fact of the decreasing migration rates across Spanish provinces. Devillanova and García-Fontes (2004) say that active population is more mobile than non-active population and obtain slightly higher inter-provincial migration rates relative to interregional ones over the period 1978-1992,- specially in high skilled workers-, both of them being relative low rates (an 2.25% and 1.68% migrants over total social security registered workers respectively), see McCormick (1997) and Hatton and Tani (2003) as examples for the UK regions. .

[3] As the authors point out, the interpretation of their general equilibrium relationship changes depending on the mobility of factors. When factor immobility holds, the model can be interpreted in supply-side terms (external changes in factor endowments cause production structure changes). When factors are perfectly mobile across regions, there is also a demand-side interpretation (external changes in demand and production cause endogenous changes in factor endowments). Moreover, this relationship holds without factor price equalisation given that both differences in relative prices and technology are controlled for in the model, and holds under factor mobility See Redding and Vera-Martin (2006) for further details.

$$X_{it} = C^{*\prime}_{it} V^{*}_{t} + D_{Rt} + \varepsilon_{it} \qquad \text{(ii2)}$$

To develop this more flexible analysis, sector GAV for each province, the provincial GDP and the provincial gross capital stock are measured in current prices as in Redding and Vera-Martin (2006), see Appendix for details.

Results

We consider three alternative econometric specifications: without any regional effects (ii1), with time-varying regional effects (ii2) and with no time-varying regional effects (ii3). These affects allow for differences in relative prices and technology to be included in our regression analysis. In the three specifications R^2 are very high 0,8-0,9, and the better results are obtained for specification (ii2), see Table J1.

As should be expected, the activities where the role played by immigrants is more important are Construction and Services, as displayed in Table J2. Our descriptive analysis has already shown that these two sectors concentrate a high share of the foreign active population in Spain. More specifically, low and medium educated foreign workers appear to be significant to explain the value added in construction (only medium when non time-varying regional effects are included in the estimation), whereas medium and high categories are statistically significant in services (also the low educated ones in the time-varying dummies estimation). It is a bit surprising the non-significance of any immigrant category in the agricultural activities, but the strong evidence in favour of undocumented foreigners working there (and, therefore, not appearing in statistical reports) could explain this result.

With regard to the other variables, capital is always significant except in agriculture when regional effects are included. Land appears to be significant in agriculture and construction, and also in public activities when we add regional effects to the estimation. In construction, low and medium educated both native and foreign are statistically significant, although the inclusion of regional dummies drops the medium educated native workers and (when the dummies are non time-varying) the low educated immigrant workers. In industry, besides the capital, the other significant productive factor is the medium-educated native labour (and the low-educated one when the regional dummies are time-varying). In services, most types of labour (native and foreign) are significant, although some of them are dropped by the inclusion of the different regional dummies specifications. In the public activities, only native labour is significant (together with capital and land). Perhaps the most variable results are those concerning energy. Depending on the econometric specification, capital and low-educated native labour are accompanied only by medium-educated foreign worker (with a negative sign), or also by high-educated native labour (time varying region effects) or low-educated foreign labour (no time-varying region effects).

Final Remarks.

On processing.

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Appendix. Variables and data sources.

We analyse the impact of immigrants, who represent and increase in the local labour force, on the patterns of production of the 50 Spanish provinces, according to the Eurostat's NUTS III classification of territories of EU members. For each Spanish province, productive activity is divided in six large sectors: agriculture, energy, manufacturing, building, private and financing services and public services over the period 1995 to 2001. In this period, begun a relevant process of immigration that is not finished yet, which is implying an increase in the labour force endowments in all the Spanish provinces but not in the same intensity. Together with this increase in labour supply, in this period it is observed an accumulation of education and physical capital in an open economy environment. Moreover, in a larger or lower intensity, in all Spanish regions it is being consolidated the restructuring process of productive activity which implies the reduction of the agriculture sector in favour of manufacturing or private services sector.

We develop our analysis in two parts. In the first part we study the adequacy of the model specification using the 1973-1993 sample period. In this part, 24 sector branches' output is measured by GAV in current market prices from 1973 to 1993 for each Spanish province, data provided by the BBV Fundation (1999). These sectors' GAV in current pesetas, is converted to 2000 constant euros by using the Spanish GAV deflator for each industrial categories. These industry deflators are obtained from the National Statistics Institute of Spain (INE), concretely from INE's Quarterly National Accounts base years 1995 and 1986. The first deflator covers the period from 1980 to 2004. For the previous decade, we take this deflator to the past by means of the application of the variation rates of the base-1986-deflator to the 1995-base ones. Moreover we make a change in the base year to 2000. In the second part, when the effect of immigration is considered over the period 1995-2003, we consider six productive sectors for each Spanish province. Sector's output is measured by means of sector GAV (gross added values) at 1995 basic current prices from the INE. We weight the model by provincial GDP. Provincial constant GDP from 1973 to 1993 is obtained from data provided by the BBVA foundation Current GDP from 1995 to 2003id obtained from INE.

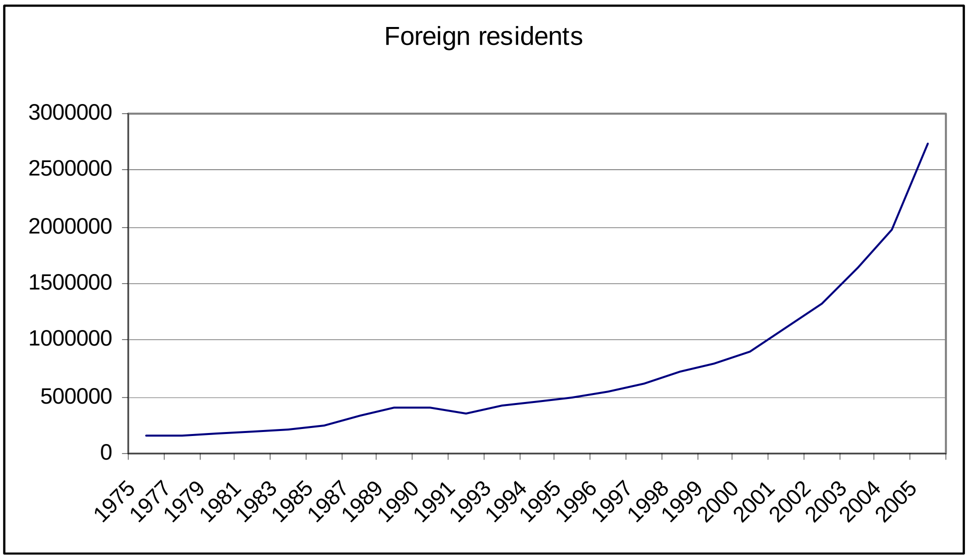
Data on arable land is provided by INE's *Statistical yearbook of Spain* and interpooling when necessary.

Data on capital stock is obtained from estimations provided by the BBVA Foundation and IVIE. Concretely, we use the gross capital stock in current euros for the period 1995-2003 and the gross capital stock in constant year 2000 euros for the period 1973-1993. As the same source points to, "gross and net capital stocks are more appropriate measures of endowment in the economy from the perspective of the value of available wealth". Since the net stock is the present value of expected incomes generated by the capital goods, and somehow depends on the technology and labour qualification and the gross stock is valued at restoration prices, we choose the second capital stock measurement to avoid endogeneity problems.

We measure native endowments of labour factor by means of data from INE's Spanish Labour Force Survey (EPA, 2002 methodology) on active population annual average. In our paper, we distinguish the skills of labour force, that is, we approximate human capital endowments, by distinguishing three groups of education level. The first is the aggregation of illiterates and primary educated workers; the second groups secondary educated and with the first level of higher education, and finally the third includes those with the second level of higher education.

To account for the immigration phenomenon from 1995 to 2003, we apply the estimated shares of native and foreign active population by educational level, extracted from the raw EPA's microdata, that is six shares summing up 1, to the aggregate active population in each province provided by the INE's EPA. We directly don't use raw levels obtained from EPA's microdata because they slightly differ from those provided by INE given computation refinements and adjustments made by INE to provide total active population

Figure 1. Foreign residents in Spain. 1975-2005.



Source INE's *Statistical yearbook of Spain.*

Table1 Composition of labour supply by education levels and nationality.

Labour Force	Year	Total	Share by Low-edu.	Share by Medium-edu	Share by High-edu
Total	1995	100	35,5	50,0	14,5
	2003	100	20,7	58,9	20,4
Immigrants	1995	3,2	19,5	62,0	18,6
	2003	6,4	14,3	67,1	18,6
Rest of labour force	1995	96,8	36,0	49,6	14,4
	2003	93,6	21,1	58,4	20,5
Dispersion* of labour shares by education level and nationality across Spanish provinces					
Immigrants	2003	0,61	0,67	0,76	0,69
Rest of Labour Force	2003	0,03	0,38	0,13	0,22
Total	2003	-	0,36	0,14	0,21

Notes: Own elaboration using Encuesta Población Activa (EPA). Education levels: Low=primary education or less; Medium=high school or equivalent; High=university degree or equivalent.

Figure 2. Composition of native labour force by education level. 2003

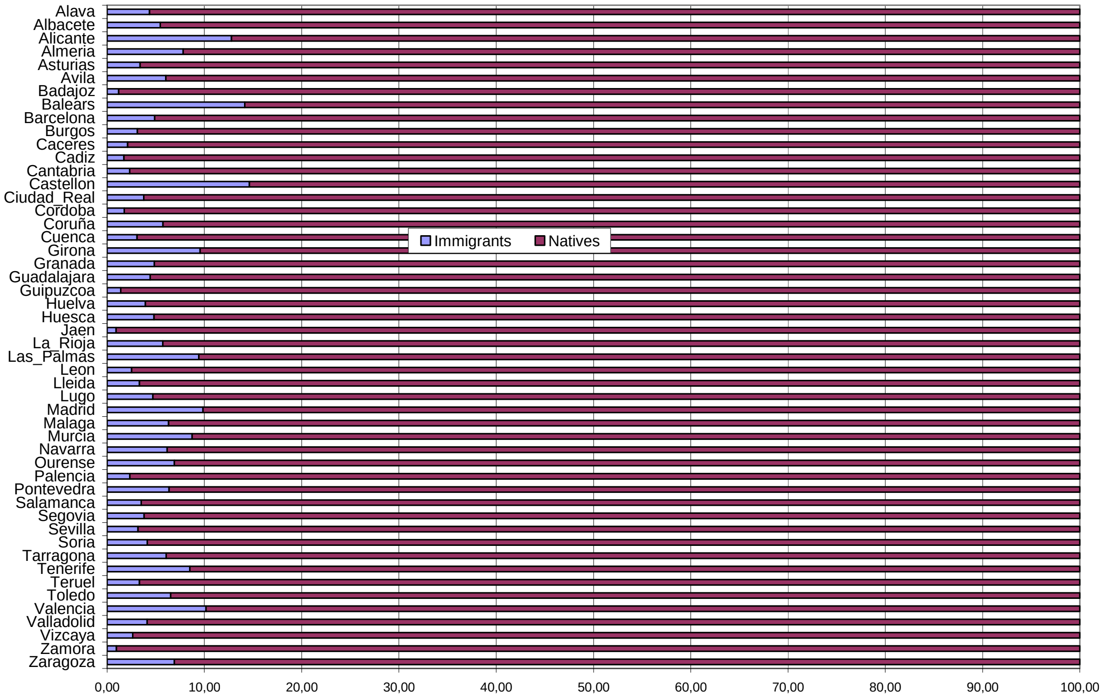


Figure 3a. Composition of native labour force by education level. 2003

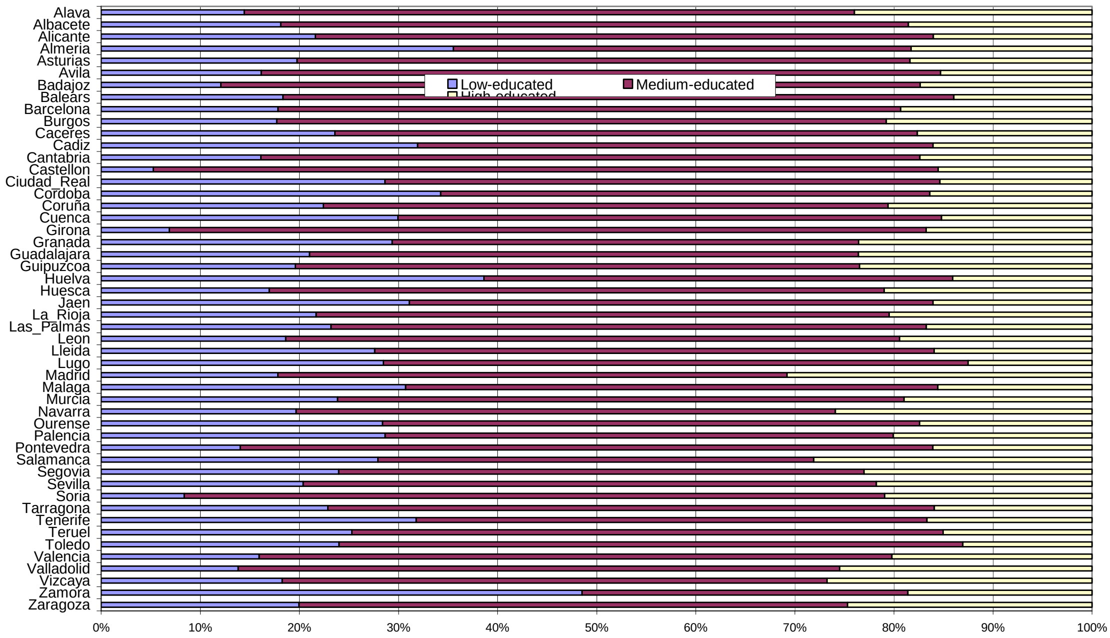


Figure 3b. Composition of foreign labour force by education level. 2003

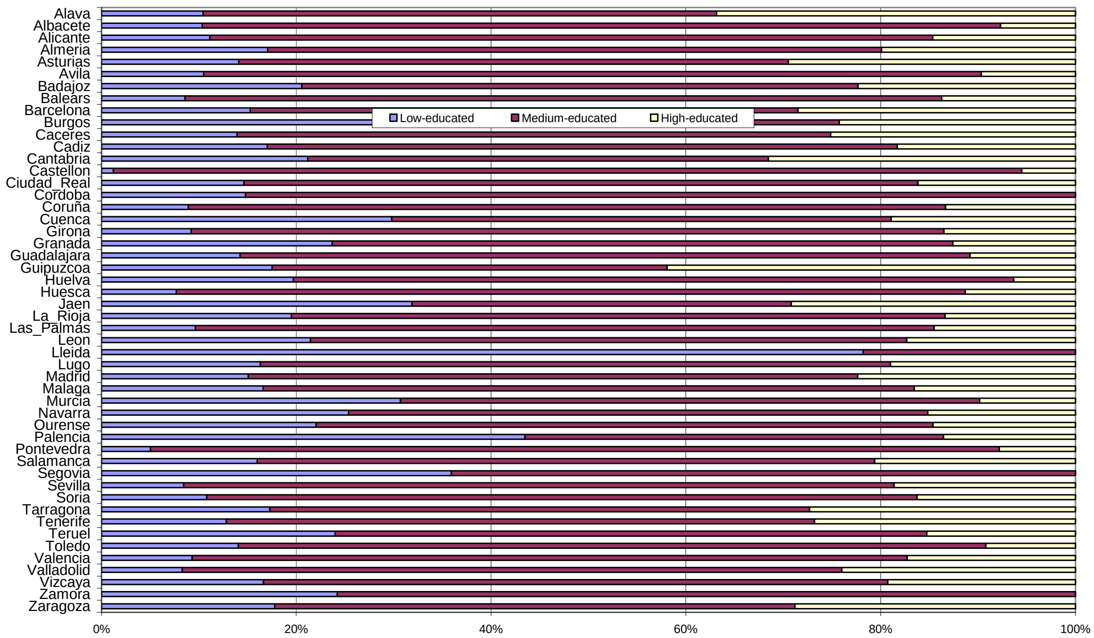
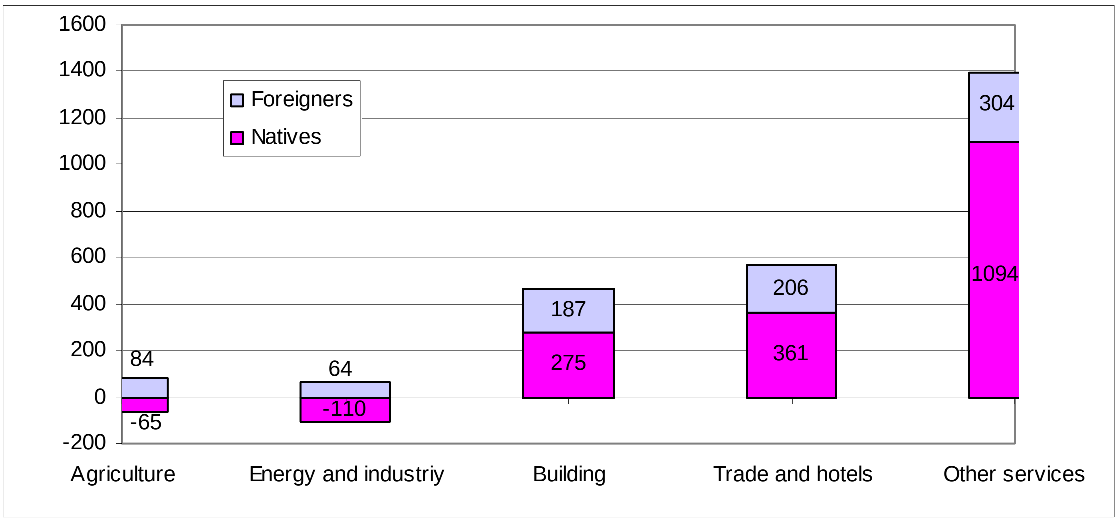
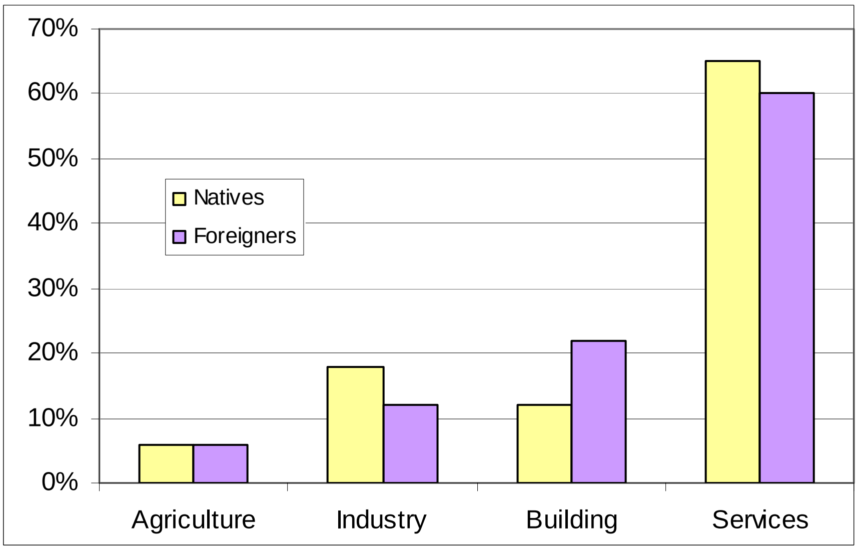


Figure 4. Net number of employments created by sector from 2001 to 2005



Source: Butlletin of labour statistics form spain 2006 and President's Economic office.

Figure 5. Share of workers by sector and nationality.(2006)



Source: Spanish INE's Spanish Labour Force Survey

Table 2. Changes in industry output shares, 1995 to 2003

Spanish provinces	Agriculture	Energy	Industry	Building	Market services	Non-market services
Alava	-0,8	-0,4	-2,1	2,2	0,2	1,0
Albacete	-6,6	-0,3	-2,0	0,7	6,4	1,9
Alicante	-2,0	-0,7	-4,6	4,4	2,9	0,1
Almería	-5,5	-0,4	-0,9	3,0	3,1	0,7
Asturias	-0,8	-4,2	-1,3	1,7	3,9	0,6
Avila	-5,4	0,0	0,5	1,8	1,9	1,2
Badajoz	3,2	-0,6	-1,1	-1,2	0,0	-0,3
Baleares	-0,5	-1,6	-1,7	2,0	1,9	-0,1
Barcelona	0,0	-0,5	-3,9	1,5	4,2	-1,3
Burgos	-3,5	-1,0	-3,9	2,0	4,1	2,3
Cáceres	-2,7	-2,7	0,2	1,2	2,4	1,5
Cádiz	-3,1	-0,2	-3,7	4,7	2,8	-0,6
Cantabria	-2,1	-1,7	-2,9	3,5	4,2	-1,1
Castellón	-2,7	-1,1	-2,2	3,7	1,2	1,1
Ceuta y Melilla	-0,2	-0,5	-0,4	1,7	-0,7	0,1
Ciudad Real	-2,2	-1,6	-0,7	0,6	3,4	0,5
Córdoba	-3,0	-2,0	-0,9	2,5	2,7	0,6
Coruña	-2,4	-3,5	-1,0	3,2	4,1	-0,5
Cuenca	-9,6	0,3	-1,5	1,7	6,2	2,9
Girona	0,3	-0,7	-2,3	1,1	1,3	0,3
Granada	-1,9	-0,4	-0,4	0,6	3,1	-1,0
Guadalajara	-6,8	-1,6	-0,9	0,9	7,2	1,2
Guipúzcoa	-0,6	-0,2	-2,1	2,4	0,6	-0,2
Huelva	0,9	-0,6	-4,5	3,7	-1,3	1,8
Huesca	-7,1	1,7	0,5	1,9	3,6	-0,5
Jaén	-4,7	-0,2	-2,7	1,1	4,9	1,6
León	-2,4	-4,7	0,8	3,0	2,9	0,5
Lleida	-5,2	-0,3	-0,3	1,0	3,7	1,1
Lugo	-7,7	-0,1	0,6	1,6	2,4	3,2
Madrid (Comunidad de)	-0,1	-1,0	-2,8	1,1	3,5	-0,7
Málaga	-1,0	-0,4	-2,0	4,6	1,3	-2,5
Murcia (Región de)	-1,8	-1,2	-1,6	2,1	4,0	-1,6
Navarra (C. Foral de)	-1,1	-0,3	-2,8	1,6	2,2	0,2
Ourense	1,9	-1,0	1,2	-1,8	-0,3	0,0
Palencia	-8,8	-0,8	3,1	3,8	0,1	2,6
Palmas (Las)	-1,6	-1,2	-1,5	3,7	2,6	-2,1
Pontevedra	-2,6	-0,3	-1,9	2,1	3,2	-0,5
Rioja (La)	-2,0	-0,4	-3,6	2,7	3,0	0,2
Salamanca	-2,4	-2,1	0,4	2,4	1,3	0,4
Santa Cruz de Tenerife	-0,9	-1,0	-1,4	5,9	-0,1	-2,6
Segovia	-0,2	-0,2	-1,6	2,3	-2,2	2,0
Sevilla	0,5	-0,2	-1,4	1,2	3,5	-3,5
Soria	-5,1	-0,2	-3,0	2,4	2,9	2,9
Tarragona	-1,4	-5,0	-3,4	3,7	5,4	0,7
Teruel	-2,5	-7,1	1,7	0,3	5,0	2,6
Toledo	-4,5	-0,6	-0,7	2,7	4,5	-1,5
Valencia	-0,7	-0,4	-5,4	3,4	5,0	-1,9
Valladolid	-3,1	0,2	-1,2	3,0	5,4	-4,3
Vizcaya	-1,0	-1,8	-2,7	2,6	3,5	-0,6
Zamora	-7,6	-1,1	0,0	3,5	3,2	2,0
Zaragoza	-1,0	-0,5	-3,0	1,9	2,8	-0,3
Spain	-1,35	-1,08	-2,65	2,19	3,46	-0,57

Note: values are the variation of each sector's share in percentage between 1995 and 2003 in each Spanish province.

Table J1. Goodness of fit. R-squared

No Region Effects.
Equation (ii1)

	1995	1996	1997	1998	1999	2000	2001	2002	2003	Mean
AGRI	0,93	0,94	0,93	0,93	0,92	0,91	0,87	0,90	0,88	0,91
ENER	0,53	0,52	0,54	0,53	0,47	0,48	0,53	0,51	0,59	0,52
INDUS	0,78	0,78	0,78	0,78	0,78	0,79	0,80	0,79	0,80	0,79
CONST	0,96	0,96	0,96	0,97	0,97	0,96	0,96	0,96	0,96	0,96
SERV	0,98	0,98	0,97	0,97	0,97	0,97	0,97	0,97	0,97	0,97
PUBLIC	0,97	0,98	0,98	0,98	0,98	0,98	0,98	0,98	0,98	0,98
Mean	0,86	0,86	0,86	0,86	0,85	0,85	0,85	0,85	0,86	0,86

Varying Region Effects.
Equation (ii2)

	1995	1996	1997	1998	1999	2000	2001	2002	2003	Mean
AGRI	0,97	0,97	0,97	0,97	0,97	0,97	0,95	0,96	0,96	0,97
ENER	0,73	0,71	0,71	0,71	0,69	0,68	0,71	0,70	0,75	0,71
INDUS	0,91	0,92	0,91	0,92	0,92	0,92	0,93	0,92	0,92	0,92
CONST	0,98	0,98	0,98	0,98	0,98	0,98	0,98	0,98	0,98	0,98
SERV	0,99	0,99	0,99	0,99	0,99	0,99	0,99	0,99	0,99	0,99
PUBLIC	0,98	0,99	0,99	0,99	0,99	0,99	0,99	0,99	0,99	0,99
Mean	0,93	0,93	0,93	0,93	0,92	0,92	0,93	0,92	0,93	0,93

Non-Varying Region Effects.
Equation (ii3)

	1995	1996	1997	1998	1999	2000	2001	2002	2003	Mean
AGRI	0,97	0,97	0,96	0,96	0,96	0,96	0,93	0,95	0,94	0,96
ENER	0,7	0,68	0,68	0,68	0,65	0,64	0,68	0,66	0,72	0,68
INDUS	0,91	0,92	0,91	0,91	0,91	0,91	0,92	0,91	0,91	0,91
CONST	0,97	0,97	0,97	0,98	0,98	0,98	0,98	0,97	0,97	0,97
SERV	0,99	0,99	0,99	0,99	0,99	0,99	0,98	0,98	0,99	0,99
PUBLIC	0,98	0,98	0,99	0,99	0,99	0,99	0,99	0,99	0,99	0,99
Mean	0,92	0,92	0,92	0,92	0,91	0,91	0,91	0,91	0,92	0,92

Table J2. Standardized Coefficient estimates

No Region Effects		AGRI	ENER	INDUS	CONST	SERV	PUBLIC
Capital		**-0,026**	**0,016**	**0,111**	**0,074**	**0,333**	**0,037**
Native Work	Low-edu	**0,063**	**0,015**	0,009	**0,016**	0,022	**0,051**
	Medium-edu	**0,030**	0,009	**0,038**	**0,008**	**0,082**	**0,057**
	High-edu	**0,010**	0,005	0,020	0,004	**0,057**	**0,047**
Immigrant Work	Low-edu	0,004	0,002	-0,006	**0,006**	0,009	-0,004
	Medium-edu	0,006	**-0,009**	-0,019	**0,006**	**0,041**	0,005
	High-edu	-0,003	0,003	-0,007	-0,002	**0,033**	0,005
Land		**0,093**	-0,011	-0,084	**0,032**	**-0,146**	0,010

Time Varying Region Effects		AGRI	ENER	INDUS	CONST	SERV	PUBLIC
Capital		-0,005	**0,021**	**0,111**	**0,085**	**0,307**	**0,058**
Native Work	Low-edu	**0,026**	**0,024**	**0,031**	**0,011**	0,016	**0,044**
	Medium-edu	**0,011**	0,009	**0,049**	-0,001	**0,098**	**0,048**
	High-edu	0,006	**0,009**	0,016	0,000	**0,070**	**0,032**
Immigrant Work	Low-edu	-0,002	0,006	-0,006	**0,006**	**0,028**	0,002
	Medium-edu	0,003	**-0,011**	-0,014	**0,007**	**0,029**	0,002
	High-edu	-0,003	-0,004	-0,005	**-0,004**	**0,033**	0,003
Land		**0,177**	-0,030	0,077	**0,059**	0,025	**0,056**

Time Non-Varying Region Effects		AGRI	ENER	INDUS	CONST	SERV	PUBLIC
Capital		-0,005	**0,016**	**0,106**	**0,085**	**0,323**	**0,069**
Native Work	Low-edu	**0,029**	**0,021**	0,028	**0,013**	**0,032**	**0,042**
	Medium-edu	**0,011**	0,009	**0,046**	0,002	**0,092**	**0,043**
	High-edu	**0,010**	0,006	0,019	0,001	**0,069**	**0,028**
Immigrant Work	Low-edu	-0,006	**0,001**	-0,003	0,003	0,023	0,001
	Medium-edu	0,004	-0,009	-0,016	**0,008**	**0,028**	0,003
	High-edu	-0,002	-0,001	-0,005	-0,002	**0,027**	0,001
Land		**0,171**	-0,012	0,087	**0,051**	0,022	**0,065**

NOTE: The standardised coefficients give the expected number of standard deviation changes in production induced by one-standard-deviation increase in the associated factor, conditional on the remaining factors. Bold indicates significance the 90 percent level