National Accounting Review

NAR, 7(2): 177–195.
DOI: 10.3934/NAR.2025008
Received: 05 March 2025
Revised: 06 March 2025
Accepted: 09 April 2025
Published: 11 April 2025

https://www.aimspress.com/journal/NAR

Research article

A regional macroeconomic approach to the link between immigration and wages in Spain: New insights from a spatial econometric perspective

Adolfo Maza[1,*] and Maria Hierro

Department of Economics, Universidad de Cantabria, Santander, Spain

* **Correspondence:** Email: mazaaj@unican.es.

Abstract: Using an extended spatial wage equation that introduces novel elements in the weight matrix and the treatment of immigrants' human capital, we analyzed the impact of immigration on wages. Examining the Spanish case at the provincial level as a sort of laboratory over the period 2006–2021, the results indicated a small, negative effect that disappears when immigrants are highly skilled. Furthermore, the empirical evidence does not support an association between the unemployment rate and wages, confirming that Spain's well-known high degree of wage rigidity persisted in the aftermath of the financial and economic crisis of 2008. Our results are shown to be robust across a battery of tests that assess their reliability from different perspectives.

Keywords: wages; immigration; weights matrix; human capital; spatial wage equation

JEL Codes: C23, R23, O15

Abbreviations: Spatial Durbin Model (SDM); Tax Administration National Agency (AEAT); Residential Variations Statistics (RVS); Spanish Labor Force Survey (EPA); Spanish National Statistics Institute (INE); Likelihood Ratio (LR); logarithm of maximum likelihood (LIK); Fundación Conocimiento y Desarrollo (Fundación CYD); Expediente de Regulación Temporal de Empleo (ERTE); Programme for the International Assessment of Adult Competencies (PIAAC)

1. Introduction

In today's globalized world, studying the impact of immigration on destination territories has gained increasing relevance, becoming one of the most prominent topics in economic research. In this regard, its effects on the labor market, and particularly on wages, are widely debated.[1] Although this issue is of great importance from a purely economic perspective, which alone justifies the substantial body of research devoted to it, its implications clearly go beyond the economic sphere. This is particularly evident in how immigration's effects on labor markets have recently become a central topic in public debates, further highlighting its significance within the policy realm (Kyriazi et al., 2023; Roos et al., 2025). Arguably, the most pressing concern, and our focus of this paper, is the potential negative effect that the arrival of migrant workers may have on wages in the host country. The case of Brexit, thoroughly examined by Ghosh and Dickey (2024), provides a clear example of how far such arguments can extend. Theresa May, who later became Prime Minister of the United Kingdom, declared to *The Times* in 2012 that "Uncontrolled, mass immigration displaces British workers, forces people onto benefits and suppresses the wages for the low paid".

Although theoretical predictions on the issue vary depending on many factors, several explanations provide insight into the possible negative impact of immigration on wages in destination regions. The most widely cited and straightforward explanation comes from the neoclassical economic theory, which suggests that there is high substitutability between native and foreign workers, especially when immigrants are willing to accept lower wages, thereby increasing labor supply and reducing the bargaining power of native workers. From another perspective, the labor market segmentation theory offers a different explanation, arguing that immigration tends to disproportionately affect low-skilled workers. According to this theory, the labor market is not homogeneous but segmented into different sectors, with immigrants filling specific, lower-paid jobs, often in industries like agriculture, construction, or low-wage services. The influx of immigrants into these sectors increases competition for jobs, which can lead to a general reduction in wage levels. Finally, the theory of skill complementarity also provides a justification for potential wage reductions, but from an alternative point of view. Here, we focus on the similarity of skills between immigrants and native workers. When immigrants possess similar abilities to native workers, they are often viewed as substitutes, which leads to downward pressure on wages, especially when the labor market does not sufficiently differentiate between them in terms of skill levels. In summary, these theories can illustrate how immigration could reduce wages through different mechanisms: by increasing labor supply and substituting native workers (neoclassical theory), by disproportionately affecting low-skilled labor markets (labor market segmentation), and by creating competition for similar skill sets (skill complementarity). They are all connected by the common factor that immigrants are perceived as competitors in the native labor market, yet each mechanism operates in a slightly different manner, contributing to a comprehensive understanding of how immigration might influence wage dynamics in destination regions.

From an empirical standpoint, a large body of literature focuses on the impact of immigration on wages, with the study by Nedoncelle et al. (2024) being the most recent survey on this topic, following earlier surveys such as Blau and Kahn (2015) and Longhi et al. (2010, 2005). The most common

[1] In any case, key studies, such as those by Dustmann and Preston (2007) and Card et al. (2012), conclude that the direct economic impact of immigrant arrivals is less significant than the concerns over compositional amenities, which are related to the characteristics of immigrants' neighbors and co-workers.

conclusion of this branch of research is that immigration negatively affects wages in destination areas, although this impact is generally weak. That being said, the results are highly heterogeneous, with studies suggesting that immigration reduces wages, while others posit a positive influence (see e.g., Dustmann et al., 2016). Researchers have mainly focused on the United States, with prominent authors drawing divergent conclusions, leading some to argue that those claiming a harmful effect on wages are overly pessimistic (Card and Peri, 2016), while, for instance, Borjas (2016) raises concerns about the data quality in studies reporting positive effects of immigration. For Europe, many researchers examine the United Kingdom (UK), providing the paper by Nickell and Saleheen (2015) a clear example of suggesting small negative effects, whereas that by Dustmann et al. (2013) concludes that immigration tends to increase wages in the UK.

That heterogeneity depends largely on factors such as the time frame, the territory under examination (national, regional, or municipal/city scope), the research approach (which is clearly influenced by the type of data used in the analysis), as well as the methodology employed. Regarding the first two points, in this paper, we use the Spanish case at the provincial level (EU NUTS3 classification) over the period 2006–2021 as a sort of laboratory. Although appealing for the reasons given below, the case of Spain has not been extensively studied, with only four articles that, broadly speaking, conclude that there is no effect (Carrasco et al., 2008; González and Ortega, 2011; Atienza-Montero and Romo-Calixto, 2021), or that the effect, if any, is negative but very small (Gutiérrez-Portilla et al., 2020). Nonetheless, some evidence of heterogeneity exists. Amuedo-Dorantes and de la Rica (2013) indirectly address the issue, as they focus on GDP; yet, they conclude that immigration flows have a long-term beneficial effect on the wages of natives.

As for the third point, regarding the method employed, there are two major approaches, each with pros and cons, for analyzing the impact of immigration on national wages: A microeconomic strategy, based on surveys and/or interviews, and a macroeconomic approach, which relies on minimal and easily accessible data and focuses on average effects. Since the objective of our work is to conduct an aggregate study at the provincial level for Spain, we adopt the latter approach. Concerning the final point, methodology, the first important novelty of this paper lies in the estimation of a spatial model. To the best of our knowledge, despite the relevance of carrying out a spatial analysis of Spanish labor markets at the provincial level has been thoroughly proven for other topics (see, for example, Maza and Villaverde, 2009; Cuéllar-Martín et al., 2019; Martín-Román et al., 2020), there is only one study that has previously addressed the interconnections between territories in the study of immigration and wages (Gutiérrez-Portilla et al., 2020).

More specifically, our goal of this paper is to capture, by using aggregate data for the Spanish provinces from 2006 to 2021, not only the direct effects that the arrival of immigrants has on a province but also the indirect effects that immigration to neighboring ones may have on that province. Therefore, while our results do not provide detailed information on the particular effects that international immigration may have on specific population groups or worker profiles, they enable us to assess, at a global level and by introducing spillover effects, whether wage restraint would be a legitimate concern in Spain.

Given these considerations, a suitable starting point for addressing our objectives is to employ the established wage equation model, which serves as a foundation for evaluating the response of wages to unemployment. This approach is further enhanced by incorporating our key variable, immigration, along with spatial variables to capture the spillover effects previously mentioned. In fact, using an extended wage equation that incorporates spatial factors has become a common approach in various studies, as seen in the works of Longhi et al. (2006), Elhorst et al. (2007), Fingleton and Palombi (2013), Ramos et al. (2015), and Baltagi and Başkaya (2022). However, none of these examine the potential effect of immigration on wages. This gap in the literature is precisely where this research makes its contribution. Besides, within the framework of a Spatial Durbin Model (SDM), this study also aims to make additional, though modest, contributions to this branch of the literature by paying attention to two points that are often overlooked:

1. The use of a non-geographical definition of the weights matrix employed in the augmented spatial wage model; and
2. the inclusion of the role played by immigrants' human capital in the analysis.

As for the first point, when modeling the influence of immigrants arriving in neighboring areas on the wages of a specific province (i.e., the spillover effects), we depart from the conventional approach of using a weights matrix based, in one way or another, on geographical distances. Instead, we propose a new matrix based on the intensity of internal migration between areas.[2] The rationale behind this change is very simple: The impact that the entry of immigrants into other territories has on a specific province depends, more than on geographical distance, on the interdependence between them in terms of internal migration. For instance, consider the case of Madrid and Cantabria. The arrival of many immigrants in Madrid will have a greater effect on wages in Cantabria if a large number of Cantabria's residents regularly move to Madrid for work. This is because, in this case, the labor supply in Cantabria may be affected by the immigrants' entry into Madrid, as some residents of Cantabria may be in direct competition with those immigrants for jobs there. In other words, some Cantabrian citizens who would typically migrate to Madrid might choose to stay in their province due to the influx of immigrants. However, without such migration flows between these two provinces—if it were uncommon for Cantabrian citizens to move to Madrid for work purposes—the labor supply in Cantabria would remain largely unaffected by immigration in Madrid. Given the above, we argue that the distance matrix we propose is much more reliable in capturing spillovers than traditional ones based on physical distances.[3]

Second, it is widely accepted in the literature, particularly in microeconomic studies,[4] that the level of human capital of immigrants influences the relationship between immigration and wages (for a comprehensive review, see Lin and Weiss, 2019). However, this issue is less explored in macroeconomic studies, primarily due to the lack of detailed data. In this paper, we introduce two variables that capture differences in the skill levels of the immigrant population in each area to determine whether the results, as often suggested, depend on this feature.

Finally, some remarks on the case study: We consider Spain to be a particularly relevant example for two main reasons. First, since Spain transitioned from being a sending country to a receiving country for migrants, and this shift, particularly during the period analyzed (Domingo and Bayona-i-Carrasco, 2024), coincided with more intense and rapid waves of immigration than any other European country in

[2] In the study of internal migrations, the use of extended gravity models is very common, highlighting that there are many other factors, apart from distance, that affect migratory movements between regions/provinces (for a detailed study addressing internal migration in several countries, see Cavalleri et al., 2021).

[3] Continuing with the reasoning from the previous footnote (number 2), statistical data show that migration from Cantabria to Madrid is much higher than migration to other provinces that are geographically much closer, a pattern that is not exclusive to Madrid and Cantabria, and which supports the proposed change in the weights matrix.

[4] The so-called "skill-cell method" is commonly used in microeconomic approaches.

modern times (Espinosa and Díaz-Esparanza, 2021). Moreover, these waves have not only varied in intensity across provinces (Fellini, 2018), but have also altered the pattern and composition of internal migration (Maza et al., 2019), which is the key variable for the proposed new weighting matrix. Taken together, these factors make Spain a focal point for studying international migration movements. Second, this relevance is further supported by a key aspect of the Spanish labor market that reinforces the appropriateness of the methodological approach employed in this piece of work. In particular, the labor market is characterized by high and very disparate unemployment rates across different provinces, with a defining feature being wage rigidity—specifically, the low responsiveness of wages to unemployment (see, e.g., Sanchis-Llopis and Cutanda, 2020). The wage equation model used in this paper is particularly well-suited to address this dynamic.

The structure of the paper is as follows. In Section 2, we present the model and the data used for its estimation. In Section 3, we illustrate and discuss the major results, along with a series of robustness checks. In Section 4, we provide the conclusions and avenues for future research.

2. Materials and methods

First, a few lines as a summary of the research case. As noted, the Spanish economy—characterized by high levels of international migration and, very importantly, a wealth of available data—has been selected for analysis. The period under study, spanning from 2006 to 2021, is the longest time frame for which consistent data is available. For the unit of analysis, we use Spanish provinces—the most detailed level for which data is provided—rather than Autonomous Communities (commonly referred to as regions), based on the principle that smaller units of analysis exhibit greater interdependence between areas, making the spatial approach more appropriate. Specifically, our data corresponds to 46 provinces since wage data is unavailable for the three Basque provinces as well as Navarre (where province and region coincide), as explained in detail below.

As indicated in the Introduction of the paper, we propose a wage equation that relates wages ($wage_{it}$, where i refers to province and t to time) and unemployment of the previous period (ur_{it-1}), which is extended due to aspatial and spatial considerations. Concerning the non-spatial factors, we include the time lag of the dependent variable ($wage_{it-1}$) to capture inertia in wage determination, a fairly common practice in the literature.[5] Similarly, and also lagged by one period since the response is not simultaneous—apart from being a regular way of coping with potential reverse causality issues—we incorporate the level of human capital (hc_{it-1}); better-endowed provinces should theoretically exhibit higher wages. In addition, our variable of interest—the working-age immigrant population as a share of the total population (im_{it-1})—is also incorporated with a one-period lag.

Moreover, we consider in the model, as is usually the case in literature, the industry mix of each province, since wages are related to the type of activity performed. Specifically, we account for the share of the primary sector (ps_{it-1}), industry (in_{it-1}), construction (co_{it-1}) and the branches of services that were significant in the estimates, namely finance (fi_{it-1}), business (bu_{it-1}), and social services (ss_{it-1}). To conclude the non-spatial components of the model, we incorporate a dummy variable to catch the economic crisis unleashed in 2008, whose negative consequences on the evolution of wages began in 2010 and persisted until 2014 (d_{10-14}). More specifically, this decision was primarily based on official wage data, which show a sharp decline in Spain starting in 2010, continuing rapidly

[5] As Porras-Arena and Martín-Román (2023, p. 3) state, it also “solves problems of serial correlation in the error terms”.

until 2012, with the decline in wages persisting until 2014. Importantly, neither the inclusion nor the definition of the dummy affects significantly the results, as we see in the robustness check section.

Concerning the addition of spatial factors, and to justify this decision, it is sufficient to point out the continuous references in the literature to the fact that economic areas cannot be treated in isolation but there are interrelationships between them, which validate the use of spatial variables (see, for example, Elhorst et al., 2007). Longhi (2010) identifies various mechanisms that cause interconnections within the context of a wage curve model. Furthermore, countless empirical papers have demonstrated that traditional models, when such spatial links exist and whatever the topic of study, produce biased and unreliable results. Some of these, focusing on the Spanish labor market, were mentioned in the Introduction of this paper.

Along these lines, we propose a Spatial Durbin Model (SDM as indicated above) that includes the unemployment rate within the group of spatially lagged explanatory variables, together with the two main control variables previously mentioned: human capital and immigration. This choice is supported by several econometric tests, which confirm that our model cannot be reduced to either a Spatial Auto-regressive Model or a Spatial Error Model; in both cases, the conventional likelihood ratio (LR) tests yielded a p-value of 0.00.

Before specifying the model, we want to stress that by combining an SDM and the use of lags in the dependent variables, we try to mitigate endogeneity issues. A factor that causes endogeneity problems is that errors in a traditional model may be spatially correlated, a circumstance that is addressed by a spatial model in its specification. In fact, variations in the explanatory variables of neighboring observations can help resolve the correlation between the explanatory variables and the error term, functioning similarly to how instruments work in other econometric approaches. In this regard, endogeneity is also often due to the omission of relevant variables, and an SDM introduces spatial lags that help reduce potential specification biases that are common in classical models. By integrating the spatial effects of the explanatory variables, it can capture patterns of influence, that is, unobserved effects, which would not be captured otherwise.

Hence, the dynamic model is specified as follows:

$$wage_{it} = \alpha_i + \beta_1 * ur_{it-1} + \delta * wage_{it-1} + \beta_2 * hc_{it-1} + \beta_3 * im_{it-1} + \beta_4 * ps_{it-1} + \beta_5 * in_{it-1} + \beta_6 * co_{it-1} + \beta_7 * fi_{it-1} + \beta_8 * bu_{it-1} + \beta_9 * ss_{it-1} + \beta_{10} * d_{10-14} + \rho\left(\sum_j W_{ij}^d * wage_{jt}\right) + \theta_1\left(\sum_j W_{ij}^m * u_{jt-1}\right) + \theta_2\left(\sum_j W_{ij}^m * hc_{jt-1}\right) + \theta_3\left(\sum_j W_{ij}^m * im_{jt-1}\right) + \epsilon_{it} \quad (1)$$

Information about the variables used, including source, definition, and descriptive statistics (mean and standard deviation), is presented in Table 1. In any case, additional information on the dependent variable seems relevant. Wages are extracted from microdata provided by the Tax Administration National Agency (AEAT, for its Spanish name). The first point to mention, as noted above, is that we do not have information for the three Basque Country provinces and Navarre, as they are not part of the common Spanish tax system but operate under a special tax regime known as the "foral regime", meaning they have their own tax powers and manage their own tax system, including tax collection.

In this study, wages are annual gross salaries at constant 2021 prices for the private sector, derived from AEAT model 190 (*modelo 190*), an informational declaration of withholdings and income tax prepayments, where companies report the gross salaries paid to their employees.

Table 1. Data: definitions, sources, and descriptive statistics.

	Definition	*Source*	*Mean*	*Std. Dev.*
Dependent variable				
Wage ($wage$)	Annual gross wages at constant 2021 prices (in logs)	Microdata from the Tax Administration National Agency (AEAT)	19,036 (9.84)	2,650 (0.14)
Independent variables				
Unemployment rate (ur)	Unemployment rate (in logs)	Spanish Labor Force Survey (EPA) published by the Spanish National Statistics Institute (INE)	17.4 (2.75)	7.67 (0.47)
Human capital (hc)	% of population with university studies or doctorate (in logs)	EPA (from INE)	35.0 (3.54)	6.79 (0.20)
Immigration (im)	% of immigrants over total population (in logs)	Municipal Register databank (from INE)	11.2 (2.25)	5.95 (0.60)
Low-skilled Immigration ($imlow$)	im * (1 - share of foreign employment without university studies) (in logs)	Municipal Register databank (from INE), Microdata from EPA (from INE)	8.9 (2.01)	4.80 (0.62)
High-skilled Immigration ($imhigh$)	im * (share of foreign employment with university or doctorate studies) (in logs)	Municipal Register databank (from INE), Microdata from EPA (from INE)	2.3 (0.44)	1.69 (1.47)
Primary sector (ps)	% of employment in Primary Sector	Microdata from AEAT	5.9	4.44
Industry (in)	% of employment in Industry	Microdata from AEAT	11.3	4.32
Construction (co)	% of employment in Construction	Microdata from AEAT	9.4	2.86
Finance (fi)	% of employment in Financial Institutions and Insurance	Microdata from AEAT	2.6	0.73
Business (bu)	% of employment in Business Services	Microdata from AEAT	11.6	2.43
Social services (ss)	% of employment in Social Services	Microdata from AEAT	25.1	4.00

Note: The values in parentheses are in logarithms.

In line with the discussion in the Introduction, we now highlight two subtle yet meaningful differences between our approach and standard spatial analyses. First, we address the spatial weights matrix. To ensure exogeneity, geographical data is routinely used, and we apply this approach to the spatial lag of the dependent variable. Specifically, the matrix W^d is constructed, where the components W_{ij}^d are computed as the inverse of the distance between centroids.[6] However, when examining the variable of interest, we believe that the impact of immigration in one province on wages in another largely depends on how changes in job opportunities and conditions in one area affect migration decisions to other areas. This is, therefore, what the weights matrix should capture. While the remarkable model proposed by Longhi (2010), which follows the job search literature and introduces new ways of measuring job competition as an alternative to the unemployment rate in the context of the wage curve literature, does not directly deal with this specific issue, it illustrates the underlying concept. Consequently, for immigration (as well as for unemployment and human capital for similar reasons), we employ a weights matrix (denoted in this case by W^m) that captures migration flows between each pair of provinces i and j. Another important additional advantage of this weighting matrix is its ability to account for asymmetric spatial interactions between territories. For instance, the interaction between the stock of immigrants in the province of Madrid and the level of wages in Cantabria does not necessarily equal the interaction between the stock of immigrants in Cantabria and wages in Madrid—an aspect that a typical distance matrix cannot capture.

In view of these considerations, the construction of the matrix W^m is as follows: We build an internal migration matrix using data from the Residential Variations Statistics (RVS) offered by the Spanish National Statistics Institute (INE), which adds migratory flows between each pair of provinces over the sample period.[7] Hence, our weights matrix reads as follows:

$$W^m = \begin{pmatrix} 0 & W_{1,2}^m = M_{1,2}^m & \cdots & W_{1,46}^m = W_{1,46}^m \\ W_{2,1}^m = M_{2,1}^m & 0 & \cdots & W_{2,46}^m = W_{2,46}^m \\ \vdots & \vdots & & \vdots \\ W_{46,1}^m = M_{46,1}^m & W_{46,2}^m = M_{46,2}^m & \cdots & 0 \end{pmatrix} \tag{2}$$

where its elements $W_{ij}^m = M_{ij}^m$ for $i \neq j$ $(i, j = 1, 2, \dots, 46)$ represent the sum of migratory flows from province i to province j during the sample period. As is evident, the diagonal elements of the matrix are set to zero, i.e., $M_{ij}^m = 0$ if $i = j$.

Finally, to conclude the discussion on the weights matrices, it is important to clarify that both matrices (W^d and W^m) have been normalized (so that the elements of each row sum to unity) in order to regularize the external influence on each province. Normalization ensures that the impact of neighbors is measured in a relative and consistent manner.

The second aspect pertains to the human capital of immigrants, which is closely related to labor market segmentation and skill complementarity theories. To address this issue, we combine the information on the stock of immigrants previously used with data on the population level of immigrant workers from another database, microdata from the Spanish Labor Force Survey (EPA) provided by the INE. Specifically, given the consensus that highly skilled immigrant workers tend not to negatively impact wages—because, as highlighted in the literature, they have a lower propensity to compete with natives who have similar characteristics—we calculate the share of foreign employment with tertiary education (university graduates or PhDs). This enables us to divide the stock of

[6] As Rincke (2010) argues, there is a trade-off between using spatial weights based on geography, which are exogenous but less economically relevant, and those that are economically more significant, such as the weights constructed from internal migration data in our analysis.

[7] In any event, due to potential endogeneity problems, we test the robustness of the results by using 2005 migration flows. The results obtained are generally consistent with those presented below. Besides, we followed the method outlined by Cheng and Lee (2017), and our findings do not support concerns about endogeneity.

immigrants into two groups: Low-skilled immigration and high-skilled immigration. In short, if the stock of immigrants constitutes 10% of the total population and 20% of the foreign employed, according to EPA, are highly qualified, we consider two new variables reaching values of 8% ($imlow$) and 2% ($imhigh$).[8] Thus, by re-estimating equation (1) twice—once by replacing the total immigration variable with the proportion of low-skilled immigration ($imlow$) and once with the proportion of high-skilled immigration ($imhigh$)—we can assess how the skill level of immigrants affects the immigrant-wages nexus.

3. Empirical results and discussion

3.1. Major results

We now turn to the discussion of the major results attained. Table 2 reports the coefficients obtained from the spatial dynamic quasi-maximum likelihood estimation of Equation (1) with the three alternative variables on immigration (total, low-skilled, and high-skilled). However, it is important to note that in spatial models, point estimates cannot be interpreted in the usual manner; instead, they serve as a preliminary step for the computation of the so-called direct, indirect, and total effects, which has been shown to capture the real impact of each of the independent variables included in the spatial model (see, for instance, the seminal book by LeSage and Pace, 2009, or for a more pedagogical approach, Golgher and Voss, 2016). For this reason, we immediately focus on these effects for interpretation purposes, although it is useful to include Table 2 so that the reader can gain insight into aspects such as the number of observations, model statistics, and so on. The most important point we wish to stress as for Table 2 is the high value of the *R-square* statistic, which demonstrates a strong goodness-of-fit (always higher than 0.8). In addition, in all cases, the coefficient associated with the spatial lag of the dependent variable is quite high and statistically significant, which confirms the presence of spatial dependence in the wage equation. This further strengthens the argument for the relevance of the spatial approach we have adopted, as it confirms the importance of spatial interrelationships in explaining wage dynamics.

[8] We acknowledge that by combining different sources, this distribution is, at best, an approximation. As a result, the distribution should be interpreted with caution.

Table 2. Results for the SDM, 2006–2021. Point estimates.

Dep. variable: $wage_{it}$	*Total Immigration*	*Low-Skilled Immigration*	*High-Skilled Immigration*
	Coefficients	Coefficients	Coefficients
$wage_{it-1}$	0.408*** (0.023)	0.402*** (0.023)	0.344*** (0.022)
ur_{it-1}	0.001 (0.004)	0.002 (0.004)	0.001 (0.004)
hc_{it-1}	−0.003 (0.006)	−0.010 (0.007)	−0.007 (0.007)
im_{it-1}	−0.036*** (0.007)	-	-
$imlow_{it-1}$	-	−0.014*** (0.003)	-
$imhigh_{it-1}$	-	-	0.000 (0.000)
ps_{it-1}	−0.007*** (0.001)	−0.007*** (0.001)	−0.008*** (0.001)
in_{it-1}	0.004*** (0.001)	0.003*** (0.001)	0.003** (0.001)
co_{it-1}	−0.003*** (0.001)	−0.003*** (0.001)	−0.004*** (0.001)
fi_{it-1}	0.013*** (0.002)	0.011*** (0.002)	0.009*** (0.002)
bu_{it-1}	−0.005*** (0.001)	−0.005*** (0.001)	−0.004*** (0.001)
ss_{it-1}	−0.001** (0.001)	−0.002*** (0.001)	−0.003*** (0.001)
d_{10-14}	−0.010*** (0.002)	−0.011*** (0.002)	−0.017*** (0.002)
$\sum_j W_{ij}^d * wage_{jt}$	0.737*** (0.027)	0.716*** (0.028)	0.703*** (0.029)
$\sum_j W_{ij}^m * u_{jt-1}$	0.001 (0.005)	0.002 (0.005)	0.001 (0.005)
$\sum_j W_{ij}^m * hc_{jt-1}$	0.096*** (0.015)	0.060*** (0.015)	0.037** (0.016)
$\sum_j W_{ij}^m * im_{jt-1}$	−0.036*** (0.013)	−0.042*** (0.009)	0.002 (0.001)
LIK	2164.55	2144.46	2118.69
R-square	0.810	0.862	0.865
Number of observations	690	690	690

Notes: standard errors in parenthesis. ***, (**), (*) Significant at 1%, (5%), (10%). LIK: logarithm of maximum likelihood. Provincial fixed effects are included.

Accordingly, we present, in Table 3, the direct, indirect and total effects. Likewise, Figure 1 provides a more intuitive display of the differences between direct and indirect effects for all variables in each of the three estimates of our model for the alternative definitions of the variable capturing immigration. Focusing on the variable of interest, and first considering the entire stock of immigrants (at the top of the table), we observe that the total effect of immigration on wages is negative, statistically significant, but debatably small. Specifically, the elasticity reaches a value of −0.275. Moreover, and perhaps more importantly, when breaking down the total effect into its two components, we observe that the influence is predominantly indirect (−0.234), meaning the wage change in a province when immigration increases in the rest of Spain (for a more visual comparison, see Figure 1). This leaves a direct effect, i.e., the effect on the province itself, of only −0.041. Although this finding is somewhat unexpected a priori, it is common in spatial studies, since the indirect effect is computed as the sum of spatial spillovers from all other units of analysis. On average, the spillover effect from each of the other provinces individually is −0.234/45 = −0.0052. Thus, when considered separately, the largest effect is the direct one by far (a detailed explanation and the computation of single spillover effects for each pair of units of analysis can be found in Gutiérrez-Portilla et al., 2020).

Delving into the previous discussion, our findings seem to support the neoclassical theory, suggesting that immigration could reduce wages due to the increase in labor supply. Although this effect is rather small, the approach employed in this paper allows us to demonstrate that it does not affect only the province receiving immigration. There are also spillover effects, which, in accordance with the novel definition of the weights matrix proposed here, convey the idea that there may also be a constraint on internal migration from other provinces to the province receiving the influx of immigration. Consequently, immigration towards a province also affects the labor supply in the remaining provinces, all the more so the greater the flow of internal migration. To illustrate this again using the example presented in the Introduction, the idea is that a wave of immigration to Madrid negatively impacts wages in Madrid, but also wages in Cantabria, because some workers who might have migrated to Madrid may now choose not to, as immigrants may already be occupying or at least competing for the jobs available in their potential destination.

Regarding the role of immigrant human capital (see, for example, the seminal paper by Borjas, 2003), only low-skilled immigrants appear to cut wages, with a total effect of −0.2000. In contrast, the impact of high-skilled immigrants on wages is negligible, since the elasticity is statistically equal to zero. From this perspective, our findings seem to be, to a certain extent, aligned with the standard labor market segmentation theory and the principle of skill complementarity. Indeed, when both variables are included together (results are not reported but available upon request), the effect of high-skilled immigrants on wages becomes positive and statistically significant, though very small (with an elasticity of 0.014). This finding could tentatively be also linked to the fact that the phenomenon of underemployment/overqualification is not so much circumscribed to immigrants in Spain but is more widespread (e.g., Nieto and Ramos, 2017),[9] meaning the downgrading of immigrants' skills is less pronounced than in other countries (Dustmann et al., 2016).

Finally, a few brief comments on the remaining variables. Wage rigidity, a feature of the Spanish labor market that has been analyzed in numerous studies (see, e.g., Maza and Moral-Arce, 2006), seems to be confirmed, as the link between provincial wages and unemployment is negligible. This is an important result, indicating that little has changed in this regard since the 2008 crisis. In addition, the direct effect of provincial human capital is not significant either, although this variable has a positive total effect, once again due to spillovers coming from the remaining provinces. A preliminary explanation could be that the wage premium in Spain is not as high as in other countries, and that wage increases occur in response to a country-wide increase in skill levels (for a reference on this specific issue, see Felgueroso et al., 2016). Regarding industry mix, provinces that are specialized in industry and finance tend to enjoy higher wages, while the opposite appears to hold for agriculture, construction, business and social services. Last, the negative idiosyncratic effect of the 2008 economic crisis on wages during the 2010–2014 period, which was intended to be captured with the dummy variable, is strongly verified.

[9] As the latest report of the *Fundación Conocimiento y Desarrollo* (Fundación CYD, 2024, chapter 2) indicates, Spain has the highest rate of overqualification in the EU.

Table 3. Results for the SDM, 2006–2021. Direct, indirect, and total effects.

Variable	*Total Immigration*		
	Direct effects	Indirect effects	Total effects
$wage_{it-1}$	0.430*** (0.023)	1.135*** (0.152)	1.565*** (0.156)
ur_{it-1}	0.001 (0.004)	0.008 (0.014)	0.010 (0.015)
hc_{it-1}	0.005 (0.006)	0.347*** (0.060)	0.353*** (0.061)
im_{it-1}	−0.041*** (0.006)	−0.234*** (0.048)	−0.275*** (0.048)
ps_{it-1}	−0.007*** (0.001)	−0.019*** (0.004)	−0.026*** (0.005)
in_{it-1}	0.004*** (0.001)	0.011*** (0.003)	0.015*** (0.004)
co_{it-1}	−0.003*** (0.001)	−0.008** (0.003)	−0.011*** (0.004)
fi_{it-1}	0.014*** (0.002)	0.036*** (0.007)	0.050*** (0.008)
bu_{it-1}	−0.005*** (0.001)	−0.013*** (0.003)	−0.018*** (0.004)
ss_{it-1}	−0.001* (0.001)	−0.004* (0.002)	−0.005* (0.003)
d_{10-14}	−0.011*** (0.002)	−0.028*** (0.006)	−0.039*** (0.007)
	Low-Skilled Immigration		
	Direct effects	Indirect effects	Total effects
$wage_{it-1}$	0.422*** (0.023)	1.007*** (0.131)	1.428*** (0.135)
ur_{it-1}	0.002 (0.004)	0.013 (0.014)	0.015 (0.014)
hc_{it-1}	−0.006 (0.006)	0.177*** (0.046)	0.171*** (0.047)
$imlow_{it-1}$	−0.017*** (0.003)	−0.182*** (0.035)	−0.200*** (0.036)
ps_{it-1}	−0.008*** (0.001)	−0.018*** (0.004)	−0.026*** (0.005)
in_{it-1}	0.003*** (0.001)	0.008*** (0.003)	0.011*** (0.004)
co_{it-1}	−0.003*** (0.001)	−0.008** (0.003)	−0.012*** (0.004)
fi_{it-1}	0.011*** (0.002)	0.027*** (0.005)	0.038*** (0.007)
bu_{it-1}	−0.005*** (0.001)	−0.012*** (0.003)	−0.017*** (0.004)
ss_{it-1}	−0.002*** (0.001)	−0.005** (0.002)	−0.007** (0.003)
d_{10-14}	−0.011*** (0.002)	−0.027*** (0.006)	−0.039*** (0.007)
	High-Skilled Immigration		
	Direct effects	Indirect effects	Total effects
$wage_{it-1}$	0.360*** (0.022)	0.809*** (0.106)	1.168*** (0.109)
ur_{it-1}	0.001 (0.004)	0.008 (0.014)	0.008 (0.014)
hc_{it-1}	−0.004 (0.006)	0.102** (0.049)	0.099** (0.055)
$imhigh_{it-1}$	−0.000 (0.000)	0.007 (0.005)	0.007 (0.005)
ps_{it-1}	−0.008*** (0.001)	−0.019*** (0.004)	−0.027*** (0.005)
in_{it-1}	0.003** (0.001)	0.006** (0.003)	0.009** (0.004)
co_{it-1}	−0.004*** (0.001)	−0.010** (0.003)	−0.014*** (0.004)
fi_{it-1}	0.009*** (0.002)	0.021*** (0.005)	0.030*** (0.006)
bu_{it-1}	−0.004*** (0.001)	−0.010*** (0.003)	−0.014*** (0.004)
ss_{it-1}	−0.003*** (0.001)	−0.006*** (0.002)	−0.009*** (0.003)
d_{10-14}	−0.017*** (0.002)	−0.039*** (0.006)	−0.057*** (0.007)

Notes: standard errors in parenthesis. ***, (**), (*) Significant at 1%, (5%), (10%). Provincial effects are included.

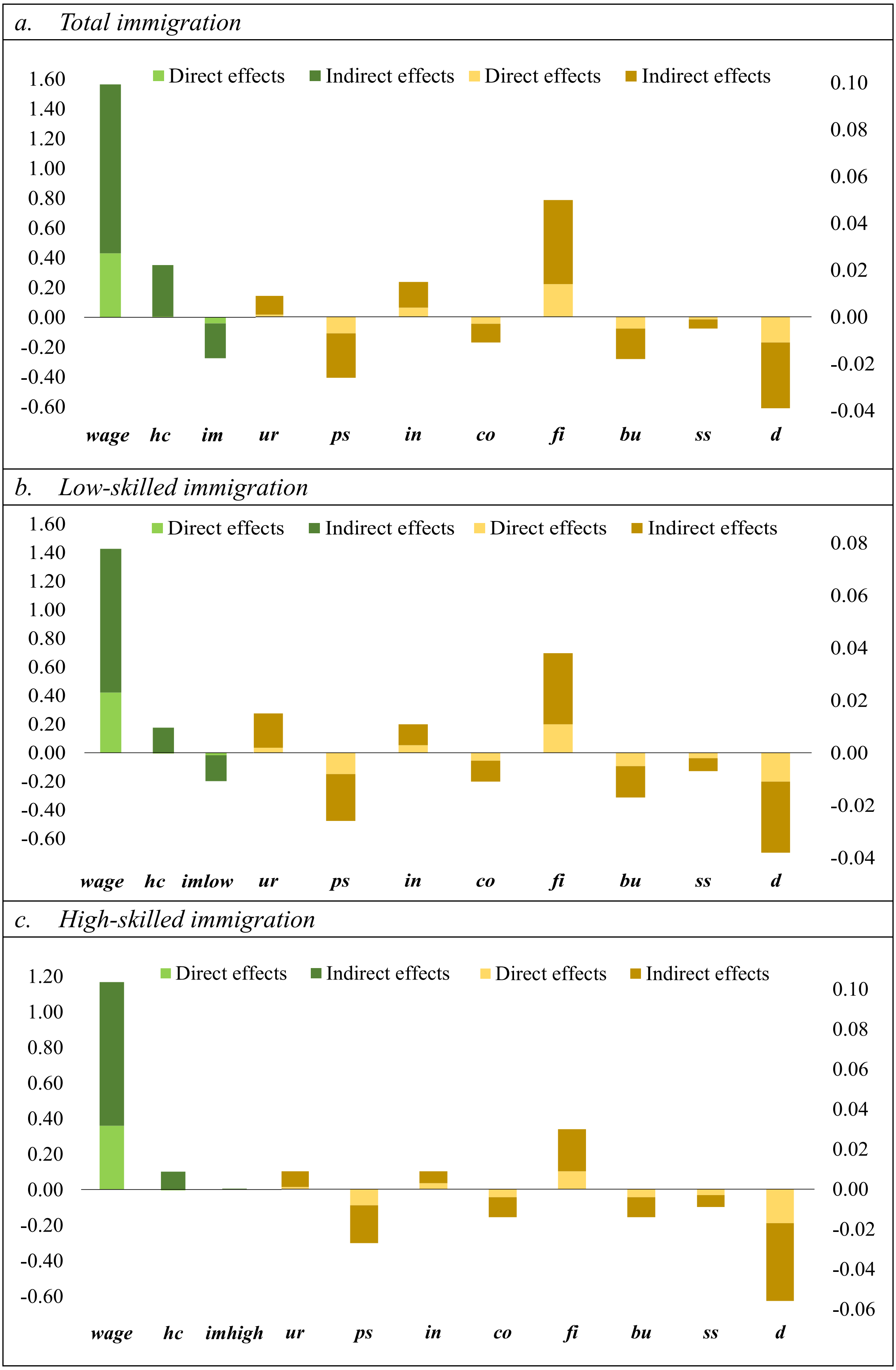

Figure 1. Share of direct and indirect effects. Note: Variables in green with left-hand reference axis; variables in yellow with right-hand reference axis.

3.2. Robustness check

To ensure the robustness of the results obtained, we perform several additional tests. Although the detailed results are not shown here to avoid redundancy, they are available upon request.

3.2.1. Distance matrices

Initially, we ran two robustness tests focused on the likely central issue of the paper: The definition of the distance matrix. First, for the spatial lag of the dependent variable, we now also use in Equation (1) a weights matrix based on migratory movements (to wit, W^m) rather than the conventional distance-based definition. An additional advantage of this variation is that it eliminates the problem associated with including the two Canary Islands provinces in a distance-based weight matrix, as their considerable remoteness from the others could potentially distort the results. Second, considering that the arrival of immigrants in a province can reduce internal migration from another province (captured by the proposed distance matrix), but can also lead to an outflow of population from the receiving province to others, we have redefined the distance matrix so that each cell accounts for the sum of migration flows in both directions—from i to j and from j to i. This enables us to capture bidirectional migration processes. Using our previous example, a wave of immigration to the province of Madrid would affect wages in Cantabria not only in terms of how many people move from Cantabria to Madrid (since they may stop migrating and continue to be part of the labor supply in Cantabria), but also (through a secondary effect) in terms of how many people move from Madrid to Cantabria (because, in this case, if this migratory flow is somewhat established, some people will move to Cantabria due to the competition with incoming immigrants in Madrid, thus increasing the Cantabrian labor supply again). Needless to say, this change in the weights matrix produces a symmetric matrix, just as it does when using a standard distance matrix based on geographical data.

These supplementary analyses proved the reliability of the conclusions discussed earlier, since the changes in the results from both robustness checks were not significant at all, enabling us to reinforce the idea that the inferences drawn above remain valid.

3.2.2. Other robustness checks

Additionally, we checked the consistency of the results from different perspectives not centered on the weighting matrix. In this regard, the first approach involves replacing the first lag with the second lag of the immigration variable in our model, which could help mitigate the potential endogeneity problem to a greater extent, as increasing the lag (from 1 to 2 years) makes it less likely that the variable is correlated with wage shocks. We did not include both the first and second lags simultaneously due to multicollinearity issues in the model, and in fact, when doing so, the first lag was not statistically significant. About the new findings, and focusing on the migration variable for the total immigration to avoid reiteration, we observe a decrease in the total effect of immigration on wages, which, although still statistically significant, now reaches an elasticity of -0.18, with a greater relative weight on the direct effect here than in the reference model. Accordingly, it seems that the influence of immigration on wages fades over time, especially the spillover effects from other provinces.

The second test, not related to the weight matrix, refers to another of the potential causes of endogeneity: Measurement errors. Specifically, we aim to address the distortion in the measurement of unemployment caused by the pandemic in Spain, mainly due to the application of temporary layoff procedures (known as *ERTE*s, or *Expediente de Regulación Temporal de Empleo* in Spanish). As Porras-Arena et al. (2024, p. 106) indicate, "*(during the pandemic)* the unemployment rate has not been a good indicator of the underutilization of labor." As a way of example, Dolado et al. (2021) demonstrate that the unemployment rate in the second quarter of 2020 actually reached, according to the criteria of the United States Bureau of Labor Statistics, more than 40%, while the official data from Spain showed less than 13%. Accordingly, we decided to re-estimate the model but only for the period 2006–2019. The results in this case are basically the same as the ones obtained in our benchmark model, with a total effect of immigration of −0.24.

Finally, we dealt with the dummy variable defined to capture the effects on wages of the Great Recession in Equation (1). Explicitly, we re-assessed the model by changing the definition to include only the period 2010–2012, as the drop in wages during this time was particularly notable. The results here, unlike the previous ones, show an increase in the total effect of migration, which attains a value of −0.42, with an even greater weight on the indirect effect.[10]

To conclude, when evaluating the consistency of the results based on this comprehensive set of aspects unrelated to the definition of the weights matrix, the differences are more pronounced compared to when the focus is on that matrix. Nonetheless, these differences do not undermine the main conclusion of this study, namely that international migration has had a negative but weak effect on wages in Spain. More detailed information on these differences between the benchmark model and the findings in this sub-section, including specific figures, is provided in the final section of the paper.

4. Conclusions

The results reported in this work indicate a small link between immigration and wages in Spain. To provide some context, if the number of immigrants were to increase by a notable 10% in every single province of the country—representing an unprecedented and currently unlikely wave of immigration for Spain—wages would decrease by 2.7%. Given that the average monthly gross wage over the sample period was approximately 1,600 euros (see Table 1), this translates to a reduction of about 43 euros per month; in the robustness tests, the total negative effect of migration ranged from 1.8% to 4.2%, which would imply a reduction of between 29 and 67 euros per month. As for the skill level, there is no discernible effect when considering high-skilled immigrants.

These findings have at least two straight implications. First, concerns about wage reduction due to immigration are misplaced, aligning, for instance, with recent research for the UK by Ghosh and Dickey (2024). This point is significant given that authoritarian populism—described by Norris and Inglehart (2019, p.7) as a "dangerous combination fueling a cult of fear"—often employs this argument as a key message against immigration. Second, our results suggest, when accounting for human capital, that policy efforts should indeed prioritize attracting skilled immigrants through both employer-driven and employee-driven schemes. A valuable contribution that examines this issue and compares Spain's situation with that of other countries is Facchini and Lodigiani's (2014) paper, while the paper by Blanco and Golik (2024) exclusively focuses on Spain.

[10] Following a suggestion from one reviewer, we also removed the dummy variable, and the results were quite similar to those we have just discussed.

Additionally, empirical evidence raises questions about the existence of a wage curve in Spain, as the wage-unemployment elasticity was found to be insignificant. It seems, therefore, that the Spanish labor market has seen little transformation since the latest economic crisis, and there are clear signs of wage rigidity. Another tentative conclusion is that some recently implemented labor policy reforms, which, among other things, emphasize company-level agreements over sectoral, regional, or state-level agreements, appear to have had no remarkable impact on wage rigidity. This result is largely inconsistent with findings from other studies, such as those by Devicienti et al. (2008) for Italy and Daouli et al. (2017) for Greece, which conclude that the wage curve becomes stronger as collective bargaining is less binding.

Although some may argue that wage rigidity offers benefits in terms of job security, the more common interpretation of our results is that such rigidity may hinder the adaptability and efficiency of the Spanish labor market. In any case, if Spain had greater flexibility to adjust wages and absorb changes in labor supply and demand—leaving less of the adjustment burden on unemployment—our findings regarding the immigration-wages nexus might be more significant. This is a promising avenue for future research.

Other potential directions for future research are linked to the own limitations of this study. Its approach is predominantly macroeconomic, using data at the provincial level, which, although advantageous as, for instance, it enables us to examine how the characteristics of each territory modulate the effect of immigration on wages, as well as the study of spillover effects between provinces, does not provide the means for a detailed exploration of the mechanisms through which immigration affects wages. The use of microdata/individual data would be complementary and enable us to deepen our macro conclusions. By way of illustration, it would help us to detail the link between the skills of immigrants and their effect on wages, for which the OECD Program for the International Assessment of Adult Competencies (PIAAC) database could be employed. Another extension of this study would involve delving into the substitution effects between native workers and low-skilled immigrants, as well as exploring the expected heterogeneity of these effects across industries and provinces. In summary, the complexity of the topic suggests that there is much more to address, which will hopefully be the subject of future investigation.

Use of AI tools declaration

The authors declare they have not used Artificial Intelligence (AI) tools in the creation of this article.

Acknowledgments

The authors would like to express their gratitude to the three anonymous reviewers for their valuable and insightful comments during the review process. Their feedback has greatly contributed to enhancing the quality of the article.

Availability of data

Data for this paper: https://figshare.com/articles/dataset/Data_Immigration-Wage_Link/25398604.

Conflict of interest

All authors declare no conflicts of interest in this paper.

References

Amuedo-Dorantes C, de la Rica S (2013) The immigration surplus and the substitutability of immigrant and native labor: Evidence from Spain. *Empir Econ* 44: 945–958. https://doi.org/10.1007/s00181-011-0534-4

Atienza-Montero P, Romo-Calixto CE (2021) El efecto de la población inmigrante sobre el empleo y salarios de los trabajadores nativos. Una investigación empírica para España, 2009–2018. *Estud Econ Apl* 39: 133–3197. https://doi.org/10.25115/eea.v39i2.3706

Baltagi BH, Başkaya YS (2022) Spatial wage curves for formal and informal workers in Turkey. *J Spat Econometrics* 3. https://doi.org/10.1007/s43071-022-00021-y

Blanco MR, Golik M (2024) Why moving there? Spanish SIEs: Factors and motivations involved in the choice of the host destination. *J Glob Mobil* 12: 520–544. https://doi.org/10.1108/JGM-08-2023-0059

Blau FD, Kahn LM (2015) Immigration and the distribution of incomes, In: *Handbook of the Economics of International Migration*, 1: 793–843. https://doi.org/10.1016/B978-0-444-53768-3.00015-1

Borjas GJ (2003) The labor demand curve is downward sloping: Reexamining the impact of immigration on the labor market. *Q J Econ* 118: 1335–1374. https://doi.org/10.1162/003355303322552810

Borjas GJ (2016) The wage impact of the Marielitos: Additional evidence. Working Paper 21850, National Bureau of Economic Research.

Card D, Dustmann C, Preston I (2012) Immigration, wages, and compositional amenities. *J Eur Econ Assoc* 10: 78–119. https://doi.org/10.1111/j.1542-4774.2011.01051.x

Card D, Peri G (2016) Immigration economics by George J. Borjas: A review essay. *J Econ Lit* 54: 1333–1349. https://doi.org/10.1257/jel.20151248

Carrasco R, Jimeno JF, Ortega AC (2008) The effect of immigration on the labour market performance of native-born workers: Some evidence for Spain. *J Popul Econ* 21: 627–648. https://doi.org/10.1007/s00148-006-0112-9

Cavalleri MC, Luu N, Causa O (2021) Migration, housing and regional disparities: A gravity model of inter-regional migration with an application to selected OECD countries. OECD Economics Department Working Papers 1691, OECD Publishing. https://doi.org/10.1787/421bf4aa-en

Cheng W, Lee LF (2017) Testing endogeneity of spatial and social networks. *Reg Sci Urban Econ* 64: 81–97. https://doi.org/10.1016/j.regsciurbeco.2017.03.005

Cuéllar-Martín J, Martín-Román ÁL, Moral A (2019) An empirical analysis of natural and cyclical unemployment at the provincial level in Spain. *Appl Spat Anal Policy* 12: 647–696. https://doi.org/10.1007/s12061-018-9262-x

Daouli J, Demoussis M, Giannakopoulos N, et al. (2017) The wage curve before and during the Greek economic crisis. *Empir Econ* 52: 59–77. https://doi.org/10.1007/s00181-016-1073-9

Devicienti F, Maida A, Pacelli L (2008) The resurrection of the Italian wage curve. *Econ Lett* 98: 335–341. https://doi.org/10.1016/j.econlet.2007.05.013

Dolado J, Felgueroso F, Jimeno J (2021) Past, present and future of the Spanish labour market: When the pandemic meets the megatrend. *Appl Econ Anal* 29: 21–41. https://doi.org/10.1108/AEA-11-2020-0154

Domingo A, Bayona-i-Carrasco J (2024) Second Latin American migratory boom in Spain: From recovery to COVID-19. *Migr Stud* 12: 93–113. https://doi.org/10.1093/migration/mnad039

Dustmann C, Frattini T, Preston IP (2013) The effect of immigration along the distribution of wages. *Rev Econ Stud* 80: 145–173. https://doi.org/10.1093/restud/rds019

Dustmann C, Preston I (2007) Racial and economic factors in attitudes to immigration. *B.E. J Econ Anal Policy* 7. https://doi.org/10.2202/1935-1682.1655

Dustmann C, Schönberg U, Stuhler J (2016) The impact of immigration: Why do studies reach such different results? *J Econ Perspect* 30: 31–56. https://doi.org/10.1257/jep.30.4.31

Elhorst JP, Blien U, Wolf K (2007) New evidence on the wage curve: A spatial panel approach. *Int Reg Sci Rev* 30: 173–191. https://doi.org/10.1177/0160017606298426

Espinosa AM, Díaz-Emparanza I (2021) The long-term relationship between international labour migration and unemployment in Spain. *J Int Migr Integr* 22: 145–166. https://doi.org/10.1007/s12134-019-00716-6

Facchini G, Lodigiani E (2014) Attracting skilled immigrants: An overview of recent policy developments in advanced countries. *Natl Inst Econ Rev* 229: R3–R21. https://doi.org/10.1177/002795011422900102

Felgueroso F, Hidalgo-Pérez M, Jiménez-Martín S (2016) The puzzling fall of the wage skill premium in Spain. *Manch Sch* 84: 390–435. https://doi.org/10.1111/manc.12116

Fellini I (2018) Immigrants' labour market outcomes in Italy and Spain: Has the Southern European model disrupted during the crisis? *Migr Stud* 6: 53–78. https://doi.org/10.1093/migration/mnx029

Fingleton B, Palombi P (2013) The wage curve reconsidered: Is it truly an 'Empirical law of economics'?. *Région et Développement* 38: 49–92.

Fundación CYD (2024) Informe CYD 2024. Available from: https://www.fundacioncyd.org/publicaciones-cyd/informe-cyd-2024/.

Ghosh D, Dickey H (2024) The wage impact of immigration into the UK after the Great Recession. *J Int Migr Integr* 25: 1943–1961. https://doi.org/10.1007/s12134-024-01152-x

Golgher AB, Voss PR (2016) How to interpret the coefficients of spatial models: Spillovers, direct and indirect effects. *Spat Demogr* 4: 175–205. https://doi.org/10.1007/s40980-015-0016-y

González L, Ortega F (2011) How do very open economies adjust to large immigration flows? Evidence from Spanish regions. *Labour Econ* 18: 57–70. https://doi.org/10.1016/j.labeco.2010.06.001

Gutiérrez-Portilla M, Villaverde J, Maza A, et al. (2020) A spatial approach to the impact of immigration on wages: Evidence from Spain. *Reg Stud* 54: 505–514. https://doi.org/10.1080/00343404.2018.1424994

Kyriazi A, Mendes MS, Rone J, et al. (2023) The politics of emigration in Europe: A research agenda. *J Common Mark Stud* 61: 563–575. https://doi.org/10.1111/jcms.13392

LeSage JP, Pace RK (2009) *Introduction to spatial econometrics*, Boca Raton: CRC Press. https://doi.org/10.1201/9781420064254

Lin KH, Weiss I (2019) Immigration and the wage distribution in the United States. *Demography* 56: 2229–2252. https://doi.org/10.1007/s13524-019-00828-9

Longhi S (2010) Job competition and the wage curve. *Reg Stud* 46: 611–620. https://doi.org/10.1080/00343404.2010.521145

Longhi S, Nijkamp P, Poot J (2005) A meta-analytic assessment of the effect of immigration on wages. *J Econ Surv* 19: 451–477. https://doi.org/10.1111/j.0950-0804.2005.00255.x

Longhi S, Nijkamp P, Poot J (2006) Spatial heterogeneity and the wage curve revisited. *J Reg Sci* 46: 707–731. https://doi.org/10.1111/j.1467-9787.2006.00474.x

Longhi S, Nijkamp P, Poot J (2010) Joint impacts of immigration on wages and employment: Review and meta-analysis. *J Geogr Syst* 12: 355–387. https://doi.org/10.1007/s10109-010-0111-y

Martín-Román ÁL, Cuéllar-Martín J, Moral A (2020) Labor supply and the business cycle: The "Bandwagon Worker Effect". *Pap Reg Sci* 99: 1607–1642. https://doi.org/10.1111/pirs.12542

Maza A, Gutiérrez-Portilla M, Hierro M, et al. (2019) Internal migration in Spain: Dealing with multilateral resistance and nonlinearities. *Int Migr* 57: 75–93. https://doi.org/10.1111/imig.12472

Maza A, Moral-Arce I (2006) An analysis of wage flexibility: Evidence from the Spanish regions. *Ann Reg Sci* 40: 621–637. https://doi.org/10.1007/s00168-005-0033-7

Maza A, Villaverde J (2009) Provincial wages in Spain: Convergence and flexibility. *Urban Stud* 46: 1969–1993. https://doi.org/10.1177/0042098009106018

Nedoncelle C, Marchal L, Aubry A, et al. (2024) Does immigration affect native wages? A meta-analysis. Available from: https://hdl.handle.net/10419/281775.

Nickell S, Saleheen J (2015) The impact of immigration on occupational wages: Evidence from Britain. Staff working paper, Bank of England, 2015. http://dx.doi.org/10.2139/ssrn.2706493

Nieto S, Ramos R (2017) Overeducation, skills and wage penalty: Evidence for Spain using PIAAC data. *Soc Indic Res* 134: 219–236. https://doi.org/10.1007/s11205-016-1423-1

Norris P, Inglehart R (2019) *Cultural Backlash: Trump, Brexit, and Authoritarian Populism*, Cambridge: Cambridge University Press. https://doi.org/10.1017/9781108595841.002

Porras-Arena S, Martín-Román AL (2023) The heterogeneity of Okun's law: A metaregression analysis. *Econ Model* 128: 106490. https://doi.org/10.1016/j.econmod.2023.106490

Porras-Arena S, Martín-Román ÁL, Dueñas-Fernández D, et al. (2024) Okun's law: The effects of the Covid-19 pandemic and the temporary layoffs procedures (ERTEs) on Spanish regions. *Investig Reg* 59: 105–125. https://doi.org/10.38191/iirr-jorr.24.013

Ramos R, Nicodemo C, Sanromá E (2015) A spatial panel wage curve for Spain. *Lett Spat Resour Sci* 8: 125–139. https://doi.org/10.1007/s12076-014-0118-y

Rincke J (2010) A commuting-based refinement of the contiguity matrix for spatial models, and an application to local police expenditures. *Reg Sci Urban Econ* 40: 324–330. https://doi.org/10.1016/j.regsciurbeco.2010.04.002

Roos C, Nagel M, Kieschnick H, et al. (2025) The emigration conundrum: EU countries of origin of migrants between integration and demarcation. *J Common Mark Stud* 63: 160–178. https://doi.org/10.1111/jcms.13637

Sanchis-Llopis JA, Cutanda A (2020) The Spanish cyclicality of the user cost of labour. *Econ Bull* 40: 1893–1899.