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Abstract

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JEL-Codes: F220, J310, J610, R230.

Keywords: immigrant mobility, wages, employment, local labour market, Great Recession, Spain.

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Abstract

During the Great Recession, immigrants reacted to the drop in labour demand in Spain through internal migration or leaving the country. Consequently, provinces lost 13.5% of their immigrants or - 3% of the total labour supply, on average. Using municipal registers and longitudinal administrative data, I find that immigrant outflows slowed the decline in employment and wage of natives. I use a modified shift-share instrument based on past settlements to claim causality. Employment effects were driven by increased entries to employment, while wage effects were limited to natives that were already employed. These effects also persisted in the medium-term.

1 Introduction

How do local labour markets adjust when immigrants leave during a crisis? Despite the extensive literature on the effects of immigrants' arrival on the labour market outcomes of the native populations, little is known about the impact of their departure.[1] The absence of literature on this topic is surprising since immigrant outflows during labour market downturns are substantial (Schündeln, 2014; Cadena and Kovak, 2016; Basso and Peri, 2020). While natives in distressed local markets stay in the area, immigrants relocate to other markets and dissipate the shock spatially. Thus, immigrants can absorb part of the shock through their higher geographical mobility and help the local labour markets recover more rapidly.

Using the case of Spain during the Great Recession, this paper fills this gap by documenting the short and medium-term effects of immigrant outflows from local labour markets on natives' labour market outcomes during an economic downturn. During this period, the Spanish economy experienced one of the most severe contractions among developed countries. The immigrant population reacted to the decreased labour demand by moving internally or leaving the country altogether. Due to immigrant departures, provinces lost 13.5% of their working-age immigrant male populations, thereby shrinking the total male labour supply in provinces by an average of 3%. As such, this context provides a rare opportunity to examine the impact of outflows on labour markets during a crisis.

To guide my empirical investigation, I develop a general equilibrium model that predicts how a decrease in the local labour supply due to immigrants' outflow affects the wages and employment of the native workers. Empirically, I exploit the variation in immigrant outflow intensity (relative to the local workforce) across provinces to examine their impact on natives' labour market outcomes over the 2009–2014 period.[2] Since local economic conditions could affect both the immigrant outflows and the labour market outcomes of natives, I use a modified version of the standard shift-share instrument to identify causal effects (Card, 2001). I analyse short-term and medium-term effects of outflows on employment and wages for specific groups of workers (e.g., young or unskilled natives) and types of employment adjustments in response to outflow. For example, while native employment adjustments can occur through higher inflows

[1] See for instance Altonji and Card (1991); Card (2001); Angrist and Kugler (2003); Glitz (2012); Ottaviano and Peri (2012); Dustmann et al. (2017).

[2] The period of analysis starts in 2009, the first year of economic crisis with net population outflows from Spain and ends in 2014, the last year where the Spanish economy had a negative growth. While immigrant population continued to decrease until 2016, I omit the recovery period in order to alleviate concerns about my results being driven by the positive growth observed in these years. I provide results including the recovery period for robustness.

from non-employment into employment, but it can also result from fewer employed workers leaving the labour force. Furthermore, natives can react to outflows through geographic movements across local labour markets, which is a mechanism essential for explaining the impact of immigration on labour markets. I provide evidence of each type of response's magnitude and show how their relative importance varies across worker groups.

The empirical analysis combines two large individual-level datasets. First, to measure labour market outcomes of natives, I use the longitudinal Spanish social security data. This rich administrative dataset allows me to track individuals over time and space based on the location of their workplace, and investigate their wages but also moves between employment and non-employment. Moreover, the large sample size allows me to obtain precise estimates of the effects of immigrant outflow on wages and employment, even for specific subgroups(Aydemir and Borjas, 2007). Finally, the longitudinal nature of the data also allows me to measure labour market changes for fixed cohorts of workers, thereby avoiding the compositional biases that confound cross-sectional analyses (Bratsberg and Raaum, 2012; Dustmann et al., 2016; Ortega and Verdugo, 2021). I combine this data with individual-level municipal registers that cover 100% of the population to precisely count the number of immigrants residing in each province annually. I use this data to measure the intensity of immigrant outflows across Spanish provinces based on the annual decline in the immigrant population, relative to the entire population in the previous year.[3]

I find a positive and causal effect of the net outflow of the immigrants on the wage and employment growth of natives located in the province. During the 2009–2014 period, a 1% increase in the annual net outflow rate of the immigrant population increases the local native wages and employment by 2 and 2.4%, respectively. These results are robust to pre-crisis trends and use of different measures of outflows as well as alternative instruments or weights, including of time-varying controls that capture the changes in the local demand, the structure of the local economic activity, changes in the skill and age composition of the native workforce, and native outflows. Given the recession context and the overall decrease in the employment and wages during the period, these effects suggest that immigrant outflows dampened the negative effects of demand shock by slowing employment and wage losses in the local labour market. While natives of all skill and age groups benefited from the immigrant outflows, the positive effects are more substantial for workers that have the highest substitutability with immigrants (e.g., natives below 30 or low-skilled) or have the high elasticity to labour market conditions (e.g., natives above 50).[4]

Furthermore, I show that immigrant outflows increase the recruitment of natives who were not previously employed, while those who were already employed are not less likely to leave employment in the short-run. This finding is in line with Dustmann et al. (2016), who find that an increase in the labour supply due to the arrival of immigrant workers reduces the employment of outsiders, while insiders are protected by labour market institutions. However,

[3]Naturalisation rates are high in Spain, especially for immigrants originating from Latin American countries. For this reason, throughout the paper I use the terms immigrant and foreign-born interchangeably to refer to individuals who were born outside of Spain, regardless of their nationality.

[4]Labour market institutions and policies can affect the impact of immigration on labour markets. On average, labour market rigidities such as regulations, policies, or minimum wages can dampen immigration's negative effects (Edo and Rapoport, 2019; Foged et al., 2019). However, such rigidities can also lead to larger employment effects for older workers than young workers, who have a higher degree of wage rigidity as shown in Dustmann et al. (2017). The theoritical model which I present in the next section accounts for such rigidities.

I find statistically significant positive effects on wages only on workers who were employed prior to the immigrant outflows. This suggests that changes in the worker composition, due to possible negative selection into employment, attenuate overall wage effects.

Natives can also react to the immigrant labour supply changes through geographical mobility (i.e., relocating to other provinces). Detecting the presence of such effects is crucial for obtaining a complete picture of the natives' adjustment to such shocks. It is also important because such moves can lead to a misestimation of the consequences of immigration (Peri and Sparber, 2011). I find that for every 10 immigrants that depart from a province, the native population increases by 3. Furthermore, I study the arrival and departure rates of natives to understand the source of this increase in the native population. I determine that these changes are mainly driven by increased inflows of natives from other regions. This finding is in line with recent literature noting that population inflows respond to economic shocks or immigration more strongly than outflows (Monras, 2018; Dustmann et al., 2017).

The positive effects of outflows on local wages persist until the fourth year and becomes statistically insignificant afterwards, while employment effects remain positive and significant throughout the period. This recovery is faster than what is observed following an immigration episode, where the negative effects are estimated to last from 5 years (Monras, 2020) to up to 20 years (Blanchard and Katz 1992; Jaeger et al. 2018; Edo 2020). Since these effects are estimated using cross-sectional data, they are subject to changes in the worker composition driven by the geographical mobility of workers or moves in and out of employment. To isolate the composition changes, I use the panel dimension of my data and follow the outcomes of workers based on their initial location (Foged and Peri, 2015; Ortega and Verdugo, 2021).[5] Once the worker composition is fixed, positive wage effects remain significant even beyond the 4-year mark. This result suggests that changes in the worker composition attenuate overall wage effects. Furthermore, the employment effects also remain positive and significant throughout this period but are smaller than those found using cross-sectional data where the composition is not fixed.

My findings contribute to three strands of literature. First, they relate to the literature showing that the mobility of immigrant workers can be a mechanism for equalising differences across labour markets (Bartik, 1991; Blanchard and Katz, 1992). Due to their higher responsiveness to spatial differences in economic opportunities compared to natives, immigrants have higher geographical mobility, which "greases the wheels" of the labour markets (Borjas, 2001; Cadena, 2010; Basso and Peri, 2020). My paper is specifically related to the recent literature on immigrant mobility and its cushioning effects for the natives during a demand shock. In a seminal work on the Great Recession in the US Cadena and Kovak (2016) shows that Mexican workers' mobility reduced the incidence of local demand shocks on natives. In a similar study, Basso et al. (2019) also finds that the immigrant workers' mobility in the euro area is strongly cyclical, and it reduces the variation of overall employment rates over the business cycle. I advance this literature by providing the first estimates of the direct impact on both wages and employment in the local labour markets. Moreover, by using individual-level administrative data, I am able to control for selection and account for other adjustment margins that outflows

[5]In particular, Ortega and Verdugo (2021) show that immigration can lead to reallocation of natives to other locations or occupations, especially in the medium-term. As this can affect the measurement of the impact of immigration, grouping natives by their initial location (or occupation) and thus controlling for possible changes in the composition effects is crucial estimating the labour market effects

may entail.

Second, the findings of the present study contribute to the literature focusing on the labour market effects of outflow-induced supply shocks. Despite the extensive literature studying the effects of inflows, evidence on the impact of outflows remains scant. Focusing on the emigration of the Mexicans to the US between 1970 and 2000, Borjas and Aydemir (2007) and Mishra (2007) presented the first econometric results on the effect of emigration on the national wages in Mexico. Similarly, Elsner (2013) and Dustmann et al. (2015) study the impact of emigration on the wages of the natives that remained in Lithuania and Poland, respectively. Unlike papers that focus on the impact in the sending country, I examine the effects of the immigrant population's departure on the natives in the host country. Second, apart from Dustmann et al. (2015), all of the aforementioned studies focus on the wage effects using the skill-cell approach of Borjas (2003). I follow a purely spatial approach and exploit the variations in the total outflows to study the effects on local labour markets' in the short and medium-term.[6]

Finally, I contribute to the literature studying the natives' residential choices, or the so-called native displacement, in response to immigration. There is a long-standing debate on whether natives relocate to other areas as a reaction to immigration. While testing the presence of such an adjustment mechanism is relevant and interesting, it also matters for the validity of studies that exploit the spatial variation in immigration to identify the labour market effects (Peri and Sparber, 2011). The literature provides estimates for the displacement of natives only due to immigrants' arrival(Borjas, 2003; Peri and Sparber, 2011; Clemens and Hunt, 2019). I contribute to this literature by providing the first evidence on the effects of immigrant outflows on natives' residential choices and show that immigrants' departures attract natives to local areas.

The remainder of this paper is organised as follows. The next section provides a theoretical model that allows understanding the impact of a decrease in labour supply due to the outflow of immigrants on local labour markets. Section 3 provides background information on the economic crisis in Spain and the differences in mobility patterns between the immigrant and native population during this period. Section 4 describes the data and presents the descriptive statistics. Section 5 presents the empirical strategy and addresses identification issues. Section 6 provides the main results, and Sections 7 and 8 present the robustness tests and heterogeneity analysis, respectively. Section 9 discusses the underlying adjustment mechanisms and Section 10 discusses the dynamic adjustment effects over time. Section 11 concludes.

[6] Very recently the immigration literature has turned to the labour market effects of immigration restrictions. Clemens et al. (2018) for instance study the effects of the exclusion of Bracero workers in the US in 1964, on the wages and employment of natives in the agricultural sector. They find that the reduction in the entry of seasonal Mexican workers did not increase the wages and the employment of natives in the industry, as the reduction in the labour supply was compensated by an increase in technology adoption in the sector. Similarly, Yasenov et al. (2019) study the forced repatriation of Mexicans in the US between 1930-1940, and find that these repatriations increased low-skilled native employment while high-skilled employment was not affected.

2 An equilibrium model with heterogeneous labour supply, demand shock and wage rigidities

To motivate the empirical specifications and help the interpretation of my estimated parameters, I commence by setting out a theoretical framework building on Docquier et al. (2014) and Dustmann et al. (2017). I construct a simple aggregate model of an economy where the workers are differentiated by their place of birth (native and immigrant) as well as their education (skill) levels. I also allow exogenous variations in A which captures the changes in the local demand. This structure allows me to examine the wage and employment effects due to changes in the labour supply driven by the outflow of the immigrant population.

The model aims to provide a simple framework, where labour is the only production input and output is an interaction of this input with A, which is both TFP and the unit price of the output. It is assumed that physical capital is nationally mobile (its supply is perfectly elastic), that each single region is too small relative to the national labour market and returns to physical capital are equalised across locations.

I start out with a fully competitive labour market as a benchmark. In a second step, I allow the degree of wage rigidity to vary across skill or demographic groups.

2.1 Set-up

2.1.1 Production function

The output Y (homogeneous and perfectly tradable) in a specific area is the product of labour L and total factor productivity A.

$$Y = AL \tag{1}$$

Following the literature, I assume that labour L is a nested CES function of skilled (S) and unskilled (U) labour L_g where $g = U, S$.

$$L = \left[\theta_U L_U^{\beta} + \theta_S L_S^{\beta}\right]^{\frac{1}{\beta}} \tag{2}$$

where θ_U and θ_S are the productivity levels of unskilled (less than tertiary education) and skilled workers (tertiary education or above). The elasticity of substitution between the two skill groups equals $\sigma = \frac{1}{1-\beta}$, with $\beta \leq 1$.

This representation implies two types of simplifications. First, I assume that the relevant split in terms of production abilities is between college and non-college-educated workers. This is consistent with the previous literature which finds high substitutability between workers with no schooling and high school degree, but small substitutability between them and workers with college education (Card, 2009; Ottaviano and Peri, 2012). Second, for simplicity I omit further classification into age groups, considered as imperfectly substitutable skills (Borjas, 2003; Ottaviano and Peri, 2012; Docquier et al., 2014).

I distinguish between natives and immigrants within each skill-specific labour aggregate, L_g^N and L_g^S. Similar to Dustmann et al. (2017), I assume that within each skill group g, natives (N) and immigrant (M) are perfect substitutes in production, which gives[7]:

[7] In my theoretical model, I assume perfect substitution between natives and immigrants within the same skill group, similar to Docquier et al. (2014) or Dustmann et al. (2017). Although elasticity of substitution

$$L_g = L_g^N + L_g^M \tag{3}$$

2.1.2 Labour demand for natives

Each region is a single labour market. Assuming that firms are pricetakers in the labour and product market, firms choose labour such that marginal costs equal the marginal products of each type of worker. I derive the marginal productivity for workers of both skills (w_S and w_U) by substituting Equation 2 into Equation 1 and taking the derivative with respect to the total quantity of labour L_S and L_U. This yields the labour demand for each type of worker:

$$w_g = A(\theta_g)L_g^{\beta-1}L^{1-\beta}$$

In Appendix A.1, I take the logarithm of the demand functions for each type and derive the firm's change in the demand of native workers from skill group g, $dlogL_g^N$, due to overall immigration-induced change in the labour supply ($dlogL_g^M$) and the demand ($dlogA$)[8]and obtain the following:

$$dlogL_g^N = \frac{1}{\gamma}dlogw_g - \frac{(1-\beta)}{\gamma}(S_{g'})[dlogL_{g'}^N\theta_{g'}^N + dlogL_{g'}^M\theta_{g'}^M] - \frac{1}{\gamma}dlogA + [(1-\beta)(S_g-1)](\frac{\theta_g^M}{\gamma})dlogL_g^M \tag{4}$$

where g' denotes the other skill group, $\gamma = \frac{1}{[(1-\beta)(S_{g'}-1)]\theta_g^N}$ is the (negative) slope of the aggregate labour demand curve, S_g denotes the contribution of labour type g to the total labour aggregate and θ_g^N and θ_g^M denote the share of workers of skill group g (in head counts) among natives and immigrant (i.e., $\theta_g^N = \frac{L_g^N}{L_g}$ and $\theta_g^M = \frac{L_g^M}{L_g}$).

Suppose that g indexes unskilled labour and g' skilled labour. Equation 4 demonstrates that in the absence of any wage response to immigration (i.e., $\frac{dlogw_g}{dlogL_g^M} = 0$), unskilled native employment declines by the rate $(1-\beta)(S_g-1)(\frac{\theta_g^M}{\gamma})$. The equation also shows that a decline in the wage of unskilled labour in response to immigration (i.e., $\frac{dlogw_g}{dlogL_g^M} < 0$) will dampen the employment response of the unskilled, as the slope of the demand curve γ is negative. An increase in the labour demand for other skill groups, would increase the demand for unskilled native employment. (i.e., $\frac{dlogL_g^N}{dlogL_{g'}^M} > 0$, $\frac{dlogL_g^N}{dlogL_{g'}^N} > 0$). Finally, a positive demand shock will also increase the labour demand for natives (i.e., $\frac{dlogL_g^N}{dlogA} > 0$).

is almost perfect within refined cells (see Ottaviano and Peri, 2011) it still remains a strong assumption. For this reason, in the empirical section I estimate wage and employment responses for different skill groups to the overall decrease in labour supply due to immigrants' mobility. This means that in my estimation procedure, I do not allocate immigrant workers to skill groups based on their observed skills (Dustmann et al., 2013). Other models have emphasized the role of complementarity within education groups as well as upgrading and specialization of native workers in response to immigrants and have found null or positive wage effets (Card, 2009; Peri, 2012; Ottaviano and Peri, 2012). The parameter I estimate will give the aggregate of both complementarity and substitution effects. Complementarity and substitutability (and also the elasticities) between natives and immigrants depend on the period of analysis. For instance, in the short-term, one would expect the substitutability to be stronger while the complementarity is more likely to play out in the medium or long-term.

[8]Demand for native workers depends on total labour demand and labour supply of the immigrant workers. I include exogenous variation of A to capture the changes in the labour demand for native workers due to shifts in the total labour demand.

2.1.3 Labour supply

Labour supply of natives and immigrants constitute the total supply. Following the literature, I make the simplification that all working-age immigrants supply a constant amount of labour ($\phi_M > 0$) so that total employment of immigrants is given by $L_g^M = \phi_M M_g(A^\alpha)$, where M_g denotes the total number of working-age immigrant population.[9] The size of the immigrant population is function of A, with an elasticity $0 < \alpha \leq 1$. For simplicity, I assume that variations in A impact immigrant population of both education groups equally.

Using N_g to denote the (fixed) number of natives who could potentially supply labour to the local labour market, the local labour supply function for skill group g is:

$$L_g = L_g^N + L_g^M = N_g f_g(w_g, w'_g) + L_g^M \tag{5}$$

Local labour supply of natives depends on skill-specific wages in the market under consideration (w_g) and other local labour markets (w'_g). The local labour market elasticity for natives, which I allow to vary by skill group, is then given by $\eta_g = \frac{w_g}{\partial w_g} \frac{\partial (N_g f_g(w_g, w'_g))}{(N_g f_g(w_g, w'_g)}$. Note that η_g is the local labour market elasticity for natives, which varies by skill group. It captures various potential adjustment mechanisms such as moving into and out of non-employment, internal migration of workers between areas, or entries into and exits from the labour force. These adjustment margins may have different importance for different types of workers and thus help explain why some groups respond more elastically than others.

From the labour supply function 5, it follows that (see Appendix A.2 for details):

$$dlog(L_g^N) = \eta_g dlogw_g \tag{6}$$

2.2 Equilibrium effect of migration and demand

2.2.1 Competitive equilibrium with flexible wage

In a competitive equilibrium, quantities supplied must equal quantities demanded. The intersection of the demand and supply curve, determine the skill-specific wages and employment in the local labour market.

The equilibrium wage and employment responses are determined by the two skill-specific labour demand curves:

$$dlogw_S = (\beta - 1)dlogL_S + (1 - \beta)dlogL + dlogA \tag{7}$$

$$dlogw_U = (\beta - 1)dlogL_U + (1 - \beta)dlogL + dlogA \tag{8}$$

and two skill-specific supply curves:

$$dlogL_S^N = \eta_S dlogw_S \tag{9}$$

[9]The goal of this paper is to analyse the effects of a change in immigrant supply on natives' labour market outcomes. This definition implies that a certain percentage change in immigrant population translates into the same percentage change in immigrant employment. See Borjas (2003), Docquier et al. (2014) or Dustmann et al. (2017) for a similar simplification.

$$dlogL_U^N = \eta_U dlogw_U \tag{10}$$

By substituting Equation 9 and 10 into Equation 7 and 8, and rearranging them, I derive the equilibrium employment response as (see Appendix A.3):

$$dlogL_g^{N*} = -\frac{(1-\beta)S_{g'}\theta_g^M\eta_g}{1+(1-\beta)S_{g'}\eta_g\theta_g^N+(1-\beta)S_g\eta_{g'}\theta_{g'}^N}dlogL_g^M$$

$$+\frac{(1-\beta)S_{g'}\theta_{g'}^M\eta_{g'}\eta_g}{1+(1-\beta)S_{g'}\eta_g\theta_g^N+(1-\beta)S_g\eta_{g'}\theta_{g'}^N}dlogL_{g'}^M$$

$$+\frac{(1+(1-\beta)S_g\eta_{g'}\theta_{g'}^N)\eta_g}{1+(1-\beta)S_{g'}\eta_g\theta_g^N+(1-\beta)S_g\eta_{g'}\theta_{g'}^N}dlogA \tag{11}$$

Since $\beta \leq 1, S_{g'} \geq 0, S_g \geq 0$, the denominator, and the numerators are always positive. Thus, an increase in the number of immigrants of the skill group g would have a negative impact on the employment of natives of the same skill group (g) due to substitution. An increase in the number of immigrants in the other skill group (g') would be positive due to complementarities between the two groups.

A negative demand shock (captured in A) would impact the equilibrium through multiple channels:

$$\frac{dlog(L_g^{N*})}{dlog(A)} = \underbrace{\frac{\partial logL_g^N}{\partial logA}}_{(-)} + \underbrace{\frac{\partial logL_g^N}{\partial logL_g^M}}_{(+)} \times \underbrace{\frac{dlogL_g^M}{dlogA}}_{(-)} + \underbrace{\frac{\partial logL_g^N}{\partial logL_{g'}^M}}_{(-)} \times \underbrace{\frac{dlogL_{g'}^M}{dlogA}}_{(-)}$$

A decrease in A will:

- decrease the demand for native labour $dlogL_g^N$ (i.e., $\frac{\partial logL_g^N}{\partial logA} < 0$)
- decrease the labour supply of immigrants for the skill group g (i.e., $\frac{dlogL_g^M}{dlogA} < 0$), which increases the demand for native labour of the same skill group (i.e., $\frac{\partial logL_g^N}{\partial logL_g^M} > 0$).
- decrease the labour supply of immigrants for the skill group g' (i.e., $\frac{\partial logL_g^N}{\partial logA} < 0$), which decreases the demand for native labour of the skill group g' (i.e., $\frac{\partial logL_g^N}{\partial logL_g^N} < 0$)

The final effect will be the sum of all these forces. A decrease in A will decrease the labour demand for natives, yet it will be dampened by the positive effect due to decreased competition from the immigrant population of the same skill group. In reverse, in case of a positive demand shock (i.e. A is positive), an increase in the labour demand for natives will be slowed by the increase in the competition due to the increased presence of immigrants from the same skill group.

2.2.2 Wage rigidities

The equilibrium above assumes the flexibility of wages. However, in the context of Spain, wages are rigid and thus have low cyclicality especially in the short-term (Bentolila et al., 2012b; De la Roca, 2014). Moreover, the degree of rigidity may vary across sectors, skills, tenure, type of job contract or occupation (Card and Kramarz, 1996; De la Roca, 2014; Font et al., 2015). These labour market rigidities, while protecting some native workers from negative demand shock or immigrant competition, can also increase the employment response (Angrist and Kugler, 2003; Dustmann et al., 2017).

If the decline of wages is constrained due to labour market rigidities, then the wages cannot fall by as much as the equilibrium wage response given by the labour supply (Equation 5) or the equilibrium (Equation 11). This would create a demand-side constraint in the market, and in consequence generate an oversupply of (native) workers who would like to work for the current wage rate, but cannot find a job. In this case, the wages would be determined exogenously depending on the wage rigidity for the group, and the employment response of natives would be determined by the labour demand function (Equation 4).

The differences in labour supply responses and the degree of wage rigidities can generate "perverse" effects where the group experiencing the largest shock may not be the one suffering the largest changes in wages or employment (Edo, 2016; Verdugo, 2016; Dustmann et al., 2017).

3 Spanish context

3.1 Immigrant population in Spain

Between 1998 and 2008, Spain experienced one of the most significant immigration episodes among the OECD countries in recent history.[10] Until 2009, Spain received an average of nearly half a million immigrants annually, becoming the second-largest recipient of immigrants in absolute terms in the OECD after the United States (Arango, 2013). The proportion of immigrants (based on nationality) in the total population increased from 1.6% in 1998 to 12.1% in 2009, reaching to 5.6 million (Appendix Figure C1). Due to the high naturalisation rates in Spain, this figure is even higher. For instance, there were 6.4 million foreign-born people in Spain in 2009, resulting in a 13.7% share of immigrants in the population.

A substantial portion of immigration to Spain consisted of migration flows from a diverse set of countries, which was driven by labour market motives due to Spain's strong economic growth lasting more than a decade (de la Rica et al., 2014; Moral-Benito, 2018). Beyond the economic pull factors, cultural and linguistic factors also played a role in shaping Spain's immigration experience by attracting many immigrants from Latin American countries (Adserà and Pytliková, 2015). In addition to the cultural proximity, the special arrangements that allowed citizens of the former colonies to enter Spain without a visa increased immigration from Latin America (Bertoli and Fernández-Huertas Moraga, 2013, 2015).

[10] This rapid increase in the immigrant population generated academic interest in the labour market impact of immigration. See for instance Amuedo-Dorantes and De La Rica (2005); Carrasco et al. (2008); Amuedo-Dorantes and de la Rica (2011); Gonzalez and Ortega (2011) for labour market impact of immigration. See also de la Rica et al. (2014) for a more comprehensive review of the literature on the immigration wave experienced by Spain over the last decade on other dimensions (i.e., housing, immigrant assimilation, inflation rate etc.). See Appendix Section C.1 for further details on immigration in Spain before and during the Crisis.

Spain was one of the hardest-hit economies during the Great Recession. Notably, it was hit by two shocks: the end of the construction sector's speculative bubble in Autumn 2007 and the global financial shock in September 2008. The negative shock in the construction sector reversed the positive employment trend observed until the crisis. Then, the global financial shock triggered a rapid increase in the unemployment rate. Appendix Section B provides further details on the evolution of this crisis and its impact on the Spanish economy.

During the crisis, immigrants—especially male immigrants—suffered higher unemployment rates than native workers (see Appendix Figure E1). There are many reasons why immigrants in Spain were hit harder. First, up to 50% of immigrants were concentrated in sectors that are more sensitive to business cycles (e.g., construction, wholesale, and hotels and restaurants) before the crisis. Second, immigrants were more likely to hold temporary contracts before the crisis, which made them more vulnerable to being fired (Fernandez and Ortega, 2008).[11]

The crisis caused a decrease in the immigrant population, which was driven by a sudden drop in immigrant inflows and an increase in return migration. The significant and immediate drop in labour-related entries was due to two reasons. First, unlike most other European countries where the drop was less pronounced and gradual, migration flows in Spain had always been heavily dependent on economic cycles (OECD, 2009). Due to a contraction in its economy, Spain's appeal as a destination decreased.[12] Second, the Spanish government took action to reduce the labour-related entries (see Appendix Section D for more details). Simultaneously, departures also began to increase due to the drop in economic activity and encouragement policies of the Spanish government (see Appendix Section D for more details).[13]

Between 2009 and 2014, 2.8% of the working-age male population left each year, resulting in a net decrease of 170 000 people. This net reduction caused a 6% decline in the working-age immigrant male population across Spain and a 10.1% reduction in the immigrant male population relative to 2009.[14] The outflows were negatively selected in terms of skills (Fernández-Huertas Moraga, 2014; Izquierdo et al., 2016). During this period, the proportion of immigrants in the low-skilled working-age male population decreased from 17.9 to 16.3%, and from 12.2 to 11.6% in the high-skilled workers (Appendix Figure C5). Finally, the average age of immigrants increased from 35.2 in 2009 to 37.3 in 2014 and remained roughly unchanged at approximately 40 for natives, which indicates that younger migrants were more likely to leave Spain.

3.2 Immigrant and native mobility during the Great Recession

Immigrants are more mobile than native-born workers across regions, industries and occupations (Borjas, 2001; Orrenius and Zavodny, 2007). Recent literature has shown that native-born

[11]The fact that the changes in the business cycles affect immigrants differently has been explored in other country contexts. Dustmann et al. (2010) find larger unemployment responses to economic shocks for immigrants relative to natives within skill groups in the UK and Germany, especially for non-OECD immigrants. Focusing on the Great Recession in the US, Orrenius and Zavodny (2010) also conclude that immigrants, especially the low-skilled, have higher sensitivity to the business cycle than natives.

[12]For instance, the number of foreigners residing abroad who are offered jobs in Spain — a process known as contratación en origen declined from 45 995 in 2006 to 4 429 in 2009.

[13]A reasonable question is whether the economic crisis impacted flows differently for those who are from EU countries, thus benefiting from free mobility, vs. those who are not. I discuss these issues in Appendix Section C.2 further and show that there are no striking differences between the mobility patterns of the two groups.

[14]While the Spanish economy came out of the Great Recession officially end of 2014, the immigrant population continued to decrease until 2016. Between 2009-2016, the working-age male immigrant population's net decrease amounted to 250 000, corresponding to a 9% decrease in the working-age male population relative to 2009.

populations are less sensitive to labour demand shocks and respond much less by geographic mobility compared to their immigrant counterparts (Schündeln, 2014; Cadena and Kovak, 2016; Bartik, 2017; Basso et al., 2019; Yu, 2021; Galvez-Iniesta, 2021). These differences can be due to their observable demographic characteristics (i.e., age, education, family structure, home ownership) as well as their unobservable characteristics (i.e., self-selected group of people with high levels of labour force attachment and a greater willingness to move long distances for better economic opportunity). The difference in the responsiveness between natives and the immigrant is especially high within the lower-skilled.

I begin by establishing whether a difference in mobility between natives and immigrants exists in Spain during the Great Recession. Figure 1 presents scatter plots for working-age native-born and immigrant men and compare their mobility. Each circle represents a province and circle sizes are proportional to the provincial population. The x-axis shows the change in log employment for each group, while the y-axis shows the change groups' log population which can be due to both internal and international mobility. The figure demonstrates that immigrant workers respond much more strongly to local labour demand shocks than natives. Thus, immigrant populations in hard-hit areas move out, while natives remain.

[Figure 1 about here.]

These figures show that the native population was less responsive to shocks when compared to the immigrant population. The higher mobility of immigrants compared to the natives in Spain has also been confirmed by earlier work focusing on the internal migration in Spain (David and Javier, 2009; Hierro and Maza, 2010; Gil-Alonso et al., 2015). More recent work focusing on individual internal moves in a gravity-type setting, show that immigrant moves have much higher elasticity to labour market conditions (Gutiérrez-Portilla et al., 2018; Melguizo and Royuela, 2017). For instance, while both natives' and immigrants' moves were partially motivated by amenities (e.g., temperate climate, sunny days) during the pre-crisis period, these amenities lost their importance for foreigners as the driver of geographical moves during the crisis (Maza et al., 2019).

In Appendix Section F, I further explore the issue by decomposing the mobility by the skill group to determine whether the elasticities differ depending on the skill group. Similar to the results of Cadena and Kovak (2016) for the US, I find that the native population in Spain is much less sensitive to the demand shocks. While high-skilled natives have higher elasticities than low-skilled natives, these elasticities are lower than those estimated for low-skilled immigrants.[15]

Despite the low share of native outflows compared to its population, it is important to account for them empirically since they could affect the re-adjustment of the local labour markets. In Section 7.1, I present the results of controlling for native mobility.

[15] Despite large differences in unemployment rates and economic conditions, labour mobility has been low in Spain especially compared to other European countries (Mulhern and Watson, 2009; Bell et al., 2015). The low mobility response of natives to changes in unemployment is not a new phenomenon in Spain, and there are many reasons why natives are less responsive to the demand shocks. For example, the low mobility is partially explained by the safety net provided by the families (Bentolila and Ichino, 2008), or the fact that access to welfare benefits are conditional on residency (Bover and Velilla, 2005;Amuedo-Dorantes and Borra, 2018). For similar analysis for earlier periods, see Antolin and Bover (1997); Bentolila and Dolado (1991).

4 Data and summary statistics

This section presents the data used to estimate the effects of net immigrant outflow from Spanish provinces on natives' outcomes. After describing the data and selected sample, I provide some descriptive statistics.

4.1 Data

4.1.1 Social security data

The labour market data come from Spain's Continuous Sample of Employment Histories (MCVL *or Muestra Continua de Vidas labourales* in Spanish).[16] This is an administrative data set with longitudinal information obtained by matching social security, income tax and census records for a 4% non-stratified random sample of the population who have a relationship with Spain's social security system in a given year. Individuals can either be working as employees, self-employed or receiving unemployment benefits or pension.

For each date, each individual's labour market status, daily wage, occupation, contract type, establishment's sector of activity at the NACE three-digit level, and the location of the establishment are known. The data also includes individual characteristics such as age, gender, country of birth, nationality, and educational attainment, which was retrieved from Padrón or municipal registers.

This rich administrative data set is well suited for my analysis for multiple reasons. First, the large sample size allows me to obtain precise estimates of outflow on wages and employment even for specific subgroups. Second, the data allows me to track individuals across time and space based on their workplace location, which allows me to investigate moves between employment and non-employment. Third, the longitudinal nature of the data also allows me to measure changes in labour markets for constant cohorts of workers while avoiding compositional biases that confound cross-sectional analyses. Fourth, in addition to information on education, age, tenure, and other individual characteristics, the data include citizenship and country of birth which facilitates the identification of all immigrant workers who have naturalised.

4.1.2 Sample restrictions

After combining the social security and income tax records, my monthly panel covers job spells in 2005-2016 for individuals aged 18 and over, those born from 1962 onward, and those employed at any point between January 2005 and December 2016. This initial sample includes 777 593 workers and 75 945 441 monthly observations (see Appendix Section I.1 for further details).

First, I exclude jobspells for workers who are self-employed because wages are not available. I also exclude Ceuta and Melilla given their special enclave status in continental Africa. Job spells in agriculture, fishing, mining, and other extractive industries are excluded because these activities are covered by special social security regimes where workers self-report wages and the number of working days recorded is not reliable (De la Roca and Puga, 2017). Job spells

[16] This dataset is distributed by Directorate General of Planning for the Social Security (*Dirección General de Ordenación de la Seguridad Social*) under the Ministry of labour, Migrations and Social Security (*El Ministerio de Trabajo, Migraciones y Seguridad Social*). It has been widely used in research on labour markets (e.g., Bonhomme and Hospido, 2017; De la Roca, 2017; De la Roca and Puga, 2017).

in the public sector, international organisations, and in education and health services are also left out because wages in these sectors are regulated by the national and regional governments. Apprenticeship contracts and certain rare contract types are also excluded. Furthermore, workers who have not worked at least 30 days in any year and those with missing education data are also excluded.

I also exclude women and immigrants from the sample. Women are excluded for three reasons. First, they are excluded to provide estimates that can be comparable with other studies on the labour market impact of immigration (De la Roca, 2014; Ortega and Verdugo, 2021; Dustmann et al., 2017; Edo, 2020; De la Roca and Puga, 2017). Second, despite significant increases in female employment in Spain, female employment remains lower than in comparable countries. In fact, the gender gap in employment is among the highest in the industrialised countries (21% in Spain, 18% in the EU-27 and 10% in the US; Farré et al., 2011). Third, women's employment decisions are likely to depend on labour market opportunities and the cost of child care and elderly care services (Farré et al., 2011; Cortés and Pan, 2018). Finally, if married, women are likely to depend on their husbands' employment—especially during an economic crisis (Baslevent and Onaran, 2003). In this sense, the substitutability and complementarity relationships between immigrants and native workers might differ for men and women (Carrasco et al., 2008). Despite excluding them from the main analysis, I present some results for female workers in Section 8. I leave-out immigrant workers since I am interested in the labour market outcomes of natives.

I restrict the sample to workers aged 25 to 54 between 2009-2014 to avoid problems with potentially endogenous labour market participation in educational decision for young people and early-retirement decisions (Ortega and Verdugo, 2021; De la Roca and Puga, 2017; Hunt, 2017). I focus only on full-time workers in a year which is standard in the literature (Katz and Murphy, 1992) but also provide results for part-time workers in the Appendix S. These restrictions reduce the sample to 193 247 native-born workers with 814 197 yearly observations. This means that on average I observe each native around 4 years.

Finally, I use the individuals in the sample to calculate the province-year labour market outcomes of native workers.

4.1.3 Mobility data

Outflows from provinces are measured using microdata from the Municipal Register of Population (*Padrón Municipal de Habitantes*), which is the official population registry of municipalities. According to the law (*Ley de Bases de Régimen*), anyone living in a Spanish municipality must register upon arrival in the country, and to de-register upon departure. Arriving individuals have strong incentives to register since it allows them to enjoy municipal services (such as getting a national ID, drivers permit, passport, proof of residence) and grants them access to education and health services (Rodenas Calatayud and Marti Sempere, 2009).

Immigrants have additional incentives to register, which makes this data particularly useful for recording data on immigrants residing in Spain, both legally and illegally (see Appendix Section I.2 for further details). Regardless of their legal status, immigrants can register to access the public health and education systems with no risk of detention by the authorities. Furthermore, registering allows illegal immigrants to report their presence, which is a necessary condition for regularisation eligibility (Bertoli et al., 2013; Monras et al., 2019).

I have access to individual microdata from the official registry, which provides information on the complete universe of individuals living in Spain. For each individual, the data includes information on municipality of residence, nationality, the place of birth (municipality if born in Spain, country of birth otherwise), age and sex. These details allow me to calculate precise stocks of the immigrant and native stocks flexibly according to my sampling criteria (i.e., age, sex, country of birth). I use the changes in these stocks to account for variations in the labour supply similarly to the papers that study the impact of changes in immigrant labour supply (Gonzalez and Ortega, 2011; Ortega and Verdugo, 2021; Edo, 2020; Yasenov et al., 2019).

I use population stocks to account for the mobility of the immigrant population for two reasons. First, it is considered a good measure of the number of immigrants living in the country, whether they have a legal residence or work in the formal or informal sector. Second, since I am interested in changes in supply as a share of the total population during the previous period, these registers are useful because they precisely measure the available labour supply each year.

Using the municipal registers, I calculate the total stocks (both immigrant and Spanish[17]) and the net change in immigrant population between two periods using the male population that is of working-age (16–65 years old).[18] I apply these criteria since these stocks provide more precise measures for those involved in the labour market. As a robustness, I also provide results including female population and all the age groups, which provide similar results with smaller magnitudes, as expected.

4.2 Summary statistics

Table 1 presents the summary statistics. My sample covers 50 provinces, changes between the years 2009 and 2014 which leads to 250 province-year observations. The table presents the main variables in the regression. The first two lines of the table present average number of employed male native workers, and average salaries. I use these numbers to compute the annual growth rate in employment which I use as the dependent variable.

[Table 1 about here.]

Table 1 also gives an idea about the annual outflow that each province faced. During the period, Spanish provinces lost annually, on average, 1597 immigrant working-age male. Given that average working-age population in a province is around 316 000, this corresponded to an outflow rate, or a reduction in the labour supply of 0.5 percent annually.

Figure 2 plots the raw data and shows the evolution of the average monthly wages (top panel) and employment (bottom panel) for natives in Spain. Both figures are normalised to

[17] I consider an individual native if the person was born in Spain and has Spanish nationality. An immigrant is therefore any person born outside Spain independent of current nationality.

[18] The measure captures changes in population stocks that are driven by international or internal mobility. From model's perspective, it does not matter which mobility margin is driving the change in the local labour supply. To verify that either internal or external moves do not drive changes in the population stocks, I use the Residential Variation Statistics (EVR, or *Estadistica de Variaciones Residenciales,* in Spanish) provided by the Spanish Statistical Institute (INE). This micro-data which records all individual moves originating or ending in Spain based on changes in the Municipal Register of Population. I find that internal moves between provinces constituted 55% of the total moves while those with an origin or destination outside of Spain constituted 45%. There are also moves within the province borders that I do not capture in my measure as they remain within the geographical unit of analysis.

1 in 2008 (the beginning of the Crisis) to make the comparisons simpler. A few things are worth noting. First, the average wages continued increasing in the first year of the crisis, due to rigidities in the labour market and, possibly, due to changes in the worker composition due to employment shedding. Second, starting from 2009, the average wages decreased for both skill groups, while the drop was more significant for the low-skilled workers. Third, while wages for high-skilled workers recovered to their pre–shock levels by 2014 (the start of the Recovery), the wages for low-skilled continued decreasing until 2015. Finally, while both skill groups suffered employment losses, low-skilled workers suffered the largest shock, driving the overall employment losses.

[Figure 2 about here.]

Figure 3 presents the total outflows during the period 2009-2014, as a share of the total population in 2009 using the municipal registers. It can be seen that the net departures of the immigrant population, resulting from internal and international moves, corresponded on average to 3 percent of the working-age population of the province during the period as a result of both internal and international moves.[19] Almost all provinces experienced a reduction in their labour supply, although the insensity varied from just above zero in Sevilla to 5.5 percent as in Alicante.

[Figure 3 about here.]

5 Empirical strategy

In this section, I first explain how my main regression equations relate to the theoretical model presented in Section 2, and then describe my estimation and identification strategy.

5.1 Econometric equation

I estimate the effect of the net outflow of the immigrant population on the changes of labour market outcomes for native workers over the same period. Corresponding to my theoritical setup, I use the following first differences regression model:[20]

$$\triangle lnw_{g,j,t} = \beta_g \triangle foreign_{j,t} + \alpha_t + \varepsilon_j \tag{12}$$

$$\triangle L_{g,j,t} = \delta_g \triangle foreign_{j,t} + \alpha_t + \varepsilon_j \tag{13}$$

where

$$\triangle L_{g,j,t} = \frac{L^{Native}{}_{j,t} - L^{Native}{}_{j,t-1}}{L^{Native}_{j,t-1}} \text{ and } \triangle foreign_{j,t} = \frac{\triangle N^{foreign}{}_{j,t-1} - N^{foreign}{}_{j,t}}{N^{Native}_{j,t-1} + N^{foreign}_{j,t-1}}$$

[19] In terms of immigrant population, these departures are even more striking. Figure H1 presents the same results using the share of the immigrant population in the province in 2009. The net departures between 2009 and 2014, correspond on average to 16% of the immigrant population in 2009.

[20] For more examples of using first differences models to measure the impact of immigration, see Gonzalez and Ortega (2013); Ortega and Verdugo (2021); Dustmann et al. (2017); Sanchis-Guarner (2021)

$\triangle lnw_{g,j,t}$ is the change in mean of log wages of natives[21], in group (i..e, skill, sex, age, contract type) g, and province j, between two periods, $t-1$ and t. $\triangle L_{g,j,t}$ is the percentage change in the native employment in group g, and province j, between two periods, $t-1$ and t, $\triangle foreign_{j,t}$ is the net-change in immigrant population ($N^{foreign}$) between two periods, divided by the province initial population, α_t is the time–fixed effect. Finally $\varepsilon_{j,t}$ is the random error term. Equations 12 and 13 are written in first differences to eliminate time-constant area and, when applicable, group fixed effects.

The variable of interest is the normalised net-change in immigrant population in province j divided by the province initial population.[22] The net-change is calculated as the difference between immigrant population between t and $t-1$. Using the normalised net-change instead of (log) net change as the measure of net outflows eliminates any unobservables that might equally affect both the numerator (foreign–born outflows) and the denominator (original province population, sum of natives and immigrant). Standardising net-change by initial population stocks also deals with the fact that regions have different population sizes and labour market dynamics (Card, 2001; Peri and Sparber, 2009; Dustmann et al., 2017). Moreover, scale effects can induce spurious correlation between higher outflows and higher changes in labour market outcomes. This correlation could arise due to the fact that the average and standard deviation of both variables are likely to be proportional to the population in the province.

Consistent with the model, I use only the *total* but not the group-specific outflow of immigrant population. This approach is preferable as it does not require pre-allocation of immigrants to skill groups based on their observable characteristics, thus avoiding the problem of misclassification that arises when such observable characteristics are used to assign immigrants into skill groups in which they do not compete with natives.[23] It thus gives the *total* wage and employment effects of a decrease in labour supply due to the outflow of the immigrant population as derived in equation 11.

The parameters β_g and δ_g, measure the impact of the total net outflow of immigrants on the percent change in wages and employment of native workers in skill group g in area j between the two time periods. If wages are fully flexible, these parameters correspond to the expression derived in equations 6 and 11. If wages are partially rigid, the wage response β_g is determined exogenously by the degree of rigidity and employment response δ_g as given by equation 4. The employment response in equation 13 captures, employment movements across areas in addition to movements from and to non-employment (inactivity or unemployment).

Finally, I estimate equation 12 and 13 weighting by the number of observations used to compute the dependent variables in each province-skill cell at base period and cluster the errors by province to account for potential location-specific correlations (Moulton, 1990).[24]

[21]Some papers in the literature use changes in the log of mean wages. See Borjas et al. (2012) for a discussion on why this is an error.

[22]I compute these rates using only working-age male population, i) for consistency with the outcome variable which includes only working-age male natives, ii) to better capture the moves driven by labour market conditions, and iii) for consistency with my model. In the following sections, I test the robustness of my results by using measures which are calculated using both female and male population, as well as all age groups.

[23]Dustmann et al. (2013) show that immigrants often downgrade upon arrival, which Fernandez and Ortega (2008) show to be the case in the Spanish context as well. Thus assigning immigrants to skill groups based on observed characteristics may lead to serious misclassification. This estimation strategy is similar to Altonji and Card (1991); Dustmann et al. (2013, 2017); Ortega and Verdugo (2021).

[24]While the use of weights proportional to the number of observations used for the computation of the dependent variables are common (Ottaviano and Peri, 2012; Dustmann et al., 2017), some papers use the inverse of the sampling variance weights (Hunt, 1992; Clemens and Hunt, 2019). All the results presented in

5.2 Identification

My identification strategy relies on exploiting the variation in the net outflow rate which, after controlling for province and time fixed effects, is not correlated with local determinants of labour market demand and economic performance between 2009-2014.[25] There are two issues regarding the identification of the effects. First, the immigrant population located in provinces which are more severely affected by the crisis will be more likely to leave. Second, the distribution of the immigrant across provinces before the crisis may not be random.

5.2.1 Concern 1: Outflows and Ordinary Least Squares as lower bound estimates

A first-order concern is identifying a source of variation for the net outflow rate that is uncorrelated with local determinants of labour market demand and economic performance during the study period. Notably, there is geographical variation in the intensity of the Great Recession across provinces. Provinces that experienced a stronger increase in the unemployment rate also saw more departures (Appendix Figure G1).

This creates a correlation between demand shock intensity and outflow rates.[26] Since outflow is higher in provinces that experience stronger negative wage and employment shocks, this association induces a spurious negative correlation between outflow, employment and wage growth that could lead to a negative bias in the Ordinary Least Squares (OLS) estimate. Hence, given the estimated positive effects I estimate, the OLS estimator provides a lower bound for the actual effect of outflow on mean wages and employment (see Dustmann et al. (2015), for a similar argument). In Section 7, I further address this issue by controlling for changes in the local labour demand.

5.2.2 Concern 2: Non-random distribution of immigrant populations and the endogenous location of natives

The departure of immigrants is only possible if there is an immigrant population in the province. However, the initial distribution of immigrants across provinces may not be random. Using first-differences takes care of the province characteristics that are fixed over time which allows me to make progress towards the identification of β_g and δ_g. Still, the unbiased identification of these parameters requires the outflow rate to be uncorrelated with the time-varying component of the error term. There is no prior on the direction of the bias since I am investigating the impact of outflows during a demand shock which is less straightforward than immigration in good times (as per most of the immigration literature). For instance, if immigrants located in areas with more rapid wage and employment growth (conditional on all of the time-varying and time-invariant controls) were more likely to leave, the estimated parameters would be upward biased. Conversely, if immigrants located in areas with slow growth rates were more likely to leave, then the parameters would be downward biased.

the present paper are robust to the use of both weights.

[25]Although not presented, I test the endogeneity of net outflow rate by using an augmented regression tests (Durbin-Wu-Hausman test), as suggested by Davidson and MacKinnon (1995). The results show that OLS is not consistent and use of instruments is necessary. Results are available upon request.

[26]Although the negative demand shock and outflow rates are correlated, there are still important spatial variations in the distribution of immigrants in 2009, the share of the construction sector before the crisis and intensity of the demand shock, as can be seen in the maps in Appendix Section O1.

To deal with this identification issue, I construct an instrument adapting the "shift-share" methodology which is widely used in the literature.[27] Immigrants tend to be disproportionately located in areas where other immigrants from the same nationality or ethnicity have lived in the past, which allows them to benefit from social and economic networks established by those who arrived earlier. I exploit this "past settlement instrument" and use the past spatial distribution of the immigrants in order to predict their current location patterns. Specifically, I distribute the year-to-year variation of the national stocks (the "shift") of different nationalities across provinces according to the historical distribution of immigrants (the "share").

To construct the instrument, I first calculate the share of immigrants located in province j in 1991.

$$Share^{n}_{j,1991} = \frac{Immigrant^{n}_{j,1991}}{\sum_{j} Immigrant^{n}_{j,1991}} \tag{14}$$

To obtain yearly predictions of the number of immigrants by nationality n for province j in year t, I multiply the expression 14 by the annual national stock of immigrants $Immigrant^{n}_{j,t}$ of nationality n . This stock is calculated by adding the number of immigrants of that nationality in all provinces in Spain, in year t. I leave-out the stocks in the same province, to address concerns due to the introduction of own-area stocks which may mechanically increase the predictive power of the instrument (Autor and Duggan, 2003; Goldsmith-Pinkham et al., 2020). The imputed immigrant stock of a specific nationality n in province j at time t is thus calculated allocating yearly total national stocks weighted by their historical share (14):

$$\widehat{Immigrant}^{n}_{j,t} = (Immigrant^{n}_{Spain,t}) * Share^{n}_{j,1991} \tag{15}$$

To calculate the imputed total (all nationalities) immigrant stock in province j at time t, I sum (15) across nationalities (N):

$$\widehat{N^{foreign}_{j,t}} = \sum_{n}^{N} (\widehat{Immigrant}^{n}_{j,t}) \tag{16}$$

Notably, the instrument is constructed by combining nationality-specific predictions for each province (i.e., a weighted sum of the national-minus-province inflows using the distribution of nationality in 1991 as weights). These predicted stocks generate a variation by exploiting differences in national flows and the initial distribution across labour markets, which are arguably less endogenous to local economic conditions.

As a final step, I calculate the change in predicted immigrant stocks and divided it by the imputed population (total immigrant stock plus the observed native stock) in province i at the beginning of the period $t-1$. The instrument is constructed as follows:

$$\triangle \widehat{foreign}_{j,t} = \frac{\widehat{N^{foreign}_{j,t-1}} - \widehat{N^{foreign}_{j,t}}}{\widehat{N^{foreign}_{j,t-1}} + N^{native}_{j,t-1}} \tag{17}$$

[27]This strategy has been set by Altonji and Card (1991) and modified by Card (2009), and followed by many including Card (2001); Ottaviano and Peri (2006); Basso et al. (2019), applied in the case of Spain by Gonzalez and Ortega (2011, 2013); Sanchis-Guarner (2021); Fernández-Huertas Moraga et al. (2019).

For this instrument to be valid it must be sufficiently correlated with the outflow rate but uncorrelated with the local shocks that affect variations in the labour market outcomes of the natives, which are based on the province and time fixed effects. The relevance of the instrument can be assessed by its F-statistics values at the first stage of the two-stage-least-squares (2SLS) regressions, and additionally by using weak identification tests.[28]

The validity of the instrument relies on the two components of Equation 15 not being correlated with local shocks that affect outcome variables. Regarding the local share of immigrants by nationality in the base year, the exclusion restriction requires that the only channel through which immigrant geographical distribution in 1991 affects current changes in labour market outcomes is through its influence on shaping the current immigrants location patterns, conditional on fixed effects. In other words, the unobserved factors determining the location of immigrants in one province with respect to another in the base year (1991) must be uncorrelated with the relative economic prospects of the provinces during the period of analysis (2009–2014). I consider 1991 to be separate enough from 2009-2014 for immigrant shares to be uncorrelated with the past demand shocks.[29] However, it remains possible that unobservable shocks correlated with local labour market conditions that affected immigrants' location decisions in 1991 have continued. In Appendix Section K.1, I show factors that were determinant in the distribution of the immigrant population in 1991. Notably, these were not relevant to the distribution during the period of analysis.

Furthermore, as shown by Jaeger et al. (2018) for the US, such an instrument can be problematic if the location choice of immigrants and country-of-origin mix are stable over time. This is likely of lesser concern in the case of Spain because both, the country-of-origin mix and destination locations, have largely changed for immigrants between 1991 and 2009. For instance, autocorrelation coefficient for both the observed immigrant shock $\triangle foreign_{j,t}$, and the shock predicted by my instrument $\triangle \widehat{foreign}_{j,t}$, is 0.55. This correlation level is dramatically lower than those observed in the US by Jaeger et al. (2018) where they are above 0.9 since the 1990s. Regarding the country-origin mix, the serial correlation in national composition between 1991 and 2009 is 0.67. If Moroccans—which constituted the largest immigrant group in 1991 and the second largest group in 2009—are excluded, the correlation drops to 0.39. These numbers are much lower than the levels found by Jaeger et al. (2018) for the US, which are between 0.9 and 0.99 since the 1970s. Both figures suggest that the "overlapping response problem" seems to be significantly less critical in the context of Spain. However, to alleviate remaining concerns I apply the "multiple instrumentation" procedure as suggested by Jaeger et al. (2018) and show that the results are robust to the inclusion of lagged outflows (see in Appendix Section 6.1).

The final issue when constructing the instrument is the endogenous location choices of natives as a response to immigrant mobility. The total population stock, which appears in the

[28] All the result tables in section 6 provide the Kleinbergen-Paap statistics (test of weak identification), which is robust to non-i.i.d error terms, and corresponds roughly to the t-stat of the included instruments in the first-stage to the square.

[29] Spain went through an important economic crisis (1992-1993) followed by economic recovery and growth (from 1997). Given the changes in the economy, it is unlikely that 1991 immigrants were able to predict these future shocks (or any other shock not captured in the area/time fixed effects) 18 years before my period of analysis starts. Use of past settlement patterns that are sufficiently lagged are important for the validity of this instrument. For such an argument see for instance Dustmann et al. (2013); Orrenius and Zavodny (2010). In Section 7.3 I check the robustness of my results using various base years.

denominator, results from the sum of the (imputed) immigrant and native stocks. The number of total natives residing in a given province might depend on the number of immigrants in the same location or on unobservables correlated with the labour market outcomes. For this reason, I use a similar shift-share strategy to predict the location choice of natives, based on their past location patterns similar to the immigrants' and replace the observed native stock with predicted stocks. The details of this procedure are provided in the Appendix Section J.1.

$$\triangle \widehat{foreign}_{j,t} = \frac{\widehat{N^{foreign}_{j,t-1}} - \widehat{N^{foreign}_{j,t}}}{\widehat{N^{foreign}_{j,t-1}} + \widehat{N^{native}}_{j,t-1}} \tag{18}$$

I use this instrument in my estimation and different versions of it were used in the robustness checks. In Section 6.1, I discuss and test the validity of this instrumental variable approach. Section 7.3 outlines the robustness of the results using different definitions of the shift and share in constructing the instrument.

6 Main results

In this section, I present the first stage results and discuss the validity of the instrument, and then present the second stage results.

6.1 First-stage and validity of instruments

My main identification strategy consists of implementing the 2SLS estimation outlined in Section 5.2. Figure 4 provides a visual representation of the first stage. It plots the predicted outflow rate in the horizontal axis against the actual outflow rate. Each observation in the figure corresponds to a province-year observation between 2009-2014. The figure shows that actual and predicted outflow rates are strongly correlated.

[Figure 4 about here.]

In Table 2 I show the coefficients from the first-stage regression:

$$\triangle foreign_{j,t} = \theta \triangle \widehat{foreign}_{j,t} + \alpha_t + \varepsilon_{j,t}$$

The coefficient θ, reported in the first row of the table, represents the effect of the imputed change in immigrant population (obtained as in Equation 17) on the actual change in immigrant population, both expressed as a share of the total working-age population, which is the explanatory variable in my second-stage regression. All of the regressions include time-fixed effects and errors are clustered at province-level.

[Table 2 about here.]

In the first column of Table 2, I report the regression coefficient weighted by the total working age population in the province in the base period. The estimated coefficient is highly significant and around 0.41. Specifically an increase in the imputed outflow rate by one percentage point leads to a 0.41 percentage point increase in the actual outflow rate between 2009-2014.

In my baseline specification which is in first-differences, I only include the outflow rate and time-fixed effects. However, in Section 7.1 I test the robustness of my results by adding various controls in order to address concerns about spurious correlations between the variable of interest and the outcome variables. In columns 2-5, I add these controls (which I explain in detail in Section 7.1) gradually. Across all specifications, the imputed outflow rate remains stable and highly significant. In all cases, the F-statistic remains high showing that the instrument is strong.

6.2 Second–stage results

Table 3 presents the results of estimating Equations 12 and 13. As previously explained, the parameters β_g and δ_g correspond to the total effect and they capture the combined impact of changes in natives' labour market outcomes due to immigrant outflow and endogenous native mobility in response to these outflows. These results are obtained using data on annual changes in average wages and the employment of natives during the period 2009–2014 period. In all specifications I include time dummies to control for national shocks, and cluster the standard errors at the province level. There are no province dummies since the analysis is in first differences. Each regression is based on a sample of 250 observations, for 50 provinces and 5 time periods.

[Table 3 about here.]

The first and third columns of Table 3 show the OLS results obtained for wage and employment growth, respectively. This simple correlation is 0.2 for wages and 1.15 for employment. Both models have high explanatory power (the R^2 around 49% for wages and 53% for employment). In order to make causal claims about the estimates, I implement the IV strategy explained in Section 5.2.2.

In columns 2 and 4, I repeat this exercise by instrumenting the net outflow rate using the *predicted* net outflow rate based on the distribution of the immigrant population in 1991. Similar to the OLS results, standard errors are clustered at the province level. The table displays the instrument strength test (F-stat Kleibergen-Paap). As expected, the standard errors increase when using instrumental variables in all specifications.

My instrumental variable approach confirms the spurious correlation between the depth of the recession and the outflow rates. As explained in Section 5.2.2, provinces that were hit harder by the recession saw higher outflow rates. Introducing the instrument resolves this downward bias and increases the estimated coefficients. In all models, the instrument is strong and the Kleibergen-Paap F-stat is above the Stock-Yogo critical values. Over the 2009–2014 period, I find that the outflow of the immigrant population has positive effects on the wages and employment of native workers. The estimates imply that a 1% increase in the annual outflow rate increases the native wages and employment in the province by 2 and 2.4%, respectively.

Based on the averages presented in Table 1, these estimates indicate that for every 3160 immigrants who leave a province, the monthly wages of natives increase by 32 euros and natives' full-time employment in the formal sector increases by 64 in the same year. Given the overall decline in employment and wages observed throughout the period, the outflows from provinces slowed down the reduction in native employment and wages as predicted in the model. In other words, the immigrants' mobility provided a cushioning effect for natives against the adverse effects of the crisis.

In their seminal work, Cadena and Kovak (2016) show that i) migrants are geographically more mobile than natives, and that ii) natives located in areas with a larger migrant population before the crisis experienced reduced job losses due to the labour demand shock. However, their results do not indicate the precise channel through which the presence of immigrant populations protects native populations in a downturn. My results indicate that the likely channel at play involves migrant mobility reducing their labour supply in the local labour market, which slows down the decline in natives' labour market outcomes caused by a demand shock. In Appendix F.2, I provide further empirical evidence and show that the outflow measure captures the exact effects presented in Cadena and Kovak (2016).

7 Robustness

In this section, I describe the various exercises performed to test the robustness of these results. I begin by examining whether spurious correlations or pre-trends are driving the results. Thereafter, I show that the results are robust to using different outflow measures, alternative instruments, and weights.

7.1 Bartik and other controls

The effects highlighted in the previous section indicate that the departure of the immigrant population improved the wages and the employment outcomes of the natives. Could these results be driven by factors that are correlated with the outflows? To test the robustness of these results, I test their validity while including controls that may be correlated with the evolution of the labour market outcomes during the period.

Table 4 presents the results with various controls. Columns 1 and 4 present 2SLS results with no controls, as a benchmark. In columns 2 and 6, I control for changes in demographic characteristics, (i.e., changes in average age and the proportion of high-skilled workers among the total number of individuals employed between two periods).[30] These controls ensure that the positive effects are not due to changes in the composition of the workers based on observable characteristics. My results indicate that including these variables does not change the significance of my variable of interest and my instrument remains strong.

[Table 4 about here.]

The economic structure at the start of the study period (i.e., 2009) may also be correlated with the presence of the immigrant population and the labour market performance of each province throughout the period. Although immigrants were employed in agriculture and services, they were also highly concentrated in the construction sector. To account for differences in the structure of economic activity, in columns 3 and 7, I include the share of agriculture, construction, manufacturing and services in the overall employment.[31]

[30] As pointed out in Verdugo (2016), during the Great Recession the labour force in Europe became older and more skilled as the younger and less-skilled workers were first to be fired.

[31] Use of base year characteristics is common practice in similar exercises (see for instance Boustan et al., 2010; Autor et al., 2013). I use the sectoral shares in employment for the year 2009 as it is the base year of the analysis. The results also hold if I use the shares in 2007.

More importantly, the period under study is that of an economic crisis. Notably, the severity of the Great Recession differed significantly across provinces. This period saw a significant decline in economic activity across several industries. The sectoral composition of provinces might explain a large part of the employment performance and could be correlated with the immigrant presence. In line with my model, I control for shifts in demand that is independent of local labour supply characteristics. Following the literature, I introduce a variant of "shift-share" ($\triangle Bartik_{j,t}$) shocks as per the method of Bartik (1991) to capture the severity of the Great Recession in the local economy. The construction of this variant is outlined in Appendix Section L.

One important remaining issue is the potential for omitted variable bias that may result from native outflows. Natives may also be leaving provinces similar to immigrants. If natives' outflow rates follow a similar distribution to those of immigrants, the estimated parameters may be capturing the combined effects of both immigrant and native departure. However, as discussed in Section 9.1, native mobility was minimal before the crisis and limited during the crisis. Moreover the outflow rates for immigrant and natives were not correlated (see Appendix Figure N1). Still, to alleviate any concerns, I control for native mobility in columns 4 and 8. Specifically, I construct the native outflow rate as the net change in the native-born population between two periods, normalised by the total population in the base period (similar to the immigrant outflow rate).[32] The results hold.[33]

Overall, the results indicate that the effects of the outflow rate are not due to spurious correlations caused by the economic and demographic conditions at the beginning of the crisis or the changes that followed during the period.[34]

7.2 Pre-trends

It is important to ensure that the observed changes in wages and employment are not driven by persistent unobserved factors and pre-crisis trends. To explore this, I conduct three tests.

First, I regress pre-recession changes in wages and employment on the total outflow rate from 2009 to 2014. Specifically, I use the total outflow rate over this 5-year period and test whether it has any explanatory power over the changes during the pre-crisis period. Similar to the main specification, I weight the regressions using the employed population in the base year (i.e., 2009). Panel A in Table 5 shows this falsification test for the 2003–2008 period.[35] The OLS and 2SLS results for wages are presented in columns 1 and 2, while the employment results are in columns 3 and 4. I find a negative and non-significant relationship for wages as well as negative and highly significant results for employment. These results imply that provinces with higher outflow rates during the Great Recession were in a negative wage and

[32] Native outflows can suffer from measurement error as Spanish citizens are not deleted from Padron after two years. In Appendix Section I.4, I discuss this issue and explain why it does not pose any threat to the empirical exercise.

[33] In models with the full set of controls, the F-test is below the threshold value of 10. If I use alternative instruments (which I present in the next section), I find similar elasticities and the instruments pass the weak instrument test. I choose to be parsiminous and use the same instrument across all tables in the paper.

[34] Throughout the paper, to be transparent I present results where outflow rate is the only explanatory variable and without including any controls. However, all of the results presented in the paper are robust to the inclusion of these controls. Results are available upon request.

[35] I do this exercise by looking at the change in the 5-year period prior to the crisis as it corresponds to the lenght of my analysis period (i.e., 2009-2014). The results are robust to changing the start and end years in the pre-crisis period, or testing for longer/shorter differences.

employment growth trend before the Recession.

[Table 5 about here.]

Second, in the spirit of Dix-Carneiro and Kovak (2017), I regress Equations 12 and 13, but include the pre-recessions changes in the outcomes ($y_{j,2008} - y_{j,2003}$) as controls to address the possibility of confounding pre-existing trends. Panel B presents the 2SLS results. Columns 1 and 3 present baseline results for comparison. In columns 2 and 4, I include the pre-trends for wages and employment that were calculated as the change in the outcomes from 2003 to 2008. Pre-trends for both wages and employment are small and not statistically significant. These results confirm the aforementioned findings.

Third, I test the correlation between the share of immigrants in the 2009 population and the pre-trends for changes in wages and employment. This test aims to determine whether the distribution of immigrants before the crisis is correlated with the outcomes in the following period. I test for two different periods, 1998-2008 and 2003-2008. Results in Panel C show that the immigrant distribution in 2009 is not correlated with the wage growth of natives in the previous period. It is however negatively correlated with the employment growth of natives. This shows that, provinces with higher share of immigrant population in 2009 were in negative employment growth trend for natives, which is in line with the results in the previous falsification tests.

These three exercises show that province-specific pre-trends do not drive the positive wage and employment growth observed in provinces with higher immigrant outflows. On the contrary, native wages and employment in provinces with higher outflows during the crisis were experiencing a negative growth trend before the crisis.

7.3 Alternative instruments

For my baseline results, I use a shift-share instrument that uses the furthest period possible for the share while accounting for the endogenous allocation of natives. While this instrument aims to answer all possible concerns related to using such instruments, it is important to show that the results are not dependent on one particular instrument. To test the robustness of my results, I use alternative instruments that are based on different shifts and shares. All of the instruments, regardless of the shift or the share that is used, pass the weak instrument test. Although estimated coefficients vary depending on the instrument, they are not statistically different from each other and my baseline results. These results confirm that the results are not dependent on the precise share and shift that I use in constructing the instrument. For more details see Online Appendix Section M.1.

7.4 Alternative measures of the supply shock

The baseline measure of the local supply shock induced by the outflow of the immigrant population is $\triangle foreign_{j,t}$, which is the immigrant departures as a share of the total population during the base period. Papers that focus on the impact of immigration use various definitions for the supply shock. I reconstruct the outflow rate following different measures used in the literature and show that my results are robust to alternative shock measures.

As previously explained, I measure the outflow rate by only considering changes in the working-age *male* population. As a robustness, I re-calculate the outflow measure for males of all age groups and working-age population including women. As expected inclusion of all age groups decreases the estimated relationship slightly. Inclusion of female immigrant population gives slightly larger point estimates for wages while giving smaller estimates for employment. Despite these differences, I cannot reject the null hypothesis that differences in the elasticities are statistically significant. Overall, this confirms that the main results are not driven by the numerator or denominator chosen to construct the outflow measure. For more details, see Online Appendix Section M.2.

7.5 Alternative weights

The results presented in Section 6 use weights that are proportional to the number of observations used to compute the dependent variable since it corrects for heteroscedastic error terms and thus achieves the more precise estimation of coefficients (Solon et al., 2015). Using such weights naturally changes the importance of each province-year observation as more populated provinces are assigned more weight. To test the importance of weights in the estimation, I run the main regressions with and without weights. Online Appendix Table M3 reports the 2SLS results for both wages and employment. The results in column 1 and 2 are the baseline, where regressions are weighted by the number of employed natives during the base period. In columns 3 and 4, there are no weights.

In particular, three results stand out. First, although the coefficients for wages hardly change, the coefficient for employment becomes larger. This suggests that growth in native employment was especially important in less populated provinces. However given the standard errors, one cannot reject the hypotheses that both coefficients are statistically different from each other. Second, weighting by the number of observations leads to smaller standard errors and thus a more precise coefficient estimation.[36] Finally, both weighted and unweighted estimates are consistent with each other which indicates that the model provides a good approximation.

8 Heterogeneity analysis

The model predicts that the outflow of the immigrant population would have a stronger impact on the wage and employment outcomes of natives that have higher substitutability with the departing immigrant population (Equation 11). However, depending on the groups' supply elasticities or wage rigidities, the final effect may differ in magnitude or the margin of adjustment (i.e., employment vs. wage). In this section, I assess the heterogeneous effects of outflows across groups with different skills and demographics.

For all regressions, I use the exact same specifications and regress group-specific changes in the outcomes on the outflow rate of working-age immigrant males, using the same instrument. Moreover, I cluster the errors by province but weight each regression with the number of observations used to compute the changes in the dependent variable, which is specific to the

[36] As discussed in Solon et al. (2015), when the number of observations used to compute the dependent variable is uneven across groups or small for some groups, using weights can improve the estimates' precision.

group that is analysed.

8.1 Skill groups

Most of the departing immigrant were from the lower half of the education distribution. For Spain, this means they have completed primary school and may have some secondary school education. The MCVL includes information on the highest education level attained by the workers. Using this information, I group native workers into two skill groups: those who have less than a university degree (i.e., low-skilled) and those with a university degree or more (i.e., high-skilled).

Panel A in Table 6 presents the OLS and 2SLS results for wage growth for different skill groups. The OLS results (presented in columns 1 to 3) show that the effect of the outflow rate on wages is statistically insignificant. This is due to the negative correlation between the outflows and economic shock that was discussed earlier. Once the bias is taken care of with the instrument, all of the coefficients become much larger, positive and significant.[37]

[Table 6 about here.]

Panel B in Table 6 reports the OLS and 2SLS results for employment growth for the same skill groups. Both the OLS and 2SLS results show that the outflows of immigrants benefited native employment for both skill groups. Similar to the wage results, the 2SLS coefficients are much higher than those obtained through OLS since the instrument takes care of the downward bias. The results show that a 1% increase in the outflow rate increased the employment growth of the low- and high-skilled groups by 1.8 and 4.6%, respectively.

Given the model's predictions, one would expect larger coefficients for the low-skilled group since they have the highest substitutability with the immigrant population and are more likely to be affected by the outflows. However, the results are in line with the model for a few reasons. First, these coefficients measure the employment growth rates and not increases in the number of workers. For instance, given the average number of low-skilled workers (2196) and high-skilled workers (486), a 1% increase in the outflow rate adds approximately 40 low-skilled and 22 high-skilled workers. Second, it is important to note that different skill groups have different degrees of wage rigidity and elasticity in labour supply responses. As discussed in Dustmann et al. (2017), these differences can create "perverse" effects in which the group that experiences the greatest shock may not be the group that benefits the most in terms of wages or employment.

8.2 Demographics

The outflow of the immigrants can have a different impact depending on the demographic characteristics of the natives. Table 7 provides a more detailed analysis by investigating the asymetric effects of the outflows across different demographic groups.

[Table 7 about here.]

Panel A of Table 7 presents the results for wage growth, while Panel B reports employment results. In terms of wages, all groups benefited from the departure of the immigrants, although

[37] The estimate for the high-skilled is significant at 11%.

the estimated elasticities are not statistically different from one another. Given the wage rigidities in Spain, it is reasonable that there are no significant differences.

The outflows also accelerated the employment growth of all groups. While males (column 1) and females (column 2) benefited roughly equally from the outflows, there are significant differential effects for different age-groups. The coefficient for natives (both female and male) under the age of 30 (column 3) is two to three times larger than other groups, and the difference is statistically significant. This strong effect is in line with the model's prediction which shows that natives who have the highest substitutability with the immigrants should benefit the most from their departure. Given that the departing immigrants were young and more likely to compete for jobs held by young natives (due to downgrading), this result is understandable.[38] Conversely, natives between 30 and 40 years of age (column 4) benefit the least from the immigrant outflows, possibly due to their higher labour market integration. Finally, as expected, workers above 40 years of age also benefit from the departure of immigrants, less than young natives but clearly more than those between 30 and 40 years of age.

9 Mechanism

This section explores the mechanisms that are driving the results observed in the previous sections. I start by exploring the impact of outflows on the geographic mobility of natives. In the following part of the section, I decompose the changes in the employment and wage margins to highlight the underlying mechanisms.

9.1 Geographic mobility of natives

Natives can respond to the departure of immigrants from a local labour market through geographical mobility. Changes in the mobility patterns can affect both the native population levels and the growth rate of the native workforce.

In addition to its importance as a mechanism, understanding the mobility patterns is also crucial for identification. When estimating the average local impact of immigration outflows, one must consider that changes in the local population affect the whole equilibrium between regions. For instance, if the outflow of immigrants simultaneously triggers the outflow of natives (thus reducing the native population in the area), then the coefficient would be overestimating the effect of immigrants' departure. If on the other hand, it triggers an inflow of natives (increasing the native population), the final effect might be underestimated or null. This means that the average effect of outflow on local labour markets would be affected by changes in the native population and thus native mobility.[39]

[38] If the number of employed young natives is small, it can also generate higher growth rates in group employment due to a smaller denominator. However, this is not the case. Given the average group sizes, the coefficients correspond to 88, 24 and 45 workers for the group under age 30, 30-40, and above 40, respectively.

[39] Through mobility of natives, the effects of immigration can be diffused to other labour markets, which would invalidate the results obtained from cross-regional analysis (Lewis and Peri, 2015). Thus it has been an important element in the long-standing debate on whether immigration reduces the employment oppurtunities and wages of natives. According to Borjas (2006), the native migration response attenuates the measured impact of immigration on wages in a local labour market by 40 to 60 percent. Failure to account for this mechanism is given as an explanation for lack of robust estimates on the impact of immigration on wages in the US. Some papers howewer find no or little displacement effect (Card, 2001; Card and DiNardo, 2000). Replicating various methodologies in the literature Peri and Sparber (2011) find evidence against the existence of native displacement due to immigration.

I test the impact of outflows on native mobility following the empirical strategy proposed by Peri and Sparber (2011). Specifically, I use the normalised change in native population as the dependent variable and use exactly the same right-hand-side elements that as in the main analysis (i.e., Equations 12 or 13):

$$\triangle native_{j,t} = \lambda \triangle foreign_{j,t} + \alpha_t + \varepsilon_{j,t} \tag{19}$$

where $\triangle native_{j,t}$ is the net-change in the native-born population between two periods, divided by the initial provincial population.[40] The sign and size of λ captures the relationship between immigrant outflows and natives' location choice. If the estimated λ is positive, this would indicate that the native population is increasing in areas where immigrants are leaving. If natives leave areas along with immigrants, then the estimated λ will be negative. Table 8 shows the results of the estimation of Equation 19. Columns 1 to 3 show the OLS results and 4 to 6 show the 2SLS results.

[Table 8 about here.]

I find a positive and significant impact of outflows on the native population in both the OLS and in the IV results, both for males and females. These results show that the outflows of immigrants increases the net native population. These estimates predict that for every three immigrants that leave a given province, the native population increases by one. This elasticity is exactly the same as those reported in Boustan et al. (2010); Dustmann et al. (2017); Fernández-Huertas Moraga et al. (2019); Monras (2018).[41]

Although informative, these results do not show what is driving the change in the native population. For example, natives can respond by decreasing in-migration from other areas, increasing out-migration from the area, or both. To answer this question, I use the Residential Variation Statistics (EVR) and calculate the arrival (i.e., in-migration) and departure (i.e., out-migration) rates of natives.[42]

Specifically, I define the arrival rate to province j at time t as follows:

$$Arrival_{j,t} = \frac{Arrivals_{j,t}}{N^{Native}_{j,t-1}}$$

where $Arrivals_{j,t}$ denotes the number of natives that live in j at time t and were living somewhere else (in Spain or abroad) at time $t-1$. Similarly, I define the departure rate from a province j as:

$$Departure_{j,t} = \frac{Departure_{j,t}}{N^{Native}_{j,t-1}}$$

where $Departure_{j,t}$ denotes the number of individuals that lived in j at time $t-1$ and were living somewhere else at time t.

[40] $\triangle native_{j,t} = \frac{\triangle N^{native}{}_{j,t} - N^{native}{}_{j,t-1}}{N^{Native}_{j,t-1} + N^{foreign}_{j,t-1}}$

[41] When I repeat the exercice in 5-year long-differences (LD) from 2009 to 2014, I get similar results. Results can be provided upon request.

[42] Spanish Statistical Institute (INE) provides Residential Variation Statistics (EVR, or Estadistica de Variaciones Residenciales, in Spanish), a micro-data which records the universe of individual moves originating or ending in Spain based on the Municipal Register of Population (Padrón Municipal de Habitantes, in Spanish).

In Table 9, I show this decomposition at the province level. The arrival and departure rates can differ between provinces due to structural differences or province-specific trends. To net out these differences, I include province fixed-effects along with time fixed-effects. Given that mobility rates may be affected by the intensity of the local demand shock (e.g., outflow rates are stronger in areas which were hit harder by a demand shock), I include the Bartik as a control.

Table 9 shows that an increase in the net outflow rate of immigrants accelerates the growth rate of the net native population (columns 1 and 4).[43] This net increase is due to both increase in the arrival rates (columns 2 and 5) and decrease in departure rates (columns 3 and 6). In terms of point estimates, arrival rates seem to matter more than departures. This result echoes the findings of Dao et al. (2017) and Monras (2018) who find that population adjustments during a local demand shock mainly driven by the changes in the arrival rates rather than departure rates.[44]

[Table 9 about here.]

These results show that the outflow of immigrants attracted natives to these provinces while reducing native departures. This result also implies that the estimated effect of immigrant outflow on the change in average wages between 2009 and 2014 includes a small downward bias due to the arrival of new natives, which presents a lower bound for the positive effects.

9.2 Margins of the employment effects

The positive employment effects presented so far are based on the average changes across local labour markets. These observed effects can be due to the increased entry of the natives into employment or lower probability of separation.

The overall employment effects reported here can be decomposed between movements from and to non-employment (i.e., inactive or unemployed). Specifically,

$$\frac{L_{j,t}^{Native} - L_{j,t-1}^{Native}}{L_{j,t-1}^{Native}} = \frac{Entries_{j,t}^{Native}}{L_{j,t-1}^{Native}} - \frac{Exits_{j,t}^{Native}}{L_{j,t-1}^{Native}}$$

where $Entries_{j,t}^{Native}$ is the number of natives employed in area j in year t but not in year $t-1$, while $Exits_{j,t}^{Native}$ captures those natives who were employed in $t-1$ but not in t. To test this, I first calculate the entry and exit rates for each skill group.[45] Then, I formally test it by using these rates as the dependent variable. These entry and exit rates can differ between provinces due to structural differences or province-specific trends. To net out these differences, I include province fixed-effects along with time-fixed effects. Hence, the estimated parameters capture the deviation from the provincial average due to immigrant outflows.

Table 10 reports the results for entry (columns 1–3) and exit rates (columns 4–6) for different skill groups. These results indicate that an increase in the outflow rate accelerates the entry from non-employment to employment for both skill groups. An increase of 1% in the outflow of the immigrant population accelerates the entry rate of low-skilled and high-skilled natives

[43] $Net_{j,t} = Arrival_{j,t} - Departure_{j,t}$

[44] In Appendix Table Q1, I decompose the outflows for different demographic groups and show that strongest effects are observed for young male population.

[45] I calculate the entry and exit rates, by dividing the number of newly employed workers or those exiting employment to the number of employed workers in the area similar to Dustmann et al. (2017).

into employment by 2.4 and 2%, respectively. Results presented in columns 4–6 suggest that outflows are also decelerating the exit rates of low-skilled and high-skilled by 1.3 and 0.4%, respectively; however, these estimates are not statistically significant.

These results indicate that, most of the short-term employment effects occur through increased entries rather than decreased exits. This also suggests that the outflow of immigrants benefits the "outsiders" (who become more likely to enter to employment) rather than "insiders" (who are already employed). These results mirror the effects noted by Dustmann et al. (2017), who showed that the inflow of Czech workers into German municipalities has reduced the entries of natives from non-employment to employment, while those who were already employed were not affected.

[Table 10 about here.]

9.3 Margins of the wage effects

The average wage growth noted in the previous section can be driven by three different channels. This increase in the average wages can be due to higher entry wages, the wage growth of stayers or the exit of the least productive workers.[46] To analyse this, I use the panel dimension of my data and decompose the wage growth separately for those who enter employment ("*New Entries*") and for those who were employed in two consecutive periods ("*Stayers*"). Table 11 presents these results. Columns 1 to 3 show the change in the entry wages while columns 4 to 6 show the change in the average wage of those who remained employed during both periods.

The results presented in columns 1 to 3 indicate that the entry wages were higher in provinces with higher immigrant outflows; however, these results are not statistically significant. These insignificant results are driven by two opposing forces. As discussed in the model, the departure of immigrants decreases competition in the labour market, which increases wages (or slows their decline). However, such departures can also potentially increase the entry of less productive workers into employment (negative selection), which could lower the average wages.

The results shown in columns 4 to 6 indicate that higher immigrant outflows increased the average wages for natives who were employed during both periods. Given that the composition of workers in this specification is fixed between two periods, these results are entirely driven by decreased competition in the labour market due to the departure of immigrants.

[Table 11 about here.]

9.4 Margins by contract types

As shown in the previous sections, the departure of the immigrants has increased both the employment and the wages of workers of both skill groups, which confirms the standard economic theory and the results in Equation 13. However, as mentioned in the Section 2.2.2, the prediction of the model and the margins of adjustment depend on the degree of wage rigidity.

[46] Monthly wages can also increase or decrease due to changes in number of days worked. In Appendix Section R, I address this issue and show that outflow does not have any statistically significant effect on the number of days worked.

Spain has a dual labour market which creates important differences between indefinite and fixed-duration contracts in terms of firing costs and wage-setting (Bentolila et al., 2012a,b).[47] As shown in De la Roca (2014), although indefinite contracts provide higher protection they also generate greater wage rigidity and thus lower cyclicality. On the other hand, fixed-term contracts provide higher flexibility in terms of wages. Moreover, the duration of fixed-term contracts is relatively short and their termination has no cost, firms can adjust their demand through these contracts. Since the wages for these contracts are less influenced by the institutional framework, their levels better reflect cyclicality.[48] Given these differences in the degree of wage rigidities, the type of job contract may affect the responsiveness of wages and employment to the outflow of immigrants.

To test how immigrant outflows impact the wage and employment growth of natives, I decomposed the workers into two groups by job contract type: those with a fixed-term (temporary) contract and those with an indefinite (permanent) contract.[49] I run the regression for both groups seperately and present the 2SLS results in Panel A of Table 12. For each contract type, I present wage growth (columns 1 and 2) and employment growth (columns 3 and 4). To prevent the results from being driven by differences in labour demand or changes in the composition of the workers, I include Bartik and demographic controls.

[Table 12 about here.]

Columns 1 and 2 show that the outflow of immigrants increased the wages of workers under fixed-term contract positively and significantly while not affecting the wages of those with indefinite contracts. Columns 3 and 4 show that in provinces where immigrant outflows were higher, the number of native workers with indefinite contracts increased, while the number of fixed contracts was unaffected. These margins of adjustment echo the findings of Edo (2016) who look at the effects of immigration in France, another highly rigid labour market.

However, these results are based on the average effect of outflow on both newly recruited workers and those who were already in the labour market. To understand the underlying mechanism, Panel B of Table 12 further decomposes the wage growth of the workers by those who entered the labour market vs. those who were already in the labour market. These results are particularly informative. Columns 1 and 2 show that the outflows did not affect the wages of the newly recruited individuals regardless of their contract, which is consistent with the previous findings. On the other hand, results in columns 3 and 4 indicate that those who were employed in the previous period saw their wages increase due to the departure of the immigrants. Differences in the estimated coefficients between columns 3 and 4 indicate increases are mainly driven by the fixed-contracts. These elasticities are in line with De la Roca (2014), who found that wage cyclicality in Spain for temporary contracts is twice as large as for workers under indefinite contracts.

[47] Workers under permanent contracts benefit from a high level of employment protection through generous severance payments and legal defense in case of a firing event. Workers under temporary contracts have much lower severance payments and do not face legal proceedings when the contracts expires. As a result, workers in permanent contracts enjoy high protection and bargaining power, while workers in temporary contracts earn lower wages and suffer from high turnover rates and low levels of job tenure.

[48] For instance, in Spain De la Roca (2014) shows that wage cyclicality for workers under temporary contracts is twice as large for workers under permanent contracts.

[49] Indefinite contracts include the *contrato indefinido ordinario* and the *contrato de fomento de al contraction indefinida*. Temporary job contracts are *emploi interimaire* or *contrato temporal.*

These results complement the findings in the previous section. The outflows benefited "outsiders" at the employment margin by accelerating their entries to employment. Those who were already employed, or the "insiders", benefited from the outflows through higher wages.

10 Dynamics of adjustment

The results presented in the previous sections discuss the annual (or the short-term) effects of outflows on local labour markets. However, in the medium or long run, labour markets may adapt to supply shocks through the relocation of labour and capital across provinces, thereby mitigating the initial effects on wages or employment. Therefore, understanding the wage and employment dynamics over longer periods following a decrease in immigrant labour supply is informative. In this section, I explore the dynamics of wage and employment adjustments by testing the effects of outflows in longer time windows (i.e., in longer differences) to understand their medium-term effects and provide estimates that are comparable with the literature studying similar long-run effects.

As shown in Table 13, in addition to my benchmark analysis (which involved 1-year differences), I also investigate longer time windows to study the changes in the estimated relationship. I begin the analysis in 2009 as before, but extend the end period to 2016 (i.e., the final year with net outflows of immigrants from Spain) to have a longer time span. Specifically, I look at the annual changes between 2009 and 2016, changes between 2009 and 2013 (4-year difference) and between 2009 and 2016 (7-year difference). To achieve this, I reconstruct outflow rates, the instruments, and the outcome variables using longer differences. I use the specification in first differences as in the previous section.[50] I limit the observations so that both the start and the end dates of the period remain within the period of interest (i.e., 2009–2016).[51]

Panel A of Table 13 presents the results for wage and employment growth. Columns 1 and 4 present the baseline results (1-year differences) for comparison. Columns 2 and 5 report the elasticities for the change between 2009 and 2013, while columns 3 and 6 report those for 2009 and 2016. It can be seen that the positive effects of outflows on wages persist until the fourth year and disappear thereafter. However, the employment effects remain even in a 7-year window.

[Table 13 about here.]

As previously shown, the natives respond to the outflows by relocating across labour markets. Such relocation can change the composition of the local labour force and complicate the assessment of the impact of these outflows, especially when studying the medium-term effects using cross–sectional data. To address this issue, I exploit the panel dimension of the data, which allows me to track the same workers over time and construct a sample based on the initial location of native workers. Specifically, I define groups using the location of workers in 2009 instead of their current location in subsequent years similar to the literature using panel data (Foged and Peri (2015); Ortega and Verdugo (2021)). This allows me to isolate the

[50] I further check the robustness of the results by adding the same controls as in Section 7.1. Results can be provided if requested.

[51] I make this condition to make sure that my estimation captures the variation that takes place during the crisis period. I can relax this condition by allowing all the observations with either the start or the end period falling between 2009-2016. The results do not change.

precise effect of outflows on native workers who were employed during the base year. More importantly, since the composition of workers remains constant over time, this approach also prevents biased estimates due to changes in the observable native characteristics driven by selection and attrition.

Panel B of Table 13 presents the results for wage and employment growth where worker composition is fixed. Similar to the previous table, columns 1 and 4 present the baseline results (which are annual) for comparison. Columns 2 and 5 report the elasticities for the change between 2009 and 2013, while columns 3 and 6 report those for 2009 and 2016. While the estimate for changes in wages between 2009 and 2013 remains significant, the coefficient is slightly lower compared to previous results. More strikingly, the estimated coefficient for the 2009–2016 period, increases in terms of magnitude and becomes highly significant. The difference between this estimate and that found using cross-sectional data is consistent with a story in which natives moved-in to provinces which experienced higher outflows to look for jobs. This result indicates that native workers who were employed in the base year (or the "insiders") continued benefiting from positive wage effects even in the medium-term while positive effects disappeared for new recruits due to native inflows or entry of workers with lower abilities into employment.

The employment results presented in columns 5 and 6 have slightly smaller coefficients than those found using cross-sectional data; however, they remain highly significant. The differences in the magnitudes of the estimates suggest that the increase in local employment is driven by two factors: i) natives who were employed in the base year are less likely to lose their jobs due to immigrant outflows (captured by the magnitude in Panel B), and ii) new recruits who were either located in the province but were unemployed or those coming from other provinces (difference between the estimate in Panel A and Panel B).

Overall, the results where worker composition is not fixed suggest that the positive effects of outflows on local wages persist until the fourth year end disappear thereafter. This "recovery" is clearly faster than what is observed following an immigration episode, where the negative effects due to immigration disappeared after 5 years in Monras (2020) and 14–20 years in Blanchard and Katz (1992); Jaeger et al. (2018); Edo (2020). However, once the worker composition is fixed, the positive wage effects remain significant, even beyond the 4-year mark. This result corroborates earlier findings and suggests that as natives move-in to a province or enter employment, they also change the composition and attenuate overall wage effects, which is mainly due to possible negative selection. Furthermore, the employment effects remain strong and significant, suggesting that immigrant outflows helped native employment by increasing entries to employment and decreasing the probability of losing their jobs throughout this period.

11 Conclusion

This paper documents the impact of immigrant outflows from local labour markets on the wages and employment of native workers in Spain during the Great Recession. Using administrative data and municipal population registers, I find that outflows accelerated the local wage and employment growth for natives in all skill and demographic groups. Moreover, the departure of immigrants increased geographic inflows of natives from other provinces and reduced their outflows, increased the entry to employment from non-employment, and improved the wages of those who were already employed.

In the context of economic contraction with wage declines and employment losses, the departure of immigrants cushioned the natives against the adverse labour market effects of the crisis. Since the locations which were hit harder by the crisis also lost more immigrants, this smoothing effect contributes as a mechanism for equalising differences across labour markets. This suggests that the higher mobility of immigrants improves the functioning of local labour markets during both good times (Borjas, 2001) and bad times. This finding underlines an important benefit of immigration that has rarely been explored in the literature. This benefit of migration is particularly important given the concerns about the relative lack of mobility among natives, especially native low-skilled workers, since this leads to a significant divergence in local unemployment rates and workers' wages across local labour markets (Bound and Holzer, 2002; Cadena and Kovak, 2016; Dao et al., 2017).

The estimated magnitudes should be considered within the specific context of this study. Spain is a country in which the immigrant population has an average substitutability with the native population that is much higher than that of many other countries. For instance, the immigrants who left were from Spanish-speaking countries or other European countries; thus, they were close substitutes to the natives in terms of linguistic capabilities or skills. The high substitutability between immigrants who left and natives who stayed can potentially explain part of the positive effects. That is why—despite the fact that the conclusions derived from this case study can be generalised to other migration contexts—the effects could be of smaller magnitude when immigrants and natives of similar observable skill (i.e., education) and age are imperfect substitutes or complement production. These estimations are also valid for formal sector employment and wages. Whether similar effects can be expected in the informal sector is another question that is beyond the scope of this paper.

The findings of the present study also shed light on how rigid labour markets adjust to changes in labour supply. First, they show that labour market rigidity determines whether the effects operate through the employment or wage margin. Second, they show that changes in labour supply could have differential effects for workers who are "outsiders" vs "insiders". Hence, my findings have implications beyond the immigration literature and contribute to understanding how labour markets respond to local shocks.

This paper provides evidence of the impact of immigrant mobility on the local labour market outcomes of natives. However, it does not focus on the individual heterogeneity of either group or address the individual selection component. A better understanding of selection due to individual ability for both departing immigrants and natives has not been achieved. Thus, it remains an important topic for future research.

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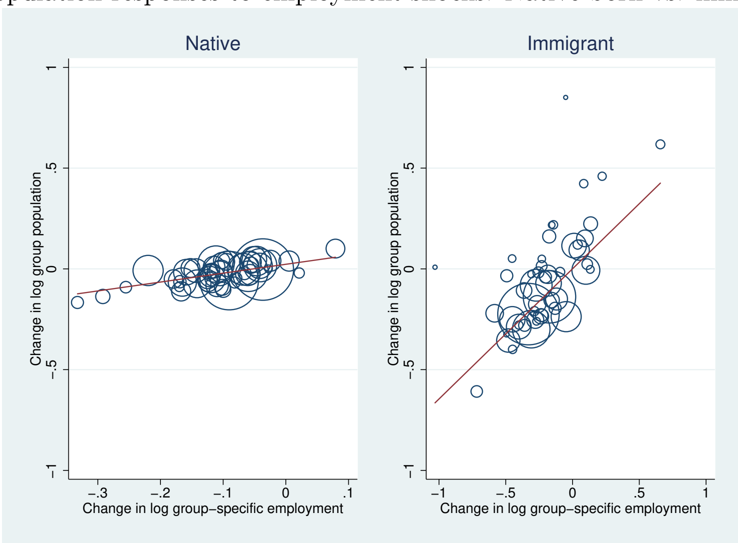
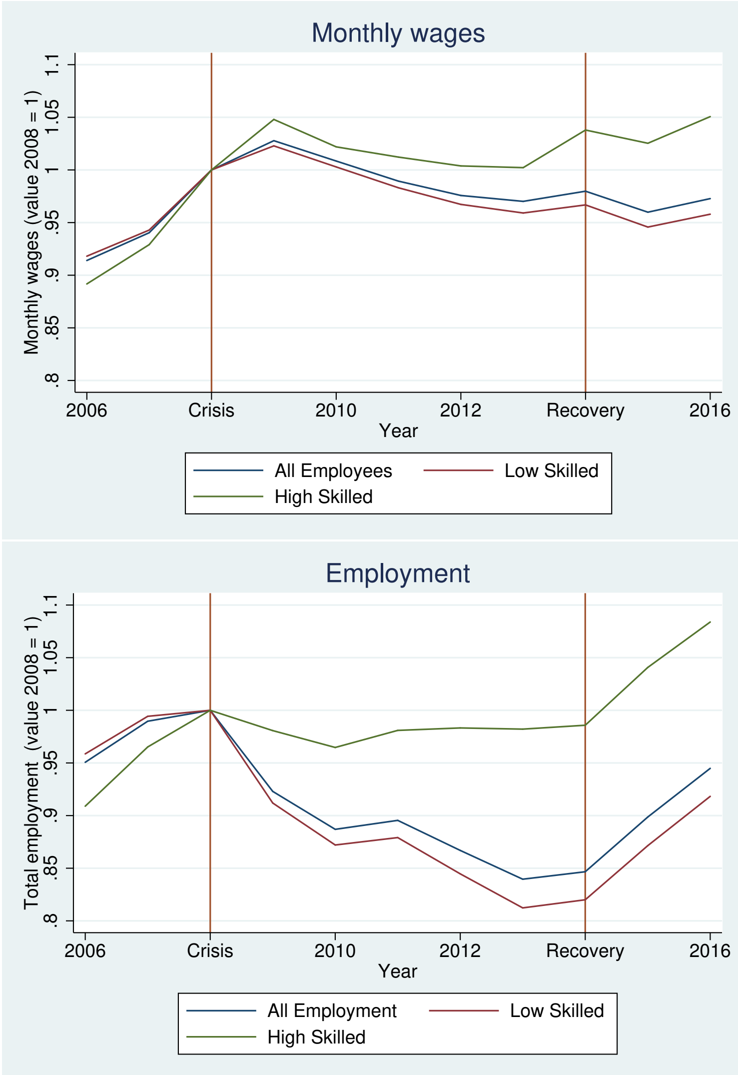
Figure 1: Population responses to employment shocks: Native-born vs. immigrant men



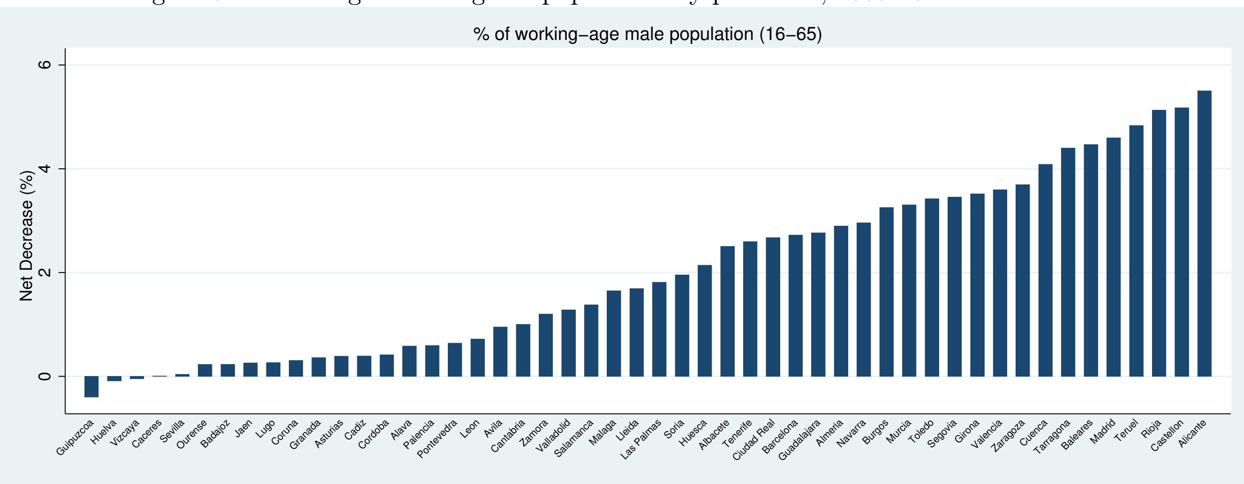
The figures plot the changes calculated as the long difference in logs from 2009 to 2014 for each province. The x-axis is the group-specific change in employment and y-axis is the change in population. Observations are weighted by the group population in 2009.
Data: Spanish labour Force Survey (EPA)

Figure 2: Wages and employment



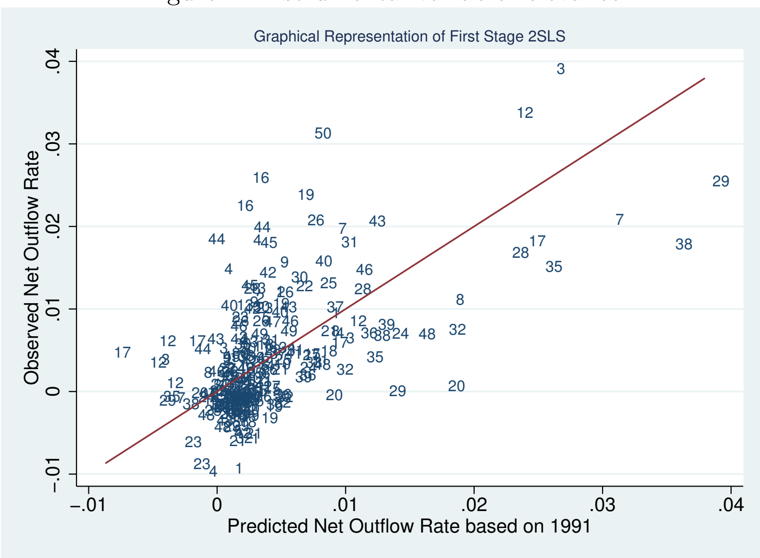
The figures plot the evolution of average monthly wages (top panel) and employment (bottom panel) in Spain separately for all, low and high skilled native workers between 2006 and 2016. The values are normalised by group values in 2008.
Data source: Continuous Sample of Employment Histories (MCVL)

Figure 3: Net change in immigrant population by provinces, 2009-2014



The figure plots the net change in the total immigrant male working-age population between 2009 and 2014, as a share of the total working-age male population in 2009. Positive bars correspond to the net outflow of the population.
Data source: Municipal Register of Population (Padrón)

Figure 4: Instrumental variable relevance



The figure plots the predicted outflow rate based on the distribution in 1991 (horizontal axis) in each province-year pair between 2009 and 2014 in the horizontal axis against the observed outflow rate (vertical axis) in the same period. The figure represents a graphical visualization of the first stage of the two-stages-least-squares estimation.
Data source: Municipal Register of Population (Padrón) and Spanish Statistical Institute (INE)

Table 1: Summary Statistics

Variable	**N**	**Mean**	**sd**	**Min**	**Max**
Native Workers	250	2,683.0	4,198.2	232.0	25,414.0
Monthly Wage, in Euros	250	1,668.2	215.1	1,339.8	2,283.8
Annual Decrease in FB	250	1,597.2	4,457.0	-2,437.0	36,309.0
Total Population	250	316,065.3	388,844.3	30,006.0	2,204,700.0

These are the main variables used in the analysis of the effect of outflow on wage and employment growth of natives. The averages are unweighted, so do not necessarily coincide with the true average of Spain. The data covers the period 2009-2014 (5 years) and 50 provinces. Data source: Continuous Sample of Employment Histories (MCVL) and Municipal Register of Population (Padrón)

Table 2: First-stage regressions, 2009-2014

	1	2	3	4	5
Predicted Net Outflow Rate	0.4145	0.3769	0.3094	0.3333	0.3044
	(0.099)***	(0.097)***	(0.120)***	(0.107)***	(0.108)***
Demographic	No	Yes	Yes	Yes	Yes
Economic 2009	No	No	Yes	Yes	Yes
Bartik	No	No	No	Yes	Yes
Native Outflows	No	No	No	No	Yes
N	250	250	250	250	250
r2	0.53	0.55	0.74	0.78	0.78
Cragg-Donalds Stat	48.20	25.93	114.60	123.36	145.43

The table reports OLS estimates for first-stage results. The dependent variable is the net change in immigrant population between year t and $t-1$, relative to total working-age population in year $t-1$ in 50 provinces between 2009-2014 (5 periods). The explanatory variable is the predicted net change in the immigrant population during the same period. Demographic characteristics correspond to changes in average age and schooling of the native workers. Characteristics of the Economy in 2009 include the share of agriculture, manufacturing, construction and services in the overall employment. Bartik refers to the change in predicted total employment. Native outflows correspond to change in the total native population between year t and $t-1$, relative to the total working-age population in year $t-1$. All regressions include year fixed-effects and use weights corresponding to the number of employed natives in the base period ($t-1$). Standard errors are clustered at the province level. Data source: Continuous Sample of Employment Histories (MCVL), Municipal Register of Population (Padrón) and Spanish Statistical Institute (INE)

$^{*}p < 0.10, ^{**}p < 0.05, ^{***}p < 0.01$

Table 3: Effects on wages and employment of natives, 2009-2014

	Wage		Employment	
	OLS	2SLS	OLS	2SLS
Net Outflow Rate	0.2092	2.0286	1.1586	2.4122
	(0.248)	(0.609)***	(0.348)***	(0.752)***
N	250	250	250	250
Adj R2	0.49	0.26	0.53	0.49
KP F-Stat		17.45		17.45

The table reports OLS and 2SLS estimates for the impact of net outflow rate of the immigrant population in a province, measured as the decrease in the number of the working-age male immigrant population between t and $t-1$ as of total working-age male population in year $t-1$, on native wage and employment growth. Columns 1 and 2 report OLS results, while columns 3 and 4 report 2SLS results where predicted net outflow rates are used as instruments. Regressions are estimated annually, across 50 provinces between 2009-2014 (5 periods). Regressions are weighted by total employment in the base year and include year-fixed effects. Standard errors are clustered at the province level. Data source: Continuous Sample of Employment Histories (MCVL), Municipal Register of Population (Padrón) and Spanish Statistical Institute (INE)

$^{*}p < 0.10, ^{**}p < 0.05, ^{***}p < 0.01$

Table 4: Wages and Employment with local controls

	Wage				Employment			
	2SLS	2SLS	2SLS	2SLS	2SLS	2SLS	2SLS	2SLS
Net Outflow Rate	2.0286	2.0066	2.4734	2.8256	2.4122	2.7436	2.6549	2.8845
	(0.609)***	(0.674)***	(0.966)**	(1.147)**	(0.752)***	(0.829)***	(0.965)***	(1.089)***
Demographic	No	Yes	Yes	Yes	No	Yes	Yes	Yes
Economic 2009	No	No	Yes	Yes	No	No	Yes	Yes
Bartik	No	No	Yes	Yes	No	No	Yes	Yes
Native Outflows	No	No	No	Yes	No	No	No	Yes
N	250	250	250	250	250	250	250	250
KP F-Stat	17.45	14.99	9.67	7.97	17.45	14.99	9.67	7.97

The table reports 2SLS estimates for the impact of net outflow rate of the immigrant population in the province, measured as the decrease in the number of the working-age male immigrant population between period t and $t-1$ as of total working-age male population in t, on native wage and employment growth. Predicted net outflow rates are used as instruments. Characteristics of the economy in 2009 include the share of agriculture, construction, manufacturing and services in the total employment. Bartik refers to the change in predicted total employment. Native outflow is measured as the annual decrease in the number of the working-age male native-born population between period t and $t-1$ as of total working-age male population in t. Regressions are estimated annually, across 50 provinces between 2009-2014 (5 periods). Regressions are weighted with total employment in period $t-1$ and include year fixed-effects. Standard errors are clustered at the province level. Data source: Continuous Sample of Employment Histories (MCVL), Municipal Register of Population (Padrón) and Spanish Statistical Institute (INE)

$^{*}p < 0.10, ^{**}p < 0.05, ^{***}p < 0.01$

Table 5: Testing for pre-trends

Panel A: Growth in 2003-2008 as dependent variable				
	Wage (2003-08)		Employment (2003-08)	
	OLS	2SLS	OLS	2SLS
Net Outflow Rate 2009-14	-0.0179	-0.0059	-1.8976	-2.7861
	(0.019)	(0.025)	(0.701)***	(1.332)**
N	50	50	50	50
KP F-Stat		57.36		57.36
Panel B: Growth in 2003-2008 as explanatory variables				
	Wage		Employment	
	2SLS	2SLS	2SLS	2SLS
Net Outflow Rate	2.0286	2.0680	2.4122	2.0633
	(0.609)***	(0.724)***	(0.752)***	(0.702)***
Pre-trend wage		0.0188		
		(0.089)		
Pre-trend employment				-0.0428
				(0.032)
N	250	250	250	250
KP F-Stat	17.45	16.02	17.45	12.69
Panel C: Immigrant share in 2009 and past growth				
	Wage		Employment	
	1998-2008	2003-2008	1998-2008	2003-2008
Immigrant share in 2009	0.0024	-0.0030	-6.5886	-0.6329
	(0.015)	(0.005)	(2.364)***	(0.166)***
N	50	50	50	50
Adj R2	0.00	0.01	0.19	0.31

Panel A: The table reports OLS and 2SLS estimates for the impact of the net outflow rate of the immigrant population in in the province, measured as the decrease in the number of the working-age male immigrant population between 2009 and 2014, relative to the total working-age male population in the year 2009, on wage and employment growth of natives between 2003 and 2008. Columns 1 and 2 report results on wage growth, while columns 3 and 4 report employment growth results. Regressions are weighted by total employment in each province in 2009. Panel B: The table reports OLS and 2SLS estimates for the net outflow rate of the immigrant population in an area, measured as the decrease in the number of the working-age male immigrant population between 2009 and 2014, relative to the total working-age male population in the year 2009, on native local wage and employment growth of natives in the aggregate during the same period. Columns 1 and 2 report results on wage growth, while columns 3 and 4 report employment growth results. Variables pre-trend wage and pre-trend employment correspond to change between 2003 and 2008. Regressions are weighted by total employment in the base year. Panel C: The table reports OLS estimates for the employment and wage growth in the previous periods, standardized by initial employment. The explanatory variable is the share of the immigrant in the total working-age population in 2009. Columns 1 and 2 report results on wage growth, while columns 3 and 4 report results for employment growth during the period indicated in the column header. Regressions are weighted by total employment in each province in 2009. In all panels, the unit of observations are provinces, and standard errors are clustered at province-level. Data source: Continuous Sample of Employment Histories (MCVL), Municipal Register of Population (Padrón) and Spanish Statistical Institute (INE)

$^{*}p < 0.10, ^{**}p < 0.05, ^{***}p < 0.01$

Table 6: Wages and employment by skill groups

Panel A: Change Wages						
	OLS			2SLS		
	All	Low Skilled	High Skilled	All	Low Skilled	High Skilled
Net Outflow Rate	0.2092	0.1289	0.0227	2.0286	1.5773	1.7531
	(0.248)	(0.182)	(0.380)	(0.609)***	(0.470)***	(1.114)
N	250	250	250	250	250	250
Adj R2	0.49	0.41	0.43	0.26	0.26	0.36
KP F-Stat				17.45	16.74	17.90
Panel B: Change Employment						
	OLS			2SLS		
	All	Low Skilled	High Skilled	All	Low Skilled	High Skilled
Net Outflow Rate	1.1586	0.9453	1.2907	2.4122	1.8168	4.6534
	(0.348)***	(0.296)***	(0.402)***	(0.752)***	(0.777)**	(1.400)***
N	250	250	250	250	250	250
Adj R2	0.53	0.55	0.16	0.49	0.54	-0.13
KP F-Stat				17.45	16.74	17.90

The table reports OLS and 2SLS estimates for the impact of net outflow rate of the immigrant population in a province, measured as the decrease in the number of the working-age male immigrant population between t and $t-1$ as of total working-age male population in year $t-1$, on native wage (Panel A) and employment (Panel B) growth by skill groups. Columns 1-3 report OLS results in both panels, while columns 4-6 report 2SLS results where predicted net outflow rates are used as instruments. Regressions are estimated annually, across 50 provinces between 2009-2014 (5 periods). Regressions are weighted by group-specific employment in the base year and include year fixed-effects. Standard errors are clustered at the province level. Data source: Continuous Sample of Employment Histories (MCVL), Municipal Register of Population (Padrón) and Spanish Statistical Institute (INE)

$^{*}p < 0.10, ^{**}p < 0.05, ^{***}p < 0.01$

Table 7: Wages and employment by demographic groups

Panel A: Change Wages					
	Native Male	Native Female	< 30	30-40	> 40
Net Outflow Rate	2.8302	1.5539	3.0141	1.8647	2.4601
	(0.906)***	(0.629)**	(0.986)***	(0.863)**	(0.946)***
N	250	250	250	250	250
Adj R2	0.28	0.55	0.53	0.16	0.29
KP F-Stat	18.50	18.29	18.99	18.99	17.00
Panel B: Change Employment					
	Native Male	Native Female	< 30	30-40	> 40
Net Outflow Rate	2.5822	3.3757	6.1559	0.9597	2.3923
	(0.786)***	(1.046)***	(2.298)***	(0.566)*	(0.708)***
N	250	250	250	250	250
Adj R2	0.37	0.13	0.02	0.33	0.28
KP F-Stat	18.50	18.29	18.99	18.99	17.00

The table reports 2SLS estimates for the impact of net outflow rate of the immigrant population in a province, measured as the decrease in the number of the working-age male immigrant population between t and $t-1$ as of total working-age male population in year $t-1$, on native wage (Panel A) and employment (Panel B) growth. Predicted net outflow rates are used as instruments. Regressions are estimated annually, across 50 provinces between 2009-2014 (5 periods). Regressions are weighted by group-specific employment in the base year and include year fixed-effects. Standard errors are clustered at the province level. Data source: Continuous Sample of Employment Histories (MCVL), Municipal Register of Population (Padrón) and Spanish Statistical Institute (INE)

$^{*}p < 0.10, ^{**}p < 0.05, ^{***}p < 0.01$

Table 8: Impact of outflow on native displacement between 2009-2014

	OLS			IV		
	Male	Female	Total	Male	Female	Total
Net Outflow Rate	0.1703	0.1709	0.1707	0.3831	0.3763	0.3792
	(0.083)**	(0.079)**	(0.081)**	(0.154)**	(0.154)**	(0.152)**
Bartik	Yes	Yes	Yes	Yes	Yes	Yes
N	250	250	250	250	250	250
Adj R2	0.26	0.24	0.25	0.19	0.18	0.19
KP F-Stat				15.75	16.75	16.24

The table reports OLS and 2SLS estimates for the impact of the net change in the immigrant population in a province, measured as the decrease in the number of the working-age male immigrant population between t and $t-1$ as of total working-age male population in year $t-1$, on native displacement during the same period. Columns 1-3 report OLS results, while columns 4-6 report 2SLS results where predicted net outflow rates are used as instruments. Regressions are estimated annually, across 50 provinces between 2009-2014 (5 periods). Regressions are weighted by group-specific population in the base year and include Bartik control and year fixed-effects. Standard errors are clustered at the province level. Data source: Municipal Register of Population (Padrón), Residential Variation Statistics (EVR) and Spanish Statistical Institute (INE)

$^{*}p < 0.10, ^{**}p < 0.05, ^{***}p < 0.01$

Table 9: Impact of outflow on native mobility margins betweeen 2009-2014

	OLS			IV		
	Net Rate	Arrival Rate	Departure Rate	Net Rate	Arrival Rate	Departure Rate
Net Outflow Rate	0.0632	0.0269	-0.0363	0.1597	0.0947	-0.0650
	(0.030)**	(0.032)	(0.015)**	(0.053)***	(0.054)*	(0.023)***
Bartik	Yes	Yes	Yes	Yes	Yes	Yes
Prov FE	Yes	Yes	Yes	Yes	Yes	Yes
Year FE	Yes	Yes	Yes	Yes	Yes	Yes
N	250	250	250	250	250	250
Adj R2	0.67	0.97	0.99	0.64	0.97	0.99
KP F-Stat				13.38	13.38	13.38

The table reports 2SLS estimates for the impact of the net change in the immigrant population in a province, measured as the decrease in the number of working-age male immigrant population between t and $t-1$ as of total working-age male population in year $t-1$, on the mobility margins of working-age male native population during the same period. Regressions are estimated annually, across 50 provinces between 2009-2014 (5 periods). Regressions are weighted by working-age male population in the base year. All regressions include the Bartik control, year and province fixed-effects. Standard errors are clustered at province-level. Data source: Municipal Register of Population (Padrón), Residential Variation Statistics (EVR) and Spanish Statistical Institute (INE)

$^{*}p < 0.10,^{**} p < 0.05,^{***} p < 0.01$

Table 10: Entries versus exits: Employment

	Entry			Exit		
	All	Low Skilled	High Skilled	All	Low Skilled	High Skilled
Net Outflow Rate	2.3223	2.4515	1.9569	-1.2718	-1.3810	-0.3503
	(0.875)***	(0.938)***	(0.990)**	(1.063)	(1.178)	(1.208)
Prov FE	Yes	Yes	Yes	Yes	Yes	Yes
Year FE	Yes	Yes	Yes	Yes	Yes	Yes
N	250	250	250	250	250	250
KP F-Stat	22.92	22.92	22.92	22.92	22.92	22.92

The table reports 2SLS estimates for the impact of the net change in the immigrant population in a province, measured as the decrease in the number of the working-age male immigrant population between t and $t-1$ as of total working-age male population in year $t-1$, on labour market transitions of natives. Dependent variables are entry rate (columns 1-3) and exit rate (columns 4-6). Entries correspond to transitions from non-employment to employment, while exits refer to the opposite situation. Regressions are estimated annually, across 50 provinces between 2009-2014 (5 periods), include province and year fixed-effects. Standard errors are clustered at the province level. Data source: Continuous Sample of Employment Histories (MCVL) and Municipal Register of Population (Padrón)

$^{*}p < 0.10, ^{**}p < 0.05, ^{***}p < 0.01$

Table 11: New entries versus stayers: Wages

	New Entries			Stayers		
	All	Low Skilled	High Skilled	All	Low Skilled	High Skilled
Net Outflow Rate	1.8395	1.4190	1.7956	1.1957	0.7391	1.8437
	(1.202)	(1.219)	(4.161)	(0.439)***	(0.325)**	(0.578)***
N	250	250	244	250	250	250
KP F-Stat	38.94	36.76	40.74	29.85	27.07	35.98

The table reports 2SLS estimates for the impact of the net change in the immigrant population in a province, measured as the decrease in the number of the working-age male immigrant population between t and $t-1$ as of total working-age male population in year $t-1$, on the wages of natives. All columns present 2SLS results where predicted net outflow rates are used as instruments. Columns 1-3 present the changes in the average wages of workers who were not employed in the previous period (New Entries), while columns 4-6 presents the changes for workers who were employed in both periods (Stayers). Regressions are estimated annually across 50 provinces between 2009-2014 (5 periods), include province and year fixed-effects. Regressions are weighted by group-specific employment in the base year, and standard errors are clustered at the province level.

Data source: Continuous Sample of Employment Histories (MCVL), Municipal Register of Population (Padrón) and Spanish Statistical Institute (INE)

$^{*}p < 0.10, ^{**}p < 0.05, ^{***}p < 0.01$

Table 12: Wages and employment: Contract types

Panel A: Average Wages and Employment				
	Wages		Employment	
	Indefinite	Fixed	Indefinite	Fixed
Net Outflow Rate	-0.2312	4.1571	3.8046	-1.0169
	(0.397)	(1.348)***	(1.380)***	(1.517)
Bartik	Yes	Yes	Yes	Yes
Demographic	Yes	Yes	Yes	Yes
N	250	250	250	250
KP F-Stat	11.27	19.51	11.27	19.51
Panel B: Wages by Cohorts				
	New Entries		Stayers	
	Indefinite	Fixed	Indefinite	Fixed
Net Outflow Rate	-4.0547	2.7734	0.6037	3.8769
	(2.739)	(1.853)	(0.288)**	(1.797)**
Bartik	Yes	Yes	Yes	Yes
Demographic	Yes	Yes	No	No
N	250	250	250	250
KP F-Stat	15.12	22.50	23.30	15.30

The table reports 2SLS estimates for the impact of the net change in the immigrant population in a province, measured as the decrease in the number of the working-age male immigrant population between t and $t-1$ as of total working-age male population in year $t-1$, on the wage and employment growth (Panel A) or average wages (Panel B) by type of contract. All columns present 2SLS results where predicted net outflow rates are used as instruments. Regressions are estimated annually across 50 provinces between 2009-2014 (5 periods), include year fixed-effects. Demographic characteristics correspond to changes in average age and schooling of the native workers. Bartik refers to the change in predicted total employment. Regressions are weighted by group-specific employment in the base year, and standard errors are clustered at the province level. Data source: Continuous Sample of Employment Histories (MCVL), Municipal Register of Population (Padrón) and Spanish Statistical Institute (INE)

$^{*}p < 0.10,^{**} p < 0.05,^{***} p < 0.01$

Table 13: Effects on wages and employment of natives using alternative time intervals

Panel A: Cross-Sectional data						
	Wage			Employment		
	Yearly 2009-2016	2009-2013	2009-2016	Yearly 2009-2016	2009-2013	2009-2016
Net Outflow 1-year differences	1.6195			2.2611		
	(0.421)***			(0.785)***		
Net Outflow 4-year differences		1.4696			5.0082	
		(0.426)***			(1.273)***	
Net Outflow 7-year differences			0.5119			2.5436
			(0.413)			(0.432)***
N	350	50	50	350	50	50
KP F-Stat	15.73	21.34	73.41	15.73	21.34	73.41
Panel B: Fixed cohorts						
	Wage			Employment		
	Yearly 2009-2016	2009-2013	2009-2016	Yearly 2009-2016	2009-2013	2009-2016
Net Outflow 1-year differences	1.6195			2.2611		
	(0.421)***			(0.785)***		
Net Outflow 4-year differences		1.0948			4.3980	
		(0.316)***			(1.119)***	
Net Outflow 7-year differences			0.7625			1.2510
			(0.247)***			(0.439)***
N	350	50	50	350	50	50
KP F-Stat	15.73	20.26	55.86	15.73	22.82	77.46

The table reports 2SLS estimates for the impact of the net change in the immigrant population in a province, measured as the decrease in the number of the working-age male immigrant population between t and $t-1$ as of total working-age male population in year $t-1$, on the wage and employment growth of natives. Regressions are estimated for different lags and periods expressed in the variable labels and column headers, respectively. All columns present 2SLS results where predicted net outflow rates are used as instruments. The unit of observations is provinces. Regressions are weighted by total employment in the base year. Standard errors are clustered at province level.

Data source: Continuous Sample of Employment Histories (MCVL), Municipal Register of Population (Padrón) and Spanish Statistical Institute (INE)

$^{*}p < 0.10,^{**} p < 0.05,^{***} p < 0.01$

For Online Publication

The Cushioning Effect of Immigrant Mobility

Cem Özgüzel

May 24, 2021

A Model

A.1 Derivation of the firm's demand curve

In perfect competition, factors of production are paid according to their marginal productivity. In such set-up, firms maximize their profits for given output and input prices.

$$\pi = A[\theta_U L_U^\beta + \theta_S L_S^\beta]^{\frac{1}{\beta}} - w_S L_S - w_U L_U$$

First-order condition:

$$\frac{\partial \pi}{\partial L_g} = A\frac{1}{\beta}\beta L_g^{\beta-1}\theta_g L^{1-\beta} - w_g = 0$$

$$w_g = A(\theta_g)L_g^{\beta-1}L^{1-\beta}$$

This relationship is independent of the sign of β. The magnitude of the effect, however, depends on the value of β (see graph with parameters). I take the logarithm of the demand function for one group (as both give the same result):

$$logw_g = log(A) + log(\theta_g) + (\beta - 1)(logL_g) + (1-\beta)(logL)$$

Calculating the total differential with respect to variations of employment of workers within the skill group (i.e. L_S) and of the total employment (i.e.L) gives me this:

$$dlogw_g = (\beta - 1)dlogL_g + (1-\beta)dlogL + dlogA \tag{A1}$$

I take the total differential of L:

$$L = [\theta_U L_U^\beta + \theta_S L_S^\beta]^{\frac{1}{\beta}}$$

$$dlogL = \frac{1}{L^\beta}\frac{1}{\beta}[dL_U\theta_U\beta L_U^{\beta-1} + dL_S\theta_S\beta L_S^{\beta-1}]$$

$$dlogL = \frac{1}{L^\beta}[dL_U\theta_U L_U^\beta L_U^{-1} + dL_S(\theta_S)L_S^\beta L_S^{-1}]$$

$$dlogL = \frac{1}{L^\beta}[\frac{dL_U}{L_U}\theta_U L_U^\beta + \frac{dL_S}{L_S}(\theta_S)L_S^\beta]$$

$$dlogL = \frac{1}{L^{\beta}}[dlogL_U \theta_U L_U^{\beta} + dlogL_S(\theta_S)L_S^{\beta}]$$

$$dlogL = \frac{dlogL_U \theta_U L_U^{\beta}}{L^{\beta}} + \frac{dlogL_S(\theta_S)L_S^{\beta}}{L^{\beta}}$$

$$dlogL = S_U dlogL_U + S_S dlogL_S \tag{A2}$$

where $S_U = \frac{\theta_U L_U^{\beta}}{L^{\beta}}, S_S = \frac{\theta_S L_S^{\beta}}{L^{\beta}}$

Totally differentiating L_g:

$$L_g = L_g^N + L_g^M$$

$$dL_g = dL_g^N + dL_g^M$$

$$\frac{dL_g}{L_g} = \frac{dL_g^N}{L_g} + \frac{dL_g^M}{L_g}$$

$$\frac{dL_g}{L_g} = \frac{dL_g^N}{L_g^N}\frac{L_g^N}{L_g} + \frac{dL_g^M}{L_g^M}\frac{L_g^M}{L_g}$$

$$dlogL_g = \theta_g^N dlogL_g^N + \theta_g^M dlogL_g^M \tag{A3}$$

where $\theta_g^N = \frac{L_g^N}{L_g}, \theta_g^M = \frac{L_g^M}{L_g}$

Assuming that I am interested in the outcomes of skilled workers (i.e. $g = s$). I plug Equation A2 into Equation A1 for $dlogL$:

$$dlogw_S = (\beta - 1)dlogL_S + (1 - \beta)(S_U dlogL_U + S_S dlogL_S) + dlogA$$

$$dlogw_S = [(\beta - 1 + (1 - \beta)S_S)]dlogL_S + (1 - \beta)(S_U)(dlogL_U) + dlogA$$

Plug in Equation A3 for $dlogL_g$:

$$dlogw_S = [(1-\beta)(S_s-1)][dlogL_S^N \theta_S^N + dlogL_S^M \theta_S^M] + (1-\beta)(S_U)[dlogL_U^N \theta_U^N + dlogL_U^M \theta_U^M] + dlogA$$

Isolating $dlogL_S^N$ gives me the labour demand (Equation 4) in the paper.

A.2 Derivation of labour supply

Starting from:

$$L_g = N_g f_g(w_g, w_g') + L_g^M$$

$$L_g^N = N_g f_g(w_g, w'_g)$$

$$log(L_g^N) = log(N_g f_g(w_g, w'_g))$$

$$dlog(L_g^N) = \frac{\partial(N_g f_g(w_g, w'_g))}{(N_g f_g(w_g, w'_g)} \frac{dw_g}{\partial w_g} \frac{w_g}{w_g}$$

$$dlog(L_g^N) = dlogw_g \frac{w_g}{\partial w_g} \frac{\partial(N_g f_g(w_g, w'_g))}{(N_g f_g(w_g, w'_g)} \tag{A4}$$

This gives me the labour supply in Equation 6 in the text.

A.3 Derivation of equilibrium wage and employment responses under flexible wages

The equilibrium wage and employment responses are determined by the two skill-specific labour demand curves:

$$dlogw_S = (\beta - 1)dlogL_S + (1 - \beta)dlogL + dlogA \tag{A5}$$

$$dlogw_U = (\beta - 1)dlogL_U + (1 - \beta)dlogL + dlogA \tag{A6}$$

and two skill-specific supply curves:

$$dlogL_S^N = \eta_S dlogw_S \tag{A7}$$

$$dlogL_U^N = \eta_U dlogw_U \tag{A8}$$

where $dlogL$ is given by Equation A2. By plugging A7 and A8 in A5 and A6, I obtain:

$$dlogw_S = [(1-\beta)(S_s-1)][\theta_S^N dlogL_S^N + \theta_S^M dlogL_S^M] + (1-\beta)(S_U)[\theta_U^N dlogL_U^N + \theta_U^M dlogL_U^M] + dlog(A) \tag{A9}$$

$$dlogw_U = [(1-\beta)(S_u-1)][\theta_U^N dlogL_U^N + \theta_U^M dlogL_U^M] + (1-\beta)(S_S)[\theta_S^N dlogL_S^N + \theta_S^M dlogL_S^M] + dlog(A) \tag{A10}$$

Regroup and solve A9 for $dlogw_S$:

$$dlogw_S = \frac{(1-\beta)(S_U)[\eta_U(dlogw_u)\theta_u^N + dlogL_U^M \theta_U^M] + [(1-\beta)(S_s-1)]dlogL_S^M \theta_S^M + dlogA}{1 - [(1-\beta)(S_s-1)\eta_s \theta_S^N]} \tag{A11}$$

$$dlogw_U = \frac{(1-\beta)(S_S)[\eta_S(dlogw_S)\theta_S^N + dlogL_S^M\theta_S^M] + [(1-\beta)(S_u-1)]dlogL_U^M\theta_U^M + dlogA}{1-[(1-\beta)(S_u-1)\eta_u\theta_U^N]} \tag{A12}$$

Plugging A12 into A11 and placing all terms over a common denominator then yields:

$$dlogw_S = \frac{(1-\beta)(S_U)[(\eta_U\theta_U^N)(1-\beta)(S_S)(\eta_S\theta_S^N)(dlogw_S) + (\eta_U\theta_U^N)(1-\beta)(S_S)(\theta_S^M)(dlogL_U^M) + \theta_U^M dlogL_U^M]}{(1-[(1-\beta)(S_S-1)]\eta_s\theta_S^N])((1-([(1-\beta)(S_U-1)]\eta_U\theta_U^N))}$$

$$+ \frac{[([(1-\beta)(S_s-1)](dlogL_S^M)\theta_S^M)(1-([\beta-1+S_U-S_U\beta]\eta_U\theta_U^N)]}{(1-[(1-\beta)(S_S-1)]\eta_s\theta_S^N])((1-([(1-\beta)(S_U-1)]\eta_U\theta_U^N))}$$

$$+ \frac{(dlogA)(1-([(1-\beta)(S_U-1)]\eta_U\theta_U^N)}{(1-[(1-\beta)(S_S-1)]\eta_s\theta_S^N])((1-([(1-\beta)(S_U-1)]\eta_U\theta_U^N))}$$

Solving for $dlogw_S$ gives:

$$dlogw_S^* = \frac{[((1-\beta)(S_S-1)) + (\eta_U\theta_U^N)[(1-\beta)^2(S_U)(S_S) - ((1-\beta)(S_U-1))(1-\beta)(S_U-1)]]\theta_S^M}{(1-((1-\beta)(S_S-1)\eta_S\theta_S^N))(1-((1-\beta)(S_U-1)\eta_U\theta_U^N)) - ((1-\beta)^2 S_U(\eta_U\theta_U^N)(S_S)(\eta_S\theta_S^N))} dlogL_S^M$$

$$+ \frac{[(1-\beta)(S_U)(\theta_U^M)]}{(1-((1-\beta)(S_S-1)\eta_S\theta_S^N))(1-((1-\beta)(S_U-1)\eta_U\theta_U^N)) - ((1-\beta)^2 S_U(\eta_U\theta_U^N)(S_S)(\eta_S\theta_S^N))} dlogL_U^M$$

$$+ \frac{(1-(1-\beta)(S_U-1)\eta_U\theta_U^N)}{(1-((1-\beta)(S_S-1)\eta_S\theta_S^N))(1-((1-\beta)(S_U-1)\eta_U\theta_U^N)) - ((1-\beta)^2 S_U(\eta_U\theta_U^N)(S_S)(\eta_S\theta_S^N))} dlogA$$

Plugging this into A7 and simplifying gives the equilibrium employment in Equation 11 in the paper.

B The Great Recession in Spain

Spanish economy and labour market were hit severely by two shocks: the end of the speculative bubble of the construction sector in Autumn 2007 and the global financial shock in September 2008.[52] The negative shock in the construction sector reversed the positive trend in the em-

[52] According to Akin et al. (2014), Spain was hit more severely than other developed countries due to the joint presence of excessive dependence of the real estate industry and soft credit standards which were applied during the boom years. Moreover, Moral-Benito (2018) argues that too much credit was given to firms with high real-estate collateral, especially in municipalities with higher housing prices growth. This rendered Spanish firms much more reliant on bank credit than other similar countries and vulnerable to credit supply shocks (Bentolila et al. (2018)).

ployment observed until the crisis.[53] The global financial shock triggered a rapid increase in the unemployment rate and initated the *Recession*.

As the contraction in the economic activity deepened, the labour costs continued to increase. Spain is a country characterized by a rigid labour market with very low wage cyclicality (De la Roca, 2014; Font et al., 2015).[54] The low association with the cyclical conditions in the labour market and real wages, limited the use of wage reductions by the firms as a channel to adjust to the lower demand in the market. When the crisis started in 2008, the wages failed to react to the strong deterioration of the labour market, and a rise in real wages was observed in 2008-2009, even after controlling for the strong composition effects in employment (Puente and Galán, 2014). Although some reduction in real wages was observed in 2012 and 2013, negative inflation reduced the scope for further real wage adjustment.

The rigidity of wages in the initial phases and the small adjustment in the following years forced the firms to adjust to the increase in the labour costs and the decrease in demand via employment margin, which caused the unemployment rates to triple, generating a high employment-GDP elasticity (Bentolila et al., 2012a).[55][56] The deterioration in the labour market following the crisis in 2008 unfolded in three stages. In the first stage of the crisis, very sharp job losses took place, driven by the sharp decline in GDP. Over the course of 2010, the decline rate in employment tended to soften, helped by some recovery in economic activity. However, this recovery was not sustained and led to a double-dip recession from early 2011 that once more intensified job losses. In this relapse employment accumulated a further decline of around another 8 percent taking it to its cyclical trough in late 2013 to 26%, which was slightly lower than Greece (Figure B1). Since 2014, the economy started recording positive employment growth, entering officially into the *Recovery* period.

[Figure B1 about here.]

Job losses were highest among workers with temporary contracts (more than 1.7 million between 2008 and 2013), due to high reliance on the use of such contracts in the Spanish economy.[57] Although the losses were concentrated among temporary workers in the first stage of the crisis, very soon the dismissals of workers with open-ended contracts reached historical levels (Malo, 2015).

[53]Between 1995 and 2007, the Spanish economy experienced the longest expansion in its recent history, where the real GDP grew above 3.5% per year (Moral-Benito, 2018). During this period, Spain experienced one of the most important housing booms among developed economies. See Gonzalez and Ortega (2013); Akin et al. (2014); Sanchis-Guarner (2021) on the topic.

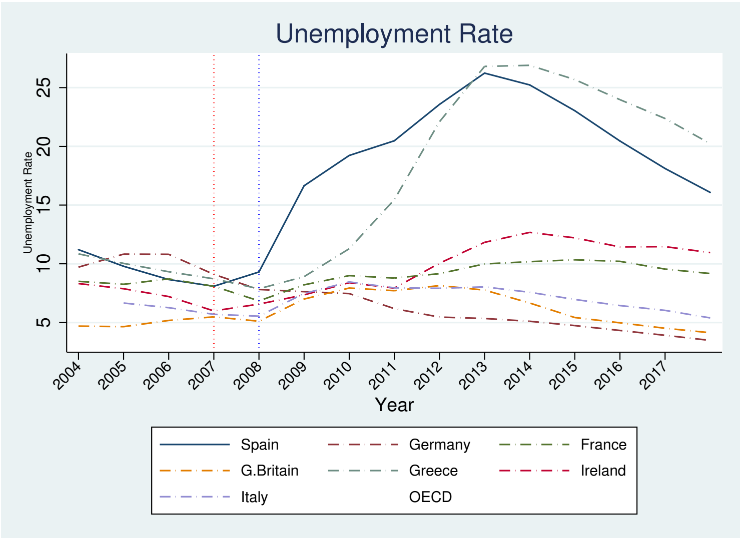
[54]This rigidity, due to various institutional features such as strong wage indexation to inflation, dual market structure or the collective bargaining system, makes it very difficult for wages to adjust to the economic cycles (Bentolila et al., 1994; Messina et al., 2010; De la Roca, 2014; Font et al., 2015). More importantly, the rigidity is found to be even stronger during economic downturns limiting wage adjustments in recessions (Font et al., 2015).

[55]The adjustment through employment margin is not unique to the Spanish context. Cadena and Kovak (2016) and Rothstein (2012) argue that during in the US, changes in average wages were relatively small compared to the substantial changes in employment during the Great Recession.

[56]Wage Dynamics Network (WDN) survey, conducted by the European Central Bank across the Eurozone, offers important insights into the effects of the crisis on firms and their adjustment during the 2010-2013 period. Survey results show that due to the wage rigidities, firms of all sizes and sectors made adjustment at the employment margin rather than wage margin. The report "Wage Dynamics in Europe: Final Report of the Wage Dynamics Network" is available at http://www.ecb.europa.eu/ home/pdf/wdn_finalreport_dec2009.pdf.

[57]Some seasonal activities (such as tourism) and or per-task activities (such as construction) have a higher share of temporary contracts compared to their total employment. However, they are not the main reason for the high reliance on temporary contracts. In fact, temporary contracts are more widespread in Spain than in other countries irrespective of the sector, industry or occupation (Malo (2015)). Also see Bentolila et al. (2012a) for a discussion on the role of temporary contracts in the increase in the unemployment rates in Spain.

Figure B1: Annual unemployment rate 2004-2017



Data Source: OECD

C Immigrant population

C.1 Immigration to Spain before and during the Great Recession

The decade between 1998 and 2008 has been characterized by one of the most significant immigration episodes in recent history among the OECD countries. Until 2009, Spain received an average of almost half a million immigrants annually, thus becoming the second-largest recipient of immigrants in absolute terms in the OECD after the United States (Arango, 2013). As can be seen in Figure C1, the immigrant share in the total population increased from 1.6% in 1998 to 12.1% in 2009, reaching to 5.6 million.[58]

[Figure C1 about here.]

A substantial portion of immigration to Spain was driven by labour market motives due to the strong economic growth (de la Rica et al., 2014). In addition to the economic pull factors, cultural and linguistic factors also played a role in shaping Spain's immigration experience. In addition to the cultural proximity, the special arrangements that allowed citizens of the former colonies to enter Spain without a visa generated large migration from Latin America (Bertoli and Fernández-Huertas Moraga, 2013, 2015).

Spain also received a substantial amount of family-based and retirement migration. Retirement migration is mainly composed of immigrants from the United Kingdom, Germany, France (which together account for two-thirds of immigrants from the EU-15 in Spain), and other northern European countries who are attracted to Spain by the country's temperate climate, among other factors.

As a consequence Spain has an extremely diverse immigrant population (de la Rica et al., 2014). Table C2 presents the top-15 largest communities by country of origin. In 2009, Morocco was the main country of origin representing almost 17% of total foreign-born population, followed by Ecuador (7.7%), Argentina (5.4%) and Colombia (5.2%) (C2). In terms of continent, immigrants originating from Central and Latin America represented 38% of total migrants, followed by Africans (25%) and EU27 nationals (25%).

[Figure C2 about here.]

Before the crisis in 2007, the average immigrant share in Spanish provinces was 8%. As can be seen in the map in Appendix O1, although immigrants settled across Spain, most of them settled in large cities or coastal provinces. For instance in 2007, the immigrant share in the total population of Barcelona and Madrid were 12.5 and 14.5%, respectively. In addition to clustering in large cities, many immigrants settled in coastal provinces with high levels of tourism and European retirees. Provinces such as Tarragona, Castellon, Almeria, Girona, the Balearic Islands, Alicante had immigrant shares above 15%. On the other hand, there were many provinces with extremely low levels of immigration: more peripheral provinces such as Coruña, Asturias or Lugo in the north; Cordoba, Jaén, Sevilla or Cádiz in the south; and provinces in central Spain all had immigrant shares that were 4-5 percentage points below the national average.

[58] This figure is calculated based on the nationality of the individual. Naturalisation rates are high in Spain, especially for those originating from Latin American countries. If, as opposed to nationality, one calculates this figure based on the country of birth of the individual the number is much higher. For instance in 2009, there were 6.4 million immigrant people, which makes the share of immigrant in the population 13.7%.

Immigrants to Spain integrated quickly to the labour market and exhibited a higher labour force participation rate compared to their native counterparts. This sets Spanish experience apart from what has been observed in the other European host countries (De La Rica et al., 2015). Especially immigrants from Latin American countries integrated faster: in the first year of arrival, their employment rates were equal to that of comparable natives (Amuedo-Dorantes and De La Rica, 2005). These immigrants specialized in occupations that are intensive in communication tasks, similar to the natives.

Overall immigrants to Spain had higher average years of schooling than natives, and thus their arrival contributed to increasing the average level of human capital in the country (Fernández-Huertas Moraga, 2014). Prior to the crisis, the average schooling and age of entering immigrants decreased (Fernández-Huertas Moraga, 2014). During this period, the employment share of immigrants in construction, services and domestic help rose markedly (Farré et al., 2011; Gonzalez and Ortega, 2011; Farr et al., 2011).[59] Focusing on the occupational distribution of immigrants, Amuedo-Dorantes and De La Rica (2005) found no occupational segreagation between EU immigrants and natives[60] while finding evidence for occupational segregation of non-EU immigrants into low-skill occupations. Over time, Eastern Europeans and Latin American immigrants experienced an improvement in their labour market conditions by moving up to better paid occupations, while no such progress was observed for Africans (Izquierdo et al., 2009). Female immigrants on the otherhand were confinend into a few "niche jobs" such as domestic service or childcare.

C.1.1 The Crisis: 2008-2014

The crisis caused a decrease in the immigrant population, driven by changes in immigrant inflows and outflows. Spanish Statistical Institute (INE) provides Residential Variation Statistics (EVR, or *Estadistica de Variaciones Residenciales,* in Spanish), a micro-data which records all individual moves originating or ending in Spain based on the Municipal Register of Population (*Padrón Municipal de Habitantes*, in Spanish). In Figure C3, I use this data to plot the annual volumes of international arrivals and departures for immigrant working-age male population. As can be seen from the figure, starting from end of 2007, entries dropped dramatically from more than 400 000 per year to below 200 000 in 2009, going all the way down to 40 000 in 2013.

[Figure C3 about here.]

Between 2009-2014, working-age male immigrant population saw a net decrease of 170 000. The departure of the immigrant created a labour supply shock between 0.1-1% annually.[61] Between this period, the total net outflow of working-age immigrant male population caused

[59] Figure C5 plots the evolution of immigrant working-age male population, as a share of total working-age male population by skill group. Between 2005 and 2009 period, the share of immigrants in the total low-skilled population increased from 12.3% in 2005 to 17.9% in 2009. During this time, share of immigrants in high-skilled population increased from 10.9 to 12.2%.

[60] Note that this study was published before the entry of Romania and Bulgaria to the EU. Thus only includes EU nationals who were member prior to 2007.

[61] The net decrease was even stronger when expressed as a share of the immigrant population. During this period 2.8% of the immigrant population left annually. The net decrease between 2009 and 2014 corresponded to 10.1% reduction in the immigrant male population in 2009. Native male population of working-age only decreased by 3.2% during this period.

a reduction of 1.1% in the total working-age male population and 6% in the working-age immigrant male population across Spain.[62]

[Figure C4 about here.]

Both in terms of numbers and as a share of the group's total population in Spain, most emigrants were Europeans and South Americans. Although Africans also emigrated their share in the total outflows was much smaller. During this period, number of immigrants from other country groups (e.g., China, India, USA, Canada, etc.) have increased although their share in the overall migrant population remained small.

In terms of skills, most of the outflow during the period happened for those who were low-skilled due to negative selection of immigrants who left after 2008 (Fernández-Huertas Moraga, 2014; Izquierdo et al., 2016). Figures C5 show the change in the immigrant population stocks between 2005 and 2017. The first graph displays the immigrant population stocks by the level of education while the second shows the same stocks as a share of the total population within that skill group. Individuals with a university degree or higher are considered high skilled, while those with less than a university degree are considered low skilled.

During the period of analysis, the immigrant share among decreased both among high-skilled and the low-skilled working-age male workers. The share decreased from 17.9 to 16.3% for low-skilled workers, and from from 12.2 to 11.6%, for high-skilled. Although not presented, these changes at the national-level were also reflected at the province level.

[Figure C5 about here.]

C.2 EU vs. extra-EU populations

Spain is part of the European Economic Area (which includes the EU) which provides freedom of movement across the area for the citizens of the member countries. The freedom of mobility can have significant consequences in the mobility choice of the individual. Following a contraction in the labour demand, a worker from a member country can leave Spain to another member state, with the knowledge of possible return in the future. On the other hand, a worker from a non-member country does not have freedom. First, he does not have the freedom to settle in another member country as his living permit is conditional on him finding a job before. Second, a worker who chooses to return home or to a third country has no guarantee of returning to Spain when the economy recovers.

Given these differences, it is possible that two migrant workers, one from the EU and other from a non-EU country, may choose different mobility strategies as an adjustment to the crisis. In this section, I check whether the differences in mobility options have an impact on the mobility choice of the migrants and see whether migrants drive any mobility options from either one of the groups. To do so, I use the EVR and exploit its individual level data to distinguish the immigrants by their nationality, and split them into two by whether they have the nationality of an EU member state or not.

[62]Immigrant populalation continued to decrease until 2016. Betwen 2009-2016, working-age male immigrant population saw a net decrease of 250 000, which corresponds to a 9 percent decrease in the working-age male population in 2009.

C.2.1 International arrivals and departures

International flows from/to Spain can be impacted differently depending on whether the individual has a EU passport or not. If the outflows are dominated by the mobility of those with EU passport, then the cushioning effects found in the main section are related to free mobility of workers within a customs union.

To investigate whether this is the case, I split the flows by nationality, between those with a passport belonging to one of the EU countries vs. those with a passport from extra-EU countries. Figures show the annual volumes of international arrivals and departures for immigrant working-age males. Figures do not display any striking difference between the two groups.

[Figure C6 about here.]

I can formally test that there is no change in the trend in immigrant stocks during this period from all countries of origin using Padrón. More specifically I use the following equation:

$$ln(Foreign_{n,t}) = \delta_n + \delta_t + \beta EU_{n,t} + \varepsilon_{n,t}$$

where $Foreign_{n,t}$ is the total number of working-age immigrants from country n at year t. EU is a dummy variable that takes value equal to 1 if the country is member of the EU and thus its citizens benefit from free mobility at time t. If $\beta = 0$, it would be evidence that the mobility patterns are not different between EU and non-EU nationales. If instead $\beta \neq 0$ then it would be mean that the mobility of the EU nationals changed during the period. I also include country fixed effects (δ_n) and time fixed effects (δ_t).

[Table C1 about here.]

Table C1 shows the results. Column 1 shows that there is no systematic change in the stock of immigrants from EU member countries during the crisis. In this first column, I focus on the years between 2007, the year before the crisis and 2014, the final year of the Recession. In column 2, I change the end period to 2016, the last year where the net outflow is positive. Regardless of the period, the results show that there is no change in the migration patterns during the Recession. In columns 3 and 4, I estimate the same regression in first differences, including the time fixed effect. Here the estimates are negative yet not statistically significant.

Both the figure and the results suggest that the mobility of the EU nationals did not differ from the mobility of the nationals of non-EU countries. This finding is also consistent with Basso et al. (2019), who do not find any difference in population elasticity to employment between EU and non-EU borns across EU countries during the period 2007-2016.

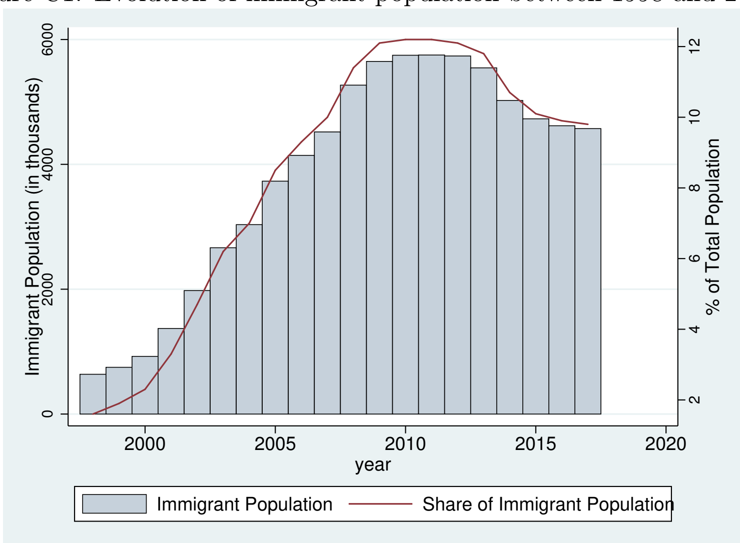
C.2.2 Domestic vs. international departures

Similarly, one could wonder whether mobility choice between EU vs. non-EU nationals can be different in terms of international vs. domestic moves. For instance, an EU national can leave the economically distressed location and choose to move to another member State, while a non-EU national can decide to move domestically.

Using the EVR, I show the annual volumes of international and domestic departures for immigrant working-age males. In the left panel of the figure, it can be seen that the crisis has decreased the number of moves within Spain for the EU nationals marginally. The international departures however increased gradually, with a jump in 2013. Right panel, shows the moves by immigrant without the EU passport. The figure shows that, while international moves increased starting from 2008, the number of internal moves decreased dramatically. This reduction can be due to migrants choosing to reduce their mobility due to tighter labour market conditions as discussed in Section 3. The figures show that for both groups, departures with a destination abroad or within Spain changed similarly.

[Figure C7 about here.]

Figure C1: Evolution of immigrant population between 1998 and 2017



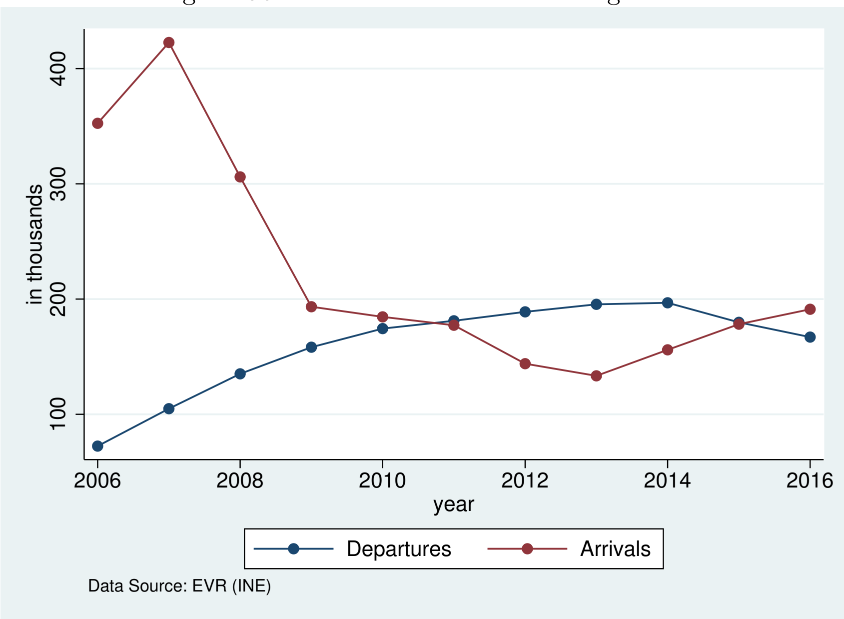
The figure plots the evolution of the immigrant population (both male and female of all age groups) and its share as of total population. Data source: Spanish Statistical Institute (INE)

Figure C2: Top 15 immigrant communties in Spain in terms of population size

	Population		% of total population	
Country-of-birth	2009	2014	2009	2014
Morocco	387055	384267	16.7	17.5
Ecuador	178860	173881	7.7	7.9
Argentina	124136	110095	5.4	5.0
Colombia	119959	126205	5.2	5.8
United Kingdom	119811	83518	5.2	3.8
France	90674	83839	3.9	3.8
Germany	86039	70457	3.7	3.2
Bolivia	81800	57894	3.5	2.6
Portugal	76940	55874	3.3	2.5
Peru	74724	72453	3.2	3.3
Bulgaria	74230	63497	3.2	2.9
China	61872	69750	2.7	3.2
Venezuela	59705	64530	2.6	2.9
Brazil	51404	34126	2.2	1.6
Italy	46365	50301	2.0	2.3

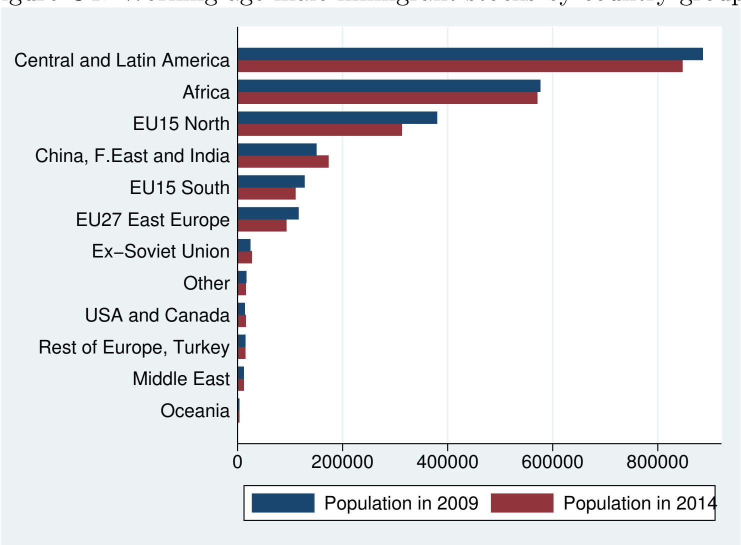
Data source: Spanish Statistical Institute (INE)

Figure C3: International flows of immigrants



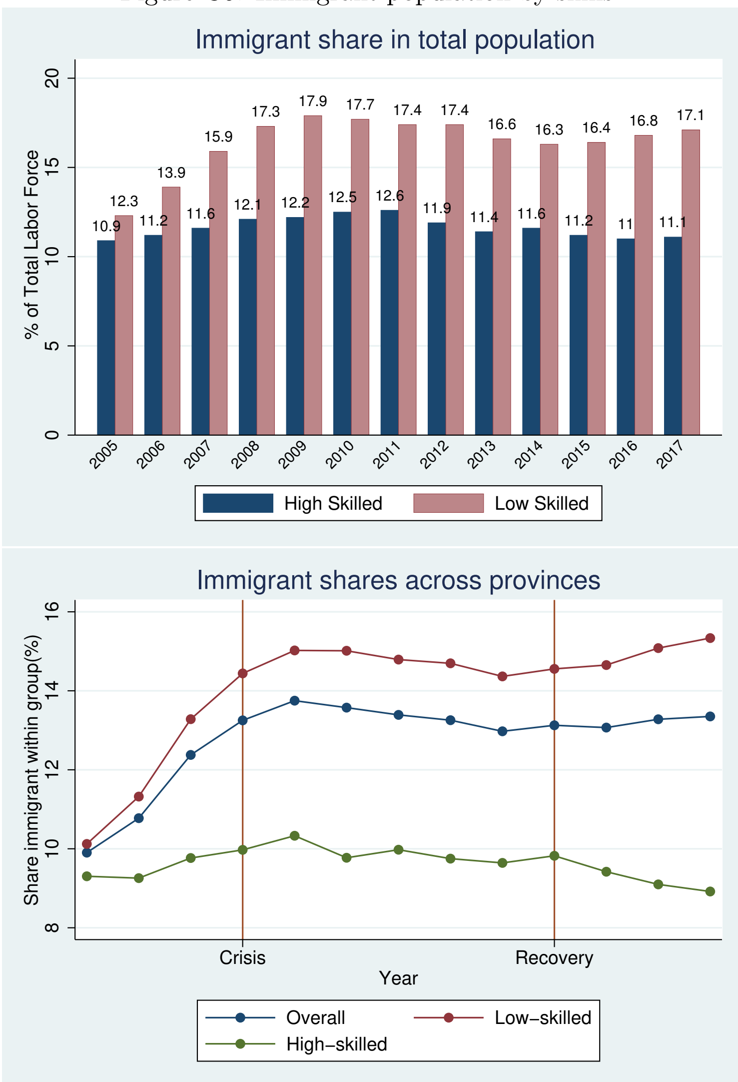
The figure presents the total flows in and out of Spain for the immigrant working-age male between 2006-2016.
Data source: Residential Variation Statistics (EVR)

Figure C4: Working-age male immigrant stocks by country groups



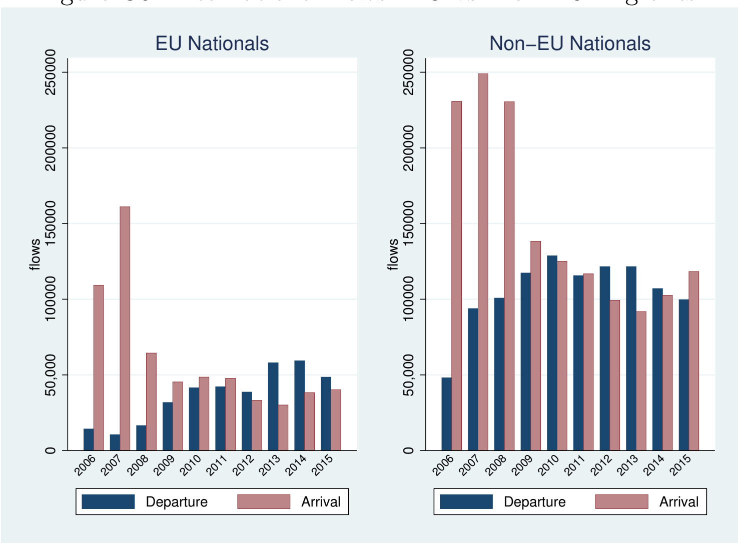
Data source: Spanish Statistical Institute (INE)

Figure C5: Immigrant population by skills



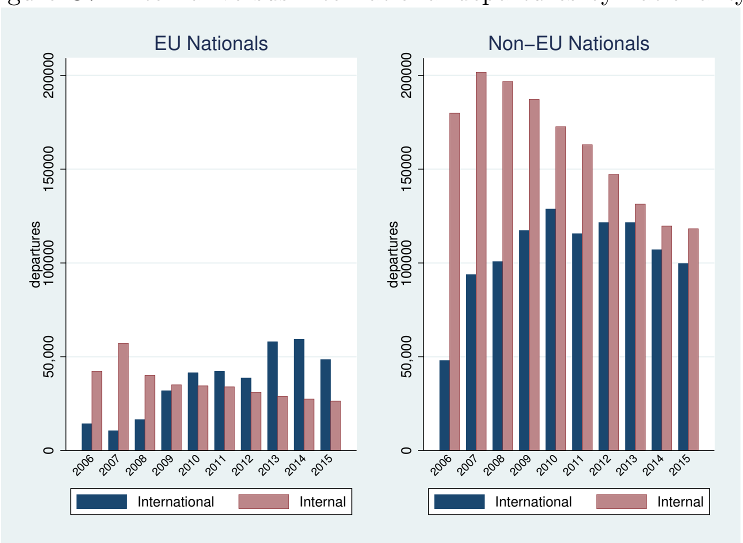
Note: First figure plots the number of working-age male immigrant population. Second figure plots the share of immigrants among low and high-skilled labour force. Third figure plots the (unweighted) average share of immigrants among overall, low and high-skilled working-age male population across 50 provinces. Shares are calculated for working–age male population. Data source: Spanish labour Force Survey (EPA).

Figure C6: International flows: EU vs. non-EU migrants



The figures present the total flows in and out of Spain for the immigrant working-age male between 2006-2016 separately for EU nationals (left-panel) versus non-EU nationals (right-panel).
Data source: Residential Variation Statistics (EVR)

Figure C7: Internal versus international departures by nationality



The figures present the total internal (i.e., domestic) and international flows for the immigrant working-age male between 2006-2016 separately for EU nationals (left-panel) versus non-EU nationals (right-panel).
Data source: Residential Variation Statistics (EVR)

Table C1: Immigrant population stocks: EU vs. non-EU migrants

	Ln(Pop)		Change in Ln(Pop)	
	2007-2014	2007-2016	2009-2014	2009-2016
EU27=1 × after=1	0.0270	0.0022		
	(0.035)	(0.042)		
EU27=1			-0.0489	-0.1053
			(0.045)	(0.064)
N	903	1129	113	113
Adj R2	0.996	0.995	0.007	0.018

The table reports OLS estimates for the change in immigrant stocks in Spain, by country of origin n at year t. Regressions are estimated for 113 countries. Columns 1 and 2 include time and country fixed-effects, while columns 3 and 4 include only year fixed-effects. Standard errors are clustered at the country of origin level. Data source: Spanish Statistical Institute (INE)

$^{*}p < 0.10, ^{**}p < 0.05, ^{***}p < 0.01$

D Government measures

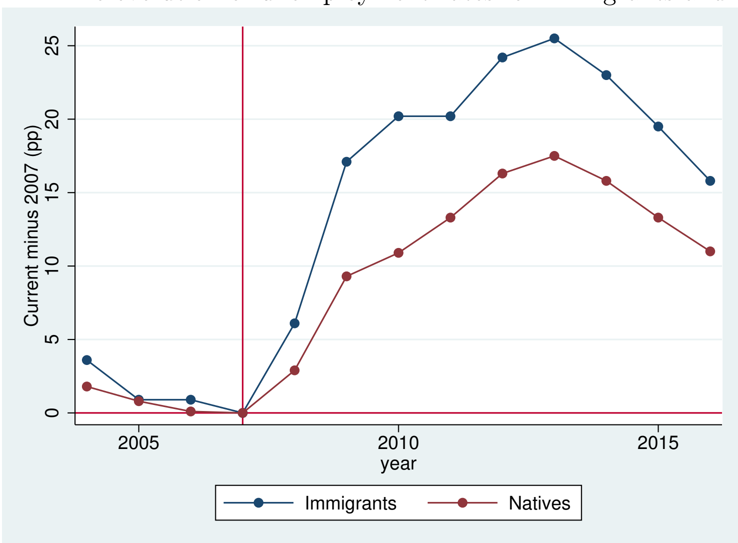
Faced with increasing unemployment, the Spanish government took various measures to reduce the entries and encourage returns of the foreigners. First, the shortage lists that are used for both the Regime Generale, which exempts nominal requests from a market test and the *Contingente*, used as criteria for anonymous recruitment from abroad, were curtailed significantly. In October 2008, the quarterly *Regime Generale* "catalogue of difficult-to-cover occupations" contained 32% fewer occupations than the previous list. The occupations which were eliminated, however, represented almost all hiring from abroad. Some occupations (painters, care assistants, waiters, bricklayers, welders, electricians, carpenters, locksmiths, cooks, gardeners, agricultural ers) disappeared altogether. Only very specific occupations (sports, trainers, doctors, neurosurgeons, dentists, optician, nurses or physiotherapists; specialized mechanics) – mostly qualified – remained. These cutbacks continued in the first list for 2009. The reduction was the sharpest that was observed in the whole OECD (OECD, 2009). Second, the ceiling for non-seasonal workers to be recruited anonymously from abroad (the *Contingente*) was reduced (OECD, 2009). In mid-December 2008, the Contingente, which sets annual regional caps by occupation for workers, was set at 901 for 2009, compared to 15 731 in 2008.

In addition to reducing the inflows, the government also tried to increase outflows in order to support voluntary returns of unemployed, Spain developed the Program for Early Payment of Unemployment Benefits to Foreigners (the *APRE*) in 2008 which allowed third-country nationals to receive on advance an accumulated payment of their unemployment benefits in two lump sums on the condition they return home and do not come back to Spain for at least three years. The proposal provided 40% of the benefit in Spain and 60% upon return and became active in November. Only the 19 countries with bilateral social security agreements are eligible, and the offer is not valid for EU citizens. While the government initially expected many unemployed to apply, uptake did not reach the targets. 11 419 unemployed immigrants, mostly from Latin America, signed up for the program by April 2010, while the government calculated that more than 80 000 were eligible. It is, however, difficult to evaluate, at this stage, the full impact of this program even if experience has shown that financial incentives are usually insufficient to drive large return migration.

E Differences in unemployment rates

[Figure E1 about here.]

Figure E1: The evolution of unemployment rates for immigrants and natives



The figure plots the evolution of unemployment rates for immigrants and natives normalised by the levels in 2008.

Data source: Spanish Statistical Institute (INE)

F Reconciling with Cadena and Kovak (2016)

In recent work, focusing on the context the Great Recession in the USA, Cadena and Kovak (2016) showed that immigrant workers (or at least low skilled migrants from Mexico) respond to changes in local labour demand through mobility across areas much more than their native counterparts. In consequence, the higher mobility of the immigrants reduces the spatial differences in employment and equilibrates the local labour markets.

In this section, I replicate their key findings for 50 Spanish provinces for the period 2009 and 2014. I do this exercise to bridge the results of Cadena and Kovak (2016) with mine.

F.1 Population responses to employment shocks

I start by exploring the differences in the population responses to employment shocks. In Figure 1 of Section 3.2, I compare the differences between native-born and immigrant working-age men, for all skill groups. Figure F1 compares the mobility response of the low-skilled men (top panel), and of the high-skilled men (lower panel). These figures confirm that immigrant in Spain also respond more strongly to local demand shocks than the native-born population. Similar to the Cadena and Kovak (2016), these differences are especially striking for the low-skilled population.

[Figure F1 about here.]

F.2 Immigrant mobility and native employment outcomes

As shown previously, immigrant workers leave areas experiencing labour demand shocks at a much faster rate than the natives. Cadena and Kovak (2016) argue that this higher mobility smooths the employment effects of local labour demand shocks on the native population living in the area.

To test this mechanism, they study the relationship between local change in the employment rate and the local demand shock. They argue that the elasticity of employment rate to the local demand shock should be weaker in areas where the mobility is higher. More specifically, they measure this smoothing effect by splitting the cities into two groups: those with above-median Mexican-to-population share before the crisis vs. those who have below-median Mexican-to-population share.

I repeat this exercise by splitting the provinces by their immigrant-population share in 2007 and regress the following equation separately for each group:

$$\triangle ln(Emp.Rate^{g}_{j,t}) = \beta^{g} \triangle ln(Employment^{g}_{j,t}) + \delta_t + \varepsilon^{g}_{j,t}$$

where the dependent variable is the change in log of employment rate (employment to population ratio) for the group g (high-skilled, low-skilled etc.), located in province j , in time t. The independent variable is the change in the group-specific log employment and δ_t is the time fixed effects.

[Table F1 about here.]

Table F1 reports the OLS results which confirm that the findings of Cadena and Kovak (2016) are also valid in Spain. The relationship between the employment rate and the labour demand shocks are much weaker in areas with high concentrations of immigrant workers. Columns 3 and 6 show that the relationship is almost 50% weaker for low-skilled native workers, which is exactly the same rate found in Cadena and Kovak (2016) for the US cities. Columns 2 and 5 show that the high-skilled also benefit from this mobility although, given the standard errors, it is not possible to reject the hypotheses that the elasticities are statistically different from each other.

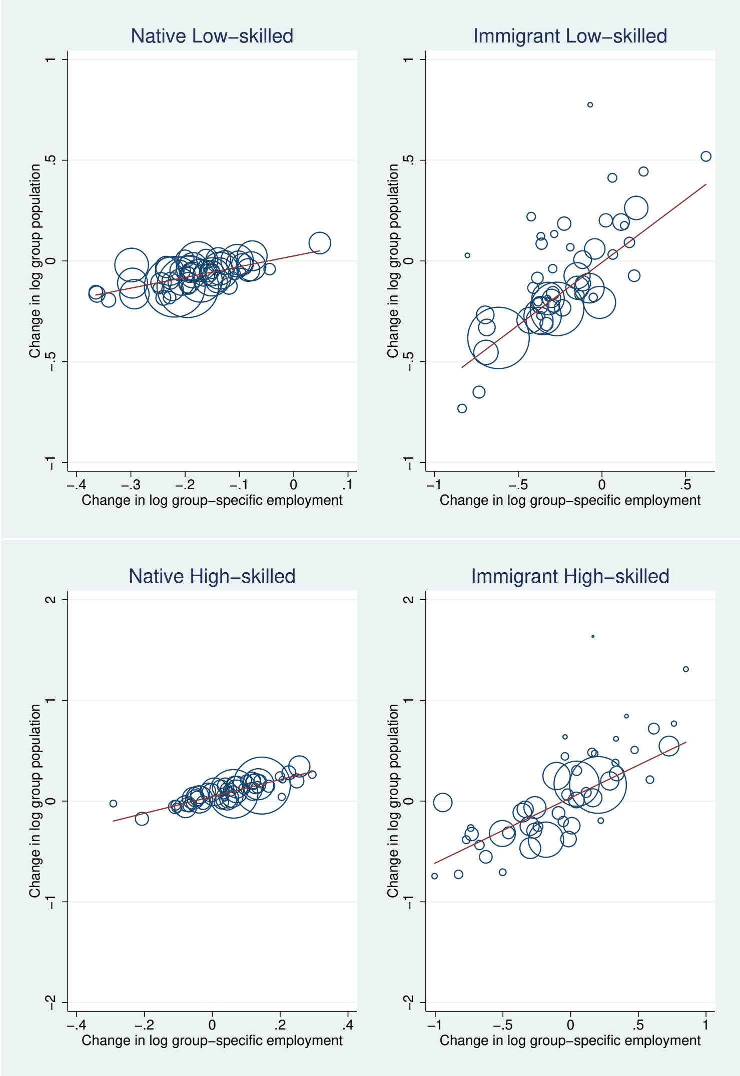
F.3 Immigrant outflows and native employment outcomes

Cadena and Kovak (2016) establish two important facts: i) that migrants are more mobile than natives, ii) natives located in areas with the higher migrant population before the crisis experienced reduced job losses due to labour demand shock. In this paper, I bring these two mechanisms together and show precisely how the immigrant outflows can reduce the incidence of a negative demand shock on natives. In order to bridge my approach with that of Cadena and Kovak (2016), I repeat the exercise in Section F.2, but split the provinces by the intensity of the outflows (treatment). Precisely, I measure the total outflows (normalized by the population in the base period) each province experienced between 2009 and 2014 and split the provinces into two groups according to the intensity of the outflows: those that experienced outflows that are above-median treatment vs. those with below-median treatment intensity.

[Table F2 about here.]

Table F2 presents the regression results. Overall the relationship between the employment rate and the labour demand shocks are much weaker in areas with higher intensity of immigrant outflows. The difference is especially significant for natives who are low-skilled. These findings confirm that my measure of outflows measure captures well the mechanism proposed in Cadena and Kovak (2016). I explore this mechanism in a more rigorous and causal framework in the rest of the paper.

Figure F1: Population responses to employment shocks: Native vs immigrant men



The figures plot the population responses to employment shocks of working-age native (left-panel) and immigrant (right-panel) men, separately for low-skilled (higher panel) and high-skilled (lower panel). Changes are calculated as the long difference in logs from 2009 to 2014. Each circle corresponds to one of the 50 provinces. Observations are weighted by the group population in 2009.
Data source: Spanish labour Force Survey (EPA)

Table F1: Immigrant presence and employment outcomes of natives

	Above Median			Below Median		
	(1) Native	(2) Native HS	(3) Native LS	(4) Native	(5) Native HS	(6) Native LS
Ch. Native	0.4945			0.7661		
	(0.065)***			(0.052)***		
Ch. HS Native		0.3170			0.3546	
		(0.058)***			(0.046)***	
Ch. LS Native			0.3583			0.6325
			(0.053)***			(0.051)***
N	125	125	125	125	125	125
Adj R2	0.78	0.46	0.69	0.82	0.40	0.76

The table reports OLS estimates where the dependent variable is the change in log employment rates (employment to population ratio) and independent variable is the change in the log employment of the relevant group, similar to Cadena and Kovak(2016). Columns 1-3 present the results for provinces with an above-median immigrant population and columns 4-6 with a below-median immigrant population in 2007. Regressions are estimated annually across 50 provinces between 2009-2014 (5 periods) and include year fixed-effects. Regressions are weighted by group-specific population in year -1. Standard errors are clustered at the province level.

Data source: Spanish labour Force Survey (EPA)

$^{*}p < 0.10,^{**} p < 0.05,^{***} p < 0.01$

Table F2: Immigrant outflows smooth employment outcomes

	Above Median			Below Median		
	(1) Native	(2) Native HS	(3) Native LS	(4) Native	(5) Native HS	(6) Native LS
Ch. Native	0.4900			0.7470		
	(0.069)***			(0.049)***		
Ch. HS Native		0.3167			0.3533	
		(0.058)***			(0.042)***	
Ch. LS Native			0.3493			0.5764
			(0.065)***			(0.058)***
N	125	125	125	125	125	125
Adj R2	0.75	0.48	0.65	0.84	0.39	0.77

The table reports OLS estimates where the dependent variable is the change in log employment rates (employment to population ratio) and the independent variable is the change in the log employment of the relevant group. Columns 1 to 3 present the results for provinces that have an above-median immigrant outflow rates betwen 2009-2014, while those with a below-median immigrant outflow rates are in columns 4 to 6. Regressions are estimated annually across 50 provinces between 2009-2014 (5 periods) and include year fixed-effects. Regressions are weighted by group-specific population in year -1. Standard errors are clustered at the province level.

Data source: Spanish labour Force Survey (EPA)

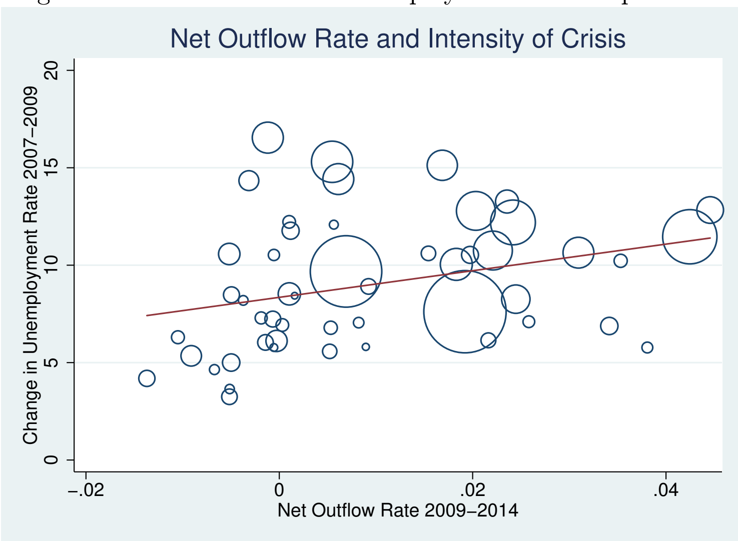
$^{*}p < 0.10,^{**} p < 0.05,^{***} p < 0.01$

G Unemployment rate and immigrant outflows

Provinces which experienced stronger increase in the unemployment rate between 2007-2009 also saw higher departures (G1). I use the increase in the unemployment rate between 2007 and 2009 for two reasons. First, the dramatic and sudden increase in the unempoyment rates happened during this period. In that sense, this measure captures well the depth of the crisis in each province. Second, I prefer using the increase in this period, as opposed to longer periods, as they are not dampened by the outflows that took place starting 2009 and thus reflect the initial demand shock. See Yagan (2019) for a similar approach. The correlation presented in the figure is robust to using longer windows.

[Figure G1 about here.]

Figure G1: Net outflow and unemployment rates in provinces

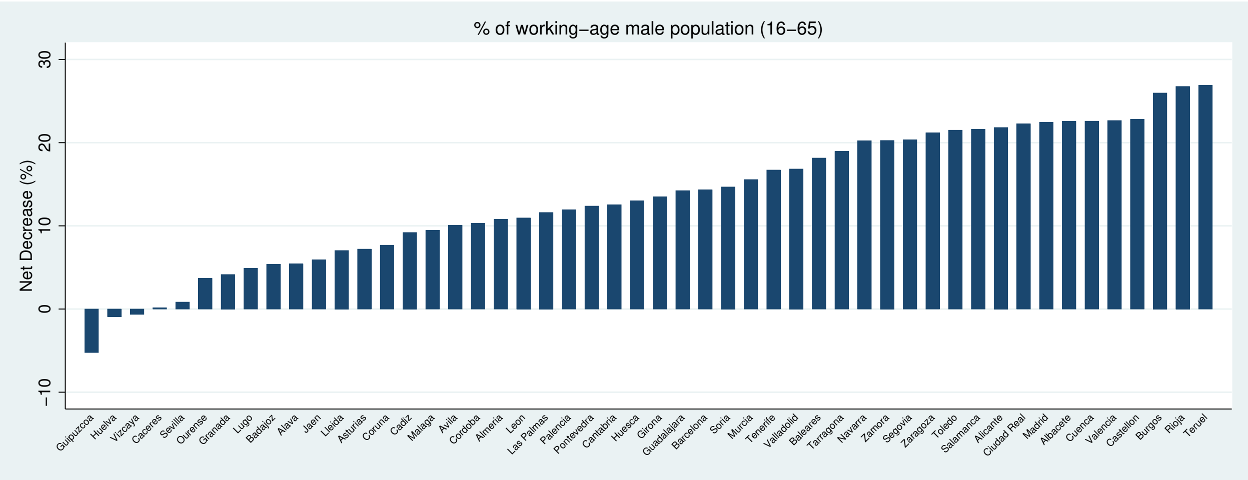


The figure plots an increase in the unemployment rate between 2007 and 2009 (y-axis) and net outflow rate of the immigrant population between 2009 and 2014 (x-axis). Each point corresponds to one of the 50 provinces, excluding Melilla and Ceuta. Each observation is weighted by province immigrant population in 2009.
Data source: Spanish Statistical Institute (INE)

H Net immigrant departures as a share of total working-age immigrant population

[Figure H1 about here.]

Figure H1: Net change in immigrant population relative to group population by province 2009-2014



The figure plots the net change in the total immigrant male working-age population between 2009 and 2014, as a share of the total working-age immigrant male population in 2009. Positive bars correspond to the net outflow of the population.
Data source: Municipal Register of Population (Padrón)

I Further details on data sources

I.1 Constructing social security panel

An individual enters the sample if he registers one day of activity with social security, between 2005-2016 and is kept in subsequent editions. Once in the sample, MCVL records any changes in individual's labour market status or job characteristics (including changes in occupation or contractual conditions within the same firm) since the date of first employment. I combine multiple editions of the MCVL, and use the unique individual identifiers across waves to construct a panel that has the complete labour market history for a random sample of approximately 4% of all individuals who have worked, received benefits or a pension in Spain at any point since 2004. By combining multiple waves, I enlarge the sample by including individuals who have an affiliation with the Social Security in one year but not in another. This allows me to maintain the representativeness of the sample throughout the study period. Individuals who stop working remain in the sample while they receive unemployment benefits or a retirement pension, and drop from the sample when their unemployment benefits run out, if they die or leave the country permanently.

I.2 Registering population living in Spain

As discussed earlier, individuals living in Spain, whether they are natives or immigrants, are obliged to register to the Municipal Register of Population (Padrón Municipal de Habitantes), to benefit from public services such as health care, childcare or education. All newborn children are immediately registered before discharge, and deceased individuals are removed upon death. If unregistered, individuals do not have access to any of these services. As it is the data covers close to 100% of the population (Fernández-Huertas Moraga et al., 2019).

Immigrants have additional incentives to register, which makes this data particularly important for recording foreigners that are residing in Spain, both legally and illegally. Since 2000 (*Ley Organica 4/2000*), regardless of their status, registered immigrants have been entitled to make use of the public health system and education with no risk of detention by the authorities. This incentivizes the illegal immigrants to report their presence (Bertoli et al., 2013). Moreover, registration has been used to prove residency in the periodical regularizations (*Ley Organica* 4/2000). Hundreds of thousands of immigrants took advantage of being duly registered in the 2000, 2001 and 2005 amnesties (see Monras et al. (2019) for the impact of the last regularization wave).

Due to this structure, municipal registers provide precise numbers on the immigration and internal moves. However, the numbers are less precise in recording emigration due to several reasons. First, individuals register and de-register on the basis of their planned length of stay in the country (for entries) or the planned length of absence from the country (for exits), so some individuals may leave the country without de-registering if they plan to return shortly. Moreover, some individuals may prefer not to de-register to keep their entitlements associated with residency. Finally, individuals may simply not think about de-registering as, unlike registering, it does not provide any additional benefits.

Since January 2006, the INE corrects this by requiring local authorities to de-register immigrants if they do not confirm their residence within two years. Once a registration is deleted, it is counted in the official data as a departure to an unspecified destination country. Thus, since 2006 data includes all internal departures and return migrations which are registered, but also changes due to non-renewal of residency within two years.[63]

I.3 Delays in the departures

Padrón is a very useful tool for accounting immigration and internal moves. Regarding the departures however the data suffers from both undercounting and differences in the exact timing of the departure and the deletion from the registers. In this section, I discuss both issues and show that empirically they do not pose a threat to my findings.

As discussed earlier, due to lack of incentives, those who leave do not necessarily take the time to de-register. This problem has been partially addressed for the foreigners as, since 2006, individuals who do not renew their registry are deleted from the Padrón registers. Although the deletion process corrects for the departures, it can have a delay of up to two years. Analysis using the long differences in Section 10, partially addresses this problem as, rather than focusing on the precise impact of annual departures it covers a longer time period which is longer than the two year window. For instance, in column 3 of Table 13 where regressions are done in three year differences, I still get significant results.

In order to alleviate concerns on the issue further, I provide additional results where I use the average of the departures in t-1, t and t+1. columns 1 and 3 of Table I1 show the main results for comparison, while columns 2 and 4 present results where the treatment is the average of the three years. It can be seen that coefficients are slightly larger when using the three year averages, and highly significant. More importantly, the measurement issue, and the potential lags in the deletions do not bias my results.

[Table I1 about here.]

[63]This rule only applies to immigrants without an EU nationality or a permanent residence permit. In case of non-renewal of the residence, the deletions are carried out automatically, exactly two years after the day of registration. This means that Padrón records can suffer from measurement error in terms of exact timing of the departure, and depending on the nationality of the departed individual. I discuss further these issues in Appendix I and show that they do not cause any empirical problem for my results.

Table I1: Robustness: Three year average treatment, 2009-2014

	Wage		Employment	
	2SLS	2SLS	2SLS	2SLS
Net Outflow Rate	2.0286		2.4122	
	(0.609)***		(0.752)***	
Three year average		2.6842		3.1484
		(0.737)***		(1.078)***
N	250	250	250	250
KP F-Stat	17.45	8.27	17.45	8.27

The table reports 2SLS estimates for the impact of net outflow rate of the immigrant population in a province, measured as the decrease in the number of the working-age male immigrant population between t and $t-1$ as of total working-age male population in year $t-1$, on native wage (columns 1-2) and employment growth (columns 3-4). Predicted net outflow rates are used as instruments. Net Outflow Rates in columns 2 and 4 are measured as the average of the decrease across three years. Rate in period t is the average departure rate of period $t-1$, t and $t+1$. Regressions are estimated annually, across 50 provinces between 2009-2014 (5 periods). Regressions are weighted by employment in the base year and include year-fixed effects. Standard errors are clustered at the province level.

Data source: Continuous Sample of Employment Histories (MCVL), Municipal Register of Population (Padrón) and Spanish Statistical Institute (INE)

$^{*}p < 0.10, ^{**}p < 0.05, ^{***}p < 0.01$

I.4 Measuring emigration of Spanish nationals

Measurement of the emigration of Spanish citizens can be particularly problematic as they are not required to renew their inscription in the Padrón. A national will be removed from Padrón, only if he or she registers at a Spanish consulate abroad, in which case the person would be included in the Register of Spaniards Living Abroad, or PERE (*Padrón de Espanoles Residentes en el Extranjero*, in Spanish). Many Spaniards living in another country do not register in a consulate because it conveys little or no advantage. On the other hand, those who are removed from the Padrón lose their health care and other subsidies or benefits, and many find it harder to exercise their voting rights in Spain(Arango (2016); González-Ferrer and Moreno-Fuentes (2017)). Furthermore registering in a consulate may not be convenient, as it requires producing an official document attesting that the emigrant will stay abroad for more than a year. Due to these issues, it is likely that both Padrón and the PERE underestimate the number of Spanish emigrants, particulary the native born.

This measurement issue of the native outflows may not be of an empirical issue for a few reasons: First, I am using the native-born outflows as a control variable. Since I am not interested in the precise magnitude of the coefficient, the overestimation of that particular coefficient is not problematic. Second, it includes departures abroad but also to other provinces. Although Padrón mismeasures the emigration, it is very precise for internal flows. Given natives' low rates of emigration, this reduces the importance of the issue even further. Third, I am using a differences-in-differences estimation strategy comparing the relative changes across provinces. Given that the mismeasurement issue is a valid concern for all of the provinces, it should not bias the estimated coefficients. Furthermore, I am taking first differences which absorbs any province-specific fixed characteristics. If for some reasons, certain provinces systematically under/over-report native departures, it should be taken care in the first differences.[64]

J Construction of the instrument

J.1 Predicting native population

As discussed in the Section 5.2.2, native population residing in a given province might depend on the number of immigrant in the same location or on unobservables correlated with the labour market outcomes. To address the issue, I use a shift shift-share strategy to predict the location choice of natives, based on their past distribution across Spain.

Following a strategy similar to Sanchis-Guarner (2021) and Edo et al. (2019), I use the past distribution of natives based on their province of birth (the "share"), and distribute the current population (the "shift") accordingly.

The strenght of the instrument depends on the historical mobility of natives from different provinces and the strength of ethinc networks. Some regions have historically had larger mobility propensities (Galicia), and some bilateral internal migration flows are based on historical location patterns (for example Galicians in Madrid or Andalusians in Cataluña). A person born in a given province b can either stay where he/she was born (stayers) or can move and

[64] The central government determines the level of local fundings in municipalities based on the population stocks using Padrón. This can incite local authorities to inflate the population numbers in order to increase their funding.

reside in a different province $j \neq b$ (movers). R is the total number of provinces in Spain in which natives can locate. I need individual level data to know the province of birth. For this purpose I use native location patterns from census 1991 as base year. I define the share of stayers in province j as the proportion of natives born and living in a province over all the natives born in the province (regardless of where they reside) in 1991 . In this case, the province of birth and residence is the same, i.e j= b. The stayers share is defined as follows:

$$Share^{b}_{j(j=b),1991} = \frac{natives^{b}_{j=b,1991}}{\sum_{j}^{R} natives^{b}_{j,1991}} \tag{J1}$$

To obtain yearly predictions of the number of immigrants by nationality n, I multiply expression J1 by annual national stock of natives $natives^{b}_{t}$ of province b living in Spain in period t. The imputed native stock of a specific province b in province j at time t is thus calculated allocating yearly total stocks weighted by its historical share (7.3):

$$\widehat{natives}^{b}_{j,t} = (natives^{b}_{Spain,t}) * share^{b}_{j,1991} \tag{J2}$$

To calculate the imputed total native stock in province j at time t, I sum (J2) across provinces of origins (R):

$$N^{\widehat{Natives}}_{j,t} = \sum_{n}^{R} (\widehat{natives}^{b}_{j,t}) \tag{J3}$$

J.2 Predicting immigrant population in Spain: Gravity Equation

The instrument's validity is conditional on immigrant outflows and labour market outcomes of natives being orthogonal to the local economic shocks. Given that the national shock (which is the sum of local shocks) partially determines the national stock of immigrants in Spain, this can create concerns about endogeneity. To address this concern, I construct instruments where I use national population stocks of immigrants that are predicted through a gravity equation that is based on factors that are specific to the country of origin (push factors) that are plausibly exogenous to local shocks in Spain.[65]

I follow a similar strategy to Saiz (2007); Ortega and Peri (2009); Sanchis-Guarner (2021); Bahar and Rapoport (2018) and compute the yearly predicted total stock of immigrants by country of origin from the results of a gravity model which depends only on push factors which are specific to the country of origin of the immigrants. Specifically I follow Frankel and Romer (2019), I use a gravity-type model that only contains push-factors from origin to predict the total stocks from nationality n in Spain in a given year t.[66] The estimated equation is:

$$ln(N^{n}_{Spain,t}) = \chi' ln(Economic_{n,t-1}) + \psi' ln(Geographic_{n,t-1}) + \eta_g + \vartheta_t + \upsilon_{n,t} \tag{J4}$$

[65]The endogeneity of national shocks to the immigrant stocks at local units is especially a valid concern if the spatial units are small and the economic conditions that attract immigrants are spatially correlated. For instance, the economic condition in large provinces such as Madrid or Barcelona could influence the total number of immigrants deciding to come to Spain, even if they end up locating somewhere else in the country based on their ethnic networks.

[66]Some examples of other studies that use a gravity model to instrument for migration stocks are Saiz (2007); Felbermayr et al. (2010); Ortega and Peri (2014); Alesina et al. (2016); Sanchis-Guarner (2021); Bahar and Rapoport (2018).

where $Economic_{n,t-1}$ is a matrix of (lagged) time-varying economic conditions of the sending country (log of gross domestic output in real terms, square of GDP, log of total population, percentage of urban population, log of used argricultural area, value added of services, value added of industry, average years of life expectancy, unemployment rate and a dummy of belonging to the EU27). $Geographic_{n,t-1}$ is a matrix of time-invariant geographic characteristics of the sending country (log of distance to Spain, log of area, number of cities, latitude and longitude and dummies for common language, common border and common colonial past with Spain). I include year dummies ϑ_t and country-group dummies η_g. I can alternatively include country dummies, which drops the time-invariant variables. The economic and country specific variables come from the World Bank, the geographic and distance variables come from Centre d'Études Prospectives et d'Informations Internationales (CEPII).

I run this regression using data for 109 countries, which represent more than 98% of the immigrant stock into Spain for the period. Results for different specifications are showed in table J1. Column titles correspond to the log transformations. In columns 1 and 2 include country fixed-effects while column 3 includes only region fixed effects. All the models have high predictive power.

From the results 1 in Table J1 I recover the predicted stocks of immigrant in Spain from nationality n for every year 1988-2017. I use the prediction from estimates from column 1 for the construction of the instrument, and I use the rest of the specifications estimates for the robustness checks. These predicted stocks replace annual national stock of immigrants ($N^n_{j,t}$) term in equation 15.

[Table J1 about here.]

Table J1: Gravity equation: Predicting immigrant population in Spain

	Log(Male)	asinh(Male)	Log(Male)
L.Log GDP	1.0429	1.0428	1.1833
	(0.330)***	(0.330)***	(0.607)*
L.Log Population	-1.3320	-1.3337	-33.0600
	(5.140)	(5.139)	(12.295)***
L.Log Urban Pop	-4.1464	-4.1448	-15.7568
	(9.278)	(9.278)	(18.014)
Log of GDP squared	0.5235	0.5235	0.1973
	(0.175)***	(0.175)***	(0.422)
Dummy for EU27=1	546.3180	546.3125	-0.0668
	(4949025.461)	(4948817.125)	(0.381)
L.Log Land Area	2.8137	2.8132	1.2796
	(8.567)	(8.567)	(13.352)
L.Life Expectancy	0.0037	0.0037	0.0119
	(0.033)	(0.033)	(0.033)
L.Agricultural Land	-0.0128	-0.0128	-0.0021
	(0.013)	(0.013)	(0.005)
L.Services, VA	0.0000	0.0000	0.0000
	(0.000)	(0.000)	(0.000)
L.Industry, VA	-0.0130	-0.0130	0.0083
	(0.010)	(0.010)	(0.011)
L.Unemployment Rate	0.0107	0.0107	0.0219
	(0.008)	(0.008)	(0.022)
L2.Log GDP	-1.4668	-1.4668	-2.3342
	(0.450)***	(0.450)***	(0.778)***
L2.Log Population	-0.8043	-0.8026	34.3745
	(5.159)	(5.158)	(12.272)***
L2.Log Urban Pop	5.3849	5.3834	17.9993
	(9.266)	(9.266)	(17.857)
L2.Log Land Area	15.4207	15.4203	-1.1598
	(5.115)***	(5.115)***	(13.339)
Common Official Primary Lang=1	0.0000	0.0000	0.9277
	(.)	(.)	(0.654)
Language Spoken=1	0.0000	0.0000	1.5103
	(.)	(.)	(0.305)***
Common Colonizer=0	0.0000	0.0000	0.0000
	(.)	(.)	(.)
Log Distance Capital	0.0000	0.0000	-2.5575
	(.)	(.)	(0.310)***
N	1889	1889	1889
KP F-Stat			

The unit of observations is country of origins (109), and 2000-2017. Errors are clustered at the country level. Columns 1 and 2 include country fixed effects, while column 3 includes only region fixed effects.

Data source: CEPII, Spanish Statistical Institute (INE) and World Bank

$^{*}p < 0.10,^{**} p < 0.05,^{***} p < 0.01$

K Instrument validity

K.1 Exogeneity of the base year

In constructing the instrument, I use the distribution of the immigrant population in 1991 as the "share". Instrumental variables estimation will be consistent if the geographical location patterns of the 1991 stock of immigrants are uncorrelated with province-specific shocks that affect the labour market outcomes of the natives between 2009 and 2014. This base year is 18 years before the main period of analysis, which provides a substantial amount of lag between the two. Still, it is possible that some unobservable shocks that determined the distribution of the immigrant population in the base year were still present and thus continued to impact the evolution of the labour market outcomes of the natives during the period of analysis despite the inclusion of time and province fixed effects.

In order to adress this concern, I follow Farr et al. (2011) and Sanchis-Guarner (2021), and I regress the provincial share of immigrant population in 1991 on that year's economic conditions and, then the change in this share during my observation period (2002-2014) on these same variables. The aim of this exercise is to show that the determinants of the geographical distribution of the mass of immigrant workers in 1991 does not perfectly predict the location during my period of analysis. The results are shows in Table K1.

[Table K1 about here.]

In the first column, I present results where the dependent variable is the share of the immigrant population in 1991. I include the log of disposable income, the log of GDP of the province, the log of average daily wage, the share of different sectors (agriculture, services, and industry) in the regional value-added (excluding the construction sector), the unemployment rate for immigrant workers. The regression includes the 50 provinces observations and a constant, so all the values are relative to the national mean. The model has high predictive power, and most of the regressors are significant, showing that economic factors influenced the location decision of the immigrant in 1991.

In the second column, I regress this same set of variables on the change of immigrant share over 2002-2014, which is the whole period of analysis. Apart from the average daily wage, all other variables are statistically insignificant. This test supports that using 1991 as the base year is appropriate. Moreover, given that the analysis is done in first-differences, most of these 1991 conditions are netted-out.

K.2 Overlapping response problem

Instrumental variables based on the shift-share methodology have been subject to a fair amount of discussion and criticism (e.g., Jaeger et al., 2018; Goldsmith-Pinkham et al., 2020). Jaeger et al. (2018) show that if the same locations keep receiving immigrant inflows, firms located in cities receiving large waves of immigrants would progressively raise their capital stock, which would push up the wages in these cities relative to others. If local conditions that influence immigrants location decisions are persistent, then the exlusion restriction assumption of the instrumental approach may not be satisfied as the the local labour market adjustments to an immigration-induced supply shock can take time. As the same cities repeatedly receive the inflows, the adjustment process of past waves (of arrivals) overlaps with that of the new waves. This "overlapping response problem" makes it difficult empirically to separate the (presumably) negative short-term wage effect of immigration from the (potentially) null medium or long run wage response.

As discussed earlier, "overlapping response problem" may be less concerning in Spain, given the changes in the country-origin mix that has been observed since 1990s. Still, in order to address concerned raised in Jaeger et al. (2018), in Table K2, I test the ability of my instrument to deal with the overlapping response problem by including both the contemporary and lagged predicted outflow flow in the regression. I construct both the contemporary and lagged instruments using the same base period year (1991), so that the variation between the two are driven by national-level changes in the composition of immigration across periods. If the composition of immigrant population does not change sufficiently, both instruments should be highly correlated and both might predict the actual inflows.

[Table K2 about here.]

In Table K2, I present results, including only the contemporary outflow rate (columns 1 and 3) for comparison. In columns 2 and 4, I also include a 5-year lagged instrument as such a lag may capture the dynamics adjustments to regional labour supply shocks. I find that the inclusion of lagged instruments does not change the point estimate of the contemporary outflow flow both for wage and employment growth. Results in column 2 show that although lagged outflows improve wage growth, it does not change the coefficient size of the contemporary outflows, which are also much stronger predictors. In column 4, I show that lagged outflows do not seem to be statistically significant for employment.

Table K1: IV validity checks: Base-year validity regressions

	(1) FB Share 1991	(2) Change 2002-2014
Log Disposable Income	-0.0620	-0.0540
	(0.027)**	(0.038)
Log GDP	0.0608	0.0460
	(0.027)**	(0.038)
Average Daily Wage	-0.0008	0.0012
	(0.000)**	(0.001)**
Share of Agriculture in VA	-0.1003	0.0450
	(0.041)**	(0.059)
Share of Industry in VA	0.0216	-0.0141
	(0.029)	(0.041)
Share of Services in VA	0.0940	0.0147
	(0.028)***	(0.039)
Foreign-born Unemployment Rate	-0.0614	-0.0315
	(0.026)**	(0.038)
Constant	0.0076	0.0661
	(0.041)	(0.058)
N	50	50
Adj R2	0.57	0.33

The unit of observations is provinces. All the regressors are from the year 1991. The omitted category is the share of construction in value-added (VA).

Data source: Spanish Statistical Institute (INE)

$^{*}p < 0.10, ^{**} p < 0.05, ^{***} p < 0.01$

Table K2: Multiple Instrumentation, 2009-2014

	Wage			Employment		
	2SLS	2SLS	2SLS	2SLS	2SLS	2SLS
Net Outflow Rate	2.0286	2.0286	2.3305	2.4122	2.4122	0.4776
	(0.609)***	(0.694)***	(1.085)**	(0.752)***	(0.765)***	(0.877)
5-year Lagged Outflows		0.7332			-0.2581	
		(0.257)***			(0.460)	
10-year Lagged Outflows			0.4472			-1.1715
			(0.338)			(0.306)***
N	250	250	200	250	250	200
r2	0.26	0.27	0.21	0.49	0.48	0.58
Cragg-Donalds Stat	34.73	17.50	11.77	34.73	17.50	11.77

The table reports 2SLS estimates for the impact of the net change in the immigrant population in a province, measured as the decrease in the number of the working-age male immigrant population between t and $t-1$ as of total working-age male population in year $t-1$, on native wage and employment growth. Regressions are estimated annually, across 50 provinces over 5 periods (2009-2014). Regressions are weighted by total employment in the base year. Standard errors are clustered at the province level.

Data source: Continuous Sample of Employment Histories (MCVL), Municipal Register of Population (Padrón) and Spanish Statistical Institute (INE)

$^{*}p < 0.10,^{**} p < 0.05,^{***} p < 0.01$

L Construction of Bartik control

The Great Depression had differential severity across Spanish provinces. The decline in economic activity in several specific industries, the sectoral composition of provinces might explain an important part of the growth in employment. Following the literature, I build a Bartik control to proxy for industry-driven local demand shocks.[67] The Bartik will absorb local variation in employment resulting from national level changes of sectors which are strongly represented in a particular province. For instance, when employment in a given industry increases (decreases) nationally, areas in which that industry represented a significant share of employment must have experienced a positive (negative) relative change in the demand for workers relative to those where that industry is not present. The predicted growth of local employment, assuming employment in each industry i grows in line with the national rate.

Specifically, I multiply the province level sectoral employment shares in 2005 by the employment level of the sector at the country level in each year t.[68] Following Autor and Duggan(2003) and Goldsmith-Pinkham et al. (2020), I leave-out the employment of the own area, to address concerns that the introduction of own-area employment may mechanically increase the predictive power of the shock. Specifically, I calculate:

$$Bartik_{j,t} = \sum_i \phi^i_{j,t_0} L_{i(-j)t} \tag{L1}$$

where ϕ^i_{j,t_0} is the share of employed individuals in area j, at time the start period (t_0) working in a two-digit industry i (53 sectors) . $L_{i,(-j),t}$ is the number of workers employed in industry i at time t nationally, excluding area j. The Bartik instrument predicts the level of emplyoment in a province, if the local industry shares had remained the same as in the starting year and employment had grown in local firms at the same rate as in same-industry firms in the rest of the country.[69] Given that my specification is at first differences, I take the difference in the predicted employment levels to obtain my control.

M Robustness tests

M.1 Alternative Instruments

In thıs sectin, I test the validity of my results using alternative instruments based on different shifts and shares. Table M1 presents the regression results where I use different instruments. Panel A presents results for wage growth while Panel B presents the results for employment growth.

The first column shows the baseline estimates, which uses the instrument where the share is immigrants' provincial distribution in 1991 and both the immigrant and native stocks in the denominator are predicted to account for endogenous allocation. In column 2, I use the

[67]See for instance Cadena and Kovak (2016); Basso et al. (2019) for the use as an instrument, and Yasenov et al., 2019 as a control or the main regressor.

[68]I build my Bartik control to obtain the predicted employment levels, similar to Basso et al. (2019). Another option is to calculate the change in sectoral employment at national level and then distribute the change across provinces based on the initial distribution (see Cadena and Kovak (2016); Yasenov et al. (2019) for instance). I prefer the first option as, given the first differences approach, the interpretation is easier. However, I test the robustness of my results using alternative measures. I get similar results.

[69]Using earlier (e.g., 2000) or later (e.g., 2009) base years does not change my results.

predicted immigrant stocks based on the distribution in 1991, and the actual stock of natives in the denominator (as opposed to predicted native stocks in the baseline). In column 3, I use as shifts nationality stocks predicted through a gravity model, to address issues related to exogeneity of the national stocks. Details of the gravity procedure are given in the Appendix J.2. In column 4, I distribute population stocks based on country of birth (as opposed to nationality).

In the following columns, I construct alternative instruments based on the distribution of immigrant population in 1996 (columns 5 and 6), in 1999 (columns 7 and 8) and in 2001 (columns 9 and 10). For each base year, I present results where I use the actual yearly stocks as shift (columns 1, 2, 4, 5,7 and 9) or stocks predicted through the gravity model (columns 3, 6, 8 and 10).

[Table M1 about here.]

All of the instruments, regardless of the shift or share that is used, pass the weak instrument test. As expected, the F-statistic gets larger when I use a share from a later period, while the use of national stocks predicted through gravity reduce the strength of the instruments. Although estimated coefficients vary depending on the instrument, they are not statistically different from each other and my baseline results. These results confirm that the results are not dependent on the precise share and shift that I use in constructing the instrument.

Table M1: Alternative instruments based on various shifts and shares

Panel A: Change Wages										
	Baseline	1991	Gravity 91	1991 FB	1995	Gravity 95	1999	Gravity 99	2001	Gravity 2001
Net Outflow Rate	2.0286	2.3059	1.9862	2.2348	1.7510	1.2842	1.5724	1.4740	1.0621	1.1566
	(0.609)***	(0.678)***	(0.971)**	(0.722)***	(0.541)***	(0.884)	(0.522)***	(0.866)*	(0.436)**	(0.732)
N	250	250	250	250	250	250	250	250	250	250
KP F-Stat	17.45	15.76	9.00	13.69	36.50	17.66	47.13	17.39	93.08	19.68
Panel B: Change Employment										
	Baseline	1991	Gravity 91	1991 FB	1995	Gravity 95	1999	Gravity 99	2001	Gravity 2001
Net Outflow Rate	2.4122	2.3127	1.8147	2.4424	2.0853	2.0018	1.9260	1.9498	1.7013	2.1853
	(0.752)***	(0.786)***	(1.077)*	(0.875)***	(0.453)***	(0.809)**	(0.364)***	(0.824)**	(0.321)***	(0.777)***
N	250	250	250	250	250	250	250	250	250	250
KP F-Stat	17.45	15.76	9.00	13.69	36.50	17.66	47.13	17.39	93.08	19.68

The table reports 2SLS estimates for the impact of the net change in immigrant population in a province (see the text for details on the measurement), on wage (Pnael A) and employment growth (Panel B) of natives. The unit of observations are provinces. Regressions are estimated annually, across 50 provinces over 5 periods (2009-2014). Regressions are weighted by total employment in the base year and include year fixed-effects. Standard errors are clustered at the province level. Data source: Continuous Sample of Employment Histories (MCVL), Municipal Register of Population (Padrón) and Spanish Statistical Institute (INE)

$^{*}p < 0.10,^{**}p < 0.05,^{***}p < 0.01$

M.2 Alternative meausures of the supply shock

Table M1 reports the IV estimates of the parameters β_g and δ_g for various specifications using the same instrument, as in section 6. Columns 1 and 5 provide results for the measure used earlier as a benchmark. In column 2 and 6, following Card and Peri (2016) I define the outflow rate as $\triangle foreign^{Card\&Peri}{}_{j,t} = \triangle N_j^{foreign}/N_{j,t-1}^{native}$, where $\triangle N_j^{foreign}$ is the net change in the number of immigrant working-age population between time t and $t-1$, $N_{j,t-1}^{native}$ is the number of working-age natives in the base period. In columns 3 and 6, I define the outflow rate similar to Friedberg (2001) as $\triangle foreign^{Friedberg}{}_{j,t} = \triangle N_j^{foreign}/N_{j,t}^{native}$, which uses the number of natives in the current year in the denominator. Finally, following Hunt (1992) I define the outflow rate as $\triangle foreign^{Hunt}{}_{j,t} = \triangle N_j^{foreign}/(N_{j,t}^{native} + N_{j,t}^{foreign})$, where the denominator is the total working-age population in period t.

The results in Table M1 support the findings in section 6, and show that regardless of how outflow rate is defined, the outflow of the immigrant increased both the wages and employment of natives.

[Table M1 about here.]

As explained earlier, I measure the outflow rate only taking into account changes in the working-age *male* population. As a robustness in Table M2, I re-calculate the measure for males of all age groups (columns 2 and 4) and working-age population including women (columns 3 and 6).[70] The results can be seen in Table M2.

[Table M2 about here.]

As expected inclusion of all age groups decreases the estimated relationship slightly. Inclusion of female immigrant population gives slightly larger point estimates for wages while giving smaller estimates for employment. Despite these differences, I cannot reject the null hypothesis that differences in the elasticities are statistically significant. Overall, this confirm that those results are not driven by the numerator or denominator chosen for the construction of the outflow measure.

M.3 Alternative weights

In order to test the importance of weights in the estimation, I run the main regressions with and without weights. In Table M3 reports 2SLS results for both wages and employment. Results in column 1 and 2 are the baseline, where regressions are weighted by the number of employed in the base period. In columns 3 and 4, there are no weights.

[Table M3 about here.]

[70] I reconstruct all the instruments to reflect the changes in the group.

Table M1: Alternative measures of outflows based on different measurement definitions

	Wage				Employment			
	Baseline	Card(2016)	Friedberg(2001)	Hunt(1992)	Baseline	Card(2016)	Friedberg(2001)	Hunt(1992)
Net Outflow Rate	2.0286 (0.609)***				2.0853 (0.453)***			
$\triangle Immigrant/$Native in t-1		1.7560 (0.771)**				2.0912 (0.603)***		
$\triangle Immigrant/$Native in t			1.7511 (0.768)**				2.0854 (0.602)***	
$\triangle Immigrant/$Total in t				2.4955 (1.137)**				2.9719 (0.930)***
N	250	250	250	250	250	250	250	250
KP F-Stat	17.45	13.63	13.58	11.58	36.50	13.63	13.58	11.58

The table reports 2SLS estimates for the impact of the net change in immigrant population in a province (see the text for details on the measurement), on wage (columns 1-4) and employment (columns 5-8) growth of natives. The unit of observations are provinces. Regressions are estimated annually, across 50 provinces over 5 periods (2009-2014). Regressions are weighted by total employment in the base year and include year fixed-effects. Standard errors are clustered at the province level. Data source: Continuous Sample of Employment Histories (MCVL), Municipal Register of Population (Padrón) and Spanish Statistical Institute (INE)

$^{*}p < 0.10, ^{**}p < 0.05, ^{***}p < 0.01$

Table M2: Alternative measures of outflows by sex and age

	Wage			Employment		
	2SLS	2SLS	2SLS	2SLS	2SLS	2SLS
Net Outflow Rate	2.0286			2.4122		
	(0.609)***			(0.752)***		
All immigrant men		1.8001			2.1405	
		(0.632)***			(0.681)***	
All immigrants (including women)			2.3232			1.9241
			(0.674)***			(0.738)***
N	250	250	250	250	250	250
KP F-Stat	17.45	20.35	20.87	17.45	20.35	20.87

The table reports 2SLS estimates for the impact of the net change in the immigrant population in a province (see the text for details on the measurement), on wage (columns 1-3) and employment (columns 4-7) growth of natives. The unit of observations is provinces. Regressions are estimated annually, across 50 provinces over 5 periods (2009-2014). Regressions are weighted by total employment in the base year and include year fixed-effects. Standard errors are clustered at the province level. Data source: Continuous Sample of Employment Histories (MCVL), Municipal Register of Population (Padrón) and Spanish Statistical Institute (INE)

$^{*}p < 0.10,^{**} p < 0.05,^{***} p < 0.01$

Table M3: Alternative weights

	Employment Weights		No Weights	
	Wage	Emp.	Wage	Emp.
Net Outflow Rate	2.0286	2.4122	2.7422	3.0470
	(0.609)***	(0.752)***	(1.357)**	(1.498)**
N	250	250	250	250
KP F-Stat	17.45	17.45	6.54	6.54

The table reports 2SLS estimates for the impact of the net change in the immigrant population in a province, measured as the decrease in the number of the working-age male immigrant population between t and $t-1$ as of total working-age male population in year $t-1$, on native wage and employment growth. Regressions are estimated yearly across 50 provinces and include year fixed-effects. Regressions in columns 1 and 2 are weighted by total employment in the base year, while those in columns 3 and 4 have are unweighted. Standard errors are clustered at the province level.

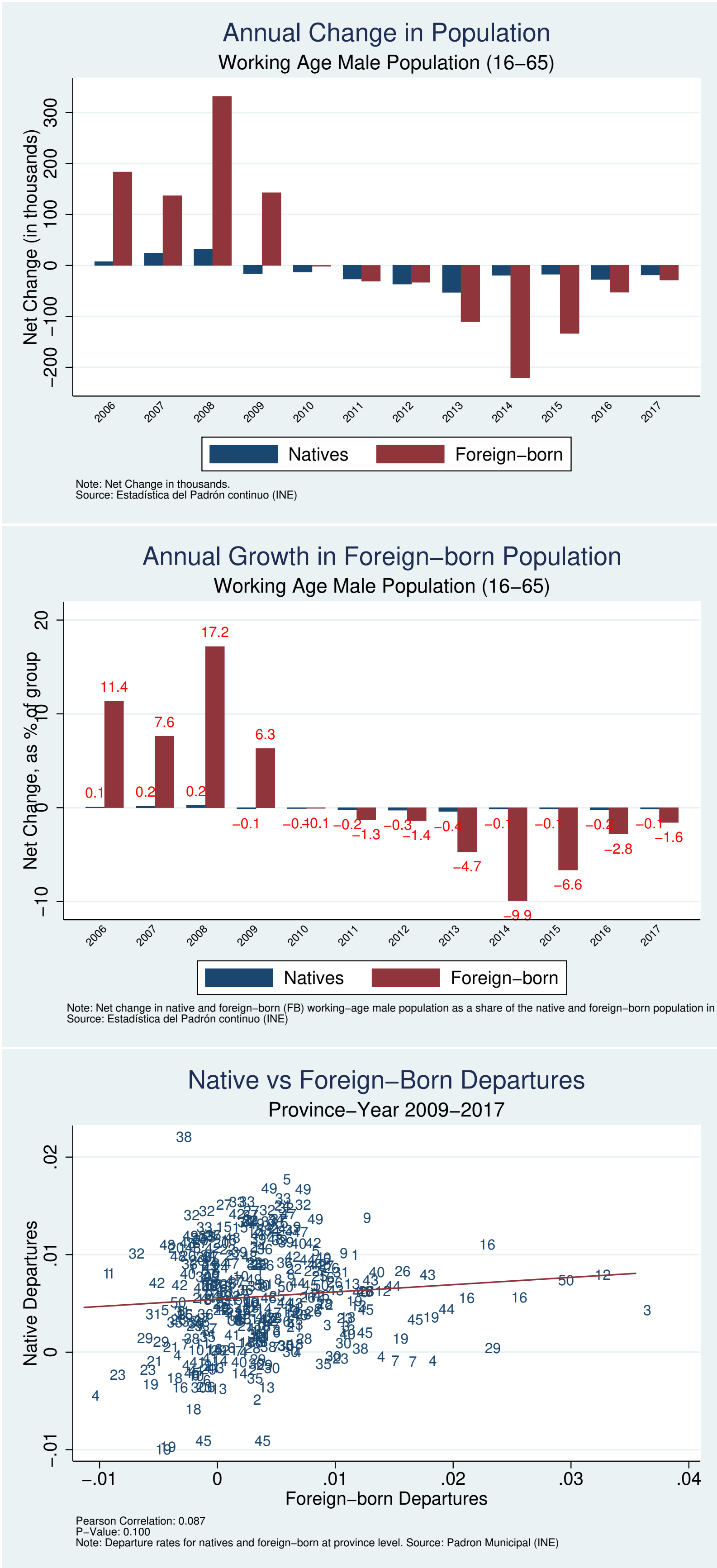
Data source: Continuous Sample of Employment Histories (MCVL), Municipal Register of Population (Padrón) and Spanish Statistical Institute (INE)

$^{*}p < 0.10,^{**} p < 0.05,^{***} p < 0.01$

N Immigrant and native outflows

[Figure N1 about here.]

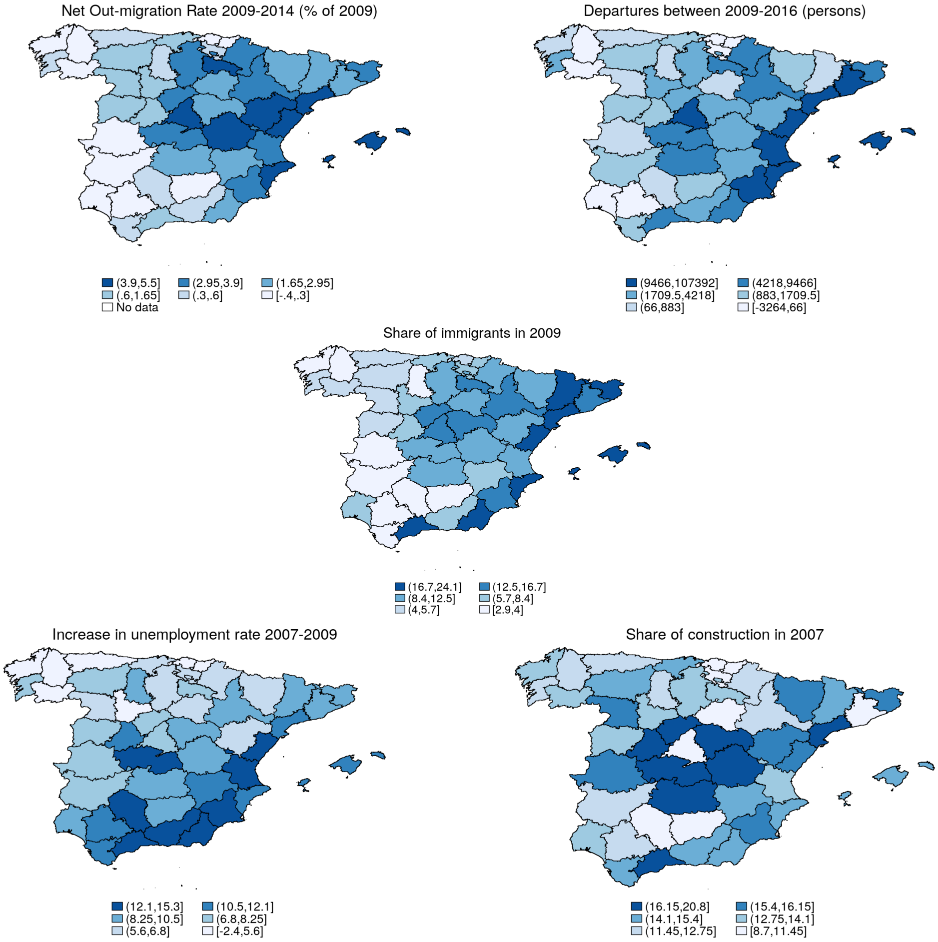
Figure N1: Immigrant and native outflows



O Maps

[Figure O1 about here.]

Figure O1: Maps



Data source: Spanish Statistical Institute (INE)

P Differentiating between boom and bust

Results in the paper show that the outflow of the immigrant accelerated both the wage and employment growth of the natives during the Recession. In this section, I extend the analysis to the previous years - the boom years - to see whether symmetric effects can be found during an economic expansion. In Table P1, I use the exact same specification for for the boom years (2002-2007) and for the bust - or Recession - years (2009-2014). For comparability with the results from the Recession, I define the boom period as the 5 years prior to the crisis to match the length of the Recession period anaylsis.[71]

[Table P1 about here.]

Panel A and Panel B present results for wages and employment, respectively. Columns 1 and 2 show results for the pre-crisis period, columns 3 and 4 show those for the Recession period. In columns 1 and 3, I regress the labour market outcomes on the net outflow rate. Panel A shows that the magnitude of the coefficient is almost ten-folds larger during the Recession than in the growth period, although it is statistically insignificant. In columns 2 and 4, I add Bartik to control for differences in the growth rates between two periods. The results do not change.

In Panel B, I repeat the exercise for the employment margin. In columns 1 and 3, I regress the employment growth on the net outflow rate. During the growth period, an increase of 1 percent in the outflow rate accelerated employment growth of the native-born by 1%, which is two times smaller than the 2% which is observed during the Recession. This suggests that net outflows have a stronger effect during economic busts that economic growth periods. In columns 2 and 4, I add Bartik to control for differences in the growth rates between the two periods. Reassuringly, once I control for the differences in the labour demand, the coefficients for both periods are similar.

The findings for the Recession is in line with the literature that argues that immigrant mobility can have a cushioning effect for the natives during a demand shock Amior (2017); Cadena and Kovak (2016); Basso et al. (2019). The results for the growth period on the other hand are novel.

[71] I check whether the outcomes for the pre-crisis period are sensitive to the definition of the period. The results available upon request.

Table P1: Boom versus Bust periods

Panel A: Change Wages				
	2002-2007	2002-2007	2009-2014	2009-2014
Net Outflow Rate	0.2180	0.2217	2.0286	1.9905
	(0.156)	(0.154)	(0.609)***	(0.699)***
Bartik		0.0200		0.0474
		(0.056)		(0.190)
N	250	250	250	250
KP F-Stat	20.50	20.20	17.45	16.64
Panel B: Change Employment				
	2002-2007	2002-2007	2009-2014	2009-2014
Net Outflow Rate	1.7525	1.8529	2.4122	1.6846
	(0.530)***	(0.507)***	(0.752)***	(0.790)**
Bartik		0.5413		0.9048
		(0.117)***		(0.145)***
N	250	250	250	250
KP F-Stat	20.50	20.20	17.45	16.64

The table reports 2SLS estimates for the impact of the net change in the immigrant population in a province, measured as the decrease in the number of the working-age male immigrant population between t and $t-1$ as of total working-age male population in year $t-1$, on native wage and employment growth. Regressions are estimated yearly across 50 provinces and include year fixed-effects for the period indicated in the column header. Regressions in columns 2 and 4 include Bartik control which refers to the change in predicted total employment. Standard errors are clustered at the province level. Data source: Continuous Sample of Employment Histories (MCVL), Municipal Register of Population (Padrón) and Spanish Statistical Institute (INE)

$^{*}p < 0.10,^{**} p < 0.05,^{***} p < 0.01$

Q Native mobility by demographics

[Table Q1 about here.]

Table Q1: Impact of immigrant outflows on native mobility between 2009-2014, by demography

Panel A: Net Rates									
	WA Male	WA Female	WA Both Sexes	Male All Ages	< 20	20-30	30-40	40-50	> 50
Net Outflow Rate	0.1597	0.1109	0.1355	0.1098	0.0774	0.3338	0.2611	0.0908	0.0207
	(0.053)***	(0.044)**	(0.048)***	(0.039)***	(0.032)**	(0.106)***	(0.096)***	(0.033)***	(0.027)
N	250	250	250	250	250	250	250	250	250
KP F-Stat	13.38	13.39	13.38	12.88	13.63	15.53	13.78	13.09	11.17
Panel B: Arrival Rates									
	WA Male	WA Female	WA Both Sexes	Male All Ages	< 20	20-30	30-40	40-50	> 50
Net Outflow Rate	0.0947	0.1058	0.1001	0.0589	-0.0193	0.1030	0.1733	0.1046	0.0701
	(0.054)*	(0.057)*	(0.055)*	(0.047)	(0.076)	(0.097)	(0.118)a	(0.066)a	(0.040)*
N	250	250	250	250	250	250	250	250	250
KP F-Stat	13.38	13.39	13.38	12.88	13.63	15.53	13.78	13.09	11.17
Panel C: Departure Rates									
	WA Male	WA Female	WA Both Sexes	Male All Ages	< 20	20-30	30-40	40-50	> 50
Net Outflow Rate	-0.0650	-0.0051	-0.0354	-0.0510	-0.0967	-0.2308	-0.0877	0.0138	0.0494
	(0.023)***	(0.032)	(0.024)a	(0.026)**	(0.066)a	(0.069)***	(0.065)	(0.048)	(0.026)*
N	250	250	250	250	250	250	250	250	250
KP F-Stat	13.38	13.39	13.38	12.88	13.63	15.53	13.78	13.09	11.17

The table reports 2SLS estimates for the impact of the net change in the immigrant population in a province, measured as the decrease in the number of the working-age male immigrant population between t and $t-1$ as of total working-age male population in year $t-1$, on the mobility margins of different groups of native population during the same period. The table reports the net change rate of population (Panel A), arrival rates (Panel B) and departure rates (Panel C). Regressions are estimated annually, across 50 provinces between 2009-2014 (5 periods) and are weighted by group population in the base year. Standard errors are clustered at the province-level.

Data source: Municipal Register of Population (Padrón)

$^{*}p < 0.10, ^{**} p < 0.05, ^{***} p < 0.01$

R Daily wage rate versus days worked

Section 9.3 presented results on the changes in monthly wages. These wages are composed of daily rates that workers received per day of work, multiplied by total days worked in that month. In this section I test whether the positive wage effects are due to an increase in daily wage rates, number of days worked, or both. Table R1 reports results for both margins. Columns 1-2 show that the outflow of the immigrant increased average daily wages for both skill groups. Columns 3-4 report the changes in the average number of days worked in a month. The results suggest that departure of immigrant increased average daily wages but not the number of days worked for natives.[72] These results mirror the findings in Edo (2016) who find effects in exactly along the same margins but in the opposite direction due to increased immigration in the French labour market.

[Table R1 about here.]

[72]These results are not driven by compositonal changes. Inclusion of changes in average schooling and age of the employed does not change results. Results can be provided upon request.

Table R1: Daily wages versus days worked in a month

	Daily Wage		Days Worked	
	Low Skilled	High Skilled	Low Skilled	High Skilled
Net Outflow Rate	1.1112	1.5213	0.1521	0.0697
	(0.332)***	(0.844)*	(0.139)	(0.260)
N	250	250	250	250
KP F-Stat	16.74	17.90	16.74	17.90

The table reports 2SLS estimates for the impact of net outflow rate of the immigrant population in a province, measured as the decrease in the number of the working-age male immigrant population between t and $t-1$ as of total working-age male population in year $t-1$, on daily wage (columns 1-2) and days worked in a month (columns 3-4). Predicted net outflow rates are used as instruments. Regressions are estimated annually, across 50 provinces between 2009-2014 (5 periods). Regressions are weighted by group-specific employment in the base year and include year-fixed effects. Standard errors are clustered at the province level.

Data source: Continuous Sample of Employment Histories (MCVL),Municipal Register of Population (Padrón) and Spanish Statistical Institute (INE)

$^{*}p < 0.10,^{**} p < 0.05,^{***} p < 0.01$

S Part-time employment

The results presented in the paper focus on full-time employment. The outflow of immigrants can also increase part-time native employment and impact the wages of those who hold such jobs. In order to test this, I repeat the main specification but measuring only changes regarding the part-time employment as the outcome variable. Table S1 presents these results. Columns 1-2 show that the outflows did not have any statistically significant effect on the average wages of part-time jobs. However, larger outflows increased the number of natives holding part-time jobs, for both skill groups.

[Table S1 about here.]

Table S1: Part-time employment and wages

	Wages		Employment	
	Low Skilled	High Skilled	Low Skilled	High Skilled
Net Outflow Rate	0.2269	0.3388	2.8739	5.5630
	(0.321)	(0.842)	(1.605)*	(3.034)*
N	250	250	250	250
KP F-Stat	21.87	18.25	21.87	18.27

The table reports 2SLS estimates for the impact of net outflow rate of the immigrant population in a province, measured as the decrease in the number of the working-age male immigrant population between t and $t-1$ as of total working-age male population in year $t-1$, on wages (columns 1-2) and employment (columns 3-4) of part-time workers. Predicted net outflow rates are used as instruments. Regressions are estimated annually, across 50 provinces between 2009-2014 (5 periods). Regressions are weighted by group-specific employment in the base year and include year-fixed effects. Standard errors are clustered at the province level. Data source: Continuous Sample of Employment Histories (MCVL), Municipal Register of Population (Padrón) and Spanish Statistical Institute (INE)
$^{*}p < 0.10, ^{**}p < 0.05, ^{***}p < 0.01$