The Cushioning Effect of Immigrant Mobility: *Evidence from the Great Recession in Spain*[*]

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Abstract

This paper provides the first direct evidence on how the geographical mobility of immigrants cushions natives during a labor demand shock. Spain was one of the hardest-hit economies during the Great Recession. Faced with a drop in the local labor demand, immigrant workers moved within Spain or left the country, generating significant decreases in local labor supply. Focusing on this episode, I use microdata from municipal registers and longitudinal Spanish administrative data to study the effects of outflow of the immigrant population from provinces on the wages and employment of the natives. I build a shift-share instrument based on the past settlements of the immigrant population across Spain to instrument outflows and argue for a causal relationship. I find that outflow of immigrants slowed down the decline in employment and wage of natives, especially of those with higher substitutability with immigrants. Moreover, I find that increased transitions from unemployment and inactivity to employment drive the positive employment effects, while wage effects are limited to those who were already employed. These findings reveal that the higher geographical mobility of immigrants cushions the natives during a demand shock.

1 Introduction

Despite an extensive literature on the effects of the arrival of immigrants on the labor market outcomes of the native population, little is known on the impact of their departure.[1] The absence of literature is surprising as mobility of the immigrant population can be an important channel for equilibrating labor markets (Cadena and Kovak 2016; Basso et al. 2019; Jauer et al. 2019). Due to their higher responsiveness to labor market differentials, immigrants react to the changes in labor market conditions through mobility much more than natives (Borjas, 2001; Schündeln, 2014). While natives in distressed local markets stay in the area, immigrants relocate to other markets and dissipate the shock spatially (Monras, 2018). Through their higher geographical mobility, immigrants can absorb part of the shock and help the local labor markets recover faster.

This paper investigates the effects of outflow of the immigrant population from a local labor market on natives' labor market outcomes during an economic crisis. Specifically, I study the changes in employment and wage outcomes of natives in Spanish provinces as a result of a reduction of labor supply due to immigrant mobility. Spain was one of the hardest-hit economies during the Great Recession. The immigrant population in the country responded to the decreased local labor demand by moving internally but also leaving the country. As a consequence of this mobility, the immigrant labor supply reduced across all provinces of Spain.

I use this context to examine the direct impact of immigrant outflow on the local labor markets over the 2009-2014 period.[2] I start by analyzing the changes in employment and wage outcomes of natives located in each province. Specifically, I regress the annual growth in employment and wages of natives in a province on net outflow rates normalized by the initial population. To make causal claims about the estimates, I use a modified version of the standard shift-share instrument (Card, 2001). I analyze short-term effects on employment and wages for specific groups of workers (e.g., young or unskilled natives) but also types of employment adjustments in response to outflow. For example, although native employment adjustments can be through higher inflows from non-employment into employment, it can also result from fewer employed workers leaving the labor force. Furthermore, the adjustment can also be through geographic movements across local labor markets, a mechanism found to be essential in explaining the long-run effects of adverse demand shocks in the United States (see Blanchard and Katz, 1992). I provide evidence on the magnitude of each type of response and show how their relative importance varies across worker groups.

To guide my empirical investigation, I start with a general equilibrium model that predicts how a decrease in the local labor supply due to immigrants' outflow affects wages and employment of the native workers located in the labor market. A shock in the local economy (i.e., in a province) reduces the demand for native labor but also the immigrant labor supply. While an increase in the intensity of the economic shock lowers the demand for native labor, the fall is dampened by the decrease in the immigrant labor supply which reduces the competition in the labor market. These positive effects are more substantial for natives who have higher substitutability with the immigrant population. For the groups with higher wage rigidities (e.g., older workers, workers with indefinite contracts), the adjustment occurs at the employment margin.

In my analysis, I use the Spanish Social Security panel which allows me to track natives over time and space. 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 measure the intensity of

[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.

departures across Spanish provinces by the annual decline in the immigrant working-age male population during this period, relative to the entire working-age male population in the previous year.[3]

I find a positive and causal effect of the net outflow of the immigrant workers on the wage and employment growth of natives located in the area. 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 about 2% and 2.4%, respectively. These results are robust to pre-trends, use of different measures of outflows, alternative weights and instruments, the inclusion of time-varying controls which capture the changes in the local demand, the structure of the local economic activity, and composition of the workforce. 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 due to the demand shock by slowing employment and wage losses in the local labor market.

Regarding differential effects by skill groups, outflows leads to an employment increase for both unskilled and skilled natives. Breaking employment responses further out by age group and gender, my results reveal that groups that have the highest substitutability with immigrants (e.g., natives below 30) or high elasticity to labr market conditions (e.g., natives above 50) benefit the most in terms of employment, which is in line with the standard migration model.

Next, I explore the relevance of various margins through which natives adjust to the outflows. First, the departure of the immigrant population increases the native population in the area.[4] I find that departure of every ten immigrant increases the native population by three. Furthermore, I study the arrival and departure rates to understand the source of the increase in the native population and find that the changes are driven by decreased outflows of natives from regions with stronger immigrant outflows. This finding is in line with recent literature which finds that population inflows respond more than outflows to economic shocks (Monras, 2018) or increases in the labor supply due to immigration (Dustmann et al., 2017).

Second, I show that outflow of the immigrant population increases the recruitment of natives who were *not* employed previously, while those who were already employed were not less likely to leave employment. This observation indicates that departure of the immigrant population benefits "outsiders" (and not "insiders") at the employment margin. This finding is in line with Dustmann et al. (2017), who find that an increase in the labor supply due to the arrival of immigrant workers reduces the employment of "outsiders", while "insiders" are protected by labor market institutions. Put together, these findings suggest that employment adjustments to positive (negative) labor shocks benefit (hurt) the outsiders in rigid labor markets. On the other hand, I find that workers who were already in the labor market ("insiders") are the only ones who benefit from wage increases. While the departures also positively affect the wages of workers who enter employment, these effects are not statistically significant.

In the final section of the paper, I extend the analysis beyond the short-run effects and explore the dynamics of adjustment over the medium-term. I find that the positive effects of outflows on local wages persist until the fourth year and disappear afterwards while employment effects remain positive and significant throughout the period. This "recovery" is clearly faster than what is observed following an immigration episode, where the negative effects due to immigration disappear after 5 years as in Monras (2019) or 14-20 years in Blanchard and Katz (1992); Jaeger et al. (2018); Edo (2019). Furthermore, exploiting the panel dimension of my data, I follow the outcomes of workers based on their initial location. Once the worker composition is fixed, I find positive wage effects which remain significant even beyond 4-years. This result corroborates earlier findings and suggest that changes in the worker composition,

[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]The question of whether an immigration-induced labor supply shock leads to relocation of the natives remain controversial. See for instance, Card (2001); Peri and Sparber (2011); Borjas (2003).

due to possible negative selection into employment and native inflows to provinces with higher outflows, attenuate overall wage effects.

My findings have implications for multiple strands of literature. First, they relate to the literature showing that mobility of (immigrant) workers can be a mechanism for equalizing differences across labor markets (Bartik, 1991; Blanchard and Katz, 1992). Due to their higher responsiveness to spatial differences in economic oppurtunities compared to natives, immigrants have higher geographical mobility which "greases the wheels" of the labor markets (Borjas, 2001; Cadena, 2010; Basso and Peri, 2020).[5] My paper is specifically related to the recent literature focusing 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 the mobility of Mexican workers 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 using individual-level administrative data to provide the first estimates on the direct impact on wages and employment margins controlling for selection, while accounting for other adjustment margins that it may entail, making it possible to provide a more comprehensive picture of the total effects. I further contribute to the literature by presenting a general equilibrium model that predicts how a decrease in the labor supply due to immigrant mobility affects wages and employment of native workers in the local labor market.

My paper is closely related to a second literature which focuses on the labor market impact of outflow-induced supply shocks. Despite the extensive literature studying the effects of immigration, evidence on the effects of outflow is 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. Similarly, Elsner (2013) and Dustmann et al. (2015) study the effect of the emigration on the wages of the staying natives in Lithuania and Poland, respectively. My paper differs from these for two reasons. First, I examine the effects of the departure of the immigrant population, on the staying natives in the host country. Second, apart from Dustmann et al. (2015), all of the mentioned studies focus on the wage effects following the skill-cell approach of Borjas (2003). I follow a pure spatial approach and exploit the variations in the total outflows to study the effects on the local labor markets in the short and medium-term.[6]

Third, I contribute to the literature studying the natives' residential choices, or the so called native displacement, following immigration. The literature provides estimates for the displacement of natives due to arrival of immigrants (Borjas, 2003; Peri and Sparber, 2011; Clemens and Hunt, 2017). I complement this literature by providing the first evidence on how the departure of the immigrants generates the exact opposite effect found in the immigration literature by attracting natives into the area.

The remainder of the paper is organized as follows. The next section provides a theoretical model that allows understanding the impact of a decrease in labor supply due to outflow of immigrants on local labor markets. Section 3 gives some background on the economic crisis in Spain and differences in mobility patterns between immigrant and native population during this period. Section 4 describes the data and presents some descriptive statistics. Section 5 presents the empirical strategy and addresses

[5] Borjas (2001) argues that the newly arriving immigrants are much more likely to be clustered in the states that offer the highest wages for the types of skills that they have to offer. In a recent paper Cadena and Kovak (2016) show that the effect is not due to new arrivals. Even immigrants who have arrived earlier are willing to move, making them instrumental for equilibrating labor market differences even after the years.

[6] Very recently the immigration literature has turned to the labor 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 labor supply was compensated by an increased 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 non-significan empmloyment effects annd wage downgrading, driven by selective in- and out-migration of natives.

identification issues. Section 6 provides the main results, and Sections 7-8 present the robustness tests and heterogeneity analysis, respectively. Section 9 discusses the underlying adjustment mechanisms and Section **??** provides a sense of the estimated magnitudes. Section 10 discusses the dynamic adjustment effects over time. Section 11 concludes.

2 An equilibrium model with heterogeneous labor 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 labor supply driven by the outflow of the immigrant population.

The model aims to provide a simple framework, where the labor 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 labor market and returns to physical capital are equalized across locations.

I start out with a fully competitive labor market as a benchmark, and allow for wage rigidities in a second step. In a second step, I allow the labor supply responses of natives, or 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 labor L and total factor productivity A.

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

Following the literature, I assume that labor L is a nested CES function of skilled (S) and unskilled (U) labor 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 labor 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]:

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

2.1.2 Labor demand for natives

Each region is a single labor market. Assuming that firms are pricetakers in the labor and product market, firms choose labor 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 labor L_S and L_U. This yields the labor 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 labor 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 labor demand curve, S_g denotes the contribution of labor type g to the total labor 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 labor and g' skilled labor. 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 labor 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 labor 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 labor demand for natives (i.e., $\frac{dlogL_g^N}{dlogA} > 0$).

[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 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 labor 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 specializaiton 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 labor demand and labor supply of the immigrant workers. I include exogenous variation of A in order to capture the changes in the labor demand for native workers that is due to shifts in total labor demand. Thus, the changes in employment of natives is due to both changes in the total demand and the labor supply of immigrant migration.

2.1.3 Labor supply

Labor supply of natives and immigrants constitute the total supply. Following the literature[9], I make the simplification that all working-age immigrants supply a constant amount of labor ($\phi_M > 0$) 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.[10] The size of the immigrant population is function of A, with an elasticity $0 < \alpha \leq 1$.[11]

Using N_g to denote the (fixed) number of natives who could potentially supply labor to the local labor market, the local labor 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 labor supply of natives depends on skill-specific wages in the market under consideration (w_g) and other local labor markets (w'_g). The local labor 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 labor 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 labor 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 labor supply function 5, it follows that (see Appendix A.2 for details):

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

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 labor market.

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

$$dlog w_S = (\beta - 1) dlog L_S + (1 - \beta) dlog L + dlog A \tag{7}$$

$$dlog w_U = (\beta - 1) dlog L_U + (1 - \beta) dlog L + dlog A \tag{8}$$

and two skill-specific supply curves:

$$dlog L_S^N = \eta_S dlog w_S \tag{9}$$

$$dlog L_U^N = \eta_U dlog w_U \tag{10}$$

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):

[9] See for instance, Borjas (2003); Docquier et al. (2014); Dustmann et al. (2017).

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

[11] For simplicity, I assume that variations in A impact immigrant population of both education groups equally.

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

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

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

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 labor $dlogL_g^N$ (i.e., $\frac{\partial logL_g^N}{\partial logA} < 0$)
- decrease the labor supply of immigrants for the skill group g (i.e., $\frac{dlogL_g^M}{dlogA} < 0$), which increases the demand for native labor of the same skill group (i.e., $\frac{\partial logL_g^N}{\partial logL_g^M} > 0$).
- decrease the labor supply of immigrants for the skill group g' (i.e., $\frac{\partial logL_g^N}{\partial logA} < 0$), which decreases the demand for native labor 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 labor 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 labor 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-run (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 labor 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 labor market rigidities, then the wages cannot fall by as much as the equilibrium wage response given by the labor 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 labor demand function (Equation 4).

The differences in labor 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.[12]

3 Spanish context

3.1 Immigrant population in Spain

Between 1998 and 2008, Spain experienced one of the most significant immigration episodes in recent history among the OECD countries.[13] Until 2009, Spain received an average of almost 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 immigrant share in the total population increased from 1.6 percent in 1998 to 12.1 percent in 2009, reaching to 5.6 million (Appendix Figure C1). Due to high naturalisation rates in Spain this figure even higher. For instance in 2009, there were 6.4 million immigrant people, which makes the share of immigrant in the population 13.7 percent.

A substantial portion of immigration to Spain consisted of migration flows from a diverse set of countries driven by labor market motives due to the 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).

Spain was one of the hardest-hit economies during the Great Recession. It was hit by two shocks: the end of the speculative bubble of the construction sector in Autumn 2007 and the global financial shock in September 2008. The negative shock in the construction sector reversed the positive trend in the employment observed until the crisis. The global financial shock triggered a rapid increase in the unemployment rate. Appendix Section B provides further details on the evolution of the crisis and its impact on the 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, immigrants were concentrated in sectors which are more sensitive to the business cycles such as construction, wholesale and hotels and restaurants where up to 50 percent of the immigrants were employed prior to the crisis. Secondly, immigrants were more likely to hold temporary contracts prior to the crisis which makes them more vulnerable to firing (Fernandez and Ortega, 2008).[14]

The crisis caused a decrease in the immigrant population, driven by sudden drop in immigrant inflows and increase in return migration. The significant and immediate drop in labor related entries was due to two reasons. First, unlike most of the other European countries where drop was less pronounced

[12]See Edo (2016); Verdugo (2016); Dustmann et al. (2017) for a similar conclusion in other rigid European markets.

[13]This rapid increase in the immigrant population generated academic interest in the labor market impact of immigration. See for instance Amuedo-Dorantes and De La Rica (2005); Carrasco et al. (2008); Gonzalez and Ortega (2011); Amuedo-Dorantes and de la Rica (2011) for labor 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.

[14]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;

and gradual, migration flows in Spain had always depended highly to economic cycles (OECD, 2009). Due to the contraction in the economy, Spain's appeal as a destination decreased.[15] Second, Spanish government took action to reduce the labor related entries (see Appendix Section D for more details). In parallel, departures also started increasing due to drop in the economic activity. Finally, Spanish government encouraged the departure of immigrants (see Appendix Section D for more details).[16]

[Figure 1 about here.]

Between 2009-2014, working-age male immigrant population saw a net decrease of 170 000. Figure 1 shows the annual net outflow of the working-age male immigrant population as a share of the total working age population (Spanish and immigrant) the year before. It can be seen that the departure of the immigrant created a labor supply shock between 0.1-1 percent annually.[17] Between this period, the total net outflow of working-age immigrant male population caused a reduction of 1.1 percent in the total working-age male population and 6 percent in the working-age immigrant male population across 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 shows that native–born population are less sensitive to labor demand shocks and respond much less by geographic mobility compared to immigrant counterparts (Schündeln, 2014; Cadena and Kovak, 2016; Bartik, 2017; Basso et al., 2019). These differences can be due to their observable demographic characteristics (i.e., age, education, family structure, home ownership), but also unobservable characteristics (i.e., self-selected group of people with high levels of labor force attachment and a greater willingness to move long distances to encounter more favorable labor market conditions). The difference in the responsiveness between natives and the immigrant is especially high within the lower-skilled.

I start by establishing whether the difference in mobility between natives and immigrants exists in Spain during the Great Recession. Figure 2 shows scatter plots for working-age native-born and immigrant men and compare their mobility. Each circle represents a province where the size is proportional to the province population. The x-axis shows the change in log employment, and the y-axis shows the change in log population for the relevant group. Note that the changes in the log population can be due to both internal and international mobility. The figure demonstrates that immigrant workers respond much more strongly to local labor demand shocks than natives. The immigrant population in hard-hit areas move out, while natives remain in the area.

[Figure 2 about here.]

These figures show that native population was less responsive to shocks compared to immigrant population. The higher mobility of the immigrant 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

[15]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.

[16]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.

[17]The net decrease was even stronger as 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. Immigrant population 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.

setting, show that immigrant moves have much higher elasticity to labor market conditions (Gutiérrez-Portilla et al., 2018; Melguizo and Royuela, 2017). For instance, while in the pre-crisis period both natives' and immigrants' moves were partially motivated by amenities (e.g. temparate climate, sunny days), during the crisis these amenities lost their importance for foreigners as the driver of geographical moves (Maza et al., 2019).

In Appendix Section F, I further explore the issue by decomposing the mobility by the skill group to see if the elasticities differ depending on the skill group. Similar to findings 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 still remain lower than those estimated for low-skilled immigrants.[18]

Despite the low share of native outflows compared to the group population, it is important to account for them empirically as they could matter for the re-adjustment of the local labor markets. In Section 7.2, I present results controlling for native mobility.

4 Data and summary statistics

This section presents the data used to estimate the effects of net outflow of immigrants 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 labor market data come from Spain's Continuous Sample of Employment Histories (MCVL *or Muestra Continua de Vidas Laborales* in Spanish).[19] This is an administrative data set with longitudinal information obtained by matching social security, income tax, and census records for a 4 percent non-stratified random sample of the population who in a given year have any relationship with Spain's Social Security. Individuals can either be working as employees or be self-employed, receiving unemployment benefits or pension.

An individual enters the sample if he registers one day of activity with social security, between 2004-2016 and is kept in subsequent editions. Once in the sample, MCVL records any changes in individual's labor 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 labor 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, 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

[18]Despite large differences in unemployment rates and economic conditions, labor mobility has been low in Spain especially compared to the European countries (Mulhern and Watson, 2009; Bell et al., 2015). There are many reasons why natives react less to demand shocks. In the case of Spain, the low mobility is partially explained by the safety net provided by the families (Bentolila and Ichino, 2008), or by the presence of welfare state which decrease the incentive for such moves (Bover and Velilla, 2005;Amuedo-Dorantes et al., 2018). The low mobility response of natives to changes in unemployment is not a new phenomenon in Spain. For similar analysis for earlier periods see Antolin and Bover (1997); Bentolila and Dolado (1991).

[19]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 Labor, Migrations and Social Security (*El Ministerio de Trabajo, Migraciones y Seguridad Social*). This dataset has been widely used in research on labor markets (e.g., Gonzalez and Ortega, 2011; Bonhomme and Hospido, 2017; De la Roca, 2017; De la Roca and Puga, 2017).

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, die or leave the country permanently.

On each date, I know the individual's labor market status, daily wage[20], the occupation and type of contract, the establishment's sector of activity at the NACE three-digit level, and the province where the establishment is located. I also obtain individual characteristics such as age, gender, country of birth, nationality, and educational attainment which come from *Padrón* or Municipal Register.[21] Furthermore, by exploiting the panel dimension, I construct precise measures of tenure and experience, calculated as the actual number of days the individual has been employed, respectively, in the same establishment and overall.

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 how increased immigrant outflows affects moves between employment and unemployment. Third, the longitudinally of the data also allows me to measure changes in labor markets for constant cohorts of workers within demographic and skill-groups, avoiding compositional biases that confound cross-sectional analyses. Fourth, in addition to information on education, age, tenure, and other individual characteristics, the data include both the citizenship and country of birth, which allows identification of all immigrant workers who have naturalized.[22]

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, born since 1962, and employed at any point between January 2005 and December 2016. This initial sample has 777 593 workers and 75 945 441 monthly observations.

First, I exclude spells 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 in the public sector, international organizations, 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. I drop workers who have not worked at least 30 days in any year and those with missing education data.

I exclude women and immigrants from the sample. I exclude women for three reasons. First, I drop women to provide estimates that can be comparable with other studies on the labor market impact of

[20] The MCVL contains wage data coming from the social security records and income tax records. The wage data coming from the social security records that go back to 1980. However, the wage data are either top or bottom coded for about 13% of observations. Income tax records on the other hand provide uncensored gross wages starting from 2004. Each source of labor income is matched between income tax records and social security records based on both employee and employer (anonymized) identifiers. The Basque Country and Navarre autonomous regions collect income taxes independently from Spain's national government. As job spells originating from these regions lack uncensored wage information, I use wages coming from the social security records after applying necessary simulations following De la Roca (2017). I further check the robustness of my results by using uncensored wage information coming from tax records.

[21] Since 2009 the Ministry of Education directly reports individuals' highest educational attainment to the National Statistical Institute and this information is used to update the corresponding records in the Continuous Census of Population.

[22] This is feature is valuable for three reasons: first, Spain permits dual citizenship under limited circumstances. Although the requirement to have a single nationality is waived for natural citizens of many countries, nationals of some countries are still required to renounce their original citizenship when they become Spanish. Second, Spain this is has high naturalization rates. As shown in Ródenas et al. 2017, in 2014, 24.7 percent of immigrants residing in Spain were Spanish citizens. Those with dual citizenship can be registered either as a immigrantnational as well as Spanish both in the municipal as well as social security records. Third, as pointed in Ródenas et al. 2017, naturalized immigrant have higher probability of emigration back to their home country during the crisis. These factors make the naturalisation an important measurement issue given the research question in this paper.

immigration (De la Roca, 2014; Ortega and Verdugo, 2016; Dustmann et al., 2017; Edo, 2019; De la Roca and Puga, 2017). Second, despite the important increase in the female employment in Spain, their participation rate is still low compared to similar countries. For instance, the female labor force particpation rate was 49.1 percent in Spain, compared with 64.5 percent in the EU-27 and 72 percent in the US. The gender gap in employment is also among the highest in the industrialized countries (21 percent in Spain, 18 percent in the EU-27 and 10 percent in the US) (Farré et al., 2011). Finally, I prefer excluding women as their employment decisions depends not only on the labor market oppurtunities but also on the cost of child-care services and elderly care (Farré et al., 2011; Cortés and Pan, 2018), and on their husbands' employment especially during an economic crisis (Baslevent and Onaran, 2003). In this sense, substitutability and complementarity relationships between immigrants and native workers might be different for men and women (Carrasco et al., 2008).[23] Although women workers are excluded in the main results, I present some result in Section 8. I leave-out immigrant workers as I am interested in the labor market outcomes of natives.

Finally, I restrict the sample to workers aged 25 to 54 between 2009-2014 to ensure that individuals have completed their education and avoid complications related to retirement decisions. [24] I keep only workers who work full-time and provide results for part-time workers in the Appendix. These restrictions reduce the sample to 193 247 native-born workers with 814 197 yearly observations. This means that on average each native is observed for 4 years. I use this sample to calculate province-year averages and changes.

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 is obliged to register upon arrival in the country, and to de-register upon departure. Arriving individuals have strong incentives to register as 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.[25] If not registered, individuals do not have access to any of these services. All newborn children are immediately registered before discharge, and deceased persons are removed upon death. The data covers close to 100 percent 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 incentivize 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 few reasons. First, individuals register and de-register on the basis of their planned length of stay in the country (for entries) or

[23]For example, child-care services provided by immigrant women might have allowed some native women to participate in the labor force as shown in Farré et al. (2011) or Cortés and Pan (2018).

[24]I apply these restrictions to avoid problems with potentially endogenous labor market participation in educational decision for young people and early-retirement decisions for men. See Hunt (2017) and De la Roca and Puga (2017); Ortega and Verdugo (2016) for a similar empirical approach.

[25]For instance the residents are assigned to schools and hospitals based on the residential proximity measured by their official registration. For more details, see Rodenas Calatayud and Marti Sempere (2009).

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.[26]

I have access to individual micro-data from the official registry, which provides information on individual's municipality of residence, nationality, the place of birth (municipality if born in Spain, country of birth otherwise), age and sex. Having 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 labor supply similarly to the papers that study the impact of changes in labor supply (Cadena and Kovak, 2016; Gonzalez and Ortega, 2013; Ortega and Verdugo, 2016; Lee et al., 2017; Sanchis-Guarner, 2017).

I use population stocks to account for mobility of the immigrant population for two reasons. First, it is considered to be a good measure for the number of immigrants living in the country, especially for both those residing legally and illegally, working in formal or informal sector. Second, as I am interested in changes in supply as a share of the total population at the previous period, it is more precise.

Using the municipal registers, I calculate the total stocks (both immigrant and Spanish[27]) and the net change in immigrant population between two periods using male population that is of working-age (16-65).[28] I apply these criteria as these stocks provide more precise measures for those involved in the labor market. As a robustness, I also provide results using female population and all the age groups, which provide similar results with smaller magnitudes as expected. Figure 3 shows the total outflows during the period 2009-2014, as a share of the total population in 2009. It can be seen that the net departures of the immigrant 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.[29] It is also important to note that the net outflow of the immigrants was observed in all the provinces (apart from Guipuscoa).

[Figure 3 about here.]

4.2 Summary statistics

Table 1 presents the summary statistics. My sample covers 50 provinces, over the 2009-2014 period which leads to 250 province-year observations. The table presents the main variables in the regression. The

[26]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.

[27]I consider an individual native if the person is born in Spain and has Spanish nationality.

[28]The measure captures changes in population stocks that are driven by internatitonal or internal mobility. From the perspective of the model, it does not matter much what is driving the change in the local labor supply. To verify that changes in the population stocks are not driven by either internal or external moves, I use the Residential Variation Statistics (EVR, or *Estadistica de Variaciones Residenciales,* in Spanish) provided by the Spanish Statistical Institute (INE), a 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 percent of the total moves while moves with an origin or destination outside of Spain constituted 45 percent of the moves. There are also moves that take place within the province borders which I do not capture in my measure.

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

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 labor supply of 0.5 percent annually.

Figure 4 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 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 labor market and, possibly, due to employmet 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 4 about here.]

5 Empirical strategy

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

5.1 Econometric equation

I estimate the effect of net outflow of the immigrant population on the changes of labor market outcomes for native workers over the same period. Corresponding to my theoritical setup, I use the following first differences regression model:[30]

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

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

where

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

$\triangle lnw_{g,j,t}$ is the change in mean of log wages of natives[31], 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

[30] For other papers using first differences models on evaluating the impact of immigration, see Gonzalez and Ortega (2013); Ortega and Verdugo (2016); Dustmann et al. (2017); Sanchis-Guarner (2017)

[31] 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.

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.[32] 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 labor market dynamics (Card, 2001; Peri et al., 2009; Dustmann et al., 2017; Lee et al., 2017). Moreover, scale effects can induce spurious correlation between higher outflows and higher changes in labor 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.[33]

Finally, 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 immigrant 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.[34] It thus gives the *total* wage and employment effects of a decrease in labor supply due to 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 immigrant 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 (in activity or unemployment).[35]

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).[36]

5.2 Identification

My identification relies on exploiting the variation in the net outflow rate which, after controlling for province and time fixed effects, is uncorrelated with local determinants of labor market demand and

[32] 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 labor 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.

[33] Measuring changes in immigrants' labor supply as a share of initial total population is standard in the literature (Dustmann et al., 2017; Lee et al., 2017). Still, in section 7.4 I test the robustness of my results by using alternative measures. Given that all provinces (except Guipuscoa) experienced net reduction in immigrant population, I measure the outflow rate as the difference in levels between $t-1$ and t so that net outflows would have positive values, which makes the interpretation of the coefficients more intuitive.

[34] 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 (2016).

[35] This differs from other studies which use the change in the local employment-to-population ratio such as Altonji and Card (1991); Boustan et al. (2010).

[36] Similar papers use weights proportional to the number of observations used for the computation of the LHS (see. for instance, Ottaviano and Peri (2012); Dustmann et al. (2017); Lee et al. (2017)). Some papers such as Hunt (1992); Clemens and Hunt (2017) use the inverse of the sampling variance as weights. All the results presented in the present paper are robust to the use of both weights.

economic performance between 2009-2014.[37] There are two issues regarding the identification. 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 OLS as lower bound estimates

A first order concern is identifying a source of variation for the outflow rate that is uncorrelated with local determinants of labor market demand and economic performance during the period. There is geographical variation in the intensity of the Great Recession across provinces. Provinces which experienced stronger increase in the unemployment rate aslo saw higher departures (Appendix Figure G1).

This creates a correlation between intensity of the demand shock and the outflow rates.[38] As 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 OLS estimate. Hence, given the 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 demand.

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

The departure of immigrants is only possible if there is an immigrant population in the province in the first place. This initial distribution of the immigrants across provinces, however, may not be random. The use of first-differences takes care of province characteristics that are fixed over time which allows me to make progress towards the identificitation of β_g and δ_g.[39] 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 as I am looking at the impact of outflows during a demand shock which is less straightforward than immigration in good times as in most of the immigration literature. For instance, if immigrants located in areas with faster wage and employment growth (conditional on all the time-varying and time-invariant controls) were more likely to leave, the estimated parameters would be upward biased. If, on the contrary, immigrants located in areas with slow growth rates were more likely to leave, then the parameters would be downward biased.

To deal with this identification issue, I construct an instrument adapting the "shift-share" methodology which is widely used in the literature.[40] Immigrants tend to locate disproportionately in areas where other immigrants from the same nationality or ethnicity have located in the past, 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 the current location patterns. Specifically, I distribute year-to-year variation of the national stocks (the "shift") of different nationalities across provinces according to some historical distribution of immigrants (the "share").

[37] 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.

[38] Although the negative demand shock and outflow rates are correlated, there is still important spatial variations in distribution of immigrants in 2009, share of construction sector prior to the crisis and intensity of the demand shock as can be seen in the maps in Appendix Section N1.

[39] The normalisation of the independent variable takes care of the concerns due to size of the immigrant population compared to the local population.

[40] 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 (2017); Fernández-Huertas Moraga et al. (2019).

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 annual national stock of immigrants $Immigrant^{n}_{j,t}$ of nationality n . This stock is calculated 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 nationaliy n in province j at time t is thus calculated allocating yearly total national stocks weighted by its 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):

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

Note that the instrument is constructed from combining nationality-specific predictions for every province (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 labor 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 (imputed immigrant plus native stock) in province i at the beginning of the period $t-1$. The instrument is constructed as follows:

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

For this instrument to be valid it has to be sufficiently correlated with the outflow rate but uncorrelated with the local shocks that affect variations in the labor market outcomes of the natives, conditional on province and time fixed effects.[41] The relevance of the instrument can be assessed by the value of the F-statistics of the instrument in the first stage of the 2-stage-least-squares (2SLS) regressions, and additionally by using weak identification tests.[42]

The validity of the instrument relies on the two components of Equation 15 being uncorrelated 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 labor 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) have to 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

[41] Taking the first differences addresses concerns about the differences due to province characteristics which are fixed over time.

[42] 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.

be uncorrelated with the past demand shocks.[43] Still, it is possible that unobservable shocks correlated with local labor market conditions that affected immigrants' location decisions in 1991, continued in the following periods. In Appendix Section K.1, I show factors that were determinant in the distribution of the immigrant population in 1991 were not relevant in the distribution during the period of analysis.

Furthermore, as shown by Jaeger et al. (2018) for the US, such instrument can be problematic if the location choice of immigrants and country-of-origin mix are stable over time. In the context of Spain these problems are likely to be milder as the local immigrant inflows over time are much less correlated as both country-origin mix and destinations have changed greatly for the immigrants between 1991 and 2009. For instance autocorrelation coefficients 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 U.S. 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 I exclude the Moroccans, which constituted the biggest immigrant group in 1991 and the second biggest in 2009, the correlation drops to 0.39. Both of these numbers are much lower than levels found by Jaeger et al. (2018) for the US which are between 0.9-0.99 starting from 1970s. Both figures suggest that the "Overlapping Response Problem" seem to not be of an important issue in the context of Spain. Still, in order to alleviate remaining concerns, in Appendix Section 6.1, I carry out the "Multiple Instrumentation" procedure as suggested by Jaeger et al. (2018) and show that the results are robust to inclusion of lagged outflows.

A final issue with the construction of the instrument is the endogenous location choices of natives as a response to immigrant mobility. The total population stock, which appears in the denominator, is the result of the sum of the (imputed) immigrant plus the native's stocks. The number of total natives residing in a given province might depend on the number of immigrant in the same location or on unobservables correlated with the labor market outcomes. For this reason, I use a similar shift-share strategy to predict the location choice of natives, based on past location patterns similar to the immigrant and replace the actual native stock by its imputed number. Details of this procedure are given in the Appendix Section J.1.

I use this instrument in my estimation and different versions of it in the robustnes checks. In Section 6.1 I discuss and test the validity of this instrumental variable approach, and in Section 7.3 I check if the results are robust to using different definitions of the shift and share in the construction of 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 in implementing the 2SLS estimation outlined in Section 5.2.

Figure 5 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

[43] 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 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.

province-year observation between 2009-2014. The figure shows that actual and predicted outflow rates are strongly correlated.

[Figure 5 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 as a share of the total working-age population, which is the explanatory variable in my second-stage regresion. 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 7.2 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 7.2) 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 the estimation of equation 12 and 13. As explained previously, the parameters β_g and δ_g correspond to the total effect and they capture the combined impact of changes in labor market outcomes of the natives due to outflow and native mobility. These results are obtained using data on annual changes on average wages and employment of natives during the period 2009-2014. In all specifications I include time dummies to control for national shocks, and cluster the standard errors at the province level. 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. Remember that I do not include province dummies as the analysis is in first differences. This simple correlation is 0.2 for wages and 1.15 for employment. Both models have high explanatory power (the R^2 around 49 percent for wages and 53 percent 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 the exercice 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 test of the strength of the instruments (F-stat Kleibergen-Paap). As expected, in all specifications the standard errors increase when using instrumental variables.

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. Introduction of the instrument takes care of 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 percent increase in the annual outflow rate increases the wages and employment in the province by 2 percent and 2.4 percent respectively.

Based on the averages presented in Table 1, these estimates indicate that for every 3160 immigrant who leave a province, natives' monthly wages increase by 32 euros and 64 natives find full-time formal employment in the same year. Given the overall decline in employment and wages observed throughout the period, the outflows from provinces slowed down the drop in native employment and wages as predicted in the model. In other words, the mobility of the immigrant provided a cushioning effect to the 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 ii) natives located in areas with the higher migrant population before the crisis experienced reduced job losses due to labor demand shock. However, their results do not indicate the precise channel through which the presence of immigrant population protects natives in a downturn. These findings show that the presence of immigrant population benefits natives by moving out of the local labour market, which slows down the decline in their labour market outcomes. 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 carry out various exercises to test the robustness of these results. I start by examining whether pre-trends or other spurious correlations are driving the results. Later, I show that the results are robust to the use of different outflow measures, alternative instruments, and weights.

7.1 Previous-trends

It is important to check that observed changes in the wages and employment are not driven by persistent unobserved factors and previous trends. In order to explore this I carry out three tests.

First I regress pre-recession changes in wages and employment on the total outflow rate from 2009-2014. Specifically I use the total outflow rate over the 5 year period, and test whether it has any explanatory power over the changes in the pre-crisis period. Similarly to the main specification, I weight the regressions with employed population in the base year (i.e., 2009). Table 4 shows this falsification test for the period 2003-2008.[44] The OLS and 2SLS results for wages are presented in columns 1 and 2, while results for the employment are in columns 3 and 4. I find a negative and non-significant relationship for wages, and negative and highly significant results for employment. These results imply that, if anything, the provinces which have witnessed higher outflow rates during the Great Recession were in a negative wage and employment growth trend before the Recession.

[Table 4 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 outcomes ($y_{j,2008} - y_{j,2003}$) to address the possibility of confounding pre-existing trends. Table 5 presents the 2SLS results. Columns 1 and 3 present baseline results for comparison. In

[44] 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.

columns 2 and 4, I add the pretrends for wages and employment that were calculated as the change in the outcomes from 2003 to 2008. Pretrends for both wages and employment are small and statistically insignificant. These results confirm the findings above.

[Table 5 about here.]

Third, I test the correlation between the share of immigrant in the 2009 population and the pre-trends for changes in wages and employment. I do this test in order to check whether distribution of immigrant 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 Table 6 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.

[Table 6 about here.]

These three exercises show that province-specific pre-trends did 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 in a negative growth trend before the crisis.

7.2 Bartik and other controls

The effects found in the previous section show that 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? In order to check the robustness of these results, I test the specification while including controls that may be correlated with the evolution of the labor market outcomes during the period.

Table 7 presents results where I include various controls. Columns 1 and 4 present 2SLS results without any controls, as a benchmark. In columns 2 and 6, I control for changes in demographic characteristics, namely changes in average age and share of high-skilled workers among the total employed between two periods.[45] If these variables affect economic performance during this period, their inclusion reduces the risk of spurious correlation. Inclusion of these variables do not change the significance of my variable of interest and my instrument remains strong.

[Table 7 about here.]

The economic structure at the start of the period (2009) may also be correlated with the presence of the immigrant population and the labor market performance of each province throughout the period. In order to control for differences in the structure of economic activity, in columns 3 and 7, I include the share of agriculture, construction, and services in the total employment.[46] As described earlier, although the immigrants were employed in agriculture and services, they were also highly concentrated in the construction sector.

More importantly, the period under study is that of an economic crisis. The severity of the Great Recession differed significantly across provinces. This period saw a significant decline in economic activity

[45] As pointed out in Verdugo (2016), during the Great Recession the labor force became older and more skilled as the younger and less-skilled workers were first to be fired. Inclusion of these controls captures increases in the wages driven by compositional changes.

[46] I use the sectoral shares in employment for the year 2009 as it is the base year of the analysis. Use of base year characteristics is common practice in similar exercises (see for instance Boustan et al., 2010; Autor et al., 2013; Lee et al., 2017). The results also hold if I use the shares in 2007.

in several specific 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 need to control for shifts in demand that is independent from local labor supply characteristics. Following the literature studying the local economies, I introduce a variant of "shift-share", $\triangle Bartik_{j,t}$, shocks à la Bartik (1991). I detail its construction in Appendix Section L.

One important remaining issue is the potential omitted variable bias that may result from native outflows. As discussed in 9.1, native mobility was minimal before and limited during the crisis period. Still, if natives' outflow rates follow a similar distribution to that of immigrants, the estimated parameters may be capturing the combined effects of both immigrant and native departure. As Appendix Figure M1 shows, outflow rates for immigrant and natives' were not correlated. Still, to address this concern, I control for native mobility in columns 4 and 8. I construct the native outflow rate as the net change in the native-born population between two periods, normalized by the total population in the base period, similar to the immigrant outflow rate.[47] The results hold.[48]

Overall results show that, the effects of outflow rate is not due to spurious correlations caused by the economic and demographic conditions at the beginning of the crisis and the changes that followed during the period.[49]

7.3 Alternative instruments

In this section, I test the validity of my results using alternative instruments based on different shifts and shares. Table 8 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 the provincial distribution of the immigrant 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 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 8 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.

[47] Native outflows can suffer from measurement error as Spanish citizens are not deleted after two years. In Appendix Section I.2, I discuss this issue and explain why it does not any threat to the empirical exercise.

[48] 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.

[49] Throughout the paper, I present results with only outflow rate, without including the controls for transparency. However, all of the results presented in the paper are robust to inclusion of these controls. Results are available if requested.

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 in the base period. Papers that are focusing on the impact of immigration use various definitions for supply shock. In this section, I reconstruct the outflow rate following different measures used in the literature to show that my results are robust to alternative shock measures.

Table 9 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 9 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 9 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 10, I re-calculate the measure males of all age groups (columns 2 and 4) and working-age population including women (columns 3 and 6).[50] The results can be seen in Table 10.

[Table 10 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, these results confirm that those results are not driven by the numerator or denominator chosen for the construction of the outflow measure.

7.5 Alternative weights

All of the results presented in section 6 use weights that are proportional to the number of observations used to compute the LHS variable as it corrects for heteroskedastic error terms and thereby achieve more precise estimation of coefficients (Solon et al., 2015). Use of such weights naturally, changes the importance of each province-year observation as more populated provinces are assigned more weight. In order to test the importance of weights in the estimation, I run the main regressions with and without weights. Table 11 reports 2SLS results for both wages and employment. Results in column 1 and 2 are the baseline, where regressions are weighted by number of employed in the base period. In columns 3 and 4, there are no weights.

Three results stand out: First although the coefficients for wages hardly change, the coefficient for employment gets larger which suggest that growth in native employment was especially important in less populated provinces.[51] Second, weighting by the number of observations leads to smaller standard

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

[51] It should be noted however that given the standard errors, one cannot reject the hypotheses that both coefficients are statistically different from each other.

errors and thus a more precise coefficient estimation.[52] Finally, both weighted and unweighted estimates are consistent with each other which indicates that the model provides a good approximation.

[Table 11 about here.]

8 Heterogeneity analysis

The model predicts (11) 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 population. However, depending on the groups' supply elasticities or wage rigidities, the final effect may differ in magnitude or the margin (i.e., employment vs. wage). In this section, I test the heterogeneous effects of outflows across groups with different skills and demographics.

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

8.1 Skill groups

As discussed earlier, 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. The MCVL includes information on the highest education level attained by the worker. Using this information, I group workers into two skill groups, those who have less than a university degree (i.e., low-skilled) and those who have a university degree or more (i.e., high-skilled).[53]

Panel A in Table 12 presents the OLS and 2SLS results for wage growth for different skill groups.The OLS results presented in columns 1 to 3, show that outflow rate's effect on wages are statistically insignificant which is due to the negative correlation between the outflows and economic shock that was discussed above. Once the bias is taken care of with the instrument, all the coefficients become much larger, positive and significant.[54]

[Table 12 about here.]

Panel B in Table 12 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 of all skill groups. Similar to the wage results, 2SLS coefficients are much higher than the ones obtained through OLS, as the instrument takes care of the downward bias. The results show that a 1 percent increase in the outflow rate increased the employment growth of the low-skilled by 1.8 percent and high-skilled by 4.6 percent.

Given the predictions of the model, one would expect larger elasticities for the low-skilled. How to explain this? First, these coefficients measure the growth rates in the employment and not the increase in the number of workers. For instance, given the average number of low-skilled workers (2196) and high-skilled (486), a 1 percent increase in the outflow rate adds around 40 low-skilled and 22 high-skilled workers. Second it is important to note that different skill groups have different degrees of wage rigidities

[52]As discussed in Solon et al. (2015), when the number of observations used to compute the LHS is highly variable and small in some, using weights can improves the precision.

[53]I assume that the relevant split in terms of production abilities is between college and non-college-educated workers. This is consistent with Goldin and Katz (2007); Card (2009); Ottaviano and Peri (2012); Docquier et al. (2014) who find high substitutability between workers with no schooling and high school degree, but small substitutability between those and workers with a college education.

[54]Estimate for the high-skilled is significant at 11%.

and elasticities in labor 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 employments.

8.2 Demographics

Outflow of the immigrants can have a different impact depending on the demographic characteristics of the natives. Table 13 provides a more detailed analysis by investigating how the outflow of the immigrant affects labor market outcomes of different demographic groups. The estimation is identical to the baseline specification, which links the *overall* outflow of (male) immigrants to employment and wage growth of each group.

[Table 13 about here.]

Panel A presents the results for wage growth, while Panel B reports results for employment. In terms of wages, all groups benefited from the departure of the immigrants, although 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 accelerated the employment growth of all groups as well. While males (column 1) and females (column 2) benefited roughly equally from outflows, there are significant differential effects by 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 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.[55] In reverse, natives who are between age 30 to 40 (column 4) benefit the least from the outflows, possibly due to their higher labor market integration. Finally, as expected, workers above 40 also benefit from the departure, less than young natives but cleary more than those between the ages 30-40.

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 shed light on the underlying mechanisms.

9.1 Geographic mobility of natives

Natives can respond to the departure of immigrants from a local labor market through geographical mobility. Changes in the mobility patterns can impact 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 local average impact of immigration outflows, one needs to take into account that changes in population in a given area affects the whole regions system equilibrium. The relocation of the population across areas within a country would hinder the identification of any area-level

[55] 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.

effects, as the effects dissipate throughout the country. For instance, if outflow of immigrants triggers outflow of natives in parallel (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 labor markets would be affected by changes in the native population, thus native mobility.[56]

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

$$\triangle native_{j,t} = \lambda \triangle foreign_{j,t} + \alpha_t + \varepsilon_{j,t} \tag{18}$$

where $\triangle native_{t,j}$ is the net-change in native-born population between two periods, divided by the province initial population.[57] 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 native population is increasing in areas where immigrants are leaving. If natives leave areas along with immigrants then estimated λ will be negative. Table 14 shows the results of the estimation of equation 18. Columns 1 to 3 show the OLS and 4 to 6 show the 2SLS results, where I use the same instrument.

[Table 14 about here.]

I find a positive and significant impact of outflows on the native population, both in 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 immigrant that leave a given province, native population increases by one. This elasticity is exact the same as those found in Boustan et al. (2010); Dustmann et al. (2017); Fernández-Huertas Moraga et al. (2019); Monras (2018).[58]

Although informative, these results do not tell us anything about how the native population is increasing. Natives can respond by decreasing in-migration from other areas, increasing outflow from the area, or both. In order to answer this question, I use the EVR data and calculate arrival and departure rates for the natives.

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 at time $t-1$. Similarly, I define the departure rate from a province j as:

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

[56]The importance of native displacement is not limited to simply understanding the direct question of natives' adjustment margin. Through mobility of natives, the effects of immigration can be diffused to other labor 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 labor 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 however 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.

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

[58]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.

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.

In Table 15, 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. In order 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 15 shows that an increase in the net outflow rate of immigrants increases the net growth rate of native population (columns 1 and 4).[59] 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).[60] In terms of point estimates, arrival rates seem to matter more than departures. [61]

[Table 15 about here.]

These results show that outflow of the immigrants attracted natives to these areas while reducing the depatures. This could be suggestive that natives and immigrant have a certain degree of substitutability. This also means that the estimated impact of the outflow on the change in the average wages between 2009 and 2014 includes a small downward bias due to the arrival of the natives, and thus 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 labor markets. These observed effects can be due to the increased entry of the natives into employment, lower probability of separation, or exit from the labor market.

The overall employment effects reported can be decomposed between movements from and to nonemployment (i.e., inactive or unemployed). Specificially,

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

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. In order to test this, I first calculate the entry and exit rates for each skill group.[62] 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. In order to net out these differences, I include province-fixed effects along with time-fixed effects. Hence the estimated parameters capture the deviation from the province average due to outflows.

Table 16 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 nonemployment to employment for both skill groups. An increase of 1 percent in the outflow of the immigrant population accelerates the entry rate of low-skilled and high-skilled natives into employment by 2.4 percent and 2 percent, respectively. Results in columns 4-6 suggest that outflows are also decelerating the exit rates of low-skilled and high-skilled by 1.3 percent and 0.4 percent, although these coefficient are statistically insignificant.

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

[60] The EVR data distinguishes moves within two provinces; and those from/to abroad. Here I use the total of both domestic and international moves for simplicity. However, the results are mainly driven by domestic moves.

[61] In Appendix Table P1, I decompose the outflows for different demographic groups and show that strongest effects are observed for young male population.

[62] I calculate the entry and exit rates, by dividing the number of newly employed workers normalised by the number of employed workers in the area.

These results show that, most of the short run employment effects go through increased entries rather than decreased exits. This suggests that the outflow of immigrants benefit the "outsiders" who are more likely to enter to employment, rather than "insiders" who are already employed. This results mirror the effects found in Dustmann et al. (2017) who show that inflow of Czech workers into German municipalities have reduced the entries of natives from nonemployment to employment, while those who were already employed were not affected.

[Table 16 about here.]

9.3 Margins of the wage effects

Average wage growth observed in the previous section can be driven by three different channels. The increase in the average wages can be due to higher entry wages, wage growth of stayers or the exit of the least productive workers.[63] To analyse this, I use the panel dimension of my data and decompose the wage growth seperately for those who enter employment ("*New Entries*") and for those who were employed in both periods ("*Stayers*").[64] Table 17 presents these results. Column 1 to 3 show the change in the entry wages while column 4 to 6 show the results for those who remained employed in both periods.

Results in the first three columns indicate that the departure of immigrants increased the wages of those who entered employment, although the results are statistically not significant. It is important to note that these insignificant results are driven by two opposing forces. As discussed in the model, the departure of immigrants decreases competition in the labor market, thus pushing up wages in the labor market. On the other hand, the departures can also potentially increase the entry of less productive workers into employment (negative selection), which could lower the average wages.

Results in columns 4 to 6, show that higher departure rates increased the average wages for those who were employed in both periods. Given that in this specification the composition of workers is fixed between two periods, these results are entirely driven by decreased competition in the labor market due to the departure of the immigrants.

[Table 17 about here.]

9.4 Margins by contract types

As shown in the previous sections, the departure of the immigrants have 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 I discuss in the Section 2.2.2, the prediction of the model and the margins of adjustment depend on the degree of wage rigidity.

Spain has a dual labor market which creates important differences between indefinite and fixed-duration contracts in terms of firing costs and wage setting (Bentolila et al., 2012a,b).[65] As shown in De la Roca (2014) while indefinite contracts provide higher protection they also generate greater wage rigidities and thus lower cyclicality. Fixed-term contracts, on the other hand, provide higher flexibility in terms of wages. Since the duration of fixed-term contracts is relatively short, and their termination has no cost, firms can adjust their demand through these contracts. As the wages of these contracts

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

[64] Here I define a worker as a "Stayer" if that person was employed for two successive periods. I do not however distinguish whether the individual remained in the same job or changed.

[65] 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.

are less influenced by the institutional framework, the wage levels better reflect the cyclicality.[66] Given these differences in the degree of wage rigidities, the type of job contracts may affect the responsiveness of wages and employment to outflow of immigrants.

In order to test how outflows of immigrants impact the wage and employment growth of natives, I decompose the workers into two groups by type of job contract: those who have a fixed-duration contract and those who have an indefinite (permanent) contract.[67] I repeat the regression for both groups seperately and present the 2SLS results in Panel A of Table 18. For each contract type, I present wage growth (columns 1 and 2) and employment growth (columns 3 and 4). In order to prevent the results from being driven by differences in labor demand or changes in the composition of the workers, I include Bartik and demographic controls.

[Table 18 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 provinces where outflows were higher, the number of workers with indefinite contracts increased, while the number of fixed contracts was unaffected. These margins of adjustment echo the findings of Edo (2016) for France.

These results are however based on the average effect of outflow on both newly recruited workers and those who were in the labor market. In order to understand the underlying mechanism, in Panel B of Table 18 I further decompose the wage growth of the worker by those who entered the labor market vs. those who were already in the labor market. The results are informative. Columns 1 and 2 show that the outflows did not affect the wages of the newly recruited individuals, which is consistent with the previous findings. On the other hand, as can be seen in columns 3 and 4, those who were employed in the previous period saw their wages increase due to the departure of the immigrants. The differences in the estimated coefficients between column 3 and 4 show that increases are mainly driven by the fixed-contracts. These elasticities are in line with De la Roca (2014), who finds that wage cyclicality in Spain for temporary contracts is twice as large as for workers under indefinite contracts.

These results complement the findings in the section. While "outsiders" benefited from the employment margin through increased entries to employment, "insiders" benefited from wage growth.

10 Dynamics of adjustment

Results in the previous sections discuss the annual (or the short-run) effects of outflows on the local labor markets. Yet, in medium or long-run, the labor markets may adapt to supply shocks through relocation of labor and capital across localities mitigating the initial effects on wages or employment. In that sense, understanding the wage and employment dynamics following decrease in immigrant labor supply is informative. In this section, I explore the dynamics of the adjustments for wages and employment by testing the effects of outflows in longer differences to understand their medium-run effects and also to provide estimates that are comparable with the literature which studies similar longer-run effects.

In Table 19, in addition to my benchmark analysis (which is in one-year differences), I also look at longer time windows (i.e., in longer differences) to study the changes in the estimated relationship. I start the analysis in 2009 as before, but extend the end period to 2016, the final year with net outflows of immigrants from Spain, to have a longer time span. Specifically, I look at the annual changes between

[66] 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.

[67] 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.*

2009 and 2016, changes between 2009 and 2013 (4-year difference) and between 2009 and 2016 (7-year difference). To do so, I reconstruct outflow rates, the instruments, and the outcome variables in longer differences. I use the same specification as in the previous section in first differences.[68] I limit the observations so that both the start and the end date of the period remain within the period of interest (i.e., 2009-2016).[69]

Table 19 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 afterwards. The employment effects, on the other hand, remain even in a 7-year window.

[Table 19 about here.]

As shown earlier, the natives respond to the outflows by relocating across labor markets. Such relocation can change the composition of the local labor force and complicate the assesment of the impact of these outflows, especially when studying the medium-run 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 the later years. As the composition of workers remains constant over time, this approach also prevents estimates to be biased due to endogenous changes in the characteristics of natives.

[Table 20 about here.]

Table 20 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 estimate for the period 2009 and 2016, 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-run while positive effects dissappeared for new recruits due to native inflows or entry of workers with lower abilities into employment.

Employment results in columns 5 and 6 are slightly smaller than those found using cross-sectional data, although remain highly significant. The differences in the magnitudes of the estimates suggest that increase in local employment is driven by two factors: by natives who were employed in the base year are less likely to lose their jobs due to outflows (captured by the magnitude in Table 20), and new recruits who were either located in the province but were unemployed or those coming from other provinces (difference between the estimate in Table 19and 20).

Overall, the results where worker composition is not fixed suggests that the positive effects of outflows on local wages persist until the fourth year, and disappears afterwards. This "recovery" is clearly faster than what is observed following an immigration episode, where the negative effects due to immigration disappear after 5 years in Monras (2019) or 14-20 years in Blanchard and Katz (1992); Jaeger et al.

[68] I further check the robustness of the results by adding the same controls as in Section 7.2. Results can be provided if requested.

[69] 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.

(2018); Edo (2019). However, once the worker composition is fixed, the positive wage effects remain significant even beyond 4-years. 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, 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 also by helping employed natives keep their jobs throughout the period.

11 Concluding remarks

This paper documents the impact of outflow of immigrants from local labor 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 of all skill and demographic groups. I find that the departure of immigrants increased geographic inflows of natives from other provinces and reduced their outflows, increased the entry to employment from nonemployment, and improved the wages of those who were already employed.

In a context of economic contraction with declines in wages and employment losses, the departure of immigrants diffused the incidence of local shocks and cushioned the fall of natives. As the locations which were hit harder by the crisis also lost more immigrants, this smoothing effect contributes as a mechanism for equilibrating differences across labor markets. This suggests that higher mobility of immigrants improves the functioning of local labor markets not only during the good times (Borjas, 2001), but also during bad times. This finding underlines an important benefit of immigration that has been little explored in the literature. This benefit of migration is particularly important given the concerns about the relative lack of mobility of natives and especially among less-skilled workers as it leads to significant divergence in local unemployment rates and workers' wages across local labor markets (Bound and Holzer, 2002; Cadena and Kovak, 2016; Dao et al., 2017).

The estimated magnitudes should be considered within its specific context. Spain is a country where the immigrant population has an average substitutability with native population, which is much higher than many countries. For instance, immigrants who left were from Spanish speaking countries or other European countries, thus were close substitutes to the natives at least in terms of linguistics capabilities or skills. High substitutability between immigrants who left and natives who stayed potentially can explain part of the positive effects. That is why, although the conclusions derived from this case study can be generalized to other migration contexts, the effects could be of smaller magnitudes when immigrants and natives of similar observable skills (i.e., education and age) are imperfect substitutes or complement in 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 which is beyond the scope of this paper.

These findings also shed light on how rigid labor markets adjust to changes in labor supply. First, it shows that labor market rigidities determine whether the effects operate through the employment or wage margin. Second, it shows that changes in labour supply could have differential affects for workers who are "outsiders" vs "insiders". Hence, my findings have implications beyond the immigration literature and contribute to understanding how labor markets respond to local shocks.

This paper provides evidence on the impact of immigrant mobility on the local labor market outcomes of natives. However, it does not focus on the individual heterogeneity of either of the groups and address the individual selection component. A better understanding of the selection due to individual ability both for departing immigrants and natives is yet to be addressed, and remains an important question for future research.

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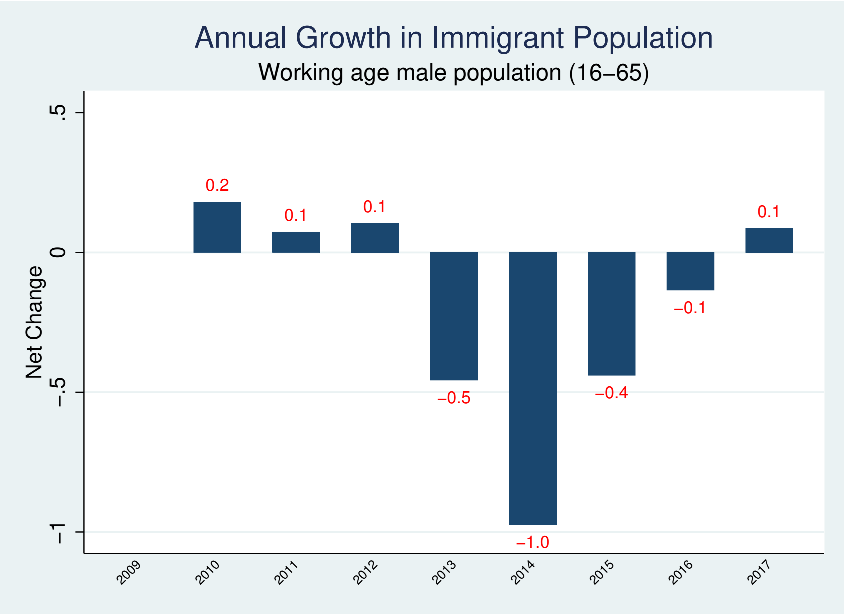
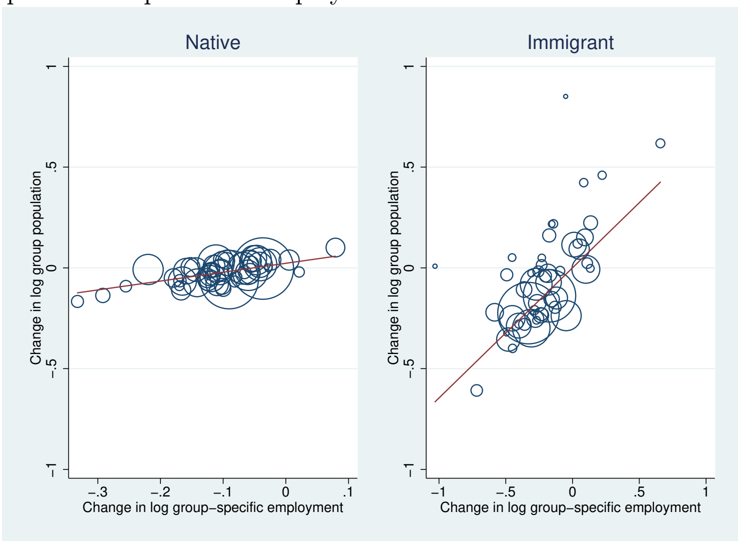
Figure 1: Yearly net change in immigrant population



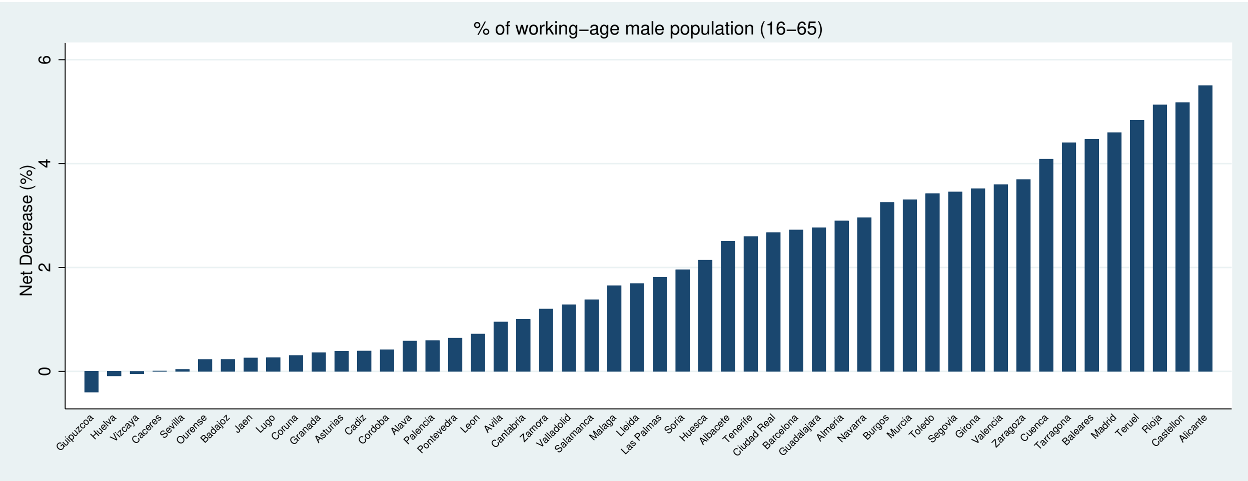
The figure plots the net change in working-age male immigrant population as a share of total working-age male population in previous year.
Source: Municipal Register of Population (Padrón)

Figure 2: Population responses to employment shocks: Native-born vs. immigrant men



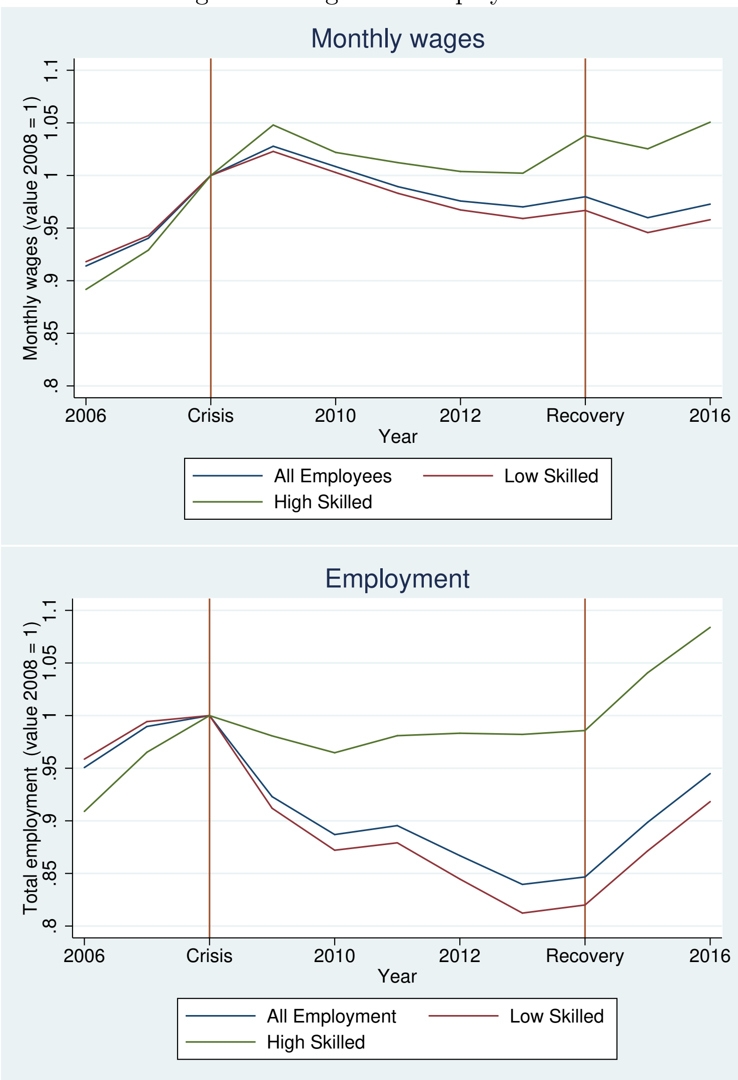
The figures plot the changes calculated as the long difference in logs from 2009 to 2014 for each province. The x-axis is the group-specific change in employment and y-axis is the change in population. Observations are weighted by the group population in 2009.
Data: Spanish Labor Force Survey (EPA)

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



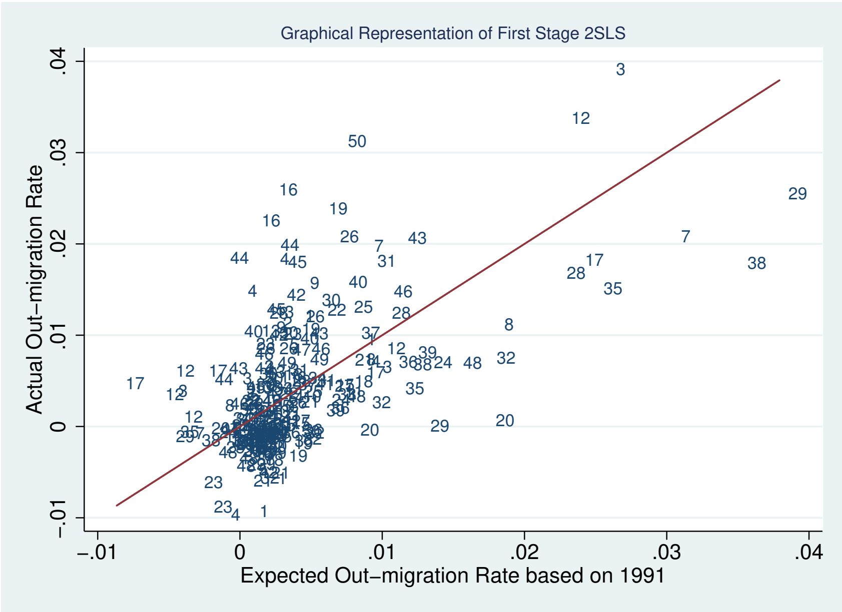
Net change in the total immigrant male working-age population between 2009 and 2014, as a share of the total working-age male population in 2009. Positive bars correspond to net outflow of the population.
Data source: Municipal Register of Population (Padrón)

Figure 4: Wages and employment



Average monthly wages (top panel) and employment (bottom panel) for all, low and high skilled native workers. The values are normalised by group value in 2008.
Data source: Continuous Sample of Employment Histories (MCVL)

Figure 5: Instrumental variable relevance



The figure plots the predicted outflow rate in each province-year pair between 2009 and 2014 (based on the distribution in 1991) in the horizontal axis against the actual outflow rate between 2009 and 2014. 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

	2	3	4	5	6
Predicted Net Outflow Rate	0.4145	0.3769	0.3150	0.2300	0.2422
	(0.099)***	(0.097)***	(0.057)***	(0.065)***	(0.060)***
Compositional	No	Yes	Yes	Yes	Yes
Pop Growth	No	No	Yes	Yes	Yes
Economic 2009	No	No	No	Yes	Yes
Bartik	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 first-stage results. The dependent variable is the change in immigrant population between year t and $t-1$, relative to total working-age population in year $t-1$. The explanatory variable is the imputed change in immigrant population during the same period. The unit of analysis is province. Weights correspond to the number of employed natives in the base period ($t-1$). Compositional characteristics correspond to changes in average age and schooling of the native workers. Population Growth corresponds to change in the total population between year t and $t-1$, relative to total working-age population in year $t-1$. Characteristics of the Economy in 2009 include share of agriculture, manufacturing, construction and services in total employment. Bartik refers to the change in predicted total employment. Regressions include year-fixed effects. 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 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 change in immigrant population in an area, 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 native local wage and employment growth in the aggregate. Columns 1 and 2 report OLS results, while columns 3 and 4 report 2SLS results. Regressions are estimated annually, across 50 provinces over 5 periods. Regressions are weighted by total employment in the base year and include year-fixed effects. 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 4: Falsification Test 1: Wage and employment growth in 2003-2008

	Wage		Employment	
	OLS	2SLS	OLS	2SLS
Net Outflow Rate 2009-14	-0.0179	0.0017	-1.8976	-3.2787
	(0.019)	(0.035)	(0.701)***	(1.671)**
N	50	50	50	50
KP F-Stat		23.13		23.13

The table reports OLS and 2SLS estimates for the impact of net change in immigrant population in an area, measured as the decrease in the number of working-age male immigrant population between 2009 and 2014 as of total working-age male population in year 2009, on native local wage and employment growth of natives in the aggregate in the previous period. Columns 1 and 2 report results on wage growth, while columns 3 and 4 report results for employment growth. Regressions are weighted by total employment in each province in 2009. 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 5: Falsification test 2: Pre-trends

	Wage		Employment	
	2SLS	2SLS	2SLS	2SLS
Net Outflow Rate	2.0286	2.0680	2.4122	1.8584
	(0.609)***	(0.724)***	(0.752)***	(0.417)***
Pre-trend wage		0.0188		
		(0.089)		
Pre-trend employment				-0.0485
				(0.031)
N	250	250	250	250
KP F-Stat	17.45	16.02	17.45	34.78

The table reports 2SLS estimates for the impact of net change in immigrant population in an area, measured as the decrease in the number of working-age male immigrant population between 2009 and 2014 as of total working-age male population in year 2009, on native local wage and employment growth of natives in the aggregate (skilled and unskilled)in the previous period. Columns 1 and 2 report results on wage growth, while columns 3 and 4 report results for employment growth. The unit of observations are provinces. Regressions are weighted by total employment in 2009 and include year-fixed effects. 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: Falsification Test 3: The share of immigrants in base year

	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

The employment and wage growth in the previous periods, standardized by intial employment. The explanatory variable is the share of immigrant in the total working age population in 2009. The unit of observations are provinces. Regressions are weighted by total employment in 2009. 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 7: Wages and Employment with 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 change in immigrant population in an area, measured as the annual decrease in the number of working-age male immigrant population between period t and $t-1$ as of total working-age male population in t, on native local wage and employment growth. The unit of observations are provinces. Regressions are weighted by total employment in period t. Characteristics of econommy in 2009 include share of agriculture, manufacturing, construction and services in total employment. Bartik refers to the change in predicted total employment. Native out-flow is measured as the annual decrease in the number of working-age male native-born population between period t and $t-1$ as of total working-age male population in t. Regressions are weighted with total employment in period $t-1$ and include year-fixed effects. 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 8: Alternative instruments

	Baseline	1991	Gravity 91	1991 FB	1995	Gravity 95	1999	Gravity 99	2001	Gravity 2001
Panel A: Change Wages										
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 net change in immigrant population in an area (see the text for details on the measurement), on native local wage and employment growth of natives. The unit of observations are provinces. Regressions are weighted by total employment in year $t-1$, and include year fixed-effects. 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 9: Alternative measures of outflows

	Wage				Employment			
	Baseline	Card(2016)	Friedberg(2001)	Hunt(1992)	Baseline	Card(2016)	Friedberg(2001)	Hunt(1992)
Net Outflow Rate	2.0286				2.0853			
	(0.609)***				(0.453)***			
$\triangle Immigrant/$Native in t-1		1.7560				2.0912		
		(0.771)**				(0.603)***		
$\triangle Immigrant/$Native in t			1.7511				2.0854	
			(0.768)**				(0.602)***	
$\triangle Immigrant/$Total in t				2.4955				2.9719
				(1.137)**				(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 net change in immigrant population in an area (see the text for details on the measurement), on native local wage and employment growth of natives. The unit of observations are provinces. Regressions are weighted by total employment in 2009. 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 10: Alternative measures of net outflows

	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 annual net outflow of immigrants (see the text for details) on native's wage and employment growth. The unit of observations are provinces. Regressions are weighted by total employment in year $t-1$. 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 11: 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 net change in immigrant population in an area, 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 native local wage and employment growth in the aggreagate. Regressions are estimated yearly, across 50 provinces. Regressions in columns 1 and 2 are weighted by total employment in the base year. All results include year fixed effects. 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 12: Wages and employment by skill group

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 employment and wage growth in the previous periods, standardized by intial employment. The table reports OLS and 2SLS estimates for the impact of net change in immigrant population in an area, 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 native local wage and employment growth in the aggregate. Regressions are weighted by group-specific employment in base period. 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 13: 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 wages and employment growth in the previous periods, standardized by intial employment. The table reports OLS and 2SLS estimates for the impact of net change in immigrant population in an area, 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 native local wage and employment growth in the aggregate. The unit of observations are provinces. Regressions are weighted by group-specific employment in year $t-1$ and include year fixed-effects. 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 14: Impact of outflow on native mobility betweeen 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 net change in immigrant population in an area, 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 of pre-existing native working age population during the same period. I use the methodology from Peri and Sparber(2011). Regressions are estimated at the yearly level, across 50 provinces. Regressions are weighted by group-specific population in the year $t-1$ and include year 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 15: Impact of outflow on native mobility 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 net change in immigrant population in an area, 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 rates of pre-existing native working age population during the same period. Regressions are estimated at the yearly level, across 50 provinces. Regressions are weighted by group-specific population in the year $t-1$. 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 16: 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

Dependent variables are entry rate (columns 1-3) and exit rate (columns 4-6). The unit of observations are provinces. Regressions are weighted by total employment in year $t-1$, include province and year fixed-effects. Standard errors are clustered at 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 17: New entries vs already employed: 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 wage and employment growth in the previous periods, standardized by levels in the base period. The explanatory variable is the share of immigrant in the total working age population. The unit of observations are provinces.Regressions are weighted by total employment in year $t-1$, include province and year fixed-effects. 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 18: 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		Already Employed	
	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 net change in immigrant population in an area, 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 wage and employment growth by type of contract. Regressions are estimated at the yearly level, across 50 provinces. Regressions are weighted by group-specific employment in year $t-1$ and include year fixed-effects. 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 19: Longer differences: Wages and employment

	Wage			Employment		
	Baseline	2009-2013	2009-2016	Baseline	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

The employment and wage growth during the periods, standardized by intial employment. The table reports 2SLS estimates for the impact of net change in immigrant population in an area, measured as the decrease in the number of working-age male immigrant population at different time differences, on native local wage and employment growth in the aggregate. The unit of observations are 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)

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

Table 20: Longer differences with fixed cohorts: Wages and employment

	Wage			Employment		
	Baseline	2009-2013	2009-2016	Baseline	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 employment and wage growth during the periods, standardized by intial employment. The table reports 2SLS estimates for the impact of net change in immigrant population in an area, measured as the decrease in the number of working-age male immigrant population at different time differences, on native local wage and employment growth in the aggregate. Native workers are grouped based on their location in 2009. The unit of observations are provinces. Regressions are weighted by group employment in the base period. 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)

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

Online Appendix for
The Cushioning Effect of Immigrant Mobility : Evidence from the Great Recession in Spain

Cem Özgüzel

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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 labor demand (Equation 4) in the paper.

A.2 Derivation of labor 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 labor 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 labor 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:

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

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

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

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 labor 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.[70] The negative shock in the construction sector reversed the positive trend in the employment observed until the crisis.[71] 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 labor costs continued to increase. Spain is a country characterized by a rigid labor market with very low wage cyclicality (De la Roca, 2014; Font et al., 2015).[72]The low association with the cyclical conditions in the labor 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 initiated in 2008, the wages failed to react to the strong deterioration of the labor 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.

[70]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. (2017)).

[71]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 has experienced one of the most important housing booms among developed economies. See Gonzalez and Ortega (2013); Akin et al. (2014); Sanchis-Guarner (2017) on the topic.

[72]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).

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 labor 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).[73][74] The deterioration in the labor 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 percent, which was slightly lower than Greece (Figure B1). Since 2014, the economy started recording positive employment growth, entering officially to the *Recovery* period.

[Figure B1 about here.]

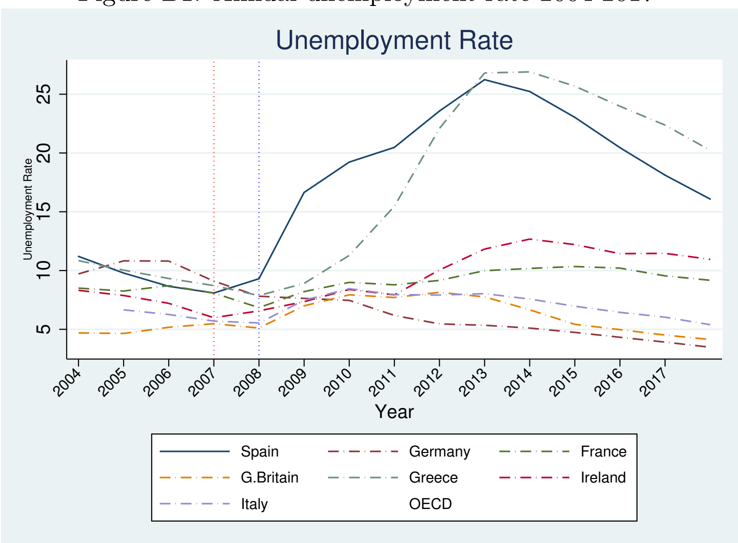
Job losses were highest among workers with temporary contracts (more than 1.7 million between 2008 and 2013), due to high reliance on the use of such contracts in the Spanish economy.[75] Although the losses were concentrated among temporary workers in the first stage of the crisis, very soon the dismissals of workers with open-ended contracts reached historical levels (Malo, 2015).

[73]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.

[74]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.

[75]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 ??, the immigrant share in the total population increased from 1.6 percent in 1998 to 12.1 percent in 2009, reaching to 5.6 million.[76]

[Figure C1 about here.]

A substantial portion of immigration to Spain was driven by labor 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 percent of total foreign-born population, followed by Ecuador (7.7 percent), Argentina (5.4 percent) and Colombia (5.2 percent). In terms of which accounted for over one quarter of Spain's immigrants (C2). In terms of continent, immigrants originating from Central and Latin America represented 38% of total migrants, followed by Africans (25 percent) and EU27 nationals (25 percent).

[Figure C2 about here.]

Before the crisis in 2007, the average immigrant share in Spanish provinces was 8 percent. As can be seen in the map in Appendix N1, 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 percent, 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 percent. 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.

Immigrants to Spain integrated quickly to the labor market and exhibited a higher labor 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

[76] 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%.

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.[77] 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 (Gonzalez and Ortega, 2011; Farré et al., 2011; Farr et al., 2011).[78] Focusing on the occupational distribution of immigrants, Amuedo-Dorantes and De La Rica (2005) found no occupational segreagation between EU immigrants and natives[79] 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 labor market conditions by moving up to better paid occupations, while no such progress was observed for Africans.[80] 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.[81] 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.[82]

[Figure C3 about here.]

Between 2009-2014, working-age male immigrant population saw a net decrease of 170 000.[83] Figure C4 shows the annual net outflow of the working-age male immigrant population as a share of the total working age population (Spanish and immigrant) the year before. It can be seen that the departure of the immigrant created a labor supply shock between 0.1-1% annually. [84] Between this period, the total net outflow of working-age immigrant male population caused a reduction of 1.1 percent in the total working-age male population and 6% in the working-age immigrant male population across Spain.[85]

[77]Fernández-Huertas Moraga (2014) shows that both before and after the crisis, the average years of schooling of immigrants always remained above those of natives.

[78]Appendix 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.

[79]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.

[80]Izquierdo et al. (2009) presents a similar picture regarding the wage gap between immigrants and natives. They find that wage assimilation is much faster for South-American and EU immigrants compared to Africans.

[81]It is important to understand whether, for example, a net decrease in the stocks, is due to increased outflows, decreased inflows or the sum of both factors. It is important to understand from which margin the effect comes from as it may have differential effect on the labor market.

[82]Migration outflows started to increase in 2007 when GDP growth in Spain started to decelerate. Still, in the first years into the crisis, although labor motivated entries decreased, the number of immigrants continued to grow, mainly due to family reunification and existing migration networks.

[83]This is consistent with the findings of Fernández-Huertas Moraga (2014), who show that the female share in among immigrants started increasing during the crisis.

[84]The net decrease was even stronger as 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.

[85]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% decrease in the working-age male population in 2009.

[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 increase in the immigrant population stocks. 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.

[Figure C5 about here.]

Similarly, departure of the younger immigrants also increased the average age of immigrant population in Spain.

[Figure C6 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 labor 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.

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 C7 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.

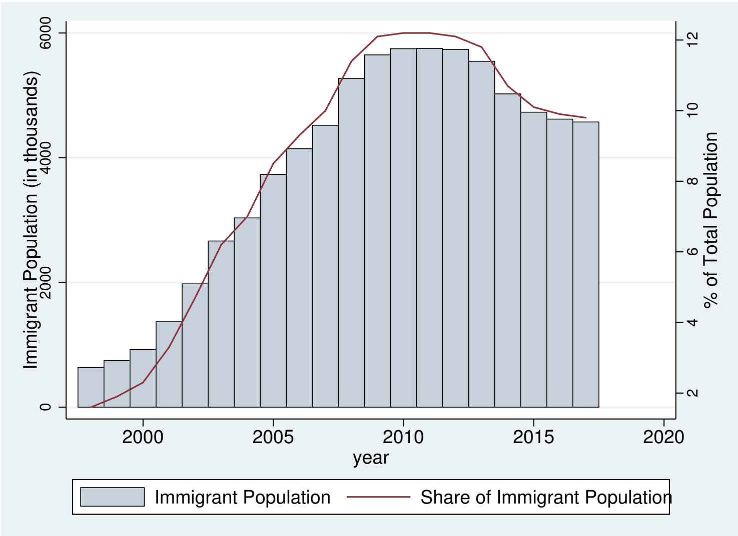
C.2.2 Domestic vs. international departures

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 tighther labor market conditions as discussed in 3 (2017). The figures show that for both groups, departures with a destination abroad or within Spain changed similarly.

[Figure C8 about here.]

Figure C1: Immigrant population between 1998 and 2017



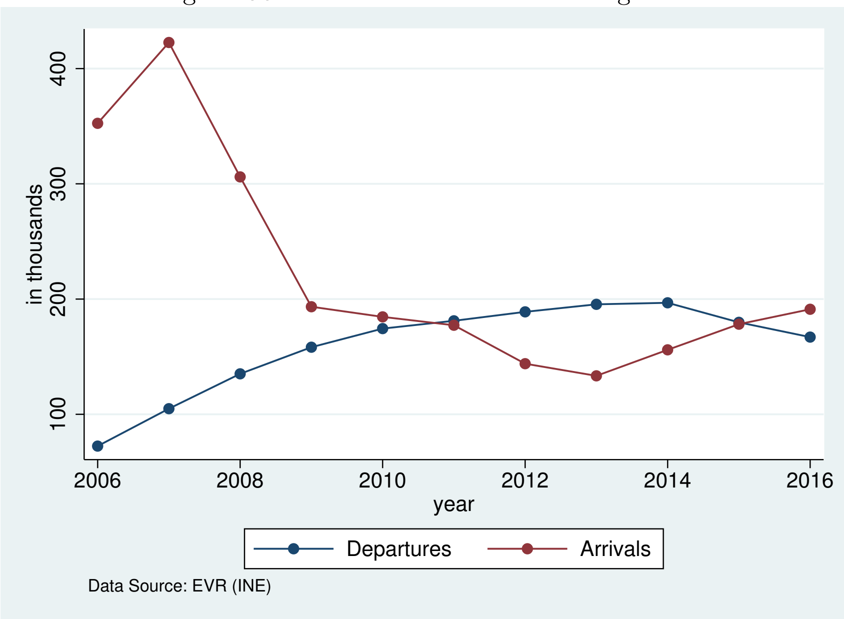
The figure shows the evolution of immigrant population (both male and female, all age grops), and its share as of total population. Data source: Spanish Statistical Institute (INE)

Figure C2: Top 15 migrant communties in Spain

	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

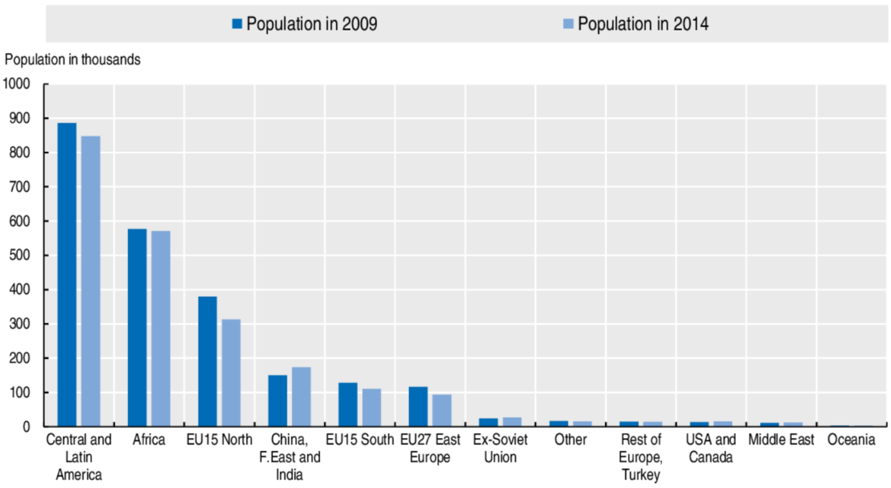
Data source: Spanish Statistical Institute (INE)

Figure C3: International Flows of immigrant



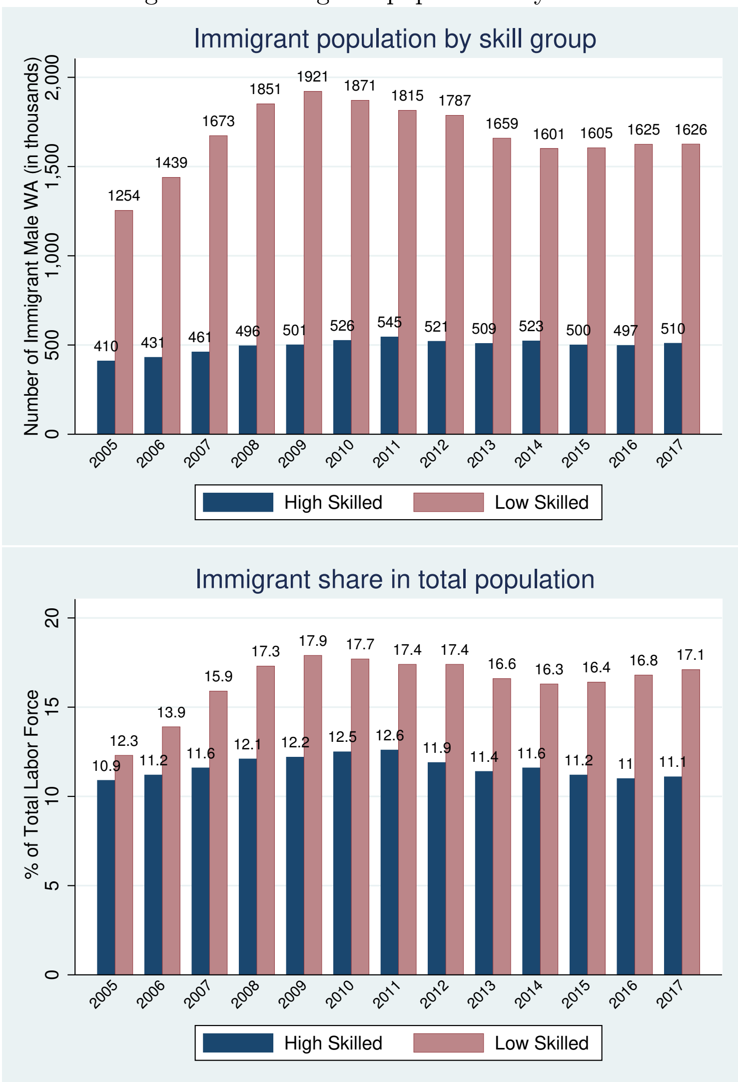
Note: The figure presents the total inflows and outflows for the immigrant working-age male between 2006-2016. Data source: Residential Variation Statistics (EVR)

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



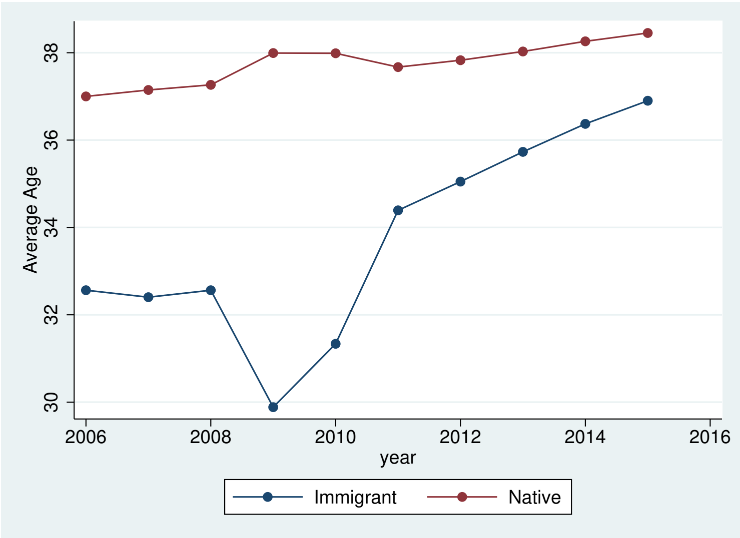
Data source: Spanish Statistical Institute (INE)

Figure C5: Immigrant population by skills



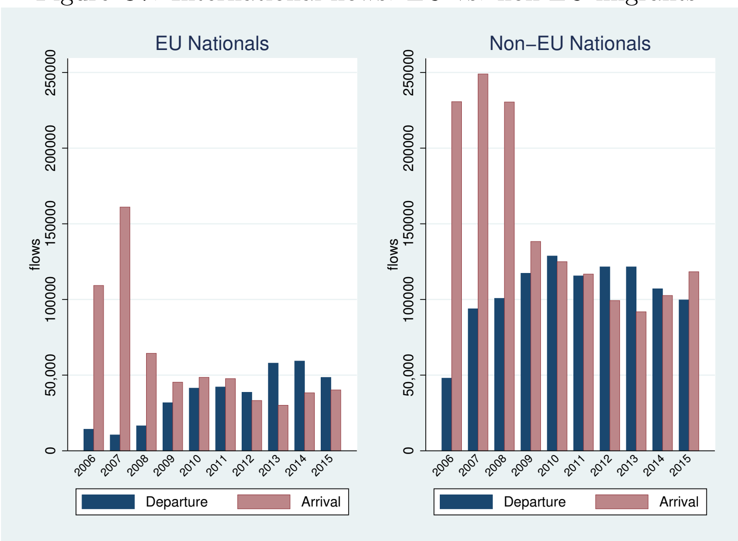
Note: First figure plots the number of working-age male immigrant population. Second figure plots the share of immigrants among low and high-skilled labor force. Shares are calculated for working–age male population. Data source: Spanish Labor Force Survey (EPA).

Figure C6: Population by average age



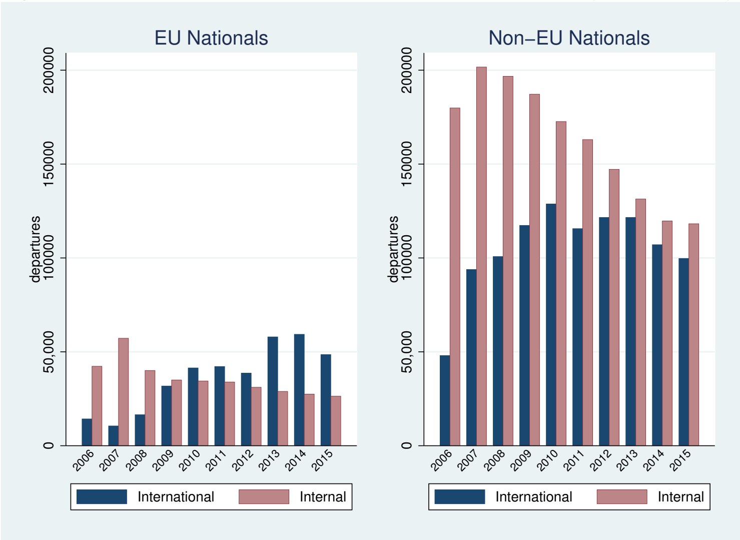
Note: Figure plots the average age of immigarnt and native male population. Data source: Spanish Labor Force Survey (EPA)

Figure C7: International flows: EU vs. non-EU migrants



Data source: Author's own calculation. Estadistica de Variaciones Residenciales (EVR)

Figure C8: Domestic vs. international departures by nationality



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, from 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

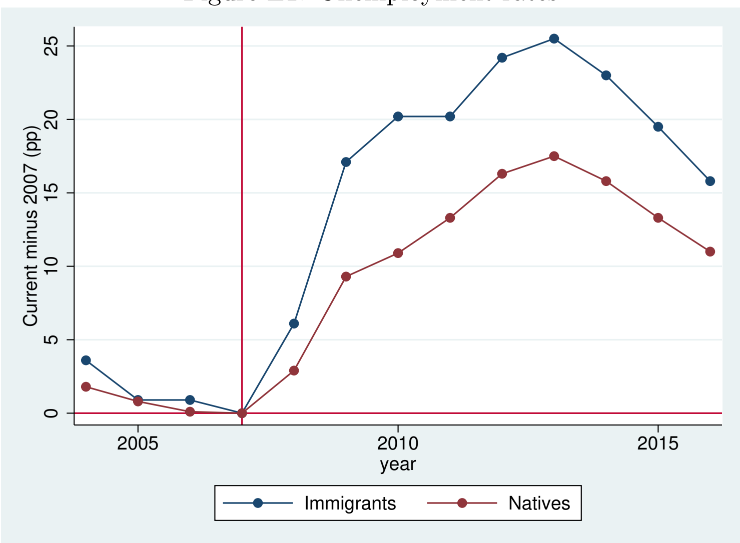
Faced with increasing unemployment, the Spanish government took various measures to reduce the entries and encourage returns of the foreigners. First, the shortage lists that are used for both the Regime Generale, which exempts nominal requests from a labor market test and the *Contingente*, used as 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 laborers) 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 countries (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 percent of the benefit in Spain and 60 percent 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 has not reached 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: Unemployment rates



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 labor 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 labor 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 2 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 much 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 labor 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 labor 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 labor demand shocks are much weaker in areas with high concentrations of immigrant workers. Columns 3 and 6 show that the relationship is almost 50 percent 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.

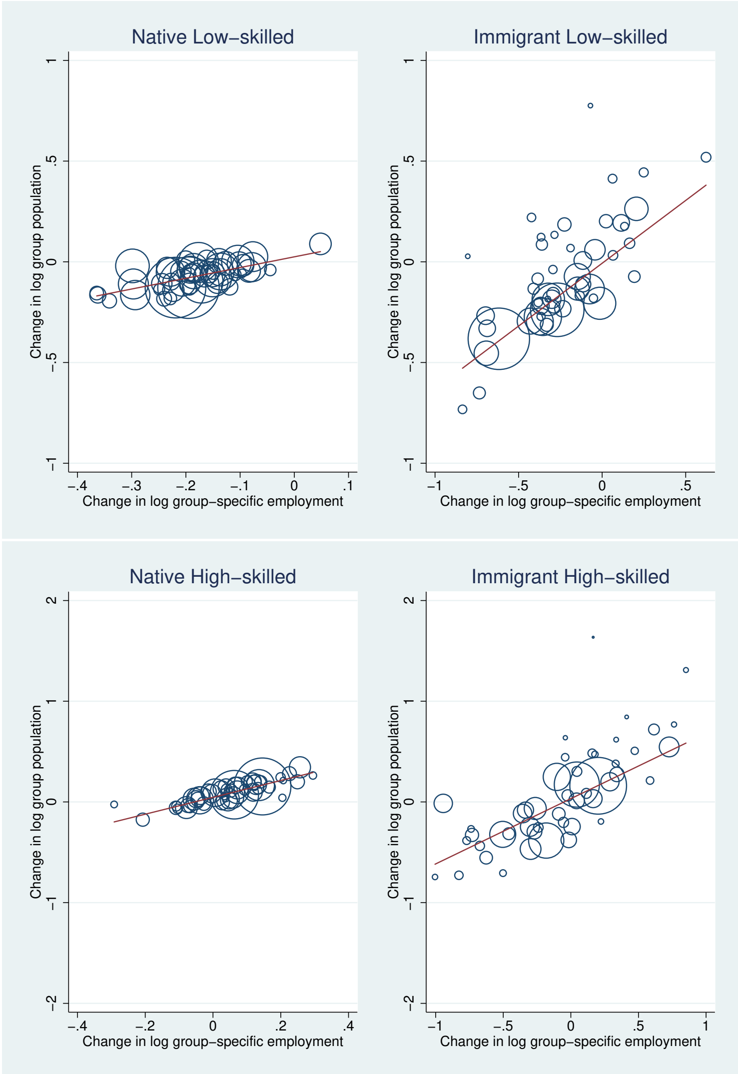
F.3 Immigrant outflows and native employment outcomes

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 labor 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 labor demand shocks are much weaker in areas with higher intensity of immigrant outflows. The difference is especially significant for natives who are low-skilled. This findings confirm that my measure of outflows capture 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: Native vs immigrant men



Note: 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 Labor Force Survey (EPA)

Table F1: Immigrant mobility 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 and independent variable is the change in the log employment of the relevant group. Columns 1-3 present the results for provinces that have above-median immigrant population and columns 4-6 that have below-median immigrantpopulation in 2007. The unit of observations are provinces. Regressions are weighted by group-specific population in year -1 and include year-fixed effects. Standard errors are clustered at province-level.

Data source: Spanish Labor Force Survey (EPA)

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

Table F2: Immigrant outflows smooths 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 and independent variable is the change in the log employment of the relevant group. Columns 1 to 3 present the results for provinces that have above-median immigrant outflow rates betwen 2009-2014 and columns 4 to 6 that have below-median immigrant outflow rates. The unit of observations are provinces. Regressions are weighted by group-specific population in year $t-1$ and include year fixed-effects. Standard errors are clustered at province-level.

Data source: Spanish Labor Force Survey (EPA)

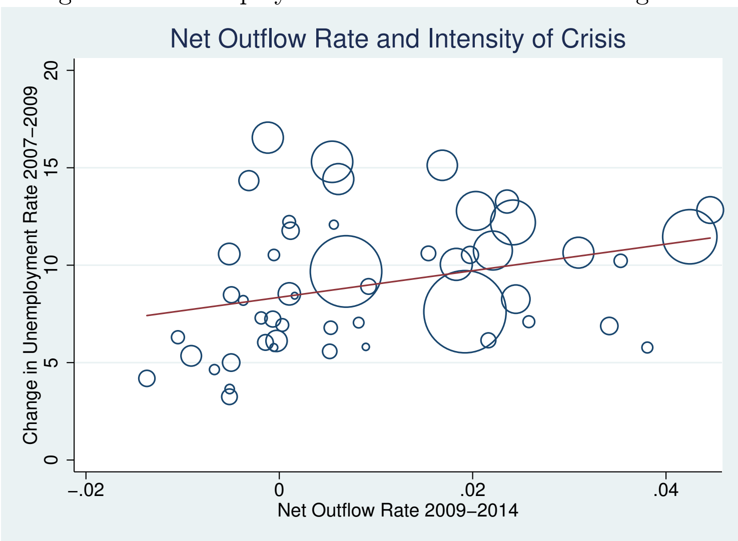
$^{*}p < 0.10, ^{**}p < 0.05, ^{***}p < 0.01$

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: Unemployment and net outflow of immigrants

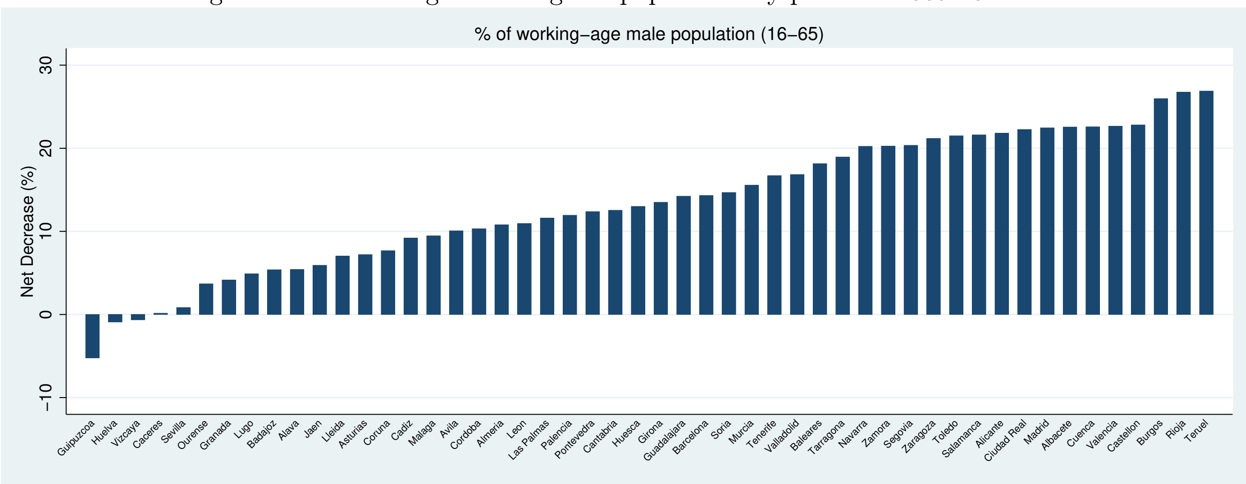


Note: The figure plots increase in the unemployment rate between 2007 and 2009 (y-axis) and net outflow rate of the immigrant population between 2009 and 2014 (x-axis). Each point corresponds to one of the 50 provinces, excluding Melilla and Ceuta. Each observation is weighted by province immigrant population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



Note: 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.
Data source: Municipal Register of Population (Padrón)

I More on mobility data

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.

I.1 Delays in the departures

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 19 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 elasticities 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.]

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 change in immigrant population in an area. The Net Outflow Rates in columns 1 and 3 are 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 $t-1$. Net Outflow Rates in columns 2 and 3 are measured as the average of the decrease in across three years. Rate in period t is the average departuree rate of period $t-1$, t and $t+1$.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 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.2 Measuring emigration of Spanish nationals

Measurement of the emigration of the 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 that 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.[86]

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 labor 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 (2017) 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 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:

[86] 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.

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

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):

$$\widehat{N^{Natives}_{j,t}} = \sum_n^R (\widehat{natives}^b_{j,t}) \tag{J3}$$

J.2 Predicting immigrant population in Spain: Gravity Equation

The instrument's validity is conditional on immigrant outflows and labor 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.[87]

I follow a similar strategy to Saiz (2007); Ortega and Peri (2009); Sanchis-Guarner (2017); 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.[88] The estimated equation is:

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

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 geographical 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 percent of the

[87] 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.

[88] 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 (2017); Bahar and Rapoport (2018).

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 are country of origins (109), period is 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 labor 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 labor 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 (2017), 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 labor 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-run 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 labor 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 are provinces. All the regressors are from year 1991. The omitted category is 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 net change in immigrant population in an area, 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 native local wage and employment growth in the aggregate (skilled and unskilled). 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 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.[89] 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.[90] 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.[91] Given that my specification is at first differences, I take the difference in the predicted employment levels to obtain my control.

M Immigrant and native outflows

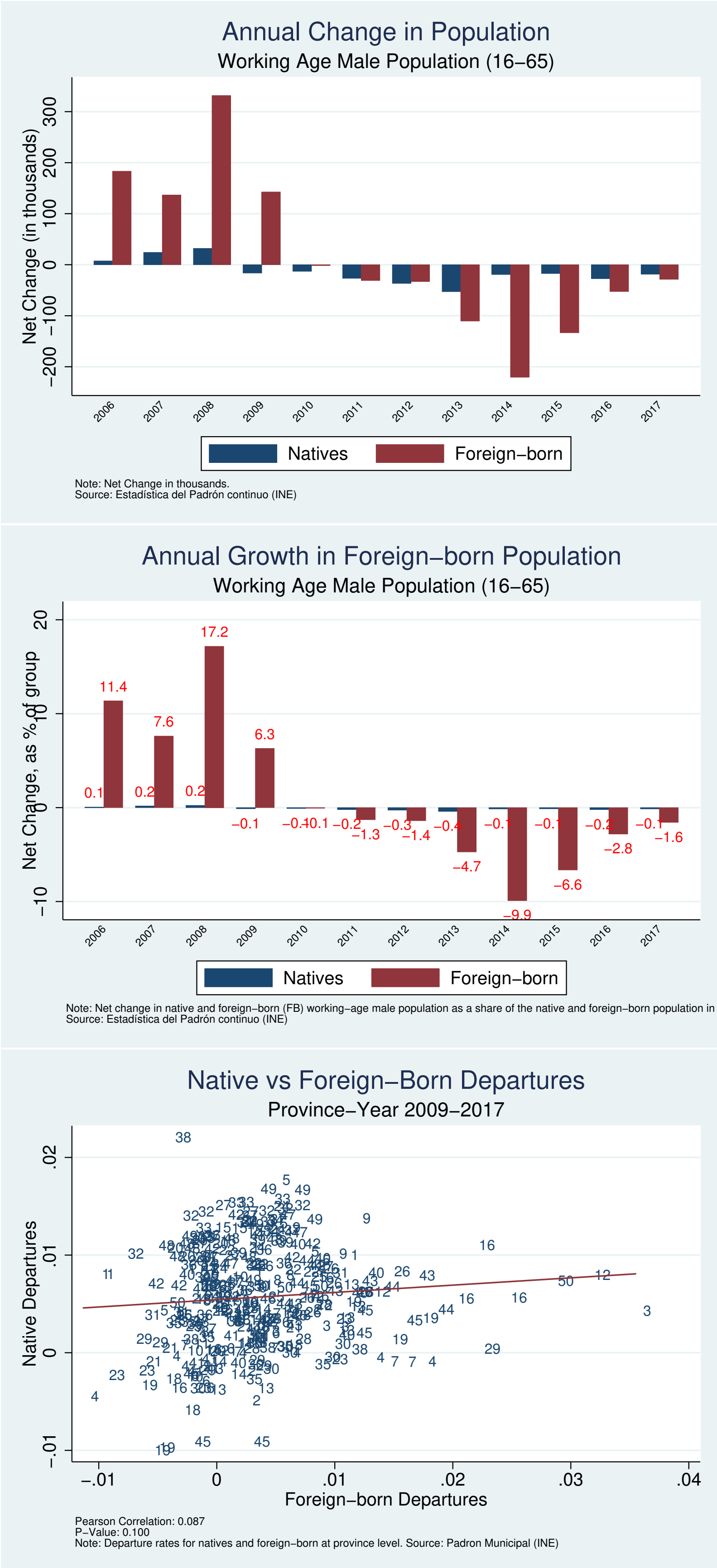
[Figure M1 about here.]

[89] See for instance Cadena and Kovak (2016); Basso et al. (2019) for the use as an instrument, and Lee et al. (2017) as a control or the main regressor.

[90] 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); Lee et al. (2017) 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.

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

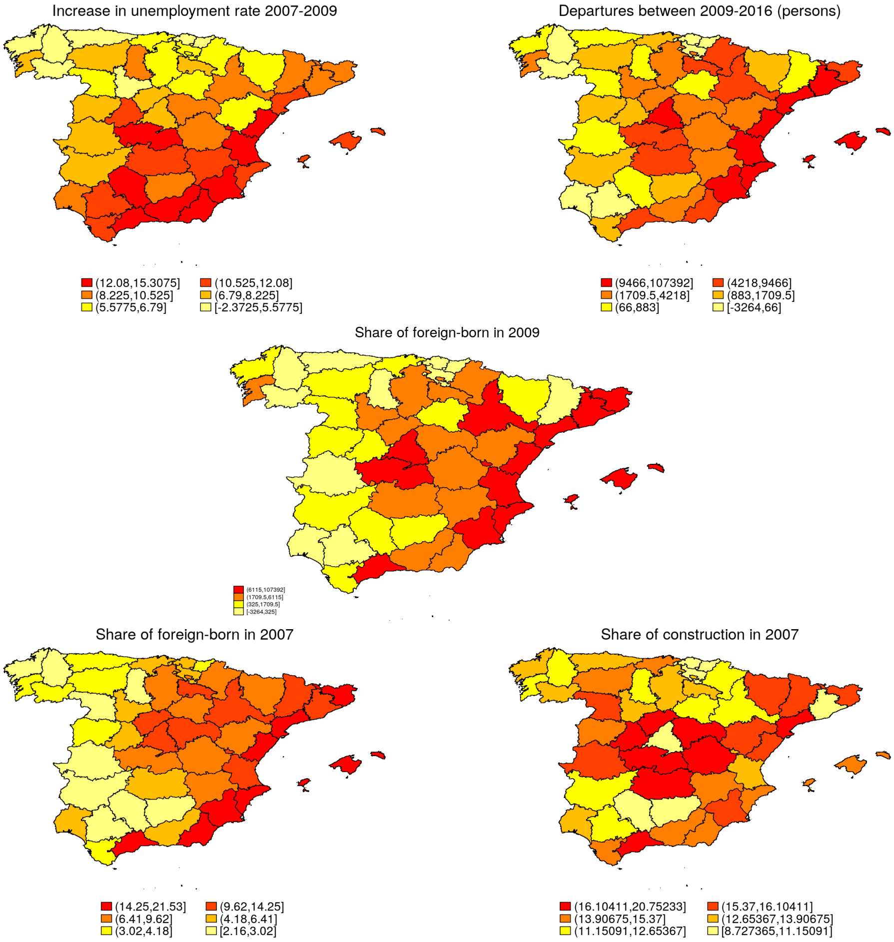
Figure M1: Immigrant and native outflows



N Maps

[Figure N1 about here.]

Figure N1: Maps



Data source: Spanish Statistical Institute (INE)

O 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 O1 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.[92]

[Table O1 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 labor 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 percent, which is two times smaller than the 2 percent 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 labor 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 otherhand are novel.

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

Table O1: Boom vs. 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 2SL2 estimates for the impact of net change in immigrant population in an area, 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 native local wage and employment growth in the aggreagate (skilled and unskilled). Regressions are estimated at the yearly level, across 50 provinces. All regressions are weighted by total employment in the base year include year fixed effects. 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)

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

P Native mobility by demographics

[Table P1 about here.]

Table P1: Impact of outflow 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 net change in immigrant population in an area, measured as the decrease in the number of working-age male immigrant population between t and $t-1$ as of group population in year $t-1$, on the mobility rates of native population during the same period. Regressions are estimated at the yearly level, across 50 provinces. Regressions are weighted by group-specific population in the year $t-1$. 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)

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

Q 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 Q1 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.[93] These results mirror the findings in Edo (2016) who find exactly the effects in exactly the same margins but in the opposite direction due to increased immigration in the French labor market.

[Table Q1 about here.]

[93] 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 Q1: Daily wages vs 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 unit of observations are provinces. Regressions are weighted by total employment in year $t-1$ and include year fixed effects. 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)

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

R 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 R1 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 R1 about here.]

Table R1: 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 wages and employment growth in the previous periods, standardized by intial employment. The table reports OLS and 2SLS estimates for the impact of net change in immigrant population in an area, 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 native local part-time wage and employment growth in the aggregate. The unit of observations are provinces. Regressions are weighted by group-specific employment in year $t-1$ and year fixed-effects. 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)

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