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ABSTRACT

The Impact of Immigration on the Employment Dynamics of European Regions*

This paper provides the first evidence on the regional impact of immigration on native employment in a cross-country framework. By exploiting the richness of the European Labour Force Surveys and past censuses, we show that the rise in the share of immigrants across European regions over the 2010-2019 period had a modest impact on the employment-to-population rate of natives. However, the effects are highly uneven across regions and workers, and over time. First, the short-run estimates show adverse employment effects in response to immigration, while these effects disappear in the longer run. Second, low-educated native workers experience employment losses due to immigration, whereas high-educated ones are more likely to experience employment gains. Third, the presence of institutions that provide employment protection and high coverage of collective wage agreements exert a protective effect on native employment. Finally, economically dynamic regions can better absorb immigrant workers, resulting in little or no effect on the native workforce.

JEL Classification: F22, J21, J61

Keywords: immigration, employment, labour supply, employment dynamics

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1. Introduction

As immigrants constitute increasingly large shares of host-country populations in Europe, the economic impact of immigration remains topical. Over the last decade, the share of the foreign-born labour force in Western European countries increased by 3.4 percentage points, from 12.8% in 2010 to 16.2% in 2019.[4] This increase is twice as large as that in the United States, where the share of foreign-born people in the labour force rose by only 1.6 percentage points (from 15.8% in 2010 to 17.4% in 2019).[5]

Despite an extensive literature on the labour market effects of immigration, most studies either use regional variations within one single country, or implement cross-country investigations with no regional dimension. Yet, regional analysis in a cross-country framework has the advantage of offering a rich set of information to identify the labour market effects of immigration, and exploit the heterogeneity of the sample to better understand the role played by labour market institutions and economic performance in shaping these effects. This paper aims to fill this gap by presenting the first empirical evidence on the regional impact of immigration on native employment in a cross-country setting by exploiting regional variations across Western Europe.[6]

We exploit micro-level data for the European Union (EU Labour Force Survey – EU-LFS) over the 2010-2019 period. The richness of the data allows estimating the impact of the share of immigrants in the labour force on the employment-to-population rate of natives (i.e. the number of employed natives over the working-age native population) at the regional level in Western European countries.[7] This cross-area analysis has the advantage of

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[4] Over the past decade, all Western European countries (except Greece) experienced a rise in the share of their foreign-born labour force (Appendix A).

[5] Source: U.S. Bureau of Labour Statistics (bls.gov)

[6] Angrist and Kugler (2003) is the first study to estimate the labour market impact of immigration in a panel of 18 Western European countries. By exploiting cross-country variations, they find that immigration decreased the employment rate of natives over the 1983-1999 period. More recently, D'Amuri and Peri (2014) and Moreno-Galbis and Tritah (2016) revisited the employment consequences of immigration in Western European countries between 1996-2010 and 1998-2004, respectively. As opposed to Angrist and Kugler (2003), these studies slice each European country into skill groups and assign natives and immigrants to them based on their observed characteristics (defined in terms of age, education or occupation). By estimating the impact of immigration on the employment rate of natives with *a priori* similar skills, D'Amuri and Peri (2014) conclude to "a null impact of immigration on native employment", while Moreno-Galbis and Tritah (2016) find positive effects.

[7] The labour force includes all working-age individuals (between the ages of 18 and 64) who are employed or unemployed.

identifying all channels through which immigration can affect the labour market opportunities of natives (Ottaviano and Peri, 2012; Dustmann et al., 2016). This approach captures the effect of an increase in the labour supply on the labour market outcomes of competing workers and the cross-effects on the outcomes of workers with different skills, and any local adjustments produced by immigration. However, such a spatial approach could lead to misleading interpretations if immigrants chose their region of residence based on economic considerations, or if internal flows across areas spread the economic impact of immigration to other local labour markets (Borjas et al., 1997; Borjas, 2006; Dustmann et al., 2005; Edo, 2019).

In order to address the potential bias arising from the endogeneity of immigrant location choices, the analysis relies on the past distribution of immigrants by country of origin across European regions as an instrument for current migrant penetration (Altonji and Card, 1991; Card, 2001). More precisely, the analysis collects and harmonizes census data for 13 countries to measure the historical distribution of migrants in 1990, and use this past distribution to predict the actual distribution of immigrants during the period of analysis. Therefore, the instrumental variable (IV) strategy relies on the fact that immigrant settlement patterns are partly determined by the presence of earlier migrants, while the historical distribution of immigrants in 1990 should be uncorrelated with contemporaneous changes in regional economic conditions. Finally, we show that immigration did not affect native internal mobility across European regions over the period considered. Therefore, our estimated employment effects should not be biased by the reallocation of natives across local labour markets.

We provide four main findings. First, we show that immigration has a detrimental impact on the employment rate of natives in the early years following the supply shock. More precisely, the short-run estimates imply that a 1% immigration-induced increase in the size of the labour force in a given region reduces the employment-to-population rate of natives in that region by 0.8 percent. This result is consistent with the empirical findings by Angrist and Kugler (2003) for Europe, Dustmann et al. (2017) and Glitz (2012) for Germany, and Borjas and Edo (2021) for France, who find that immigration induces adverse employment effects. Furthermore, the analysis shows that the native employment response is always larger in the short run when exploiting 1-year (or annual) variations than when exploiting 2-year and 3-year variations. The analysis even shows that immigration does not affect native employment in the longer run when exploiting 5-year or 10-year variations. Taken together, our results indicate that native employment opportunities declined in the early years in response to immigration and then returned to their pre-shock level after 5 years. The fact that the short-run impact of immigration dissipates over time is consistent with several empirical and theoretical contributions (Angrist and Kugler, 2003; Borjas, 2013; Edo, 2020; Jaeger et al., 2018; Monras, 2020; Ottaviano and Peri, 2012). These results are robust to alternative samples, specifications and measures of the immigration shock.

Second, the analysis decomposes the average employment impact of immigration by education groups. It finds that the estimated effects on the employment rate of high-educated natives are zero in the short run and positive in the longer run, while the employment responses are negative among low-educated natives in the short run and zero in the longer run. It is not surprising to find an adverse impact on the employment of low-educated native workers as the degree of competition between natives and immigrants within the low-skill segment of the labour market tends to be higher (Dustmann et al., 2013; Orrenius and Zavodny, 2007; Peri and Sparber, 2011b). As a result, immigration to Europe in the last decade increased the employment opportunity gap between high- and low-educated natives.

Third, we show that the potential adverse impact of immigration on employment is weaker in countries where labour market institutions are stricter. More specifically, we find that higher levels of employment protection and collective bargaining coverage dampen the employment effect of immigration by shielding native workers both in the short and longer run. In contrast, a higher degree of union density does not matter in determining the employment impact of immigration.

Finally, this paper shows that regions experiencing a stronger GDP growth can absorb immigrant inflows without significantly reducing native employment. Indeed, the fastest-growing regions experience modest adverse employment effects in response to immigration in the short run, with no effect in the longer run. This result suggests that economic dynamism plays a crucial role in shaping the labour market impact of immigration. This finding is in line with Peri (2010), who shows that the adjustment process in response to immigration is faster in growing economies.

This paper makes four main contributions to the literature. First, despite recent contributions that mainly estimate the impact of immigration on wage dynamics (e.g. Borjas, 2017; Edo, 2020; Monras, 2020; Jaeger et al., 2018), little is known about the employment dynamics of adjustment to immigrant supply shocks. Most empirical work that estimates the impact of immigration on native wages and employment capture either short-run or longer-run relationships and, therefore, cannot describe their adjustment path towards long-run equilibrium (Wozniak and Murray, 2012).

Second, this paper assesses the uneven effects of immigration across natives with different education levels at different time horizons in a multi-country setting. As discussed extensively in the literature, the labour market effects of immigration can be uneven for different workers (Borjas, 2003; Ottaviano and Peri, 2012; Dustmann et al., 2017). In fact, in most countries, the labour market effects of immigration are often concentrated on low-educated natives, while they are negligible, insignificant or sometimes positive for high-educated ones.[8] The analysis thus tests whether immigration to Europe over the past decade had uneven effects across workers with different educational levels, and whether immigration has widened the employment gap between natives with different education levels.

Third, this paper contributes to the limited literature on the role of institutional factors in mediating the labour market impact of immigration (Angrist and Kugler, 2003; D'Amuri and Peri, 2014; Edo and Rapoport, 2019; Prantl and Spitz-Oener, 2020; Foged et al., 2022). As labour market institutions are generally set at the national level, it is difficult to assess their importance in a single-country framework. We circumvent this limitation by

[8] A higher reduction in the earnings of low-educated natives due to immigration as compared to high-educated natives is documented in many studies (Borjas, 2003; Dustmann et al., 2017; Jaeger et al., 2018; Borjas and Edo, 2021). While the reasons behind these uneven effects might be complex, an important element driving the difference is that substitution is likely to be easier for less-educated workers as they are more interchangeable and training costs are lower than for skilled workers. An additional set of studies even show that high-educated natives could gain from low- and high-skilled immigration (Peri and Sparber, 2011b; Peri et al., 2015; Beerli et al., 2021).

exploiting regional data across multiple countries that differ in their institutional characteristics.

Finally, the paper provides the first evidence documenting that the dynamism of the regional economy plays a critical role in the employment effect of immigration.[9] In theory, the absorption capacity of regions depends on the dynamic response of physical capital accumulation, which depends on firms' capacity to adjust their capital stock. Yet, despite the importance of local dynamics, the literature often neglects this dimension. We thus explore whether the short-run impact of immigration on native employment is weaker in fast-growing economies that can better adjust to an immigration-induced increase in the labour supply.

The remainder of this paper is organized as follows. Section 2 discusses the relevant literature and presents hypotheses concerning the impact of immigration on native employment. Section 3 describes the data and provides preliminary correlations between immigration and native employment across European regions. Section 4 presents the main empirical strategy and identification issue. Sections 5 and 6 show the main estimated effects of immigration on native employment and mobility. Section 7 analyses different heterogeneous effects. The last section concludes.

2. Related literature and hypotheses

According to standard economic models, an immigration-induced increase in the labour supply can positively or negatively affect native employment, depending on the skill characteristics of immigrants, the host country economic conditions, and the size and suddenness of the supply shock (Dustmann et al., 2016; Peri, 2016; Edo, 2019).

An important determinant of how immigration affects wages and employment depends on the degree of substitutability between immigrants and natives of similar education and experience (Borjas, 2003; Ottaviano and Peri, 2012). If they are substitutes

[9] D'Amuri and Peri (2014) also explain that there is little research on distinguishing the impact of immigration on the labour market of the host country along the business cycle. They thus estimate the impact of immigration on job reallocation, hiring and separation rates before and after the Great Recession of 2007-2010. Our empirical strategy provides a more direct test to investigate this issue as we exploit regional economic performance to understand how it affects the impact of immigration on native employment.

and compete for the same type of jobs, then immigration should reduce the average wage and employment of natives in the short run. These predictions are consistent with several empirical studies showing that immigration tends to depress the labour market outcomes of natives (see, e.g. Angrist and Kugler (2003) for Europe; Glitz (2012), Braun and Mahmoud (2014), Dustmann et al. (2017) and Amior and Stuhler (2022) for Germany; Hunt (1992), Edo and Toubal (2015), Edo (2020) and Ortega and Verdugo (2022) for France; Mäkelä (2017) and Bohnet et al. (2022) for Portugal; Borjas (2017), Jaeger et al. (2018) and Monras (2020) for the United States; Caruso et al. (2021) and Delgado-Prieto (2021) for Colombia; Tumen (2016) for Turkey).

However, some studies show that immigrants and natives of similar education and experience are imperfect substitutes in the production process (see, e.g. Ottaviano and Peri (2012) for the United States; Manacorda et al. (2012) for the United Kingdom; D'Amuri et al. (2010) for Germany; Brücker et al. (2014) for Denmark, Germany and the UK). As a result, their simulations show that, in the long run, incoming immigrants tend to increase the average wage of native workers and decrease the average wage of the previous waves of migrants. In addition, the specialization of natives and immigrants in different and complementary tasks can boost the wage and employment of natives. In this regard, Peri and Sparber (2009) show for the United States that low-educated immigrants specialize in manual-intensive jobs for which they have comparative advantages, while natives with a similar level of education pursue jobs with more communication-intensive tasks that are better paid and more suited to their skills. D'Amuri and Peri (2014), for a panel of European countries, also find that immigration leads to job mobility, pushing natives to occupations requiring more complex skills. This mechanism is also at the core of the main findings by Foged and Peri (2016) for Denmark that low-skilled immigration increases the wages of low- and high-skilled natives.

Another stream of the literature finds that fewer outside options among immigrants (relative to natives) may generate positive externalities for natives, even in cases where natives and immigrants would be perfect substitutes in production. Due to lower reservation wages, immigrants are more willing to accept lower wages than equally productive natives, making them more profitable for firms. Therefore, an increase in the immigrant labour supply increases the average expected profit of firms, which raises their incentives to open more vacancies which in turn benefit native employment (Ortega, 2000; Chassamboulli and Palivos, 2014; Chassamboulli and Peri, 2015; Moreno-Galbis and Tritah, 2016; Battisti et al. 2018).[10]

Regardless of the degree of substitution between immigrants and natives, the labour market impact of immigration is expected to change over time. Indeed, economic theory predicts that firms should respond to increased workers in the long run through the reallocation of capital and increased investment (Ottaviano and Peri, 2012; Borjas, 2013). More specifically, existing firms can increase their capital investments while new firms can enter the market, thereby increasing labour productivity and labour demand. As a result, in the long run, the labour market effects of immigration should be more positive (or less negative) than in the short run. Such prediction is also supported by models allowing for capital-skill complementarity (Lewis, 2011), rigid labour market institutions (Angrist and Kugler, 2003) and monopsonistic firms or differentiation between migrants and natives in terms of outside options (Moreno-Galbis and Tritah, 2016). It is also supported empirically by Cohen-Goldner and Paserman (2011) and Borjas (2017). They show that, in response to the sudden flows of Jews from the former Soviet Union to Israel after the fall of Communism or to the large entry of Cuban refugees in Miami in 1980, respectively, native wages decline in the first year before returning to their pre-immigration level after 7-10 years. The wage dynamics identified in these studies are consistent with Jaeger et al. (2018) and Edo (2020), who find that regional wages recovered after immigration within a decade and a half. In sum, these results lead to the following hypothesis:

- **Hypothesis 1**: The short-run impact of immigration on native employment is more negative or less positive than in the longer run.

[10] As explained in Albert (2021), these models assume that hiring is random; i.e. firms cannot discriminate between natives and immigrants in their hiring decisions. Therefore, all workers have the same job-finding rates, and immigration unambiguously increases native employment ("job creation channel"). In addition, Albert (2021) shows that the random matching assumption is not innocuous since it neutralizes any potential direct "job competition" between immigrants and natives that may be detrimental for the outcomes of natives. The inclusion of a non-random hiring mechanism in the Albert (2021) model thus mitigates the positive impact of immigration on native employment, and could even produce more job destruction than job creation.

Immigration may also have uneven effects on the employment of natives with different levels of education. In fact, most studies show that immigration is more beneficial (or less detrimental) for highly educated natives. For instance, some studies find that immigration mainly reduces the labour market outcomes of low-educated natives in European countries (Steinhardt, 2011; Glitz, 2012; Dustmann et al., 2013; Dustmann et al., 2017; Borjas and Edo, 2021; Amior and Stuhler, 2022) and in the United States (Borjas, 2003; Orrenius and Zavodny, 2007; Ottaviano and Peri, 2012; Jaeger et al., 2018; Monras, 2020).

There are several reasons why the impact of immigrants tends to be stronger within the low-educated segment of the labour market. First, immigrants may have lower levels of formal schooling. From a simple theoretical view, if immigration increases the relative supply of low-educated workers, the low-educated native workers should face stronger competition. Second, immigrants often downgrade their skills in the labour market, meaning that they work in occupations that are below their education levels (Dustmann et al., 2013). As a result, immigrants would compete for occupations that are below their formal education levels, leading to greater competition for unskilled jobs. Third, "substitution is likely to be easier in industries with less-skilled workers because employees are more interchangeable and training costs are lower than in industries with skilled workers" (Orrenius and Zavodny, 2007).

In addition, some empirical results suggest that high-educated immigration does not lead to higher job competition for highly educated natives because of skill complementarity between immigrants and natives across occupations. For the United States, Peri and Sparber (2011b) found evidence of imperfect substitutability between highly educated migrants and natives, suggesting that immigration benefits highly educated native workers. In line with this result, Peri et al. (2015) found that high-skilled migrants concentrated in STEM (science, technology, engineering and maths) occupations are associated with significant wage gains for college-educated natives. More recently, Beerli et al. (2021) showed that the rise in the number of (highly educated) cross-border workers in Switzerland following the opening of the labour market in 2004 raised the wages of highly educated native workers in regions close to the borders.[11] This discussion implies the following hypothesis:

- **Hypothesis 2**: Immigration increases the employment opportunity gap between high- and low-educated natives.

In Western European countries, where labour market rigidities are prevalent, it is critical to understand the role played by institutional factors (such as employment protection) in mediating the impact of immigration on native employment (D'Amuri and Peri, 2010; Brücker et al., 2014; Edo and Toubal, 2015; Levai and Turati, 2021; Foged et al., 2022). From economic theory, it is not clear whether strong labour market institutions exacerbate or mitigate the native employment response to immigration. On the one hand, labour market institutions can protect native workers by reducing their direct competition with immigrants, thus dampening the potential adverse effects on their employment (Edo and Rapoport, 2019). On the other hand, higher labour market regulations can make labour markets more rigid, preventing job creation and job reallocation, which would amplify any detrimental employment effects from immigration (Angrist and Kugler, 2003; D'Amuri and Peri, 2014). As a result, the existing evidence would imply the following hypothesis:

- **Hypothesis 3**: The impact of immigration on native employment opportunities differs according to the degree of labour market regulation.

Finally, the employment impact of immigration is very likely to depend on the economic strength of the labour market. In this regard, Peri (2010) shows that the capacity of the economy to expand and adjust output in response to immigration is higher when the economy is strong and the unemployment rate is low. In contrast, if the economy is weak and the unemployment rate is high, firms may prefer to keep production below their total

[11] Note that these results do not imply that the positive impact of immigration on the labour market outcomes of similarly educated natives is limited to high-educated workers. As shown by Peri and Sparber (2009) in the US context low-educated immigrants can also boost the wage and employment of low-educated natives.

capacity, and be more reluctant to invest in physical capital or change their production techniques in response to immigration. As a result, the state of the economy should play an essential role in determining the impact of immigration on the labour market. This leads to the fourth hypothesis:

- **Hypothesis 4**: The potentially short-run adverse impact of immigration on native employment is weaker in dynamic economies.

3. Data and descriptive analysis

3.1. EU-LFS data and selected sample

This study uses the yearly European Union Labour Force Survey (EU-LFS), which presents a rich individual-level dataset that has been harmonized across countries. While the dataset lacks information on wages, it provides annual data on a large and consistent set of economic, social and demographic characteristics for most European countries: 27 EU member states and the United Kingdom and 3 European Free Trade Association (EFTA) countries (Iceland, Norway and Switzerland), as well as some candidate countries.

Our study mainly focuses on 13 Western European countries: Austria, Belgium, Finland, France, Germany, Greece, Ireland, Italy, Norway, Portugal, Spain, Switzerland and the United Kingdom. This is because the past immigrant settlement patterns used to construct our main shift-share instrument are available for these countries only. As explained in the next section, the instrument requires information on the country of origin of immigrants (i.e. country of birth or nationality) and their region of residence. Our analysis thus covers European countries for which such data are available. This information is drawn from population censuses obtained from IPUMS and national statistical institutions (see Appendix B for further details). Depending on data availability, the historical regional distribution of immigrants is drawn from a year between 1990 and 1992. We use the year 1990 for France, Norway, and Switzerland. We use 1991 for Austria, Germany, Greece, Ireland, Italy, Portugal, Spain and the UK. Finally, the Belgian data are for 1992.

To infer the origin of immigrants based on historical census data, we use country of birth or nationality, depending on data availability. For most countries, we derive the origin of immigrants based on their country of birth. However, for Finland, Ireland, Norway and the UK, we employ citizenship information to infer the origin of immigrants.

Our analysis exploits variation across geographical units at NUTS-1 or NUTS-2 (Nomenclature of Territorial Units for Statistics) level depending on data availability. The definition of the NUTS classification may vary among countries, as it aims to represent country-specific administrative area levels (e.g. autonomous communities in Spain or *régions* in France). For most European countries, data are available at NUTS-2 level, which corresponds to "basic regions for the application of regional policies".[12] For instance, they correspond to geographical units that the European Commission uses for evaluating the effectiveness of the cohesion policy and providing financial support. For countries like Austria, Germany and the UK, where the NUTS-2 level data are unavailable, we implement our analysis at the NUTS-1 level (which is used to define major socio-economic regions). In all cases, regional information in the EU-LFS is representative of the population living in the region, whether they are located in cities or rural areas.

As the regional classification changed over our period of interest, we merge the Åland Finnish islands and South Finland with the Helsinki region, and the Irish Southern region with the Eastern and Midland region. Moreover, we merge Corsica with the southeastern French Provence-Alpes-Côte d'Azur (PACA) region. We also exclude from the sample the French overseas regions, Ceuta and Melilla (two Spanish autonomous cities located in north Africa). Finally, we exclude Northern Ireland (from the UK), and three Italian regions (Valle d'Aosta, South Tyrol and Trento) as these are not identified in the 1991 census data, and, therefore, cannot be used to build our shift-share instrument. As a result, our main sample of 13 Western European countries includes 136 regions.[13]

The analysis then extends beyond our main sample of Western European regions to increase the sample size and test the robustness of the results. We expand the country coverage in two steps. First, we focus on all Western European countries, including EU15

[12] https://ec.europa.eu/eurostat/web/nuts/background.

[13] Appendix C reports the number of regions used for each country in our main sample, and provides some statistics about their size (average population, average land area and average population density). On average, our main sample has a population of 2.5 million, living on a land area of 28,380 km^2 with a population density of 89 persons per km^2.

countries (including the UK), and 3 EFTA countries (Iceland, Norway and Switzerland). We choose to focus on these countries due to their similarities in terms of income levels and economic structure, but also their longer history of receiving immigrants. In this sample of Western European countries, the average share of immigrants in the labour force is 14.4% over the 2010-2019 period. Appendix A shows that the relative size of immigrants in the labour force is heterogeneous across Western European countries and increased in all of them between 2010 and 2019, except in Greece.

Second, we extend the country coverage to include the remaining European countries, including Cyprus, the Czech Republic, Estonia, Hungary, Latvia, Lithuania, Poland, Romania, Slovakia and Slovenia. This larger sample of countries does not include Bulgaria, Croatia and Malta because the information on country of birth is not sufficiently detailed to perform the empirical analysis. Taking the 10 remaining countries together, the average share of immigrants in the labour force is 2.2% over the 2010-2019 period. This is much smaller than the immigrant share in Western European countries.

For our main sample of 136 Western European regions, we always use the historical census data to build the shift-share instrument. For the remaining European regions we build our instrument based on the EU-LFS carried out in 2004.[14] Before 2004, the EU-LFS divides the birth country of individuals into three groups, which does not allow us to build an instrument. Since 2004, however, the EU-LFS decomposes respondents' nationality and birth country into several groups for most European countries.[15]

Finally, we restrict the sample to working-age individuals between the ages of 18 and 64, not enrolled at school or in compulsory military service, and not living in group quarters (e.g. prison, hospital, religious institution). This restriction implies that asylum applicants who reside in group quarters (while their asylum applications are processed) are excluded from the sample. Finally, the labour force includes all working-age individuals who are employed or unemployed.

[14] The remaining European regions include those located outside our main sample of 13 Western European countries, plus Northern Ireland and the three Italian regions that we dropped in the first place. In total, the sample using all available European countries has 205 regions (instead of 136 regions in our main sample).
[15] We use 2007 as the reference year for Denmark as no regional information is available for that country before 2007.

3.2. Data for the heterogeneity analysis

The empirical analysis decomposes the employment impact of immigration by education group. In this regard, we follow D'Amuri and Peri (2014), Dustmann et al. (2017) and Beerli et al. (2021) by decomposing the native population into two education groups: those with tertiary education and those with less than tertiary education.

The analysis uses three measures from the OECD database on Institutional Characteristics of Trade Unions, Wage Setting, State Intervention and Social Pacts (ICTWSS) to capture the heterogeneity in country-level institutional characteristics, and investigate their role in mitigating the impact of immigration on native employment. We use three alternative measures to capture three types of labour market rigidities (Foged et al., 2022).

The first indicator captures employment protection based on two subindices that measure individual employment protection and reflects on the costs of individual dismissals, thereby capturing the strictness of employment protection for workers on regular contracts against individual dismissals. These two subindices are measured on a scale from 0 to 6, where higher values correspond to stronger protection of incumbent workers. Similar to D'Amuri and Peri (2014) and Foged et al. (2022), we combine these two indices and use a dummy variable capturing the initial intensity of employment protection. This dummy variable is equal to one if the country-level employment protection index is in the top 50% in 2010. The dummy thus captures whether the country has a high or low initial level of employment protection.

The second measure of labour market rigidity describes the level at which collective bargaining over wages takes place. This variable indicates whether wage bargaining takes place at the firm, sectoral, cross-sectoral or national level.[16] We build a dummy variable indicating whether the predominant level at which bargaining over wages take place is at the sectoral or country-level (as opposed to firm-level wage bargaining).

Our final measure refers to union density, corresponding to the number of trade union members who are employees as a percentage of the total number of employees in a

[16] We did not exploit the share of employees covered by collective wage agreements because this information is missing for several countries of our main sample, such as Finland, France, Ireland, Switzerland and Norway.

given country. It aims at capturing the degree of wage rigidity, and is available for all European countries considered. We use a dummy variable equal to one if the share of employees with union membership is in the top 50% in 2010.[17]

Furthermore, using data on Gross Domestic Product (GDP) from the OECD Regional Database, the analysis decomposes European regions based on their economic dynamism during the period. More precisely, we include a "High GDP growth" dummy to indicate whether the regional economic dynamism is weak or strong. To create the dummy, we split the regions into two groups based on the change in GDP between 2010 and 2019. Specifically, the regions in the top 25% in terms of GDP changes are defined as the fastest-growing regions (or "High GDP growth" regions), while the remaining 75% are classified as regions in which economic dynamism is relatively weak. As the fastest-growing regions represent 46% of the native population living in Western European countries, this regional decomposition (strong regional economies v. remaining regions) has the advantage of dividing the European population into two relatively balanced groups in terms of native population size.

3.3. Descriptive statistics

During the period of analysis, the share of high-educated natives (with tertiary education) living in the main sample of 13 Western European countries increased from 30.0% in 2010 to 37.2% in 2019 (Table 1). Over the past decade, immigration thus increased the supply of high and low-educated populations equally.

Table 1 also shows that the average level of education is higher among native workers than immigrants. In 2010, the shares of tertiary-educated among native and immigrant labour force were 30.0 and 26.1%, respectively. While the share of tertiary-educated in both groups increased between 2010 and 2019, the education gap between native and immigrant labour force remained unchanged.

[17] The "union density" variable has the advantage to be available for each country of our main sample. Yet, it may be an imperfect measure of wage rigidity in countries combining a small union density and a high share of employees covered by collective wage agreements.

The empirical analysis exploits regional variations to estimate the impact of immigration on native employment, and to document potential heterogeneous effects across regions and workers. To visualize the source of variation used in this paper, we build heat maps of regions for our main sample of 136 Western European regions (Figure 1). Panel A shows the employment-to-population rate of natives in 2019, and Panel B shows the change in native employment rates between 2010 and 2019. It can be seen that Southern European countries such as Spain, Italy and Greece had lower employment rates in 2019 compared to Northern European ones (Panel A). Between 2010 and 2019, the employment rate increased in most parts of Europe as the labour market recovered from the global financial crisis.

Panel C shows the share of immigrants in European regions in 2019, while Panel D provides the change in immigrant shares between 2010 and 2019. It can be seen that most European regions have witnessed an increase in the share of immigrants during this period. In addition to capital regions with a high share of immigrants, economic hubs such as the east of Spain and industrial areas like the south of Germany and the northern part of Italy attracted immigrants over the past decades.

3.4. Descriptive correlations

This section provides a preliminary look at the correlation between the share of immigrants and native employment over the 2010-2019 period. Figure 2 presents the scatter diagrams relating the difference in the log native employment-to-population rate to the difference in the log immigrant share across regions in our main sample. While Panel A of Figure 2 describes a short-run relationship by exploiting annual variations, Panel B of Figure 2 aims at capturing a longer-run relationship by using regional variations between the two years 2019 and 2010.

Panel A of Figure 2 suggests a negative and significant relationship between immigration and native employment (the slope of the regression line and robust standard error are -0.11 and 0.05). In contrast, Panel B of Figure 2 shows no significant correlation when using decadal variations (the slope of the regression line and robust standard error are 0.08 and 0.10). These basic correlations, which are moreover not driven by any outliers, show an asymmetric employment response to immigration in the short and long run. More precisely, the absence of any relationship between immigration and native employment in the longer run is consistent with Hypothesis 1.

The remainder of this paper tests the robustness of these correlations and exploits the heterogeneity of the sample across workers and regions to better understand the employment dynamics of labour supply shocks.

4. Empirical strategy

4.1. Main econometric equation

The analysis uses the following equation to estimate the impact of immigration on native employment:

$$y_{rt} = \beta_0 + \beta_1 m_{rt} + \theta_r + \theta_t + \mu_{rt} . \quad (1)$$

The dependent variable is the logarithm of the employment-to-population rate of natives in region r at time t (i.e. the logarithm of employed natives over the native population, or employment rate of natives); this strategy follows Angrist and Kugler (2003), D'Amuri and Peri (2014) and Monras (2020). The immigrant supply shock experienced in a particular area is captured by m_{rt} which is equal to $log(1 + M_{rt}/N_{rt})$, where M_{rt} and N_{rt} are the respective number of migrants and natives in the labour force in region r at time t. The algebraic definition of m_{rt} is derived from simple labour demand theory (Borjas, 2003), and used in Bratsberg et al. (2014) and Borjas and Edo (2021).[18] Equation 1 includes a vector of regional dummies θ_r and a vector of time dummies θ_t, implying that the impact of immigration on the employment rate of natives is identified from regional changes over time. The error term is denoted μ_{rt}. To account for the possible within-region correlation of random disturbances, the standard errors are clustered at the regional level (Moulton, 1990).

[18] Angrist and Kugler (2003) and D'Amuri and Peri (2014) use the log of the immigrant share as their main variable of interest. The empirical results are not sensitive to this choice.

The parameter β_1 gives the percent change in the employment rate of natives in response to 1% change in the size of the labour force due to the inflow of immigrants in a region. Defining the supply shock at the regional level (instead of assigning immigrants to skill groups) relies on Dustmann et al. (2016; 2017) and Jaeger et al. (2018). This estimation strategy has the advantage of accounting for all channels through which an immigration-induced increase in labour supply can affect local wages. Indeed, the estimate of β_1 not only captures the effect of a particular supply shift on the outcomes of competing workers, but also captures the complementarity effects induced by the increase in the supply of workers with different skills, and accounts for local adjustment in the physical capital stock. In addition, this approach does not depend on the pre-assignment of workers to particular skill groups. It thus avoids any potential mismeasurement of the immigrant supply shock due to the possibility that immigrants could downgrade their skills (Dustmann et al., 2013).

Equation 1 is estimated using regional variations with different time windows. First, it uses all available years over the 2010-2019 period, thereby exploiting one-year intervals (or annual variations). Annual variations precisely exploit short-run changes and therefore capture the short-run impact of immigration (Peri, 2010; Wozniak and Murray, 2012; Monras, 2020; Özgüzel, 2021). Second, to investigate whether the employment response to immigration differs in the longer run, the analysis is repeated in a second step by increasing the time variation progressively. First, it uses five years – 2010, 2012, 2014, 2016, 2018 – and four years – 2010, 2013, 2016 and 2019 – to run the regressions, thus exploiting biannual and triannual variations. Second, it uses three years – 2010, 2015 and 2019 – to run the regressions, thereby exploiting five-year intervals. Finally, equation 1 is estimated by using regional variations between the two years 2010 and 2019, thereby exploiting a 10-year interval. As noted in Wozniak and Murray (2012), Lewis and Peri (2015) and Monras (2020), comparing outcomes at 10-year intervals aims at capturing the longer-run effects of immigration, which should differ from short-run relationships.

Although the 10-year interval provides more time for regional labour markets to adjust to immigrant supply shocks, it is important to note that this longer time window does not capture the long-run impact of immigration. Indeed, European countries received immigrants every year in the past decade, especially in 2015-2016 during the refugee crisis.

As a result, our longer time window not only reflects the adjustment of local labour markets to immigration that occurred in the early 2010s, but also captures the labour market response to more recent immigrant inflows. Our analysis thus differs from studies investigating the short- and long-run effects of one-time supply shocks on the labour market (e.g. Cohen-Goldner and Paserman, 2011; Borjas, 2017; Edo, 2020). Yet, in order to isolate the short-run employment impact of immigration from longer-run responses, we also implement the empirical strategy of Jaeger et al. (2018). This alternative strategy allows us to decompose the short- and medium-run responses to immigration shocks, and to show that the employment dynamics of immigration identified in this paper are robust.

4.2. Endogeneity of the immigrant share

Estimating equation 1 using OLS is generally biased due to the non-random allocation of migrants across regions. Income-maximizing immigrants should be attracted to regions that offer the best current labour market opportunities, which typically bias the estimates of the labour market effects of immigration upward (Peri, 2016; Edo, 2019). The analysis follows the existing literature by using an IV approach to address this issue.

The instrument is based on historical settlement patterns among migrants and has been used extensively in the migration literature (Altonji and Card, 1991; Card, 2001; Jaeger et al., 2018). Indeed, the settlement decision of new migrants is partly determined by earlier migrants' presence, mainly through network externalities (Gross and Schmitt, 2003; Epstein and Gang, 2010); past migrants may, for instance, provide new migrants with information on labour or housing markets.

We use the 1990 spatial distribution of the immigrant population from a given origin country to instrument the allocation of migrants in the current period from that origin group across regions.[19] More specifically, we use $c = 5$ origin countries.[20] The predicted number

[19] As the census data for Belgium, Germany, Italy and Norway do not include information on age, we use the whole immigrant population to compute the spatial distribution of immigrants in 1990 across European regions. Throughout the remaining part of the section, the working-age population is used to compute the past local shares (i.e. the spatial distribution of immigrants in 2004) and the aggregate shift (the number of immigrants in the current period). Our results are insensitive to these sample choices.

[20] For country of birth, the analysis uses Europe, Asia, Africa, South America, North America and Oceania. More details are provided in Appendix B.

of immigrants in a given region r at time t is thus obtained by multiplying in each year the 1990 spatial distribution of immigrants of each origin group by the total number of working-age immigrants from that group, as follows:[21]

$$\widehat{M}_{rt} = \sum_c \frac{M_r^c(1990)}{M^c(1990)} \cdot M_t^c. \tag{2}$$

The size of the native labour force is unlikely to be exogenous to regional economic conditions. Consequently, instead of using the current native labour force to compute the instrument, a prediction of the regional number of natives for each country is constructed as follows:

$$\widehat{N}_{rt} = \frac{N_r(1990)}{N(1990)} \cdot N_t. \tag{3}$$

The baseline shift-share instrument is thus computed as follows:

$$\widehat{m}_{rt} = \log\left(1 + \frac{\widehat{M_{rt}}}{\widehat{N}_{rt}}\right). \tag{4}$$

The shift-share instrument does not isolate the true labour market impact of immigration if economic conditions that motivated earlier migrants to settle in particular areas are correlated with current economic outcomes (Jaeger et al., 2018; Goldsmith-Pinkham et al., 2020). A way to minimize the potential correlation between past immigration and current economic shocks is to use a sufficient time lag to predict the actual number of immigrants (Dustmann et al., 2005). Using a base year further in the past increases the likelihood that the unobserved factors that determined the location choice of immigrants in the base year are less likely to shape the settlement patterns in the period of

[21] M_t^c and $M^c(1990)$ respectively refer to the number of working-age immigrants originating from c at time t and the immigrant population originating from c in 1990 across all 13 European countries considered in the main analysis, except for Finland. Due to a lack of consistency in the construction of the origin groups, including Finland would not allow distinguishing immigrants originating from Asia and Africa. Thus, the computation of $\widehat{M}_{rt}$ in equation 2 excludes Finland. We predict the number of immigrants in Finnish regions by implementing equation 2 for Finland only using $c = 8$ origin groups.

analysis. Although the exclusion restriction imposed by the IV strategy is not testable, using 1990 as a reference year to build the shift-share instrument is, therefore, likely to be separate enough from 2010-2019 for current immigrant shares to be uncorrelated with past demand shocks. Yet, this strategy allows us to only study the employment response to immigration for 13 Western European countries.

We also test the robustness of our baseline results by extending the sample to the remaining European regions. For this additional set of regions, we construct a shift-share instrument based on the 2004 EU-LFS. We apply the exact same strategy as before except that the reference year for building the instrument is 2004:

$$\widehat{m}_{rt}^{2004} = \log\left(1 + \frac{\widehat{M}_{rt}^{2004}}{\widehat{N}_{rt}^{2004}}\right), \tag{5}$$

where $\widehat{M}_{rt}^{2004}$ and $\widehat{N}_{rt}^{2004}$ are the predicted number of immigrants and natives in a given region at time t. To predict the number of immigrants for each region-time cell, in each year, the 2004 spatial distribution of the working-age immigrant population of each origin group is multiplied by the working-age immigrant population from that group at time t, as follows:[22]

$$\widehat{M}_{rt}^{2004} = \sum_c \frac{M_r^c(2004)}{M^c(2004)} \cdot M_t^c. \tag{6}$$

The strategy for predicting the regional number of natives is similar:

$$\widehat{N}_{rt}^{2004} = \frac{N_r(2004)}{N(2004)} \cdot N_t. \tag{7}$$

[22] In equation 6, M_t^c and $M^c(2004)$ respectively refer to the number of working-age immigrants originating from c at time t and the immigrant population originating from c in 1990 across all available European countries, except for Finland. As in equation 2, we exclude Finland to compute $\widehat{M}_{rt}^{2004}$.

5. The average impact of immigration on native employment

5.1. Main estimates

Table 2 estimates the regional impact of immigration on the native employment rate exploiting 1-year, 2-year, 3-year, 5-year and 10-year changes between 2010 and 2019 for the baseline panel of 13 Western European countries. While columns 1-2 exploit annual variations across 136 regions, columns 3-4 and columns 5-6 respectively exploit biannual (2010 / 2012 / 2014 / 2016 / 2018) and triannual variations (2010 / 2013 / 2016 / 2019). Columns 7-8 use 5-years intervals (2010 / 2015 / 2019) to run the regressions, and columns 9-10 exploit a 10-year interval (or decadal variations) by using the two years 2010 and 2019.

The OLS estimated impact in column 1 suggests a negative association between immigration and native employment in yearly changes. While the OLS estimated coefficient in column 3 suggests a negative, though insignificant, relationship, the OLS estimates in the remaining columns are either identical or slightly positive. These estimates are consistent with Hypothesis 1, indicating that immigration can have a negative effect on native employment in the short run, while these effects should disappear in the long run as labour markets adjust. However, the limit of these regressions is that the observed correlation is not informative of any causal impact of immigration on native employment.

As immigrants do not randomly settle across regions, the remaining columns instrument the immigration variable by the shift-share instrument based on the spatial distribution of previous immigrants in 1990 (from equation 4). The IV first-stage results indicate that the estimated coefficient on the instrument hovers between 0.21 and 0.26, and is always significant at the 1% level (after clustering the standard errors at the regional level).[23] This significant and positive relationship is in line with the literature on shift-share instruments. Moreover, as shown in Table 2 and the other econometric tables below, the F-test of the excluded instrument is generally larger than the lower bound of 10 suggested by the literature on weak instruments (Stock and Yogo, 2002). This indicates that our IV

[23] The IV first-stage results are based on the following equation:

$$m_{rt} = \gamma_0 + \gamma_1 \widehat{m}_{rt} + \theta_r + \theta_t + \varepsilon_{rt}, \quad (8)$$

where m_{rt} and $\widehat{m}_{rt}$ are respectively the actual and predicted immigration-induced supply shocks, while θ_r and θ_t refer to region and time fixed effects. ε_{rt} is the error term.

estimates are unlikely to suffer from a weak instrument problem, and that $\widehat{m}_{rt}$ is a reasonably strong instrument.

The IV estimated coefficient in column 2 is significantly negative and stronger than in column 1. This stronger negative relationship is consistent with the hypothesis that endogenous immigrant inflows positively bias the estimations in column 1.[24] The estimated coefficient in column 2 implies that a 1% immigration-induced increase in the size of the regional labour force reduces the employment rate of natives in that region by 0.81%. Given the rise in the employment rate observed across European regions covered in the sample (see Appendix D for more details), the estimated magnitudes indicate that the employment rate of natives in regions with higher immigration grew more slowly compared to regions with less immigration.

To investigate whether labour markets adjust over time, the remaining columns extend the time intervals progressively. The IV estimated coefficient in column 4 (using the 2-year intervals) is still negative but weaker than in column 2. The IV estimated coefficient in column 6 is even less negative and significant than when exploiting annual variations in column 2. Moreover, the IV estimates exploiting the 5-year and 10-year changes show that immigration has no employment impact in the longer run. In sum, the IV estimated results from Table 2 indicate that native employment opportunities can decline initially in response to immigration before returning after some years to their pre-shock level.

The employment dynamics induced by immigration is consistent with the notion that economic adjustments following immigration is not necessarily immediate and can take some time (Hypothesis 1). Although economic theory does not deliver any guidance on how many years it takes for regional markets to absorb immigration, the results of this analysis suggest that regional employment tends to recover five years after an immigrant inflow. This rate of adjustment is consistent with the results by Cohen-Goldner and Paserman (2011), Borjas (2017), Jaeger et al. (2018), and Edo (2020) which show that local or skill-

[24] If migrants prefer to settle in high-wage areas, correcting for such endogenous inflows should indeed provide more negative or less positive estimates. An additional source of bias in the OLS estimates may come from sampling errors in the measure of regional migrant shares due to small sample sizes (Aydemir and Borjas, 2011). Any measurement error in the computation of immigrant shares should lead to an attenuation bias in the estimated employment effects of immigration. Correcting for such measurement bias can also lead to more negative estimates.

specific wages recover from positive supply shocks after at least five years following the inflow of immigrants.

5.2. Robustness of the main estimates

Table 3 tests the sensitivity of our previous results to alternative specifications and samples. Columns 1-2 use all available years over the 2010-2019 period and exploit the 1-year intervals (or yearly variations). These specifications capture the short-run employment consequences of immigration. In contrast, columns 3-4 use the 5-year intervals (2010/2015/2019) to run the regressions, and columns 5-6 exploit the 10-year interval (or decadal variations) by using the two years 2010 and 2019. Columns 3-6 thus capture the longer-run effects of immigration on native employment.

Panel A focuses on the main sample of 13 Western European countries. The first specification reports the OLS and IV estimates of β_1 from equation 1 for comparability. Until now, we followed Borjas (2006), Peri and Sparber (2011a) or Jaeger et al. (2018) by providing unweighted regression results. This strategy treats small and large regions equally in the analysis. In specification 2, equation 1 is estimated using weighted least-squares, where the weights are equal to the regional native labour force in 2005. Using such weights naturally changes the importance of each region-year observation as more populated regions are assigned more weight. Moreover, imposing constant weights ensures that the estimated effects are not driven by changes in the size of the native labour force as a reaction to immigration. The results from specification 2 are close to the results from specification 1.[25] More precisely, the IV estimated coefficient on the immigrant share is significant and negative when using annual variations. Instrumenting for the immigrant share in column 2 produces a more negative estimated coefficient. The short-run IV estimates imply that a 1% increase in the labour force due to migration in a given region reduces the employment rate of natives by 1.07% in that region. However, the IV estimated coefficients of immigration on native employment rate are twice as small and much less

[25] Using weights that are proportional to the number of observations used to compute the dependent variable can also be important for correcting for heteroscedastic error terms and estimating point estimates more precisely (Solon et al., 2015). In line with this explanation, we find that using weights slightly improves the precision of the IV estimates.

significant when using the 5- and 10-year intervals. The stronger negative employment response using short-run variations is consistent with the fact that the economic adjustment process triggered by immigration is not necessarily immediate and can take some time (see Hypothesis 1).

Specification 3 investigates the employment dynamics induced by immigration using a level-level specification. The benchmark specification uses the logarithm of the employment rate as the dependent variable, and $log(1 + M_{rt}/ N_{rt})$ to measure the regional immigrant supply shock. Specification 3 uses directly the employment rate and the ratio of immigrants to natives (M_{rt}/ N_{rt}) instead of using a logarithm transformation.[26] The IV estimate from specification 3 implies that a 1 percentage point increase in the immigrant-native ratio decreases the employment-to-population rate of natives by 0.16 percentage points. The difference in magnitude between the estimates from specifications 1 and 3 is mostly due to the log transformation of the immigration variable. This transformation induces more negative estimates because a 1% increase in (M_{rt}/ N_{rt}) implies a weaker magnitude in the change of relative size of immigrants than a 1 percentage point increase in (M_{rt}/ N_{rt}). The level-level specification thus shows that the previous conclusions are not sensitive to the log-log specification.

An important concern is that the use of the current native workforce as a denominator of the immigration variable could create a spurious relationship between immigration and native outcomes (Card and Peri, 2016). Although the IV strategy which also predicts the number of natives should mitigate this concern, specification 4 follows the recommendation by Card and Peri (2016) by using the size of the native labour force in the pre-immigration period to compute the immigration variable. More precisely, we use as a denominator the number of natives in the labour force in 2005 to compute the immigrant share.[27] The results and conclusions are not affected.

[26] Because the ratio of immigrants to natives (M_{rt}/ N_{rt}) is an approximation of $log(1 + M_{rt}/ N_{rt})$, Borjas and Monras (2017) use the former variable to estimate the labour market impact of refugees.

[27] In other words, the regressor of interest in specification 4 is $\log(1 + M_{rt}/N_r^{2005})$, where M_{rt} is the size of the immigrant labour force in region r at time t, and N_r^{2005} is the size of the native labour force in region r in 2005. As instrument for this alternative regressor of interest, we use $log\left(1 + \widehat{M}_{rt}/Native\ population_r^{2005}\right)$ where $\widehat{M}_{rt}$ is the predicted number of immigrants (as defined in equations 2 or 6), and $Native\ population_r^{2005}$ is the size of the native population in 2005.

Panel B adds 5 Western European countries (Denmark, Iceland, Luxembourg, the Netherlands, Sweden) to our main sample of 13 countries. Panel B thus deals with 18 countries (EU15 countries plus 3 EFTA countries), thereby considering all Western European regions. In Panel C, we extend this larger sample to all available European countries (including Cyprus, Czech Republic, Estonia, Hungary, Latvia, Lithuania, Poland, Romania, Slovakia and Slovenia). The specifications in Panels B and C reproduce the same specifications as in Panel A.[28]

In Panel B, the magnitude and significance of the econometric results are similar to those from Panel A. These results confirm that short-run employment responses to immigration are stronger than longer-run responses.

Extending the sample to all available European regions increases the magnitude and precision of the OLS estimated impact of immigration on native employment. These larger estimates suggest stronger effects in Eastern European countries. In line with the previous econometric results, the IV estimates uniformly produce more negative effects, which is consistent with the theoretical direction of the bias. As compared to the IV results from Panel A, the IV estimated results in Panel C are similar when using annual variations (column 2), while they become significant when using the 5-year or 10-year intervals (columns 4 and 6). However, the magnitude of the adverse impact of immigration on native employment rate is always stronger in the short run than in the longer run. In fact, the difference between the -0.89 estimated coefficient using 1-year changes (column 2) and the -0.35 estimated coefficient using 10-year changes (column 6) is significant at the 10% level (the t-statistic is 1.94).

In sum, the estimates from Table 3 are consistent with the previous results and Hypothesis 1: Immigration can affect the average employment rate of natives in the first years, whereas this short-run response dissipates in the longer run.

[28] As already discussed in section 4.2, we predict the regional number of natives and immigrants in the labour force for the additional regions included in Panels B and C by using the alternative shift-share instrument using 2004 as base year (see equation 5). These regions also include Northern Ireland and the three Italian regions that we had to drop from our main sample of 13 countries.

5.3. Robustness of the results using first-difference estimation and past immigration shocks

This section provides two additional tests to check the sensitivity of our main conclusions. First, we estimate an econometric equation in first differences relying on Borjas et al. (1997), Dustmann et al. (2017) and Peri and Sparber (2011a). Such an empirical strategy also allows quantifying the crowd-out effect due to immigration. Second, we rely on Jaeger et al. (2018) to provide a complementary strategy to estimate employment dynamics induced by immigration.

Our first-difference equation strictly relies on Borjas et al. (1997), and is as follows:

$$\frac{\Delta \mathrm{NAT}_{rt}}{LF_r^{2005}} = \rho_0 + \rho_1 \frac{\Delta \mathrm{IMM}_{rt}}{LF_r^{2005}} + \theta_t + \upsilon_{rt} \, , \qquad (9)$$

where the dependent and independent variables respectively give the change in native and immigrant employment in region r between t and $t-1$, both standardized by the regional labour force in 2005. θ_t is a vector of time dummies, and υ_{rt} is the error term.

As instrument for the immigration variable, we use the change in the predicted number of immigrants – i.e.$\left(\widehat{M}_{rt} - \widehat{M}_{rt-1}\right)$ where $\widehat{M}_{rt}$ is defined in equation 2 – divided by total population in 2005. Because the dependent and independent variables are scaled by the same factor, the coefficient ρ_1 measures the impact of an additional immigrant worker in a given region on the change in the number of native workers in that region.

Table 4 presents the estimated results for the same three time intervals and groups of countries already used in Table 3. We cluster the standard errors at the regional level, and follow Borjas et al. (1997) by weighting each regression by $(n_0 n_1)/(n_0+n_1)$, where n_0 and n_1 give the native labour force at time t_0 and t_1, respectively.

The short-run OLS estimates in column 1 imply that 10 additional immigrants in the regional workforce reduce the number of employed natives in that region by 3. Correcting for the endogeneity of immigration makes this crowd-out effect stronger, although the IV strategy provides less precise estimates. More generally, our estimated magnitude is close to the studies by Glitz (2012) who reports 3 native job losses for every 10 immigrants in Germany, and Angrist and Kugler (2003) for a panel of European countries or Borjas and

Edo (2021) for France who respectively find that between 4 and 8 natives lose their jobs for every 10 immigrants entering the labour force.

When exploiting 5- or 10-year changes in columns 3-6, the estimated impact of immigration on native employment is either positive, insignificant or less negative than in columns 1-2. More precisely, the IV estimate from column 6 in our main sample of countries is insignificant and 4-5 times weaker than its corresponding short-run estimate in column 2. This difference is consistent with Hypothesis 1 that native employment should recover in the longer run as the regional labour market adjusts.

In order to characterize the employment dynamics of adjustment to supply shocks, we employ a complementary strategy by adding to equation 9 past immigration shocks in the spirit of Jaeger et al. (2018) who study the impact of immigration on wage dynamics. More precisely, we estimate the following equation over the 2010-2019 period by adding four lags of our immigration variable:

$$\frac{\Delta \mathrm{NAT}_{rt}}{LF_r^{2005}} = a + c_0 \frac{\Delta \mathrm{IMM}_{rt}}{LF_r^{2005}} + \sum_{i=1}^{4} \left(c_i \frac{\Delta \mathrm{IMM}_{rt-i}}{LF_r^{2005}} \right) + \theta_t + e_{rt}\,, \tag{10}$$

where e_{rt} is the error term. In this econometric setting, the coefficient c_0 captures the impact of immigration on employment in the short run, while the coefficient c_i captures the longer-term reaction to past supply shocks.

Table 5 presents the OLS and 2SLS results for our main sample of countries. The first column simply reproduces the basic estimate from equation 9 (or equation 10 without the lagged values). Columns 2-5 progressively include lags of the immigration shocks. [29] Column 6 aims at reducing the omitted variable bias by introducing country-time fixed effects in the econometric equation. The inclusion of time-varying country fixed effects control for any country-specific time changes (such as national changes in labour market regulations or economic activity). Column 7 repeats the regression in column 6, including 4 lags, yet

[29] The correlation coefficients between the current and lagged immigration variables hover between 0.17 and -0.10.

instruments the immigrant inflow rate at time t by the same shift-share instrument used in Table 4.[30]

The estimated coefficients on c_1 are negatively significant, and stable across columns. This result indicates that the short-run impact of immigration on native employment is negative. Consistent with our previous results, its magnitude is stronger than its OLS counterpart. Moreover, the estimated coefficients are significantly positive for lagged immigrant inflows which indicate that native employment tends to recover from immigration-induced supply shocks after some years. This timing of adjustment is similar to the findings from Table 2, and shows that the immediate impact of immigration on native employment differs from longer-run effects.

6. Impact of immigration on native internal mobility

Cross-area (or spatial) studies could deliver misleading interpretations on how immigration affects national economies if natives respond to immigration by moving to other labour markets (Borjas et al., 1997; Dustmann et al., 2005; Borjas, 2006). If immigration reduces the employment opportunities of natives in a given region, some native workers could respond by moving to regions not targeted by immigrants. Such a response would dissipate the economic impact of immigration from the affected labour markets to the national economy, therefore creating a spurious positive correlation between immigration and native employment across regions.

Table 6 investigates the effect of immigration on the mobility of natives over the 2010-2019 period. More precisely, we estimate the following equation:

$$\frac{\mathrm{NAT}_{rt}}{POP_r^{2005}} = \pi_0 + \pi_1 \frac{\mathrm{IMM}_{rt}}{POP_r^{2005}} + \theta_r + \theta_t + \tau_{rt}\ , \tag{11}$$

[30] We were unable to find powerful instruments to account for the endogeneity of both current and lagged immigration variables. Given that such instruments need to be constructed using the same base period 1990, their difference would only come from changes in the national origin mix of immigrants over the 2010-2019 period. The problem is that these changes are too small. As a result, the shift-share instruments that we constructed were highly correlated, and there was too little distinct variation in each to identify separately the first-stage equations. As explained in Jaeger et al. (2018, p. 19), such an IV strategy thus suffers from a joint weak instrument problem.

where the dependent variable is the total number of natives in region r at time t standardized by the initial population in region r in 2005. The regressor of interest is the total number of immigrants in region r at time t standardized by the initial population in region r in 2005. Region and time fixed effects are captured by θ_r and θ_t, respectively. τ_{rt} is the error term.[31]

The coefficient π_1 gives the change in the size of the native population in response to 1 additional immigrant in a region when the stock of immigrants increases by 1. A positive estimate thus implies that immigration tends to attract more natives in the regions targeted by immigrants. A negative estimate implies that immigration induces a crowd-out effect on native workers, indicating that the latter respond to immigration by leaving (or not entering) the regions targeted by immigrants.

In Table 6, columns 1-2 exploit annual variations, while columns 3-4 use the 10-year interval. Specification 1 uses the main sample of 136 Western European regions. Specifications 2 and 3 repeats the analysis with an extended sample of European regions.

A major challenge in estimating the impact of immigration on native internal mobility is that immigrants are not randomly allocated across regions. If immigrants choose the most economically prosperous regions, one would expect a spurious positive correlation between the population share of immigrants and the population share of natives. To address this concern, we follow the same strategy as in specifications 4, 8 and 12 of Table 3: we instrument $\text{IMM}_{rt}/POP_r^{2005}$ by $\widehat{\text{IMM}}_{rt}/POP_r^{2005}$, where $\widehat{\text{IMM}}_{rt}$ is the predicted number of immigrants based on equation 2 for the main sample of regions, or equation 6 for the remaining set of European regions.

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[31] Although this empirical equation slightly differs from the one proposed by Peri and Sparber (2011a), we find that strictly using their specification does not affect our results and conclusions. To study the crowd-out effect of immigrants, they suggest estimating the following econometric equation:

$$\frac{\Delta\text{NAT}_{rt}}{\text{POP}_{rt-1}} = \alpha_0 + \alpha_1 \frac{\Delta\text{IMM}_{rt}}{\text{POP}_{rt-1}} + \theta_r + \theta_t + \omega_{rt}\,. \quad (12)$$

This specification amounts to regressing the change in the number of natives on the change in the number of immigrants, and standardizing both variables by the population at time t−1. It also includes area and time fixed effects. For our main sample of countries, the OLS estimates are negative when using the 1-year specification (the estimated coefficient is -0.32 and the standard error is 0.33) and positive when using the 10-year specification (the estimated coefficient is 0.20 and the standard error is 0.13), but they are not significant. The IV estimates are even less precise.

The IV estimated effects from Table 6 indicate that immigration does not affect the mobility of natives across European regions. As a result, the estimated employment effects induced by immigration are very unlikely to be biased by native internal migration.

7. Heterogeneous effects of immigration on native employment

7.1. The employment response of natives by education

Table 7 decomposes the average impact of immigration on the employment-to-population rate of natives by education group. The table presents the impact on low-educated natives in panel A and high-educated natives in panel B. While columns 1-2 exploit annual variations, columns 3-4 use the 10-year interval. Specifications 1-4 and 5-8 are identical to the specifications described in Table 3.

The short-run estimates from columns 1-2 show that a rise in the relative size of immigrants has a negative impact on the employment rate of low-educated natives, while the impact on high-educated natives is negligible. This asymmetric impact is consistent with Hypothesis 2 and indicates that low-educated natives mostly drive the average employment impact identified above.

In addition, for both education groups, the employment response to immigration becomes less negative or more positive in the longer run (Hypothesis 1). For the low-educated group of natives, the estimated employment responses to immigration when exploiting regional variations within the 10-year interval are negative yet much weaker than in column 2, and are also statistically insignificant. These results show that the short-run negative impact on the employment rate of low-educated natives is strongly mitigated in the longer run.

The longer-run impact of immigration on the employment rate of high-educated natives becomes positive in most regressions and significant at the 5% level in specifications 5 and 8 of column 4. This positive employment impact is consistent with factor demand theory. In fact, under the assumption of a constant-return-to-scale aggregate production function, capital accumulation should increase the labour market opportunities of natives and leave the (potential) distributional effects on native wages unchanged across education groups (Ottaviano and Peri, 2012; Borjas, 2013; Edo and Toubal, 2015). Given the insensitivity of employment among high-educated natives in the short run, standard economic theory would thus predict that economic adjustments triggered by immigration in the medium run would increase their employment opportunities.[32] As a result, the longer-run impact of immigration on the employment rate of high-educated natives would become positive.

7.2. The employment response of natives across country institutional characteristics

To study the role played by labour market institutions in mitigating the impact of immigration on native employment, we estimate the following equation:

$$\mathrm{y}_{rt} = \sigma_0 + \sigma_1 m_{rt} + \sigma_2 (m_{rt} \times Institution_c) + \theta_r + \theta_t + \vartheta_{rt}\ . \tag{13}$$

As in our main empirical equation 1, y_{rt} is the logarithm of the employment-to-population rate of natives in region r at time t, m_{rt} is the log share of immigrants in the labour force, θ_r is a vector of regional dummies, and θ_t is a vector of time dummies. The error term is denoted ϑ_{rt}. As compared to our baseline empirical equation 1, equation 13 adds the interaction term $(m_{rt} \times Institution_c)$ to study how the impact of m_{rt} on y_{rt} varies with the institutional characteristic of the country c.

Table 8 estimates equation 13 in the short run (1-year intervals) and the longer run (10-year interval) over the 2010-2019 period. Columns 1-6 study the impact of each of the three institutional measures separately explained in section 3, whereas the two last columns include them all together.

The results on the interaction term between employment protection and immigration indicate that labour market institutions play a role in shaping the employment impact of immigration in the short and longer run. More specifically, the IV estimated results in columns 2 and 8 show that immigration has a much weaker impact in the short run in the

[32] More precisely, this prediction assumes that physical capital has the same degree of substitutability with all education groups. It does not hold if one assumes capital-skill complementarity – i.e. physical capital and high-skilled labour are complements, while physical capital and low-skilled labour are substitutes (Edo, 2019). Under this assumption, once capital has fully adjusted, all wages return to their pre-immigration levels. Therefore, in the long run, immigration has no distributional consequences.

countries with the highest employment protection index, while the impact is negligible in the longer run. In contrast, immigration induces employment losses in the short and longer run in the regions where employment protection is weak. The estimated magnitude from column 2 indicates that the employment response to immigration is -1.34 in low initial EPI countries, while it is estimated to be -0.50 (-1.34+0.74) in high initial EPI countries. The protective effect of labour market institutions on native employment echoes the results by Edo and Rapoport (2018). They find for the United States that high minimum wages protect the labour market outcomes of natives against competition from immigrants with comparable skills.[33]

The IV estimated impact in columns 4 and 8 suggests that native employment response to immigration does not depend on union density. This result contrasts with the role played by the high coverage of wage agreements. In countries where wage bargaining does not take place at the firm level, the impact of immigration on native employment tends to be weaker (although the IV estimated coefficient on this interaction term is only marginally significant in column 8).

In accordance with Hypothesis 3, our results emphasize the important role played by labour market institutions in shaping the impact of immigration on native employment. The next section shows that this conclusion is robust to adding regional GDP growth in the empirical analysis.

7.3. The employment response of natives by region's economic performance

Regions that are economically more dynamic and able to adjust their capital should have a greater propensity to absorb the increase in the labour supply with weaker effects on native employment (Hypothesis 4). This hypothesis is tested in Table 9 where we estimate the average employment impact of migration in the short run (1-year intervals) and the longer-run (10-year interval) separately for regions based on their economic performance over the whole period. Specifically, we add an interaction term between the immigrant share and the regional economic performance to the full model presented in columns 7-8 of Table 8. More

[33] Similarly, Prantl and Spitz-Oener (2020) found that the negative effect of East German immigrants on the wages of West German workers disappeared in product and labour markets that are regulated.

precisely, we interact m_{rt} with a dummy equal to 1 if the change in GDP between 2010 and 2019 is among the top 25% ("High GDP growth").

Table 9 presents the results. The IV estimated effects from column 2 indicate that the impact of immigration on native employment is detrimental in both region groups. Yet the estimated magnitude is twice weaker in the fastest-growing regions. Indeed, at the mean value of our sample, we find that the short-run employment response to immigration in low-GDP growth regions is -1.3, while it is estimated to be -0.63 (-1.30+0.67) in high-GDP growth regions.

The IV results in column 4 indicate that immigration has a smaller longer-run impact in the low-GDP growth regions than in the short run. At the mean value of our sample, the IV estimated impact of immigration in these regions is -0.5 in the longer run (whereas it is -1.3 in the short run). The results from column 4 also show no adverse impact on native employment in the fastest-growing regions (-0.5+0.5).

The asymmetric employment response to immigration between the two region groups shows that the most economically dynamic regions are more able to absorb positive supply shocks induced by immigration (Hypothesis 4).[34] Moreover, Table 9 indicates that the regions that combine strong economic dynamism and strict employment protection are not hurt by immigration, and even experience employment gains in the longer run.

8. Conclusion

This paper investigates the employment consequences of immigration by exploiting regional variations that span across 13 Western European countries over the last decade (2010-2019). During this period, the growth in native employment rates slowed down following increases in the labour force due to immigration, especially for low-educated natives. However, this effect disappears over time as regional labour markets adjust. In a 10-year period, the effect of immigration becomes negligible for low-educated natives, while

[34] Regional economic growth is unlikely to be exogenous to the labour market outcomes of natives, or to immigration. For instance, it may be that an economic expansion leads to more public investments, or to labour market reforms that boost employment. In such cases, the small adverse employment impact of immigration identified in high-GDP growth regions may be biased due to a third omitted variable. Therefore, our results from Table 9 should be interpreted with caution.

it turns positive for highly educated ones. The natives located in regions with tighter labour market institutions are less affected by immigration, both in the short and longer run. Finally, European regions with greater economic performance are better at absorbing new immigrant workers with little or no native displacement.

These findings show that the employment impact of an increase in the labour supply due to immigration is highly uneven across workers, places and time. While the employment prospects of high-educated workers or those living in economically dynamic regions are barely affected, low-educated workers or those living in less dynamic regions experience a decline in their employment opportunities. These differential effects contribute to our understanding of the spatial differences in attitudes towards immigration. Specifically, these findings can shed light on why natives who are highly educated or living in economically growing areas tend to have more positive opinions about immigrants and immigration than low-educated natives or those living in rural regions (Ceobanu and Escandell, 2010; Barrera et al., 2022).

From a policy perspective, these results highlight the need for targeted policies. As the labour market consequences for natives are uneven across groups or places, targeted policies that take into account these heterogeneous impacts can mitigate any potential short-run adverse labour market effects on low-educated workers and economically lagging regions.

Our study has several limitations. First, the analysis focuses on the impact of immigration on native employment. For a more comprehensive understanding on how European labour markets respond to immigration, an empirical analysis along the wage margin is necessary. Second, while most labour market institutions are set at the national level and do not vary within countries, a study using institutional measures that vary across regions would provide larger spatial variation in institutional characteristics, and allow more precise estimation of their role in shaping the labour market impact of immigration. Moreover, this study implicitly assumes that labour market institutions have the same effect across native workers. However, the degree of protection should be uneven across workers with different types of job contracts, education and experience levels, occupations or industries (Edo, 2016; Dustmann et al., 2017).

Future research should aim to address these limitations by using institutional data at the regional level to better understand the relationship between labour market institutions and the labour market impact of immigration. Furthermore, using individual panel data would allow understanding the precise mechanisms through which natives adjust to labour supply shocks due to immigration, while making it possible to identify differential effects on workers who are already in the labour market (i.e. insiders) vs. those who are not (i.e. outsiders). These extensions would allow deepening our understanding of the uneven impact of immigration-induced labour supply shocks, which is crucial for formulating policies that ensure that the entire population benefits from positive economic gains associated with migration.

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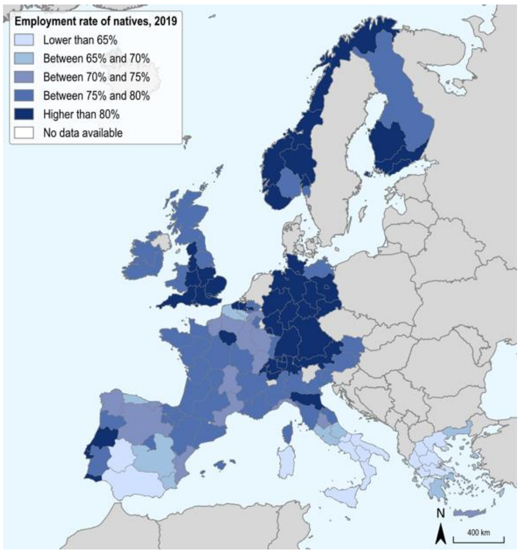
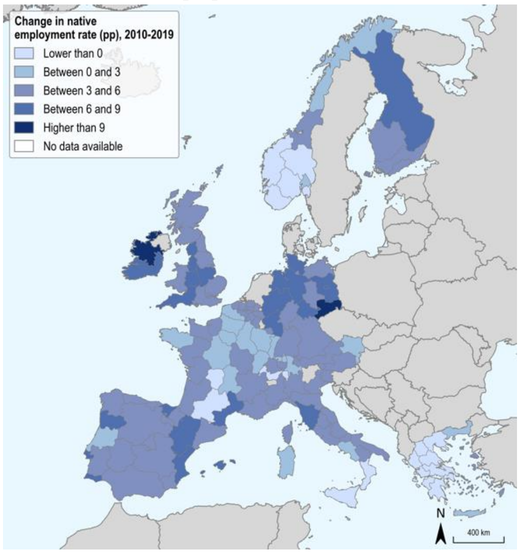
9. Figures

Figure 1: Employment rates and immigrant shares for Western European countries between 2010 and 2019

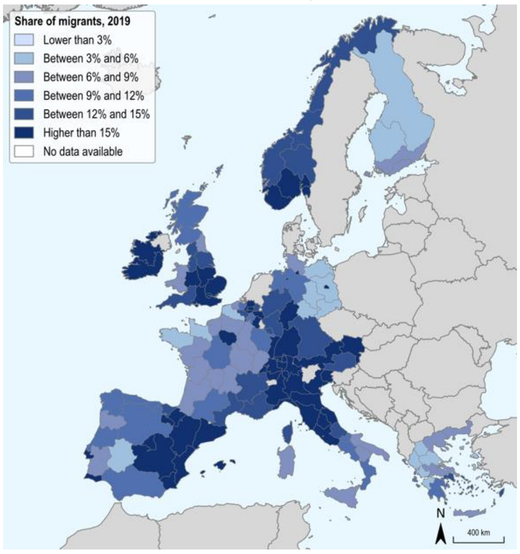
Panel A: Employment-to-population rate of natives in 2019



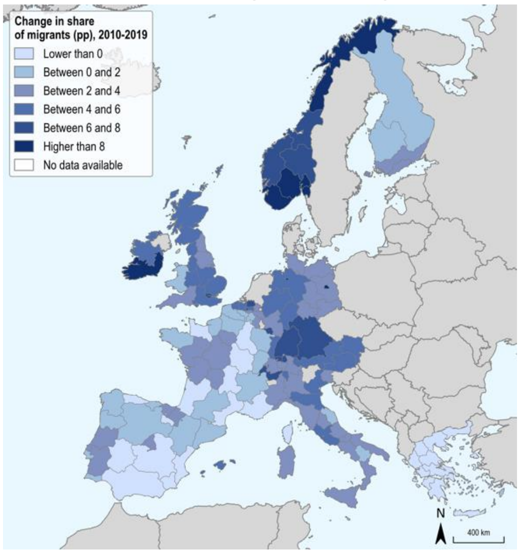
Panel B: 10-year changes in native employment-to-population rates



Panel C: Share of immigrants in 2019



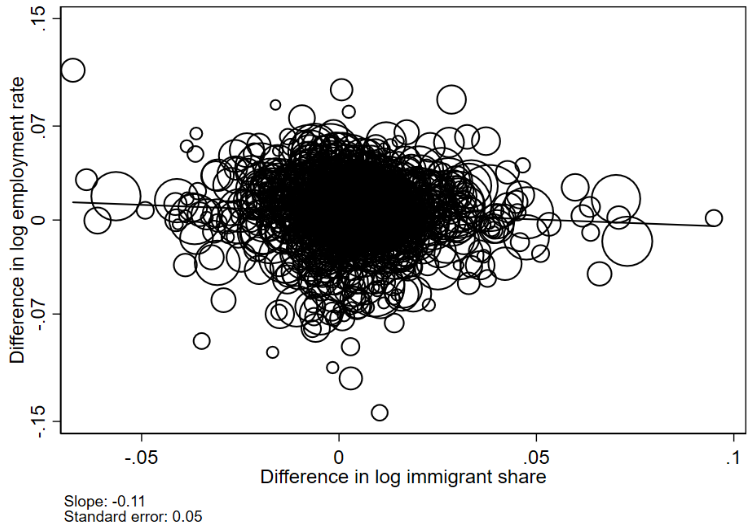
Panel D: 10-year changes in immigrant shares



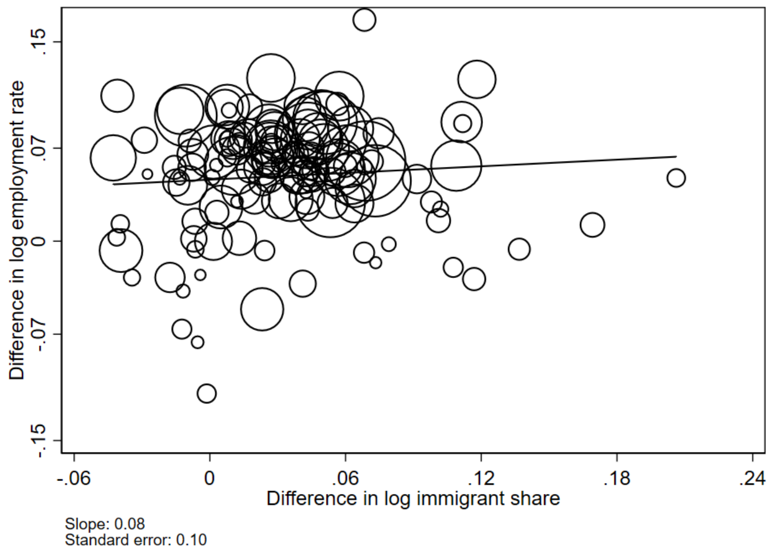
Notes: Sample of countries: Austria, Belgium, Finland, France, Germany, Greece, Ireland, Italy, Norway, Portugal, Spain, Switzerland and the United Kingdom. The share of immigrants is defined as $M/(\mathrm{M}+N)$, where M and N give the number of foreign-born and native labour force participants, respectively. Panels B and D respectively show the difference in native employment-to-population rates and immigrant shares for each region between 2019 and 2010.
Source: Eurostat (EU-LFS).

Figure 2: Relationship between native employment-to-population rate and the share of immigrants

Panel A: Short-run effects (1-year intervals)



Panel B: Long-run effects (10-year interval)



Notes: Time period: 2010-2019. Sample of countries: Austria, Belgium, Finland, France, Germany, Greece, Ireland, Italy, Norway, Portugal, Spain, Switzerland and the United Kingdom. The unit of observation in the scatter diagrams is a region-year cell. Panel A exploits annual variations (1-year intervals), and Panel B uses the 10-year interval (2010 and 2019). The two figures correlate the difference in the log employment-to-population rate of natives to the difference in the share of immigrants in the labour force. The log immigrant share is defined as $\log(1+M/N)$, where M and N give the number of foreign-born and native labour force participants, respectively.

Source: Eurostat (EU-LFS).

10. Tables

Table 1: Descriptive statistics

	2010	2015	2019
Immigrant share	12.8	14.4	16.2
With a tertiary education	11.3	13.7	14.9
With less than a tertiary education	13.4	14.7	17.0
Share of tertiary educated natives	30.0	34.2	37.2
Share of tertiary educated immigrants	26.1	32.3	33.6
Employment-to-population rate of natives	72.2	73.5	76.8

Notes: Time period: 2010, 2015 and 2019. Sample of countries: Austria, Belgium, Finland, France, Germany, Greece, Ireland, Italy, Norway, Portugal, Spain, Switzerland and the United Kingdom. The table presents the share of immigrants in the labour force, and by education. It also shows the share of the native or immigrant labour force who are tertiary-educated, as well as the employment-to-population rate of natives.
Source: Eurostat (EU-LFS).

Table 2: Baseline impact of immigration on native employment rate

	1-year intervals		2-year intervals		3-year intervals		5-year intervals		10-year interval	
	OLS	IV	OLS	IV	OLS	IV	OLS	IV	OLS	IV
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
Immigrant share	-0.13**	-0.81***	-0.06	-0.61***	0.02	-0.55**	0.13	-0.05	0.08	-0.02
	(0.06)	(0.22)	(0.08)	(0.20)	(0.09)	(0.25)	(0.09)	(0.21)	(0.10)	(0.22)
IV first-stage results:										
Instrument		0.26***		0.24***		0.21***		0.22***		0.22***
Standard error		(0.07)		(0.06)		(0.07)		(0.08)		(0.08)
Kleibergen-Paap F-test		14.15		13.61		8.80		8.14		7.30
Cluster	136	136	136	136	136	136	136	136	136	136
Observations	1,360	1,360	680	680	544	544	408	408	272	272

Notes: Time period: 2010-2019. Sample of countries: Austria, Belgium, Finland, France, Germany, Greece, Ireland, Italy, Norway, Portugal, Spain, Switzerland and the United Kingdom. The table reports the estimated impact of immigration on the logarithm of the employment-to-population rate of natives exploiting annual variations (1-year intervals) in columns 1-2, biannual variations (2-year intervals) in columns 3-4, triannual variations (3-year intervals) in columns 5-6, 5-year intervals (2010-2015-2019) in columns 7-8, and the 10-year interval (2010 and 2019) in columns 3-4. The units of observations are regions. All regressions include time and area fixed effects. The shift-share instrument is computed using census data in 1990. Below the point estimate, the standard errors in parentheses are heteroscedasticity robust and clustered by region. ***, **, * denote statistical significance from zero at the 1%, 5%, 10% significance level.

Source: Eurostat (EU-LFS), IPUMS and national statistical institutes.

Table 3: Impact of immigration on native employment rate using alternative specifications and samples

	1-year intervals		5-year intervals		10-year interval	
	OLS	IV	OLS	IV	OLS	IV
	(1)	(2)	(3)	(4)	(5)	(6)
	A. Main sample of countries					
1. Basic regression	-0.13**	-0.81***	0.13	-0.05	0.08	-0.02
	(0.06)	(0.22)	(0.09)	(0.21)	(0.10)	(0.22)
Kleibergen-Paap F-test		14.15		8.14		7.30
2. Native LF in 2005 as weight	-0.08	-1.07***	0.11	-0.48*	0.07	-0.44
	(0.08)	(0.31)	(0.09)	(0.28)	(0.10)	(0.29)
Kleibergen-Paap F-test		16.17		9.76		9.03
3. Level-level specification	-0.06*	-0.16*	0.05	-0.02	0.03	-0.01
	(0.03)	(0.09)	(0.04)	(0.04)	(0.05)	(0.03)
Kleibergen-Paap F-test		15.45		13.19		11.92
4. Initial native LF to measure	-0.11	-0.79***	0.16*	-0.14	0.10	-0.14
the supply shock	(0.08)	(0.18)	(0.09)	(0.19)	(0.10)	(0.20)
Kleibergen-Paap F-test		25.35		20.18		18.46
Cluster	136	136	136	136	136	136
Observations	1,360	1,360	408	408	272	272
	B. EU15 + 3 EFTA countries					
5. Basic regression	-0.12**	-0.66***	0.11	-0.12	0.05	-0.10
	(0.06)	(0.17)	(0.09)	(0.14)	(0.09)	(0.14)
Kleibergen-Paap F-test		22.03		12.12		10.55
6. Native LF in 2005 as weight	-0.08	-0.95***	0.10	-0.44*	0.06	-0.39
	(0.08)	(0.27)	(0.09)	(0.24)	(0.10)	(0.25)
Kleibergen-Paap F-test		19.59		12.09		11.34
7. Level-level specification	-0.05**	-0.16*	0.03	-0.02	0.01	-0.01
	(0.02)	(0.09)	(0.04)	(0.04)	(0.04)	(0.03)
Kleibergen-Paap F-test		15.45		13.19		11.92
8. Initial native LF to measure	-0.10	-0.68***	0.13	-0.18	0.06	-0.18
the supply shock	(0.06)	(0.17)	(0.08)	(0.15)	(0.09)	(0.15)
Kleibergen-Paap F-test		20.49		16.20		13.97
Cluster	156	156	156	156	156	156
Observations	1,560	1,560	468	468	312	312
	C. All European countries					
9. Basic regression	-0.31***	-0.89***	-0.14	-0.41**	-0.24***	-0.35**
	(0.06)	(0.22)	(0.09)	(0.16)	(0.09)	(0.17)
Kleibergen-Paap F-test		18.32		12.61		10.90
10. Native LF in 2005 as weight	-0.27***	-1.09***	-0.15	-0.66***	-0.26**	-0.58**
	(0.08)	(0.27)	(0.09)	(0.23)	(0.10)	(0.24)
Kleibergen-Paap F-test		16.05		13.50		12.57
11. Level-level specification	-0.13***	-0.23**	-0.06*	-0.11*	-0.10***	-0.10**
	(0.03)	(0.10)	(0.03)	(0.06)	(0.04)	(0.05)
Kleibergen-Paap F-test		20.30		20.25		18.84
12. Initial native LF to measure	-0.29***	-1.01***	-0.11	-0.60***	-0.22**	-0.57***
the supply shock	(0.07)	(0.23)	(0.09)	(0.18)	(0.09)	(0.19)
Kleibergen-Paap F-test		23.59		20.78		17.77
Cluster	205	205	205	205	205	205
Observations	2,050	2,050	615	615	410	410

Notes: Time period: 2010-2019. Sample of countries in Panel A: Austria, Belgium, Finland, France, Germany, Greece, Ireland, Italy, Norway, Portugal, Spain, Switzerland and the United Kingdom. Sample of countries in Panel B: EU15 countries (including the United Kingdom) plus Iceland, Norway and Switzerland. Sample of countries in Panel C: all available European countries (Western plus Eastern countries). The table reports the estimated impact of immigration on the logarithm of the employment-to-population rate of natives over different time intervals. To run the regressions, columns 1-2 exploit annual variations (1-year intervals); columns 3-4 use 5-year intervals (2010, 2015 and 2019); columns 5-6 use the 10-year interval (2010 and 2019). The units of observations are regions. All regressions include time and area fixed effects. The shift-share instrument is computed using census data in 1990 for our main sample of 136 regions, or using the 2004 EU-LFS for the remaining regions. Below the point estimate, the standard errors in parentheses are heteroscedasticity robust and clustered by region. ***, **, * denote statistical significance from zero at the 1%, 5%, 10% significance level.
Source: Eurostat (EU-LFS), IPUMS and national statistical institutes.

Table 4: Impact of immigration on native employment using first-difference estimation

	1-year intervals		5-year intervals		10-year interval	
	OLS	IV	OLS	IV	OLS	IV
	(1)	(2)	(3)	(4)	(5)	(6)
1. Main sample of countries	-0.29**	-0.70*	0.41***	-0.18	0.55***	-0.16
	(0.14)	(0.42)	(0.13)	(0.29)	(0.11)	(0.29)
Kleibergen-Paap F-test		5.39		8.57		7.35
Number of countries	13	13	13	13	13	13
Cluster	136	136	136	136	136	136
Observations	1,224	1,224	272	272	136	136
2. EU15 + 3 EFTA countries	-0.29**	-0.72*	0.37***	-0.24	0.52***	-0.19
	(0.13)	(0.40)	(0.12)	(0.27)	(0.10)	(0.27)
Kleibergen-Paap F-test		5.33		9.03		7.64
Number of countries	18	18	18	18	18	18
Cluster	156	156	156	156	156	156
Observations	1,404	1,404	312	312	156	156
3. All European countries	-0.32**	-0.82**	0.24**	-0.52**	0.26**	-0.47**
	(0.13)	(0.35)	(0.11)	(0.23)	(0.11)	(0.24)
Kleibergen-Paap F-test		6.31		13.37		10.83
Number of countries	28	28	28	28	28	28
Cluster	205	205	205	205	205	205
Observations	1,845	1,845	410	410	205	205

Notes: Time period: 2011-2019. Sample of countries in Panel A: Austria, Belgium, Finland, France, Germany, Greece, Ireland, Italy, Norway, Portugal, Spain, Switzerland and the United Kingdom. Sample of countries in Panel B: EU15 countries (including the United Kingdom) plus Iceland, Norway and Switzerland. Sample of countries in Panel C: all available European countries (Western plus Eastern countries). The table reports the estimated impact of the change in immigrant employment in a region on the change in native employment in that region, both relative to the region's total labour force in 2005. To run the regressions, columns 1-2 exploit annual changes; columns 3-4 use 5-year changes (2011, 2015 and 2019); columns 5-6 use changes between 2011 and 2019. All regressions include time fixed effects; and are weighted by $(n_0 n_1)/(n_0+n_1)$, where n_0 and n_1 give the size of the native labour force at time t_0 and t_1. The shift-share instrument is computed using census data in 1990 for our baseline of regions in Panel A, or using the 2004 EU-LFS for the remaining regions. Below the point estimate, the standard errors in parentheses are heteroscedasticity robust and clustered by region. ***, **, * denote statistical significance from zero at the 1%, 5%, 10% significance level.
Source: Eurostat (EU-LFS), IPUMS and national statistical institutes.

Table 5: Impact of immigration on native employment adding past immigration shocks

	OLS estimates						IV estimate
	(1)	(2)	(3)	(4)	(5)	(6)	(7)
Immigrant Inflows(t)	-0.29**	-0.25*	-0.27*	-0.29**	-0.29**	-0.48***	-0.89***
	(0.14)	(0.14)	(0.14)	(0.14)	(0.15)	(0.18)	(0.33)
Immigrant Inflows(t-1)		0.29***	0.30***	0.29***	0.29***	0.19***	0.07
		(0.08)	(0.08)	(0.08)	(0.08)	(0.07)	(0.12)
Immigrant Inflows(t-2)			0.14**	0.15**	0.15**	0.14**	0.14**
			(0.07)	(0.07)	(0.07)	(0.07)	(0.07)
Immigrant Inflows(t-3)				0.12*	0.12*	0.11**	0.19**
				(0.07)	(0.07)	(0.05)	(0.09)
Immigrant Inflows(t-4)					-0.00	0.11	0.18*
					(0.07)	(0.07)	(0.10)
Kleibergen-Paap F-test							6.72
Country-time fixed effects						X	X
Cluster	136	136	136	136	136	136	136
Observations	1,224	1,224	1,224	1224	1,224	1,224	1,224

Notes: Time period: 2011-2019. Sample of countries: Austria, Belgium, Finland, France, Germany, Greece, Ireland, Italy, Norway, Portugal, Spain, Switzerland and the United Kingdom. Column 1 reports the estimated impact of the change in immigrant employment in a region on the change in native employment in that region, both relative to the region's total labour force in 2005. Columns 2-5 progressively include lags of the immigration variable. All regressions include time fixed effects, exploit annual changes, and are weighted by $(n_0 n_1)/(n_0+n_1)$, where n_0 and n_1 give the size of the native labour force at time t_0 and t_1. Columns 6-7 include country-time fixed effects. The shift-share instrument is computed using census data in 1990. Below the point estimate, the standard errors in parentheses are heteroscedasticity robust and clustered by region. ***, **, * denote statistical significance from zero at the 1%, 5%, 10% significance level.
Source: Eurostat (EU-LFS), IPUMS and national statistical institutes.

Table 6: Impact of immigration on native internal mobility

	1-year intervals		10-year interval	
	OLS estimates	IV estimates	OLS estimates	IV estimates
	(1)	(2)	(3)	(4)
1. Main sample of countries	0.23	0.27	0.34***	0.25
	(0.18)	(0.23)	(0.12)	(0.31)
Kleibergen-Paap F-test		7.79		7.80
Number of countries	13	13	13	13
Cluster	136	136	136	136
Observations	1,360	1,360	272	272
2. EU15 + 3 EFTA countries	0.23	0.18	0.34***	0.17
	(0.14)	(0.19)	(0.10)	(0.26)
Kleibergen-Paap F-test		7.62		8.39
Number of countries	18	18	18	18
Cluster	156	156	156	156
Observations	1,560	1,560	312	312
3. All European countries	0.18	0.12	0.28***	0.12
	(0.13)	(0.16)	(0.09)	(0.20)
Kleibergen-Paap F-test		11.67		12.95
Number of countries	28	28	28	28
Cluster	205	205	205	205
Observations	2,050	2,050	410	410

Notes: Time period: 2010-2019. Sample of countries in specification 1: Austria, Belgium, Finland, France, Germany, Greece, Ireland, Italy, Norway, Portugal, Spain, Switzerland and the United Kingdom. Sample of countries in specification 2: EU15 countries (including the United Kingdom) plus Iceland, Norway and Switzerland. Sample of countries in specification 3: all available European countries (Western plus Eastern countries). The table reports the estimated impact of the immigrant population in a region on the native population in that region, both relative to the region's total population in 2005. To run the regressions, columns 1-2 exploit annual variations (1-year intervals), and columns 3-4 use the 10-year interval (2010 and 2019). All regressions include time and area fixed effects. The shift-share instrument is computed using census data in 1990 for our main sample of 136 regions, or using the 2004 EU-LFS for the remaining regions. Below the point estimate, the standard errors in parentheses are heteroscedasticity robust and clustered by region. ***, **, * denote statistical significance from zero at the 1%, 5%, 10% significance level.
Source: Eurostat (EU-LFS), IPUMS and national statistical institutes.

Table 7: Impact of immigration on native employment rate by education group

	1-year intervals		**10-year interval**	
	OLS estimates	IV estimates	OLS estimates	IV estimates
	(1)	(2)	(3)	(4)
	A. Low educated natives			
1. Basic regression	-0.12	-1.15***	0.16	-0.28
	(0.08)	(0.31)	(0.13)	(0.27)
Kleibergen-Paap F-test		14.15		7.30
2. Native LF in 2005 as weight	0.02	-1.43***	0.26**	-0.70
	(0.10)	(0.51)	(0.13)	(0.49)
Kleibergen-Paap F-test		16.17		9.03
3. Level-level specification	-0.05	-0.26*	0.04	-0.10*
	(0.04)	(0.14)	(0.06)	(0.05)
Kleibergen-Paap F-test		15.45		11.92
4. Initial native LF to measure	-0.07	-1.48***	0.17*	-0.43
the supply shock	(0.07)	(0.56)	(0.10)	(0.46)
Kleibergen-Paap F-test		9.86		6.11
Cluster	136	136	136	136
Observations	1,360	1,360	272	272
	B. High educated natives			
5. Basic regression	-0.03	0.03	0.12	0.68**
	(0.06)	(0.16)	(0.10)	(0.34)
Kleibergen-Paap F-test		14.15		7.30
6. Native LF in 2005 as weight	-0.03	-0.25	0.02	0.28
	(0.05)	(0.16)	(0.09)	(0.23)
Kleibergen-Paap F-test		16.17		9.03
7. Level-level specification	-0.03	0.05	0.04	0.15
	(0.03)	(0.06)	(0.05)	(0.10)
Kleibergen-Paap F-test		15.45		11.92
8. Initial native LF to measure	-0.05	-0.01	-0.00	0.37**
the supply shock	(0.04)	(0.12)	(0.06)	(0.18)
Kleibergen-Paap F-test		28.06		21.03
Cluster	136	136	136	136
Observations	1,360	1,360	272	272

Notes: Time period: 2010-2019. Sample of countries: Austria, Belgium, Finland, France, Germany, Greece, Ireland, Italy, Norway, Portugal, Spain, Switzerland and the United Kingdom. The table reports the estimated impact of immigration on the logarithm of the employment-to-population rate of natives for low- and high-educated natives separately. To run the regressions, columns 1-2 exploit annual variations (1-year intervals), and columns 3-4 use the 10-year interval (2010 and 2019). The units of observations are regions. All regressions include time and area fixed effects. The shift-share instrument is computed using census data in 1990. Below the point estimate, the standard errors in parentheses are heteroscedasticity robust and clustered by region. ***, **, * denote statistical significance from zero at the 1%, 5%, 10% significance level.
Source: Eurostat (EU-LFS), IPUMS and national statistical institutes.

Table 8: Impact of immigration on native employment rate interacted with institutional characteristics

	OLS	IV	OLS	IV	OLS	IV	OLS	IV
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
	A. 1-year intervals							
Immigrant share	-0.27***	-1.34***	-0.05	-0.95***	-0.40***	-1.23***	-0.33***	-1.52***
	(0.09)	(0.25)	(0.08)	(0.24)	(0.10)	(0.28)	(0.11)	(0.28)
Immigrant share*High intial EPI	0.28**	0.74***					0.13	0.68***
	(0.11)	(0.20)					(0.12)	(0.24)
Immigrant share*High intial union density			-0.18*	0.29			-0.47***	-0.21
			(0.11)	(0.19)			(0.17)	(0.30)
Immigrant share*High coverage agreements					0.43***	0.47**	0.55***	0.37
					(0.12)	(0.19)	(0.13)	(0.23)
SW F-statistic (imm. share)		26.45		26.73		23.72		28.77
SW F-statistic (imm. share*EPI)		77.19						182.37
SW F-statistic (imm. share*union density)				97.14				174.68
SW F-statistic (imm. share*coverage)						63.73		124.25
Cluster	136	136	136	136	136	136	136	136
Observations	1,360	1,360	1,360	1,360	1,360	1,360	1,360	1,360
	B. 10-year interval							
Immigrant share	-0.11	-0.47*	0.20	-0.11	-0.11	-0.39	-0.12	-0.66**
	(0.11)	(0.27)	(0.13)	(0.25)	(0.12)	(0.30)	(0.14)	(0.27)
Immigrant share*High intial EPI	0.44***	0.54***					0.35***	0.55***
	(0.14)	(0.15)					(0.12)	(0.17)
Immigrant share*High intial union density			-0.22	0.23			-0.34**	-0.16
			(0.13)	(0.15)			(0.17)	(0.21)
Immigrant share*High coverage agreements					0.24**	0.36**	0.29**	0.23
					(0.11)	(0.14)	(0.13)	(0.16)
SW F-statistic (imm. share)		9.97		12.04		11.09		10.24
SW F-statistic (imm. share*EPI)		50.80						57.39
SW F-statistic (imm. share*union density)				74.68				64.84
SW F-statistic (imm. share*coverage)						51.56		79.10
Cluster	136	136	136	136	136	136	136	136
Observations	272	272	272	272	272	272	272	272

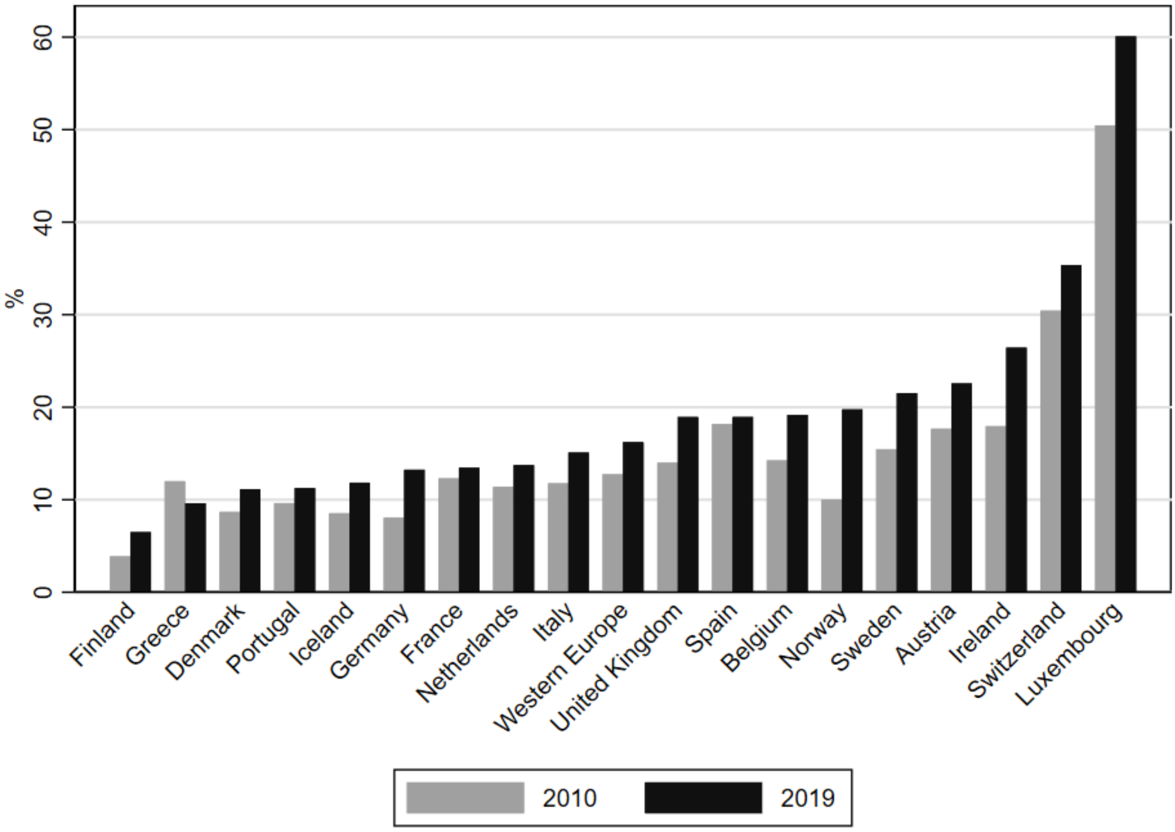
Notes: Time period: 2010-2019. Sample of countries: Austria, Belgium, Finland, France, Germany, Greece, Ireland, Italy, Norway, Portugal, Spain, Switzerland and the United Kingdom. The table reports the impact of immigration on the logarithm of the employment-to-population rate of natives by interacting the immigrant share with three different institutional characteristics at the country level (employment protection index or EPI, union density, and level of collective wage bargaining). Panel A uses annual variations (1-year intervals) while Panel B uses the 10-year interval (2010 and 2019). The units of observations are regions. The shift-share instrument is computed using census data in 1990. We report the Sanderson-Windmeijer (SW) first-stage F-statistics to test the power of our instruments. Below the point estimate, the standard errors in parentheses are heteroscedasticity robust and clustered by region. ***, **, * denote statistical significance from zero at the 1%, 5%, 10% significance level.
Source: Eurostat (EU-LFS), IPUMS and national statistical institutes.

Table 9: Impact of immigration on native employment rate interacted with institutional characteristics and regional economic dynamism

	1-year intervals		10-year interval	
	OLS	IV	OLS	IV
	(1)	(2)	(3)	(4)
Immigrant share	-0.54***	-1.83***	-0.39**	-0.91***
	(0.10)	(0.40)	(0.15)	(0.33)
Immigrant share*High intial EPI	0.21**	0.70***	0.44***	0.55***
	(0.10)	(0.22)	(0.12)	(0.18)
Immigrant share*High intial union density	-0.42**	-0.14	-0.27*	-0.10
	(0.16)	(0.29)	(0.16)	(0.21)
Immigrant share*High coverage agreements	0.59***	0.53**	0.35***	0.36**
	(0.13)	(0.21)	(0.13)	(0.17)
Immigrant share*High GDP growth	0.36**	0.67**	0.40**	0.50***
	(0.16)	(0.27)	(0.17)	(0.18)
SW F-statistic (imm. share)		25.50		9.32
SW F-statistic (imm. share*EPI)		94.59		43.49
SW F-statistic (imm. share*union density)		200.70		65.50
SW F-statistic (imm. share*coverage)		168.32		87.67
SW F-statistic (imm. share*GDP growth)		120.59		55.38
Cluster	136	136	136	136
Observations	1,360	1,360	272	272

Notes: Time period: 2010-2019. Sample of countries: Austria, Belgium, Finland, France, Germany, Greece, Ireland, Italy, Norway, Portugal, Spain, Switzerland and the United Kingdom. The table reports the impact of immigration on the logarithm of the employment-to-population rate of natives by interacting the immigrant share with regional economic growth and three country-level institutional characteristics (employment protection index or EPI, union density, and level of collective wage bargaining). Columns 1-2 use annual variations (1-year intervals), while columns 3-4 use the 10-year interval (2010 and 2019). The units of observations are regions. The shift-share instrument is computed using census data in 1990. We report the Sanderson-Windmeijer (SW) first-stage F-statistics to test the power of our instruments. Below the point estimate, the standard errors in parentheses are heteroscedasticity robust and clustered by region. ***, **, * denote statistical significance from zero at the 1%, 5%, 10% significance level.
Source: Eurostat (EU-LFS), IPUMS and national statistical institutes.

Appendix A: Share of immigrants for Western European countries in 2010 and 2019



Notes: Sample of countries: EU15 countries (including the United Kingdom) plus Iceland, Norway and Switzerland. Western Europe includes these 18 countries. The share of immigrants is defined as $M/(M+N)$, where M and N give the number of foreign-born and native labour force participants, respectively.
Source: Eurostat (EU-LFS).

Appendix B: Shift-share instrument based on the 1990 distribution

To build the shift-share instrument based on the past immigrant settlement patterns in 1990, data were collected from the Integrated Public Use Microdata Series (IPUMS) and national statistical institutes. The IPUMS-International website is at: https://international.ipums.org/international/

The IPUMS-International database includes the census microdata from 8 countries: Austria, France, Greece, Ireland, Portugal, Spain, Switzerland and the United Kingdom. For France, the nationality groups in IPUMS are not detailed enough. Thus the French census data in 1990 from the French national statistical institute (INSEE) are used instead. The analysis also uses supplementary data from national statistical institutes for Belgium, Finland, Germany, Italy and Norway.

For the remaining countries, the geographical details and origin groups were insufficient to create a shift-share instrument. Given these restrictions, the instrument was constructed for 13 Western European countries: Austria, Belgium, Finland, France, Germany, Greece, Ireland, Italy, Norway, Portugal, Spain, Switzerland and the United Kingdom. The data source for these countries is described in Table B.

Table B: Data source to compute the 1990 spatial distribution of immigrants across European regions

Country	**Source**	**Year of reference**
Austria	IPUMS	1991
Belgium	StatBel	1992
Finland	IPUMS	1990
France	INSEE	1990
Germany	Genesis Online	1991
Greece	IPUMS	1991
Ireland	IPUMS	1991
Italy	Istat	1991
Norway	Statistics Norway	1990
Portugal	IPUMS	1991
Spain	IPUMS	1991
Switzerland	IPUMS	1990
United Kingdom	IPUMS	1991

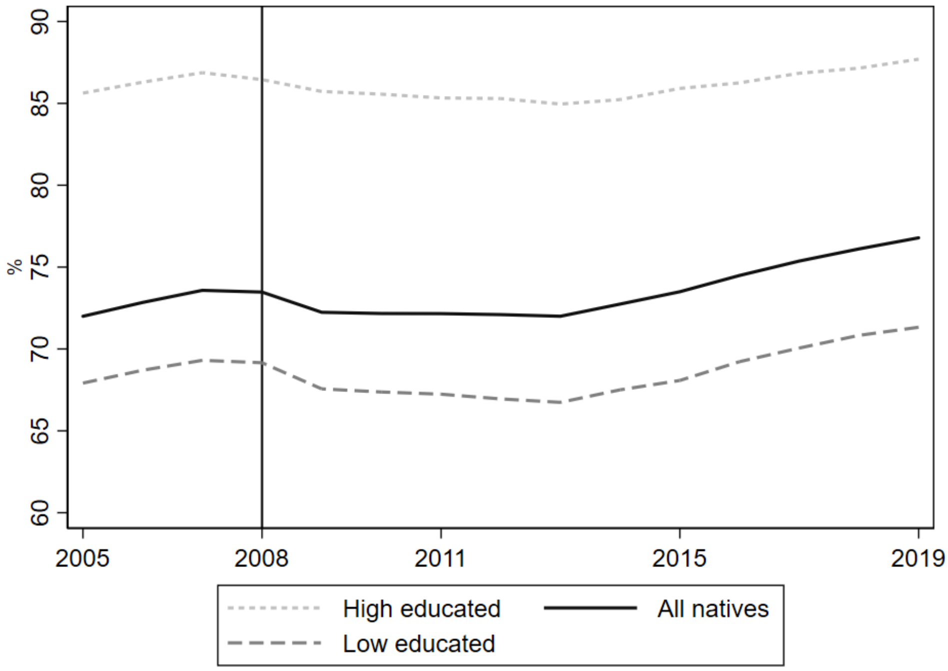
Appendix C: Average size characteristics of European regions

Country	Geographical unit	Number of regions	Average population	Average land area (km^2)	Average population density
Austria	NUTS1	3	2,952,925	27,959	106
Belgium	NUTS2	11	1,041,411	2,788	374
Finland	NUTS2	3	1,839,306	84,603	16
France	NUTS2	21	3,094,677	26,146	118
Germany	NUTS1	16	5,188,701	22,348	232
Greece	NUTS2	13	824,969	10,130	81
Ireland	NUTS2	2	2,452,120	34,974	70
Italy	NUTS2	18	3,256,499	15,845	206
Norway	NUTS2	7	761,173	46,197	16
Portugal	NUTS2	7	1,468,088	13,175	111
Spain	NUTS2	17	2,751,032	29,762	92
Switzerland	NUTS2	7	1,220,647	5,898	207
United Kingdom	NUTS1	11	5,887,448	20,913	282
Unweighted average		10	2,518,384	28,380	89

Appendix D: Evolution of the native employment rate over the 2005-2019 period

In order to interpret the estimated relationship between the increase in the immigrant share and the native employment correctly, it is important to understand the context. The period of analysis falls just after the 2008 economic crisis, a period when native employment was recovering from the negative effects of the crisis. While the recovery speed was uneven across regions in most countries, the employment rate was in a positive trend, especially after 2013. For this reason, the negative coefficients do not necessarily imply a decline in the native employment rate but rather a deceleration in its growth rate.

Figure E: Trends in employment-to-population rate of natives between 2005 and 2019



Notes: Time period: 2005-2019. Sample of countries: Austria, Belgium, Finland, France, Germany, Greece, Ireland, Italy, Norway, Portugal, Spain, Switzerland and the United Kingdom. The figure plots the evolution of the native employment-to-population rate. The high-education group considers all natives with some tertiary education and more, while the low-education group considers all natives with secondary education or less.
Source: Eurostat (EU-LFS).