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Immigration and employment dynamics in European regions

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Immigration and employment dynamics in European regions

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This paper provides novel evidence on the regional impact of immigration on native employment in a cross-country framework based on rich European Labour Force Surveys and past censuses data for 2010-2019. The paper finds a modest average impact of the rise in the share of immigrants across European regions on the employment-to-population rate of natives, but highly uneven effects over time and across workers and regions. The short-run estimates show adverse employment effects in response to immigration that nevertheless disappear in the longer run. High-school or less educated native workers experience employment losses due to immigration, whereas higher educated workers are more likely to experience employment gains. Moreover, the presence of institutions providing strict employment protection and high coverage of collective wage agreements exert a protective effect on native employment. Finally, the paper finds that regions experiencing strong growth can absorb immigrant workers, resulting in little or no effect on the native workforce, including in the short run.

JEL codes: F22, J21, J61
Keywords: Immigration, Employment, Labour supply, Europe

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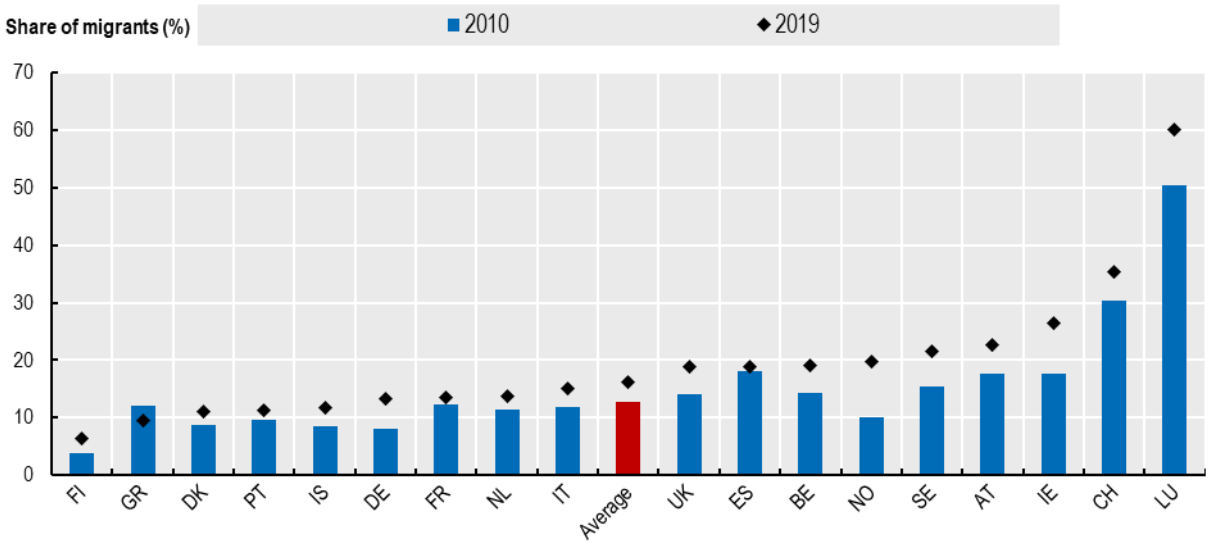
1 Introduction

Migrants account for increasingly large shares of host country populations in OECD countries. 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 percent in 2010 to 16.2 percent in 2019 (Figure 1.1)[1], narrowing gaps with the United States where shares increased from 15.8 to 17.4 percent over the same period).

Figure 1.1. The migrant share across European countries

Share of foreign-born in the labour force of Western European countries in 2010 and 2019



Note: EU15 countries (including the United Kingdom), Iceland, Norway, and Switzerland.
Source: Eurostat (2022[1]), European Labour Force Survey, accessible at https://ec.europa.eu/eurostat/web/microdata/european-union-labour-force-survey.

This paper presents the first empirical evidence on the regional impact of immigration on native employment across Western European countries. 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 comparisons at the national level with no regional dimension. Yet, subnational analysis in a cross-country framework can help understand the regional labour market effects of immigration and how labour market institutions and economic performance shape these effects.

The analysis relies on the European Union Labour Force Survey (EU LFS) covering 28 European countries over the 2010-2019 period. The richness of the data allows estimating the impact of increases in immigration

[1] Throughout the paper, the terms foreign-born and immigrant are used interchangeably.

on the employment-to-population rate of natives at the regional level in Western European countries.[2] However, because immigrants may choose their region of residence based on economic opportunities or indeed, because the native population may react to migration by moving internally to regions with fewer migrants (Borjas, 2006[2]; Edo, 2019[3]), the analysis identifies past population distributions of immigrants as an instrument for current migrant presence (i.e., shift-share instrument) (Altonji and Card, 1991[4]; Card, 2001[5]).

The paper makes four main findings:

1. In the short run, immigration has an adverse impact on employment rate growth of natives. In a region with an average share of migrants in the population, a 1 percentage point increase in the labour force due to migration leads to a 0.13 percentage points slower increase in the employment rate of the native-born population in the same year. However, after 5 years, employment opportunities for native workers were unaffected.
2. Labour market effects are uneven across natives with different education levels. While effects on the employment rate of high-educated natives (or those with tertiary education and above) are zero in the short run and even positive in the longer run, they are negative for natives with less than tertiary education in the short run, although zero in the longer run.
3. The employment impact of immigration is smaller in regions where labour market institutions are stricter. Using several institutional indicators to capture the labour market rigidities, the analysis shows that restrictive labour market institutions dampen the employment effect of immigration by shielding native workers in the short and longer run.
4. Regions experiencing strong GDP growth are better able to absorb increases in labour supply due to immigration. The fastest-growing regions experience modest adverse employment effects on the native population in the short-run but employment gains in the longer-run. This result suggests that economic dynamism plays a crucial role in shaping the labour market impact of immigration, in line with previous studies showing that the adjustment process in response to immigration is faster in growing economies (Peri, 2010[6]).

The paper continues as follows. Section 2 presents testable predictions 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 identification strategies and discusses the main identification issue. Section 5 shows the empirical results, and the last section concludes.

[2] The 136 regions used in the analysis correspond to Territorial Level 1 or Territorial Level 2, depending on data availability.

2 Conceptual framework

Notwithstanding the 'lump of labour fallacy' many recent economic models point to an immediate adverse impact of immigration on native wages and employment that generally unwind over the medium and longer term, as markets adjust, including through higher investment and new firm growth. This applies to models allowing for capital-skill complementarity (Lewis, 2011[7]), imperfect substitution between natives and migrants (Ottaviano and Peri, 2012[8]), rigid labour market institutions (Angrist and Kugler, 2003[9]), and monopsonistic firms or differentiation between migrants and natives in terms of outside options (Amior, 2017[10]).

This leads to the following testable hypothesis:

- **Hypothesis 1:** *The impact of immigration on native employment is stronger in the short run than in the longer run*.

Furthermore, many studies also show that the impact of immigration on the employment of natives is detrimental for natives with a high-school degree or less, while they are negligible, insignificant or sometimes positive for high-skilled educated workers:

- Orrenius and Zavodny (2007[11]) for the United States and Steinhardt (2011[12]) for Germany find that an increase in the share of foreign-born workers does not affect the wages of natives in occupations requiring tertiary education. In contrast, they find detrimental wage effects of immigration in high-school or less-educated occupations as "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, p. 759[11]).
- Dustmann, Schönberg and Stuhler (2017[13]) find that the inflow of Czech workers in Germany between 1990 and 1993 contributed to reducing the labour market outcomes of natives with no post-secondary degree relative to those who had completed an apprenticeship scheme or graduated from a university. Borjas (2003[14]) and Jaeger, Ruist and Stuhler (2018[15]) for the United States and Borjas and Edo (2021[16]) for France also document that immigration mainly reduces the earnings of native workers with high-school or lower education levels.
- Peri and Sparber (2011[17]) find evidence for the United States, of imperfect substitutability between highly educated migrants and natives, suggesting that immigration could be beneficial for high-educated native workers. In line with this result, Peri, Shih and Sparber (2015[18]) find that high-skilled migrants. concentrated in STEM (Science, Technology, Engineering and Math) occupations, are associated with significant wage gains for tertiary educated natives. More recently, Beerli, Ruffner, Siegenthaler and Peri (2021[19]) also find evidence that the rise in the number of 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.

In Western European countries, the relatively large increase in immigration between 2010 and 2019 affected all education segments of the labour market equally (Table 2.1). The share of migrants in the highly educated labour force increased by 3.6 percentage points from 11.3 to 14.9 percent, and the migrant share in the high-school or less educated labour force rose by 3.5 percentage points from 13.4 to 16.9 percent. Given the evidence that the labour market outcomes of skilled native workers tend to be unaffected by immigration, potential adverse impacts of immigration on native employment should be mostly concentrated among high-school or less-educated natives in European countries. This implies the following testable hypothesis:

- **Hypothesis 2:** *Immigration to Europe has mainly affected the employment opportunities of high-school or less educated natives over the past decade*.

Table 2.1. Trends in migrant share and native employment rate

Data for 13 Western European countries, 2010-2019

	2010	2015	2019
Immigrant share	12.8	14.4	16.2
With a tertiary education	11.3	13.6	14.9
With less than a tertiary education	13.4	14.7	16.9
Share of tertiary educated natives	30.0	34.2	37.1
Share of tertiary educated immigrants	26.1	32.2	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 with tertiary education, as well as the employment-to-population rate of natives.
Source: Eurostat (2022[1]), European Labour Force Survey, accessible at https://ec.europa.eu/eurostat/web/microdata/european-union-labour-force-survey.

Labour market institutions often aim to protect (native) workers by reducing the volatility in wages and employment. Institutions can however have opposing effects on the employment response of natives exposed to an immigration-induced labour supply increase. On the one hand, labour market institutions can protect native workers by reducing their direct competition with immigrants, therefore dampening the effects on their employment (Foged, Hasager and Yasenov, 2022[20]). On the other hand, a larger number of labour market regulations can make the labour markets more rigid, which would amplify any negative employment effects of immigrants (Angrist and Kugler, 2003[9]). This implies the following testable hypothesis:

- **Hypothesis 3:** *The impact of immigration on native employment opportunities should differ according to the degree of employment protection in the labour markets*.

Finally, the capital stock in the economy may not react quickly to an increase in the labour supply because of two reasons.

First, if firms do not anticipate the entry of migrants, they will not immediately invest in physical capital to face the new labour market conditions. The immediate labour market effects of *un*expected migration episodes can be detrimental because adjustments take time. Cohen-Goldner and Paserman (2011[21]) and Borjas (2017[22]) show that native wages declined in the first year before returning to pre-immigration levels after 7-10 years in response to, respectively, Jewish emigrants from the former Soviet Union to Israel or to the large entry of Cuban refugees in Miami in 1980. These findings are consistent with Edo (2020[23]), who found that French wages recovered within a decade and a half from the repatriation of citizens that followed Algeria's independence in 1962.

Second, the capacity of an economy to adjust to immigration depends on the business cycle. For example, Peri (2010[6]) shows that the capacity of the economy to expand and adjust output 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 have unused production capacity and will be less willing to immediately invest in physical capital or change their production techniques in response to immigration. This leads to the fourth and last testable hypothesis:

- **Hypothesis 4***: The short-run impact of immigration on native employment is weaker in regions experiencing strong growth performance*.

3 Data and descriptive correlations

This section details the data used in the analysis. First, it introduces the various data sources, and details the selection of the sample. Next, it provides descriptive statistics before discussing the regional correlations between migration and native employment.

The data and selected sample

This study uses the annual European Union Labour Force Survey (EU-LFS) data, a rich individual-level dataset harmonised 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, three European Free Trade Association (EFTA) countries (Iceland, Norway and Switzerland), as well as some EU accession candidate countries. This paper exploits variation in the migrant shares across geographical units at national and TL2 levels depending on the available data.[3]

Because immigrants may choose their region of residence based on economic opportunities or indeed, because the native population may react to migration by moving internally to regions with fewer migrants (Borjas, 2006[2]; Edo, 2019[3]), the analysis identifies past population distributions of immigrants as an instrument for current migrant presence (i.e., shift-share instrument) (Altonji and Card, 1991[4]; Card, 2001[5]). The instrument requires historical information on immigrants' country of origin (i.e., country of birth or nationality) and their region of residence. This study focuses on 13 Western European countries (Austria, Belgium, Finland, France, Germany, Greece, Ireland, Italy, Norway, Portugal, Spain, Switzerland and the United Kingdom) with available data on past immigrant settlement patterns, which is then extended to other countries to increase the sample size and test the robustness of corresponding results.

For the baseline sample of 13 European countries, the analysis uses historical census data to build the shift-share instrument. For the remaining countries, it uses instruments based on the EU-LFS carried out in 2004. Before 2004, the EU-LFS divides the birth country of individuals into only three groups, however, since 2004, it decomposes respondents' nationality and birth country into several groups for most European countries, allowing for its use in the instrument.[4]

Beyond the average labour market effects of immigration, the analysis also examines whether these effects are uneven across different workers and places.

First, it examines whether the labour market effects on natives vary across education groups. To do so, it follows D'amuri and Peri (2014[24]) and Dustmann et al. (2017[13]) by splitting the native population into two education groups: those with tertiary education and those with less than tertiary education.

Second, it uses three measures from the OECD/AIAS database to capture the heterogeneity in country-level institutional characteristics crucial for mediating the impact of immigration on native employment (OECD/AIAS,

[3] Regions within the 38 OECD countries are classified on two territorial levels reflecting the administrative organisation of countries. The 433 OECD "Territorial Level 2" (TL2) regions are those at the highest subnational administrative level, for example the federal states in Germany. For further information, see http://stats.oecd.org/wbos/fileview2.aspx?IDFile=cebce94d-9474-4ffc-b72ad731fbdb75b9. Data is available at the national level for Iceland and the Netherlands, and at the TL2 level for the rest of the countries in the analysis. See Annex A for further details.

[4] 2007 is used as the reference year for Denmark as no regional information is available for that country before that year.

2021[25]), such as measures related to employment protection, wage rigidities and the share of union members in the workforce (See Annex A for further details). These measures are strongly correlated and, therefore, should be considered as alternative measures for capturing labour market rigidities due to institutional structures (Foged, Hasager and Yasenov, 2022[20]).

Finally, using data on Gross Domestic Product (GDP) from the OECD Regional Database (OECD, 2022[26]), the analysis decomposes European regions based on their economic dynamism between 2010 and 2019. Specifically, the regions which are in the top 25 percent in terms of GDP growth are defined as the fastest-growing regions (or "High GDP growth" regions), while the remaining 75 percent are classified as regions with slower growth. As the fastest-growing regions represent 46 percent of the native population living in Western European countries, this regional decomposition (high-growth regions v. rest) has the advantage of dividing the European population into two relatively balanced groups in terms of native population size.

Descriptive statistics and regional correlations

The share of high educated natives (with tertiary education) living in the baseline sample of 13 Western European countries increased from 30 percent in 2010 to 37.1 percent in 2019 (Table 2.1). Moreover, the share of immigrants in the high educated labour force increased by 3.6 percentage points (from 11.3 to 14.9 percent) and the migrant share in the high-school or lower-educated labour force by 3.5 percentage points (from 13.4 to 16.9 percent).

The average level of education is higher among native workers than immigrants. In 2010, the share of tertiary educated among native and immigrant labour forces were 30 and 26.1 percent, 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.

Figure 3.1 shows regional differences in migrant shares for the baseline sample of 13 Western Europeans. 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. Panel A shows that Southern European countries including Spain, Italy and Greece had lower employment rates in 2019 compared to Northern European ones. Panel B shows that between 2010 and 2019, employment rates 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. 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 in the east of Spain, industrial areas like the south of Germany, and the northern part of Italy attracted higher shares of immigrants over past decades.

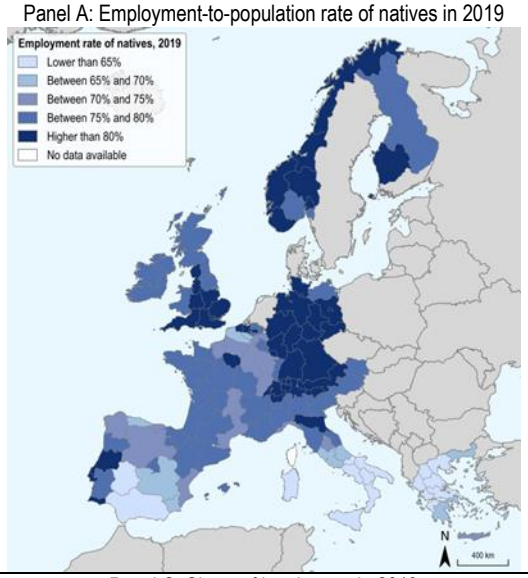
presents the scatter diagrams relating the difference in the log native employment-to-population rate to the difference in the log immigrant share across regions in the baseline sample of Western European countries. While Panel A describes a short-run relationship by exploiting annual variations, Panel B describes a longer-run relationship by using regional changes between the two years 2019 and 2010. Panel A suggests a negative correlation between immigration and native employment (the slope of the regression line and standard error are -0.11 and 0.05). In contrast, Panel B shows no significant correlation when using decadal variations (the slope of the regression line and standard error are 0.08 and 0.10). These basic correlations, which are moreover not driven by any outliers, show that employment responses to immigration are not symmetric in the short- and long run. 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 examines the uneven effects across workers and regions to better understand the employment dynamics of labour supply increases, and to test the validity of Hypotheses 2, 3 and 4.

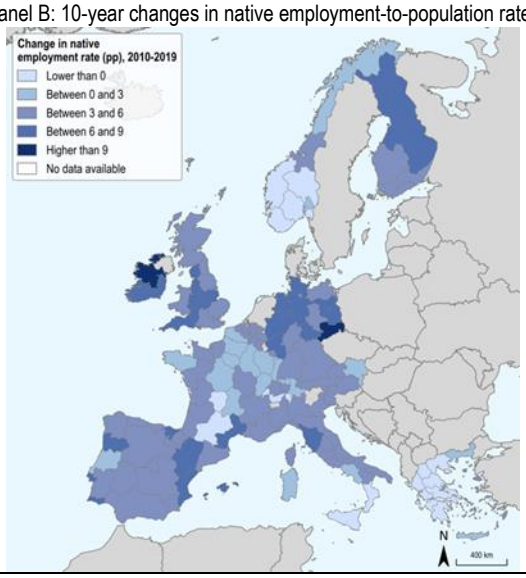
Figure 3.1. Native employment and immigration across European regions

Employment rate and immigrant share across 13 European countries in 2010 and 2019

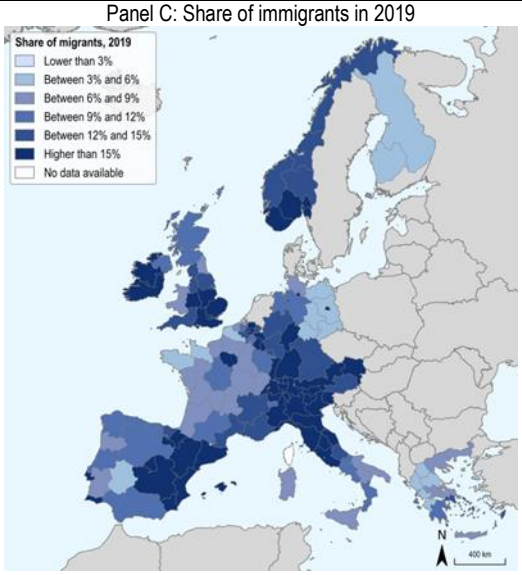
Panel A: Employment-to-population rate of natives in 2019



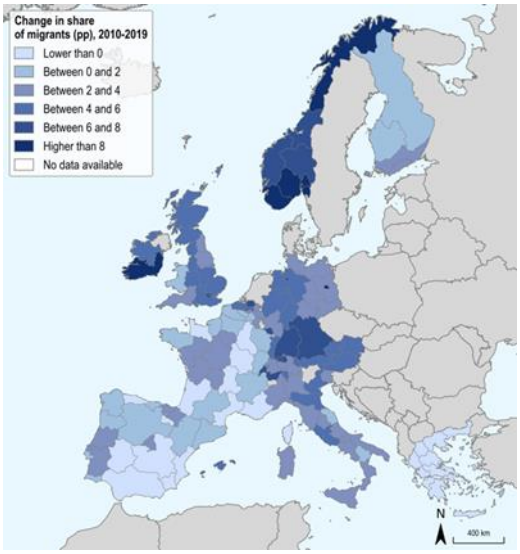
Panel B: 10-year changes in native employment-to-population rates



Panel C: Share of immigrants in 2019



Panel D: 10-year changes in immigrant shares

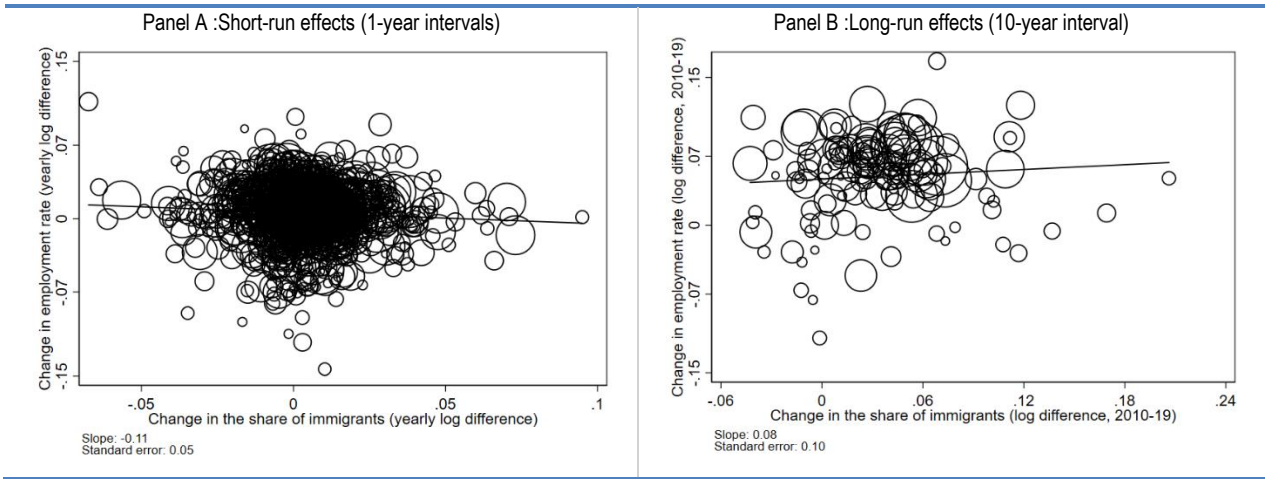


Notes: Sample of countries: EU15 countries (including the United Kingdom), Iceland, Norway and Switzerland. Immigrant shares computed using the individuals in the labour force and defined as $M/(M+N)$, where M and N give the number of foreign-born and native labour force participants, respectively. Panels 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 (2022[1]), European Labour Force Survey, accessible at https://ec.europa.eu/eurostat/web/microdata/european-union-labour-force-survey.

Figure 3.2. The association between immigration and employment over time

Raw correlations between the change in immigrant share (x-axis) and the employment rate of natives (y-axis), TL2 regions



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. While Panel A exploits annual variations (1-year intervals), Panel B uses the 10-year interval (2010 and 2019). The two figures correlate the difference in the log employment rate of natives to the difference in the log immigration share (i.e., log(1+M/N) as explained in Section 4 below).
Source: Eurostat (2022[1]), European Labour Force Survey, accessible at https://ec.europa.eu/eurostat/web/microdata/european-union-labour-force-survey.

4 Empirical strategy

This section details the empirical strategy used in the analysis. First, it details the econometric equation used to estimate the impact of immigration on native employment. Second, it discusses the empirical challenges in estimating this effect before explaining the identification strategy used in this analysis.

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 ratio among natives in region r at time t (i.e., the logarithm of employed natives over the native population), similar to Angrist and Kugler (2003[9]) and D'amuri and Peri (2014[24]). The migrant supply increase 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.[5] Equation (1) includes regional dummies θ_r and time dummies θ_t, implying that the impact of immigration on the employment rate of natives is measured through changes within region and over time. μ_{rt} denotes the error term. To account for the possible within-region correlation, the standard errors are clustered at the regional level (Moulton, 1990[27]).

The parameter β_1 gives the percent change in the employment rate of natives in response to a one percent change in the size of the labour force due to the inflow of migrants in a region. Defining the supply increase at the regional level (instead of assigning migrants to skill groups) relies on Dustmann, Schönberg and Stuhler (2016[28]; 2017[13]) and Jaeger, Ruist and Stuhler (2018[15]). This estimation strategy has the advantage to account for all channels through which an immigration-induced increase in labour supply can affect labour market outcomes of natives. 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 migrant supply increase due to the possibility that migrants could downgrade their skills (Dustmann, Frattini and Preston, 2013[29]).

Equation (1) is estimated using changes over different time windows. First, it uses all available years over the 2010-2019 period, thereby exploiting 1-year intervals (or annual variations). Annual variations precisely exploit short-run changes and therefore capture the short-run impact of immigration (Peri, 2010[6]; Wozniak and Murray, 2012[30]; Özgüzel, 2021[31]). 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. It runs the regressions using five (2010, 2012, 2014, 2016, 2018), four (2010, 2013, 2016 and 2019), three (2010, 2015 and 2019) and two years (2010 and 2019) to exploit a 2, 3, 5 and 10-year interval variations. As noted in Wozniak and Murray (2012[30]) and Lewis and Peri (2015[32]), comparing outcomes at 10-year intervals captures the

[5] The algebraic definition of m_{rt} is derived from simple labour demand theory (Borjas, 2003[14]) and used in Bratsberg, Raaum, Røed and Schøne (2014[51]) and Borjas and Edo (2021[16]). Angrist and Kugler (2003[9]) and D'amuri and Peri (2014[24]) use the log of the migrant share as their main variable of interest. The empirical results are not sensitive to this choice.

medium or long-run impacts of immigration, and these longer-run relationships should differ from the short-run relationships.

Endogeneity of the immigrant share and identifying assumptions

Estimating Equation (1) using Ordinary Least Squares (OLS) can suffer from measurement bias if migrants do not settle across regions randomly. When migrants settle in economically dynamic regions that offer better labour market opportunities, it creates a positive bias in the estimates of the labour market effects of immigration (Peri, 2016[33]; Edo, 2019[3]). To address this bias issue, the analysis uses an instrumental variable (IV) extensively used in the immigration literature that relies on historical settlement patterns among migrants (Altonji and Card, 1991[4]; Card, 2001[5]; Jaeger, Ruist and Stuhler, 2018[15]). [6]

Baseline shift-share instrument based on 1990

The analysis uses the settlement patterns of the migrant population from a given origin country c (i.e., it uses $c = 5$ origin countries) in 1990 to predict the regional settlement of migrants from the same origin group living in the current period (i.e., 2010-2019). The predicted number of migrants in a given region r at time t is obtained by multiplying in each year the 1990 spatial distribution of migrants of each origin group by the total number of working-age migrants from that group (See Annex A for further details):

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

As the size of the native labour force is likely to be correlated to regional economic conditions, instead of using the current native labour force to compute the instrument the analysis constructs a prediction of the regional number of natives for each country as:

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

The baseline shift-share instrument is then:

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

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, Ruist and Stuhler, 2018[15]; Goldsmith-Pinkham, Sorkin and Swift, 2020[34]). A way to minimise the potential correlation between past immigration and current economic conditions is to use a sufficient time lag to predict the actual number of immigrants (Dustmann, Fabbri and Preston, 2005[35]). Using a base year further in the past increases the likelihood that unobserved factors that determined the location choice of immigrants in the base year are also shaping the settlement patterns in the period of analysis. Although the exclusion restriction imposed by the IV strategy is not testable, using 1990 as a reference year to build the shift-share

[6] The settlement decision of new migrants is partly determined by earlier migrants' presence, mainly through network externalities (Gross and Schmitt, 2003[49]). Past migrants may, for instance, provide new migrants with information on labour or housing markets, which in turn may attract them to certain places.

instrument is likely to be sufficiently distant from 2010-2019 for current immigrant shares to be uncorrelated with the changes in demand in the past. Yet, this strategy allows to only study the employment response to immigration in 13 Western European countries.

While there is no formal way of testing the exogeneity of an instrument, the analysis tests whether the regional origin-specific immigrant shares used in the construction of the instrument are correlated with initial period characteristics in the spirit of Goldsmith-Pinkham, Sorkin and Swift (2020[34]). More precisely, Annex A shows that the historical settlement patterns of immigrants and the changes in native employment-to-population rates between 2010 and 2019 are uncorrelated. This result suggests that the shift-share instrument is very likely to satisfy the exclusion restriction imposed by the IV strategy. It is also consistent with the studies by Moriconi, Peri and Turati (2019[36]; 2022[37]) who show that their shift-share instrument exploiting origin-specific immigration shares in 2005 (instead of 1990 as in the present study), to estimate the political impact of immigration over the 2007-2016 period across Western European regions, tends to be exogenous. [7]

Alternative shift-share instrument based on 2004 EU-LFS

The empirical analysis also tests the robustness of the baseline analysis by constructing a shift-share instrument based on the 2004 EU-LFS data, similar to Moriconi, Peri and Turati (2022[37]). This strategy exploits the information on the education of workers, given that the network effect between migrants with the same cultural, linguistic, and educational background is expected to be stronger (Dustmann, Fabbri and Preston, 2005[35]). According to this approach, the 2004 spatial distribution of the migrant population from a given origin country for a given education group is used to instrument the allocation of migrants in the current period from that education-origin group across regions. Specifically, the analysis computes the instrument using $c = 4$ origin countries and $e = 2$ education groups[8] as:

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

where $\widehat{M_{rt}}$ and $\widehat{N_{rt}}$ are the predicted number of migrants and natives in a given region at time t. To predict the number of migrants for each region-time cell, in each year, the 2004 spatial distribution of the working-age migrant population of each education-origin group is multiplied by the working-age migrant population from that group at time t, as follows:

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

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

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

[7] Additionally, both papers show that changes in the immigrant population in European regions between 2007-2016 are not associated with the pre-existing economic regional trends prior to 2007 such as GDP or employment growth, which is also crucial for exclusion restriction.

[8] The analysis uses Africa, Asia, America and Oceania, and Europe as countries of birth, and tertiary education v. less than tertiary education as education groups.

While Moriconi, Peri and Turati (2019[36]; 2022[37]) indicate that the shift-share instrument using 2004 as the reference year is very likely to satisfy the exclusion restriction imposed by the IV in the European context and during this period, this study remains cautious. Therefore, the main analysis of this paper uses 1990 shares, which better satisfy the exclusion restriction because they have lower exposure of the IV estimator to omitted factors that affect labour market outcomes in 2010-2019. The IV results using the extended group of countries and the more recent year thus must be taken with caution.

5 Results

This section presents the results of the econometric analysis. First, it presents the baseline results on the impact of immigration on native employment as an average of all workers and regions. Next, it provides additional tests on the robustness of the results. Finally, it discusses the uneven employment effects of immigration on natives with different education levels, working in countries with varying labour market rigidities or regions with economic dynamism.

Baseline results

Table 5.1 presents the regional impact of migration on the change in native employment rate exploiting 1-year (Columns 1-2), 2-year (Columns 3-4), 3-year (Columns 5-6), 5-year (Columns 7-8) and 10-year changes (Columns 9-10) between 2010 and 2019 for the baseline panel of 13 Western European countries.

The OLS estimates are consistent with Hypothesis 1, indicating that an increase in the migrant share may have a detrimental effect on native employment in the short run (Column 1), while these effects should disappear in the long run as local labour markets adjust (Column 3). However, these results only inform about observed correlations and do not indicate a causal impact of immigration on native employment.

As migrants choose where to settle, the remaining columns instrument the immigration variable by the shift-share instrument based on the distribution in 1990 (derived in Equation 4). The IV first-stage results indicate that the estimated coefficient on the instrument hovers between 0.27 and 0.39, and it is always significant at the 1 percent level (after clustering the standard errors at the regional level). This significant and positive relationship is in line with the literature on shift-share instruments. Moreover, as shown in Table 5.1 and the other econometric tables below, the F-test of the excluded instrument is between 15 and 25. This is larger than the lower bound of 10 suggested by the literature on weak instruments indicating that the IV estimates do not suffer from a weak instrument problem (Stock and Yogo, 2002[38]). As a result, the first-stage statistical tests suggest that $\hat{m}_{rt}$ 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 migrants settling in regions with better economic opportunities positively biases the estimations in Column 1. The estimated coefficient in Column 2 implies that a 1 percent immigration-induced increase in the size of the native labour force in a given region is associated with 0.56 percent slower growth in the native-born employment rate in the average region, on average.[9] Given the increase in the employment rate observed across European regions covered in the sample (see Annex A for more details), the estimated magnitudes indicate that the employment rate of natives in regions with higher immigration grew slower compared to regions with less immigration.

To investigate whether local 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 slightly

[9] These headline estimates correspond to the average effect of a 1% increase in the labour supply due to migration across regions regardless of the size of the migrant community. However, the marginal effect of a 1% increase in the labour supply may differ depending on the share of migrants in the local labour market. In fact, the impact of an increase in the labour supply due to migration on native employment is larger in regions with a higher share of migrants.

less significant than in Column 2. The IV estimated coefficient in Column 6 is still negative but insignificant and four times weaker 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. Taken together, the IV estimated results from Table 5.1 indicate that while native employment opportunities can decline initially in response to migration the impacts disappear after around 5 years. This employment dynamic induced by immigration is consistent with the notion that economic adjustments following immigration is not necessarily immediate and can take some time (see 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 a migrant inflow. This rate of adjustment is very close to the results by Cohen-Goldner and Paserman (2011[21]), Borjas (2017[22]), Jaeger, Ruist and Stuhler (2018[15]), and Edo (2020[23]) which show that local or skill-specific wages recover from supply increases after at least five years after the inflow of migrants.

Table 5.1. Baseline impact of immigration on native employment

Point estimates from OLS and IV regressions, 2010-2019, European regions

	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**	-0.56***	-0.06	-0.48**	0.00	-0.15	0.13	-0.00	0.08	-0.02
	(0.06)	(0.19)	(0.08)	(0.22)	(0.08)	(0.15)	(0.09)	(0.17)	(0.10)	(0.18)
IV first-stage results:										
Instrument	-	0.30***	-	0.27***	-	0.39***	-	0.36***		0.35***
Standard error		(0.08)		(0.09)		(0.09)		(0.08)		(0.09)
Kleibergen-Paap F-test		14.65		10.27		17.89		20.58		15.23
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 log native employment rate to population 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 a 10-year interval (2010 and 2019) in columns 3-4. The units of observation are regions. All regressions include time and region 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 (2022[1]), European Labour Force Survey, accessible at https://ec.europa.eu/eurostat/web/microdata/european-union-labour-force-survey; Minnesota Population Center (2020[39]), Integrated Public Use Microdata Series (IPUMS), accessible at https://international.ipums.org/international/; national statistical institutes (See Annex A for further details).

Robustness of the baseline results

This section presents various results testing the robustness of the main results. It shows that the results hold when using alternative specifications like a level-level estimation or first differences strategies, the use of regression weights, other measures of the migrant supply increase, accounting for increases in the immigration that took place in the past or including other European countries.

Level-level specification

The results are robust to using level-level specification. Table 5.2 has the same structure as Table 5.1 but presents 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 migrant supply increases. Table 5.2 directly uses the employment rate and the ratio of migrants to natives ($M_{rt}/\ N_{rt}$) instead of using a logarithm transformation.

This level-level specification shows that the previous conclusions are not sensitive to the log-log specification and allows to better quantify the short-run crowding out effect due to immigration. The IV estimated coefficients are negative when exploiting annual, biannual and triannual variations, whereas they are virtually zero when exploiting the 5-year and 10-year intervals. These estimates 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 disappears in the longer run).

The short-run IV estimates in Columns 2, 4 and 6 suggest that ten additional migrants in the regional labour force are associated with one to two fewer additional native employed in that region.[10] This magnitude is close to the study by Glitz (2012[40]) who reports 3 native job losses for every 10 migrants in Germany, while it is weaker than in Angrist and Kugler (2003[9]) for a panel of European countries and Borjas and Edo (2021[16]) for France who respectively find that 4-8 and five natives lose their jobs for every ten migrants entering the labour force.

Table 5.2. Impact of immigration on native employment using a level-level specification

Point estimates from OLS and IV regressions, 2010-2019, European regions

	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	-0.06*	-0.13**	-0.02	-0.11*	-0.01	-0.09***	0.05	-0.02	0.03	-0.02
	(0.03)	(0.07)	(0.04)	(0.06)	(0.04)	(0.03)	(0.04)	(0.04)	(0.05)	(0.03)
IV first-stage results:										
Instrument	-	0.18***	-	0.17***	-	0.22***	-	0.20***		0.21***
Standard error		(0.02)		(0.03)		(0.02)		(0.02)		(0.02)
Kleibergen-Paap F-test		57.09		37.14		150.67		126.02		126.68
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 native employment rate to population 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 a 10-year interval (2010 and 2019) in columns 3-4. The units of observations are regions. All regressions include time and region 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 (2022[1]), European Labour Force Survey, accessible at https://ec.europa.eu/eurostat/web/microdata/european-union-labour-force-survey; Minnesota Population Center (2020[39]), Integrated Public Use Microdata Series (IPUMS), accessible at https://international.ipums.org/international/; national statistical institutes (See Annex A for further details).

[10] To convert this estimate into a crowd-out effect, the estimated coefficient needs to be multiplied by 1.24 (which is the ratio between the native population and the native labour force).

Alternative specifications

The results are robust to using various alternative specifications. Table 5.3 reports the OLS and IV estimates of β_1 in Equation (1) using three alternative time intervals (1, 5 and 10-year intervals) and alternative specifications to test the robustness of the previous results.

The first specification reports the baseline coefficients estimated for the sample of 13 Western European countries, as in Table 5.1, for comparability. Until now, the analysis followed Borjas (2006[2]), Peri and Sparber (2011[17]), or Jaeger, Ruist and Stuhler (2018[15]) 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. Using such weights naturally changes the importance of each region-year observation as more populated regions are assigned more weight.[11] The results from Specification 2 are very close to the results from Specification 1. The IV estimated coefficient on the migrant share is significant and negative when using annual variations. Instrumenting for the migrant share in column 2 produces a more negative estimated coefficient. The short-run IV estimates imply that a 1 percent increase in the native labour force due to immigration in a given region is associated with 0.65 percent slower growth in the native employment rate in that region. However, the IV estimated impact of immigration on native employment rate is insignificant and virtually zero 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 migration is not necessarily immediate and can take some time (see Hypothesis 1).

One potential concern is that the use of the current native workforce as a denominator of the migration variable could create a spurious relationship between immigration and native outcomes (Card and Peri, 2016[41]). Specification 3 follows the recommendation by Card and Peri (2016[41]) by using the size of the native labour force in the pre-immigration period to compute the immigration variable. Concretely, instead of using the predicted number of natives in the labour force in the denominator to compute the migrant share, the number of natives in the labour force in 2005 is used. The results and conclusions remain unchanged.

Specification 4 exploits the alternative instrument using the 2004 EU-LFS as a base year to predict the regional number of natives and migrants in the labour force (Equations 5-7). The IV estimates uniformly produce stronger negative effects, consistent with the theoretical direction of the bias. Although the IV estimated results are more negative in the short run (Column 2) than in the longer run, the results still show a stronger association between immigration and native employment in the short run.

The baseline sample of countries used to run the regressions includes 13 Western European countries. Specifications 6 and 7 extend the sample of countries. While Specification 6 considers all Western European countries (including the EU15 countries, Iceland, Norway and Switzerland), Specification 7 expands this larger sample to all available Eastern European countries (Czech Republic, Estonia, Hungary, Latvia, Lithuania, Poland, Romania, Slovakia, and Slovenia) and Cyprus. These two specifications thus focus on a panel of 28 European countries and use the alternative shift-share instrument based on the 2004 EU-LFS. The OLS results in Specification 6 are identical to the basic estimates from Specification 1. Although this specification shows more negative IV estimates than in the first specification, the estimates imply that the short-run employment response to immigration is stronger than longer-run responses.[12]

Finally, extending the sample to all available European countries increases both the OLS and IV estimated magnitudes of the impact of immigration on native employment. These larger estimates indicate stronger effects

[11] 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, Haider and Wooldridge, 2015[52]). As indicated by the standard errors, using weights does not improve the precision in this analysis.

[12] The difference between the two point estimates from specification 6 in columns 2 and 6 is indeed statistically significant at the 10 percent level (the t-statistic is 1.67).

in Eastern European countries. However, the previous conclusions about the employment dynamics to changes in the labour supply hold.

Table 5.3. Impact of immigration on native employment using alternative specifications

Point estimates from OLS and IV regressions, 2010-2019, European regions

	1-year intervals		5-year intervals		10-year interval	
	OLS	IV	OLS	IV	OLS	IV
	(1)	(2)	(3)	(4)	(5)	(6)
1. Basic regression	-0.13**	-0.56***	0.13	-0.00	0.08	-0.02
	(0.06)	(0.19)	(0.09)	(0.17)	(0.10)	(0.18)
Kleibergen-Paap F-test	-	14.65	-	20.58	-	15.23
2. Native LF as weight	-0.08	-0.65**	0.10	-0.13	0.06	-0.30
	(0.08)	(0.27)	(0.09)	(0.23)	(0.10)	(0.27)
Kleibergen-Paap F-test	-	14.08	-	18.35	-	14.49
3. Add demographic controls	-0.10	-0.53**	0.16	0.01	0.13	0.02
	(0.07)	(0.22)	(0.10)	(0.21)	(0.10)	(0.23)
Kleibergen-Paap F-test	-	12.14	-	14.36	-	9.00
4. Native LF in 2005 to measure the supply shock	-0.11	-0.58***	0.16*	-0.01	0.10	-0.07
	(0.08)	(0.21)	(0.09)	(0.18)	(0.10)	(0.19)
Kleibergen-Paap F-test	-	18.64	-	27.75	-	21.29
5. Alternative instrument	-0.13**	-1.20***	0.13	-0.62**	0.08	-0.57**
	(0.06)	(0.31)	(0.09)	(0.29)	(0.10)	(0.23)
Kleibergen-Paap F-test	-	23.49	-	14.63	-	24.58
Cluster	136	136	136	136	136	136
Observations	1,360	1,360	408	408	272	272
6. EU15 + EEA countries	-0.12**	-0.99***	0.11	-0.50**	0.05	-0.47***
	(0.06)	(0.26)	(0.09)	(0.21)	(0.09)	(0.17)
Kleibergen-Paap F-test	-	21.79	-	14.39	-	21.99
Cluster	156	156	156	156	156	156
Observations	1,560	1,560	456	456	312	312
7. All European countries	-0.31***	-1.07***	-0.14	-0.68***	-0.24***	-0.57***
	(0.06)	(0.29)	(0.09)	(0.22)	(0.09)	(0.18)
Kleibergen-Paap F-test	-	16.99	-	15.51	-	21.55
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 specifications 1-5: Austria, Belgium, Finland, France, Germany, Greece, Ireland, Italy, Norway, Portugal, Spain, Switzerland and the United Kingdom. Sample of countries in specification 6: EU15 countries (including the United Kingdom), Iceland, Norway and Switzerland. Sample of countries in specification 7: all available European countries (Western plus Eastern countries). The table reports the estimated impact of immigration on the log native employment rate to population 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 region fixed effects. The shift-share instrument is computed using census data in 1990 in specifications 1-5 and the 2004 EU-LFS in specification 6. 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 (2022[1]), European Labour Force Survey, accessible at https://ec.europa.eu/eurostat/web/microdata/european-union-labour-force-survey; Minnesota Population Center (2020[39]), Integrated Public Use Microdata Series (IPUMS), accessible at https://international.ipums.org/international/; national statistical institutes (See Annex A for further details).

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

This section provides two additional tests to check the sensitivity of the main conclusions. First, the analysis estimates an econometric equation in first-differences following Borjas, Freeman and Katz (1997[42]), Dustmann, Schönberg and Stuhler (2017[13]) and Peri and Sparber (2011[17]). Such an empirical strategy also allows quantifying the crowd-out effect due to immigration. Second, the analysis relies on Jaeger, Ruist and Stuhler (2018[15]) to provide a complementary strategy to estimate employment dynamics induced by immigration.

The first-difference equation relies on Borjas, Freeman and Katz (1997[42]), and is as follows:

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

where the dependent and independent variables respectively give the change in native and immigrant employment in region r between t and $t-1$, both standardised 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, the analysis uses 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 the total native 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 5.4 presents the estimated results for the same three-time intervals and groups of countries in Table 5.3. The analysis clusters the standard errors at the regional level, and follows Borjas, Freeman and Katz (1997[42]) 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 ten additional immigrants in the regional workforce reduce the growth in native employment by three, on average. Correcting for the endogeneity of immigration makes this crowd-out effect stronger, although the IV strategy provides less precise estimates. 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 the baseline sample of countries is insignificant and 4-5 times weaker than its corresponding short-run estimate in column 2. This difference is consistent with the theoretical prediction that native employment should recover in the longer run as regional labour market adjusts.

Table 5.4. Impact of immigration on native employment using first-difference estimation

Point estimates from OLS and IV regressions, 2010-2019, European regions

	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 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), 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 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 native labour force at time t_0 and t_1, respectively.The shift-share instrument is computed using census data in 1990 for the main sample of countries in Panel A, or using the 2004 EU-LFS for the remaining countries. 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 (2022[1]), European Labour Force Survey, accessible at https://ec.europa.eu/eurostat/web/microdata/european-union-labour-force-survey; Minnesota Population Center (2020[39]), Integrated Public Use Microdata Series (IPUMS), accessible at https://international.ipums.org/international/; national statistical institutes (See Annex A for further details).

In order to characterise the employment dynamics of adjustment to changes in the labour supply, the analysis employs a complementary strategy by adding past immigration increase to equation 9, in the spirit of Jaeger, Ruist and Stuhler (2018[15]) who study the impact of immigration on wage dynamics. The analysis estimates the following equation over the 2010-2019 period by adding four lags of the immigration variable:

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

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 coefficients c_i captures the longer-term reaction to the labour supply changes in the past.

Table 5.5 presents the OLS results for the baseline 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 increases. 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 adverse. However, the estimated coefficients are significantly positive on the 1- to 3-year lagged immigrant inflows, and zero when using the 4-year lagged immigration variable. The positive effects indicate that native employment tends to recover from immigration-induced changes in the labour supply after a year. A zero estimated coefficient on the 4-year lagged immigration variable indicates that the recovery of regional employment after an immigration shock takes around three years. This timing of adjustment is similar to the findings from Table 5.1. and shows that the immediate impact of immigration on native employment differs from longer-run effects.

Table 5.5. OLS impact of immigration on native employment adding past immigration

Point estimates from OLS regressions, 2010-2019, European regions

	(1)	(2)	(3)	(4)	(5)
Immigrant Inflows(t)	-0.29**	-0.25*	-0.27*	-0.29**	-0.29**
	(0.14)	(0.14)	(0.14)	(0.14)	(0.15)
Immigrant Inflows(t-1)		0.29***	0.30***	0.29***	0.29***
		(0.08)	(0.08)	(0.08)	(0.08)
Immigrant Inflows(t-2)			0.14**	0.15**	0.15**
			(0.07)	(0.07)	(0.07)
Immigrant Inflows(t-3)				0.12*	0.12*
				(0.07)	(0.07)
Immigrant Inflows(t-4)					-0.00
					(0.07)
Cluster	136	136	136	136	136
Observations	1,224	1,224	1,224	1224	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 the size of the native population in the base year. The shift-share instrument is computed using census data in 1990 for the main sample of countries. 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 (2022[1]), European Labour Force Survey, accessible at https://ec.europa.eu/eurostat/web/microdata/european-union-labour-force-survey; Minnesota Population Center (2020[39]), Integrated Public Use Microdata Series (IPUMS), accessible at https://international.ipums.org/international/; national statistical institutes (See Annex A for further details).

The uneven effects of immigration across people and places

The impact by education levels on natives

Table 5.6 shows regression results by disaggregating the average impact of immigration on the employment rate of natives by education group. The table presents the average impact on high-school or lower-educated natives in Specification 1 and tertiary educated natives in Specification 2. While Columns 1-2 exploit annual variations, Columns 3-4 use the 5-year intervals and Columns 5-6 use the 10-year interval.

The short-run estimates from Columns 1-2 show that a rise in the relative size of migrants is negatively associated with the employment rate of natives with high-school or lower education levels, whereas it has no employment consequences for highly educated natives. This asymmetric impact is consistent with Hypothesis 2 and indicates that workers with high-school or lower education levels drive the average employment effect 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 high-school or lower-educated group of natives, the estimated employment responses to immigration when exploiting regional variations within the 5- and 10-year intervals are negative but much weaker than in Column 2, and they become insignificant. These results show that the short-run adverse impact on the employment rate of high-school or lower-educated natives vanishes in the longer run.

Moreover, the longer-run impact of immigration on the employment rate of highly educated natives becomes positive and significant in most model specifications (Columns 4 and 6). This result is consistent with two possible explanations.

First, capital accumulation should increase the labour market opportunities of natives and leave the (potential) distributional effects on native wages unchanged across education groups (Borjas, 2013[43]; Edo and Toubal, 2015[44]). If new migrant workers do not affect the employment rate of highly educated workers in the short term, the economic adjustments triggered by immigration should increase their employment opportunities and lead to a positive longer-run impact of immigration on the employment rate of highly educated natives. Second, native internal immigration across European regions could create a spurious positive relationship between immigration and native employment rate across local labour markets (Borjas, 2006[2]). Because high educated individuals are more mobile than high-school or lower-educated ones (Molloy, Smith and Wozniak, 2011[45]; Sá, 2015[46]), such internal native flows across regions may produce the positive employment response identified in Columns 4 and 6.

Table 5.6. Impact of immigration on native employment outcomes by education group

Point estimates from OLS and IV regressions, 2010-2019, European regions

	1-year intervals		5-year intervals		10-year interval	
	OLS	IV	OLS	IV	OLS	IV
	(1)	(2)	(3)	(4)	(5)	(6)
1. Low educated natives	-0.12	-0.66**	0.18	-0.10	0.16	-0.12
	(0.08)	(0.27)	(0.11)	(0.23)	(0.13)	(0.23)
Kleibergen-Paap F-test	-	14.65	-	20.58	-	15.23
2. High educated natives	-0.03	0.01	0.17*	0.44**	0.12	0.48**
	(0.06)	(0.15)	(0.10)	(0.19)	(0.10)	(0.22)
Kleibergen-Paap F-test	-	14.65	-	20.58	-	15.23
Cluster	136	136	136	136	136	136
Observations	1,360	1,360	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 log native employment rate to population for low and high educated natives separately. 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 region 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 (2022[1]), European Labour Force Survey, accessible at https://ec.europa.eu/eurostat/web/microdata/european-union-labour-force-survey; Minnesota Population Center (2020[39]), Integrated Public Use Microdata Series (IPUMS), accessible at https://international.ipums.org/international/; national statistical institutes (See Annex A for further details).

The employment response of natives by countries' institutional characteristics

To study the role played by labour market institutions in mitigating adverse impacts of immigration on native employment, the analysis estimates the following equation:

$$y_{rt} = \sigma_0 + \sigma_1 m_{rt} + \sigma_2 (m_{rt} \times Institution_c) + \theta_r + \theta_t + \vartheta_{rt} \,. \quad (13)$$

As in the 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}. Compared to the 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 5.7 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 altogether.

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. The IV estimated results in columns 2 and 8 show that immigration has a much weaker impact in the short-run in the countries with the highest employment protection index (EPI), while the impact is negligible in the longer-run. In

contrast, immigration induces employment losses in the short and longer run in 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 (2019[47]), who find that high minimum wages protect the labour market outcomes of natives against competition from immigrants with comparable skills for the United States.

The IV estimated impact in columns 4 and 8 suggest that the 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).

The next section shows that these conclusions are robust to adding regional GDP growth to the empirical analysis.

Table 5.7. Impact of immigration on native employment rate interacted with institutional characteristics

Point estimates from OLS and IV regressions, 2010-2019, European regions

	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. The Sanderson-Windmeijer (SW) first-stage F-statistics are reported to test the power of the 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 (2022[1]), European Labour Force Survey, accessible at https://ec.europa.eu/eurostat/web/microdata/european-union-labour-force-survey; Minnesota Population Center (2020[39]), Integrated Public Use Microdata Series (IPUMS), accessible at https://international.ipums.org/international/; national statistical institutes (See Annex A for further details).

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 capacity to absorb the increase in the labour supply leading to weaker effects on native employment (Hypothesis 4). Table 5.8 shows estimates of 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. The analysis adds an interaction term between the immigrant share and the regional economic performance to the full model presented in columns 7-8 of Table 5.7, i.e., it interacts m_{rt} with a dummy equal to one if the change in GDP between 2010 and 2019 is among the top 25 percent ("High GDP growth").

The IV estimated effects from column 2 in Table 5.8 indicate that an increase in immigration leads to slower growth in native employment in both regional groups. At the mean value of the sample, the employment response to immigration in low GDP growth regions is -1.30, while it is estimated to be -0.63 (-1.30+0.67) in high GDP growth regions. In the longer run, the IV results in column 4 indicate that immigration has no impact on native employment in the fastest-growing regions, while the estimates show a less negative employment response in the remaining regions.

This asymmetric impact by regional group shows that the most economically dynamic regions are better at absorbing an increase in the labour supply due to immigration (see Hypothesis 4). Moreover, Table 5.8 shows that regions that combine strong growth performance with strict employment protection are unaffected by immigration and may even experience employment gains in the longer run.

Table 5.8. The impact of immigration on native employment rate interacted with institutional characteristics and regional economic dynamism

Point estimates from OLS and IV regressions, 2010-2019, European regions

	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. The Sanderson-Windmeijer (SW) first-stage F-statistics are reported to test the power of the 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 (2022[1]), European Labour Force Survey, accessible at https://ec.europa.eu/eurostat/web/microdata/european-union-labour-force-survey; Minnesota Population Center (2020[39]), Integrated Public Use Microdata Series (IPUMS), accessible at https://international.ipums.org/international/; national statistical institutes (See Annex A for further details).

6 Conclusion

This paper investigates the employment consequences of immigration by exploiting regional variations across 13 Western European countries over the last decade (2010-2019). It shows that native employment grew slower in regions that received more migrants. The relative slowdown was larger for natives with high-school or less education or those living in less dynamic regions. However, the effect disappears as regional labour markets adjust over time. In a ten-year period, the effect of immigration becomes negligible for high-school or less educated native-born workers, while it turns positive for workers with tertiary education. Moreover, natives with tertiary education or living in economically dynamic regions experienced little or no effect. Finally, natives in regions with tighter labour market institutions were less affected by immigration, both in the short and the long term.

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. As the labour market consequences on natives are uneven across groups or places, targeted policies that consider these uneven impacts can mitigate any short-term adverse labour market effects. Investing in the upskilling of native-born workers, especially more vulnerable groups such as non-university-educated workers and economically lagging regions, can help address labour market challenges and strengthen regional development.

This study has several limitations. First, the analysis focuses on the impact of immigration on native employment. However, immigration can also affect native wages. Therefore, additional analysis on the wage effects would allow a more comprehensive view of how European labour markets respond to immigration. 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 a 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 and across spaces. However, the degree of protection is likely to be uneven across workers with different types of job contracts, education and experience levels, occupations or industries.

Future research should aim to address these limitations by using institutional data at the regional level to understand the relationship between labour market institutions and the labour market impact of immigration. Furthermore, using individual panel data would allow an understanding of the precise mechanisms through which natives adjust to labour supply increases 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 deepen the understanding of the uneven impact of immigration-induced changes in the labour supply, which is crucial for formulating policies that ensure that the entire population benefits from any economic gains of migration.

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Annex A. Supporting material

Further information on the EU LFS sample

This study focuses on 13 Western European countries (Austria, Belgium, Finland, France, Germany, Greece, Ireland, Italy, Norway, Portugal, Spain, Switzerland and the United Kingdom) with available data on past immigrant settlement patterns. The analysis exploits variation in the migrant shares across geographical units at national or TL2 level, depending on data availability. For most countries, the EU-LFS data is available at the TL2 level. However, the geographical units do not exactly correspond to TL2 regions in Belgium, France, and Germany. The data is available at the national level for the Netherlands and Iceland.

Data preparation included some additional steps. First, the data merges the Åland Finnish islands to the Helsinki region and the Corsica French region to the PACA region. Second, the data excludes the French overseas regions of Guadeloupe, Martinique, French Guiana, La Réunion, Mayotte, and the autonomous Spanish cities Ceuta and Melilla. Finally, the data also excludes Northern Ireland (from the United Kingdom) and three Italian regions (Valle d'Aosta, South Tyrol and Trento) as these regions are not identified in the 1991 census data, and, therefore, cannot be used to build the shift-share instrument.

The analysis then extends beyond the baseline sample of 13 Western European countries to increase the sample size and test the robustness of the results in two steps. First, it focuses on all Western European countries, including EU15 countries (including the United Kingdom), and three EFTA countries (Iceland, Norway and Switzerland). The focus on these countries is due to their similarities in terms of income levels and economic structure, but also their longer history with receiving immigrants. In this sample of Western European countries, the average share of immigrants in the labour force is 12.6 percent. Moreover, between 2010 and 2019, the relative size of immigrants in the labour force was heterogeneous across Western European countries and increased in all of them except Greece (Figure 1.1).

Second, the analysis extends the country coverage to include the remaining European countries, including Cyprus, the Czech Republic, Estonia, Hungary, Latvia, Lithuania, Poland, Romania, Slovakia, and Slovenia. The analysis does not include Bulgaria, Croatia and Malta because the information on country of birth is not sufficiently detailed. In the ten remaining countries together, the share of immigrants in the labour force is two percent over the 2010-2019 period, a much smaller share than in Western countries.

Finally, the analysis restricts 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, etc.). Thus, the sample does not include asylum applicants residing in group quarters while their asylum applications are processed. Finally, the labour force includes all working-age individuals who are employed or unemployed.

Additional details on the OECD/AIAS database

The analysis uses three measures from the OECD/AIAS database to capture the heterogeneity in country-level institutional characteristics crucial for mediating the impact of immigration on native employment (OECD/AIAS, 2021[25]). These measures are strongly correlated and, therefore, should be considered as alternative measures for capturing labour market rigidities due to institutional structure (Foged, Hasager and Yasenov, 2022[20]).

The first indicator uses two subindices that measure individual employment protection and reflects on the costs of individual dismissals to capture 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[24]) and Foged et al. (2022[20]), the analysis combines 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 percent in 2010. The dummy thus captures whether the country has a high or low initial level of employment protection.

The second index measures wage rigidity using a variable describing the level at which collective bargaining over wages takes place. This variable indicates whether wage bargaining takes place at the firm-level, sectoral level, cross-sectoral level, or national level.[13] The analysis builds a dummy variable indicating whether the country is dominated by sectoral or country-level wage bargaining (as opposed to firm-level wage bargaining).

The final measure captures the union density, which corresponds to the number of trade union members who are employees as a percentage of the total number of employees in a given country. The analysis uses a dummy variable equal to one if the share of employees with union membership is in the top 50 percent in 2010.[14]

Data sources for the historical shift-share instrument

To build an alternative instrument based on the distribution in 1990, data were collected from the Integrated Public Use Microdata Series (IPUMS) (Minnesota Population Center, 2020[39]) and national statistical institutes. The IPUMS-International website is available 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 analysis uses French census data in 1990 from the French national statistical institute (INSEE) instead. The analysis also uses supplementary data from national statistical institutes for Belgium (StatBel), Finland (Statistics Finland), Germany (Genesis Online), Italy (Istat), and Norway (Statistics Norway). The data source for these countries is described in Table A A.1.

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 A A.1.

As country of birth, the analysis uses Europe, Asia, Africa, South America, North America and Oceania. Throughout the paper, the working-age population is used to compute the past local shares (i.e. the spatial distribution of migrants in 1990) and the aggregate shift (the number of migrants in the current period). However, as the census data for Belgium, Germany, Italy and Norway do not include information on age, the whole migrant

[13] The analysis does not use the information on the share of employees covered by collective wage agreements because this information is missing for several countries of the baseline sample, including Finland, France, Ireland, Switzerland or Norway.

[14] Union density is an imperfect measure of wage rigidity given the fact that some countries can have a small union density and a high share of employees covered by collective wage agreements.

population is used to compute the spatial distribution of migrants in 1990. Finally, due to a lacking consistency in the construction of the origin groups, including Finland would not allow to distinguish migrants originating from Asia and Africa. Thus, the computation of $\widehat{M}_{rt}$ in Equation (2) excludes Finland and predicts the number of migrants in Finnish regions by implementing Equation (2) for Finland only using $c = 8$ origin groups.

Table A A.1. Data source to compute the 1990 regional distribution of migrants

Source and years used to compute the shift-share instrument, Western European regions

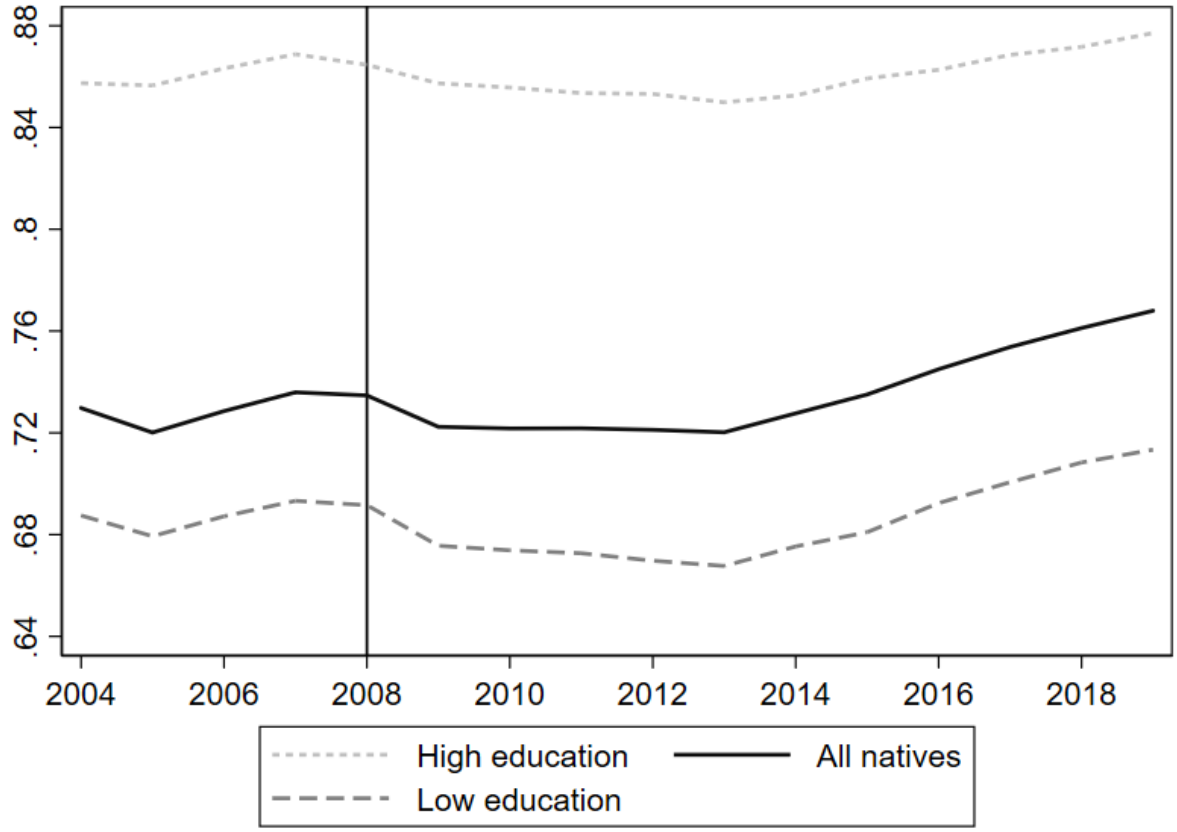
Country	Source	Year of reference
Austria	IPUMS	1991
Belgium	StatBel	1992
Finlande	IPUMS	1990
France	Census	1990
Germany	Genesis Online	1991
Greece	IPUMS	1991
Ireland	IPUMS	1991
Italy	Istat	1991
Norway	Statistics Norway	1990
Portugal	IPUMS	1991
Spain	IPUMS	1991
Switzerland	IPUMS	1990
The United Kingdom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

Evolution of native employment rate over the period of analysis

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

Table A A.2. The employment rate for natives over time

The employment rate for natives in Western European countries, 2004-2019



Notes: Time period: 2004-2019. 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 rate to the population. The high education group considers all natives with some tertiary education and more, while the low educated group considers all natives with secondary education or less.
Source: Eurostat (2022[1]), European Labour Force Survey, accessible at https://ec.europa.eu/eurostat/web/microdata/european-union-labour-force-survey

Testing the exclusion restriction of the base year

The identification strategy relies on an instrumental variable strategy. To circumvent endogeneity concerns related to the contemporary regional immigrant share, the analysis employs a shift-share approach based on historical settlement patterns. Using the past location of immigrants by country-of-origin across regions as a predictor for subsequent inflows of immigrants provide variation in the immigrant inflows that are uncorrelated (or less correlated) with current factors that may affect the employment outcomes of natives. Specifically, the analysis uses the settlement patterns in 1990-1992 as the baseline years for this instrument and distribute immigrants accordingly. For a valid IV approach, the instrument needs to be exogenous to the dependent variable in the second stage. If this condition is violated, the IV estimates are biased.

This discusses the validity of the approach, in light of recent papers on the use of shift-share instruments. First, following Goldsmith-Pinkham, Sorkin and Swift (2020[34]), it evaluates the potential exogeneity by checking whether the initial origin-specific shares used to build our instrument are correlated with initial period characteristics. Second, it tests the presence of correlation between the pre-2010 growth in native employment and other variables and the 2010-2019 growth of immigrant inflow rates.

Table A A.3. shows the correlation between the origin-specific shares and a set of regional characteristics in year 1990.[15] Similar to the Goldsmith-Pinkham, Sorkin and Swift (2020[34]), the R-squared shows that regional characteristics do not explain the cross-sectional variations in the initial spatial distribution of immigrants.[16] Moreover, the wild-cluster bootstrap p-values indicate that only 3 of 18 correlations coefficients are significant at the 10 percent level. The lack of correlation between the pre-existing characteristics such as employment-to-labour force rate and the origin-specific shares indicates the presence of plausible exogenous variation. Although this lack of correlation is reassuring, a significant correlation in levels would not invalidate the IV strategy (Goldsmith-Pinkham, Sorkin and Swift, 2020[34]).

15 The analysis uses ARDECO (Annual Regional Database of the European Commission's Directorate General for Regional and Urban Policy) provided by the Joint Research Centre. The database contains a set of long time-series regional variables and indicators for EU regions, as well as for regions in some EFTA and candidate countries. For further information see https://knowledge4policy.ec.europa.eu/territorial/ardeco-database_en.

16 Due to data availability, the analysis is only possible for 8 countries and 99 regions (excluding Austria, Finland, Norway, Switzerland and the United Kingdom). As a solution, it repeats the same test including all countries and using regional characteristics as of 2005, similar to Moriconi et al. (2019, 2022). Reassuringly no correlations exist between the origin-specific shares in the 1990s and the regional characteristics in 2005, the first year for which data is available for all countries and regions. The results are available upon request.

Table A A.3. Correlation between origin country shares and regional characteristics

	Dependent variable: Origin country shares in 1990					
	African immigrants	Asian immigrants	European immigrants	North American immigrants	South American immigrants	Natives
	(1)	(2)	(3)	(4)	(5)	(6)
Employment rate to labor force	0.26	0.20	0.12	0.13	0.23	-0.02
	(0.11)	(0.08)	(0.06)	(0.06)	(0.08)	(0.05)
Wild cluster bootstrap p-value	*0.20*	*0.09*	*0.14*	*0.15*	*0.12*	*0.70*
Log GDP per capita	0.06	0.07	0.01	0.00	0.04	0.01
	(0.04)	(0.04)	(0.03)	(0.04)	(0.05)	(0.03)
Wild cluster bootstrap p-value	*0.07*	*0.01*	*0.67*	*0.95*	*0.46*	*0.89*
Log hours worked per person employed	0.31	0.34	0.14	0.08	0.21	0.18
	(0.27)	(0.26)	(0.20)	(0.21)	(0.27)	(0.20)
Wild cluster bootstrap p-value	*0.22*	*0.16*	*0.56*	*0.90*	*0.56*	*0.43*
Observations	99	99	99	99	99	99
R-squared	0.09	0.07	0.03	0.02	0.07	0.03

Notes: Time period: 2010-2019. Sample of countries: EU15 countries except Austria, Finland, Norway, Switzerland and the United Kingdom. Each column reports the estimated coefficients of a regression of an origin-specific share in 1990 on regional characteristics in 1990. Below the point estimate, the standard errors in parentheses are clustered at the country level. Wild bootstrap p-values in italics are computed using 1,000 bootstrap replications. The units of observations are regions. Below the point estimate, the standard errors in parentheses are heteroscedasticity robust and clustered by region.
Source: Eurostat (2022[1]), European Labour Force Survey, accessible at https://ec.europa.eu/eurostat/web/microdata/european-union-labour-force-survey; Minnesota Population Center (2020[39]), Integrated Public Use Microdata Series (IPUMS), accessible at https://international.ipums.org/international/; national statistical institutes (See Annex A for further details).

As a second test, it checks the presence of pre-trends. The exclusion restriction for the validity of the instruments requires that the predicted regional inflows of immigrants are uncorrelated with the unobserved determinants of regional employment after 2010, once we control for fixed effects. Table A A.4 shows whether the predicted regional immigrant inflows in 2010–2019 (i.e. $(\widehat{M}_{rt} - \widehat{M}_{rt-1})$ divided by total population in 2005) are correlated with regional trends in the labour market outcomes of natives in the pre-2010 period, similar to Dustmann, Schönberg and Stuhler (2017[13]), (Edo, 2019[3]) or Moriconi, Peri and Turati (2019[36]; 2022[37]).

Each column in Table A A.4 shows a regression where the dependent variables (indicated in column header) are related to pre-2010 employment outcomes of natives. Panel A shows the correlation across regions between the predicted immigration rate between 2010-2019 and the differences in employment rate of natives between 2005-2009 (column 1), the employment growth of natives between 2005-2009 (column 2), the log employment rate of natives in 2009 (column 3) and the share of immigrants in 2009 (column 4).

The estimated coefficients on the pre-2010 changes are small and not statistically significant. Hence, they imply that there was no correlation between the pre-2010 trends in employment outcomes and the successive predicted inflow of immigrants across regions. This supports the validity of the instrument as it indicates a lack of persistent regional trend affecting native employment. In order to show that the results from columns 1-3 are not due to a statistical artifact, column 4 runs a placebo test which shows that the predicted regional inflow rates over the 2010-2019 period are positively correlated with the share of immigrants in 2009. This expected result is simply consistent with the fact that past immigrant shares are not independent from future immigrant inflows.

Panel B indicates slightly more correlation between pre-2010 characteristics and the observed regional inflow rates of immigrants over the 2010-2019 period. As expected, the correlation between current immigrant inflows and past employment outcomes are much more positive and significant than in Panel A. This correlation simply reflects the fact that immigrants are not randomly distributed across regional labour markets and, therefore, is consistent with the positive bias in our previous OLS estimated effects of immigration on native employment. Finally, column 4 points to a positive correlation between current immigrant penetration and past immigrant shares across regions that is likely to be driven by immigrant networks.

Table A A.4. Correlations between past regional outcomes and immigrant inflow rates

	Dependent variable			
	Difference in native employment rate between 2005 and 2009	Native employment growth between 2005 and 2009	Log employment rate in 2009	Share of immigrants in 2009
	(1)	(2)	(3)	(4)
	A. Predicted immigrant inflow rate			
1. Predicted inflows btw 2010-2019	0.00	0.00	0.01	0.06***
	(0.00)	(0.00)	(0.01)	(0.02)
2. Predicted inflows btw 2010-2015	0.01	0.01	0.01	0.11**
	(0.01)	(0.01)	(0.03)	(0.05)
3. Predicted inflows btw 2015-2019	0.01	0.01	0.01	0.11***
	(0.01)	(0.01)	(0.02)	(0.02)
	B.Immigrant inflow rate			
4. Inflows btw 2010-2019	0.09	0.10	0.77***	0.69***
	(0.08)	(0.07)	(0.16)	(0.25)
5. Inflows btw 2010-2015	0.15	0.18**	0.80***	0.69*
	(0.09)	(0.08)	(0.20)	(0.40)
6. Inflows btw 2015-2019	0.06	0.05	1.08***	1.02***
	(0.17)	(0.14)	(0.36)	(0.31)

Notes: Time period: 2010-2019. Sample of countries: EU15 countries (including the United Kingdom) plus Iceland, Norway and Switzerland. It excludes Finland from the analysis due to data availability. Each entry of the table reports the estimated result of a single regression. As dependent variables, column 1 uses the regional difference in the employment-to-population rate of natives; columns 2 uses the regional change in native employment between 2005 and 2009 relative to the region's population in 2005; while columns 2 and 3 respectively use the log employment rate and the share of immigrants in 2009 across regions. As the main regressor of interest, Panel A uses the regional change in the predicted immigrant population between 2010 and 2019, 2010 and 2015, and 2015 and 2019, relative to the region's population in 2005. Panel B replicates the regressions from Panel A by using the regional change in immigrant population relative to the region's population in 2005. All regressions include time fixed effects and have 133 observations. Below the point estimate, the standard errors in parentheses are heteroscedasticity robust. ***, **, * denote statistical significance from zero at the 1%, 5%, 10% significance level.

Source: Eurostat (2022[1]), European Labour Force Survey, accessible at https://ec.europa.eu/eurostat/web/microdata/european-union-labour-force-survey; Minnesota Population Center (2020[39]), Integrated Public Use Microdata Series (IPUMS), accessible at https://international.ipums.org/international/; national statistical institutes (See Annex for further details).