

New Workers, Changing Jobs: Immigration and Labor-Market Adjustment in Spain*

Laura Birkhölzer
CEMFI

Laura Hospido
Banco de España, CEMFI, and IZA

Jan Stuhler
Universidad Carlos III de Madrid

October 2026

Abstract

How do labor markets adjust to a large immigration expansion? By 2025, foreign-born individuals accounted for nearly one-quarter of Spain's working-age population. Using provincial data for 1999–2025 from the Spanish Labour Force Survey and Population Register, we examine native-born labor-market outcomes and the sectoral composition of native-born employment. We instrument local foreign-born shares using historical settlement patterns and the national evolution of foreign-born populations by country of birth. Immigration shifts the sectoral allocation of native-born workers: construction's share of native-born employment declines consistently across specifications, and manufacturing's share also falls, though this result is less robust. In specifications controlling for provincial trajectories, native-born unemployment and participation rates rise in response to immigration. These estimates are larger over three- and five-year differences than over annual changes. Native-born employment-rate estimates are negative but sensitive to specification, becoming statistically significant when initial education composition is interacted with year effects.

Keywords: Immigration, native-born employment, sectoral composition.

JEL codes: J21, J23, J61, R23.

*We thank Gabriel Chaves Bosch, Federico Curci, Tom Zohar, and seminar participants at Banco de España for helpful comments. We also thank Eugenia Echeberria for excellent research assistance. The views expressed in this paper are those of the authors and do not necessarily reflect those of Banco de España or the Eurosystem.

1 Introduction

Spain has experienced a rapid immigration expansion since the late 1990s. By 2025, individuals born abroad accounted for nearly one-quarter of the population aged 16–64 (Figure 1). This expansion provides an opportunity to examine how local labor markets adjust to substantial changes in the size and composition of the working-age population.¹

The period we study encompasses two major episodes of immigration growth, in 1999–2008 and 2015–2025, alongside large fluctuations in labor-market conditions. As Figure 1 shows, both immigration booms coincided with falling unemployment – during the expansion preceding the global financial crisis and again during the recovery – while the interruption in immigration growth coincided with the sharp rise in unemployment during the intervening downturn. This pattern illustrates the central difficulty in estimating the effects of immigration: immigrants arrive when economic conditions improve, so its effects have to be separated from the conditions that attracted them in the first place.

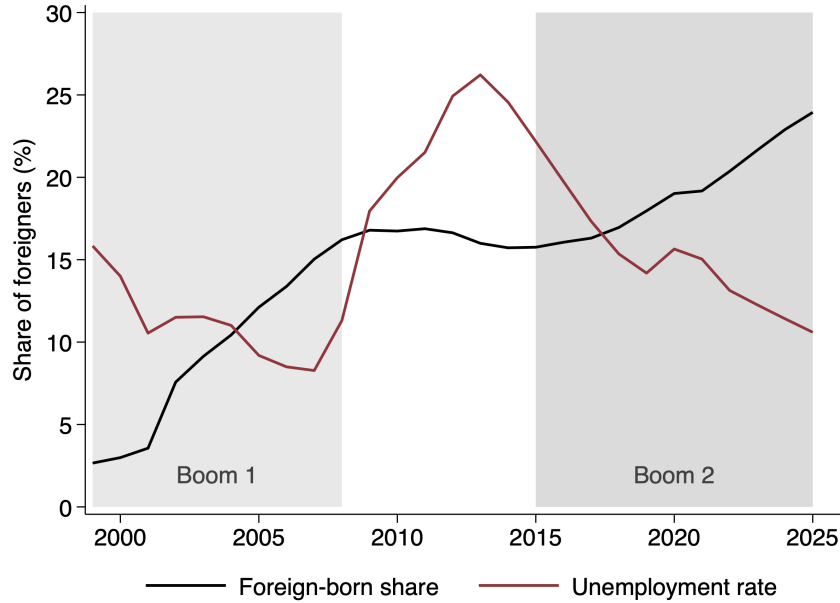
This paper examines local labor-market adjustment during Spain’s immigration expansions. We address three questions. First, how does immigration affect the employment, labor-force participation, and unemployment rates of the native-born population? Second, does an expansion of foreign-born employment translate into higher total employment, or does it come at the expense of native-born employment? Third, does immigration change the sectoral composition of native-born employment? Considering these margins jointly provides a broader account of adjustment than focusing on native-born employment rates alone. An expansion of foreign-born employment can coexist with limited changes in the native-born employment rate. Moreover, changes in participation and unemployment can partly offset one another, while changes in aggregate employment can conceal shifts in its sectoral composition. Our analysis examines these dimensions within a common empirical framework.

To exploit variation in immigration across Spanish provinces and over time, we combine the Spanish Labour Force Survey and the Population Register to construct a panel of the 50 provinces covering 1999–2025. Labor-market outcomes and employment composition are obtained from the Labour Force Survey. Local immigration exposure is measured by the foreign-born share of the working-age population in each province, constructed from the Population Register. Because immigrants may settle in provinces with more favorable labor-market prospects, variation in this share across provinces and over time is potentially endogenous, and we instrument it with a shift-share predictor that combines historical settlement patterns by country of birth with the subsequent national evolution of the corresponding foreign-born populations (Card 2001). Our main specification is estimated in levels and includes province and year fixed effects, province-specific linear trends, and demographic controls. We examine its sensitivity to the trends, which are particularly important over the long period we study, and complement it with specifications in one-, three-, and five-year differences.

The comparison across horizons is particularly relevant when immigration flows are serially

¹Throughout the paper, foreign-born individuals are those born outside Spain, irrespective of their nationality. Native-born individuals are those born in Spain.

Figure 1. Foreign-born population share and unemployment rate in Spain, 1999–2025



Source: Spanish Labour Force Survey.

Notes: The figure reports the national foreign-born share (solid black line) and unemployment rate (solid maroon line) among individuals aged 16–64. The foreign-born share is the number of foreign-born individuals divided by the population aged 16–64. The unemployment rate is the number of unemployed individuals divided by the labor force in the same age range. Shaded areas indicate the two periods of immigration growth considered in the analysis: 1999–2008 and 2015–2025.

correlated and labor-market responses unfold over time. In such settings, conventional specifications may fail to capture adjustment that takes several years to materialize, or conflate responses to current and earlier inflows (Jaeger et al. 2018). Moreover, when a policy effect builds up over time, jurisdiction-specific trends may absorb part of the variation that is due to the effect, attenuating the impact estimates (Meer and West 2016). Comparing horizons helps assess how the estimates depend on the period over which changes are measured. Longer windows do not necessarily resolve the timing problem, however, because they also change the identifying variation and may combine responses to current and earlier inflows differently.

Three main findings emerge. First, immigration appears to raise native-born unemployment and participation rates, but the participation and employment-rate estimates are sensitive to specification. In the baseline levels specification with province-specific trends, the employment-rate estimate is statistically indistinguishable from zero, while unemployment and participation estimates are positive and statistically significant. In differenced specifications with extended demographic controls and province and year fixed effects, all three point estimates increase in absolute magnitude with the horizon when each specification uses its full available sample. Employment-rate estimates remain statistically insignificant, while unemployment and participation become significant over three and five years. This pattern is consistent with gradual adjustment.

In the baseline levels specification, a ten-percentage-point increase in the foreign-born share is associated with increases of 5.5 percentage points in the native-born unemployment rate and

2.4 percentage points in participation. The corresponding employment-rate estimate is negative but imprecise. It is also the one that depends most on how provincial trajectories are handled: without province-specific trends, the levels coefficient is significantly negative at the 10% level with basic controls and at the 1% level with extended controls, but adding trends reduces it by more than half and renders it insignificant. Allowing provinces with different initial education composition to follow different trajectories moves it the other way: adding 1999 education shares interacted with year effects to the baseline specification, which already includes province-specific trends, approximately doubles the employment-rate estimate in absolute magnitude to -0.31 and makes it significant at the 1% level, while the unemployment and participation estimates remain positive and significant.

Second, we decompose total provincial employment into its foreign-born and native-born components, expressing both relative to the same base-year total so that the two coefficients sum to the total-employment effect. The native-born estimate is negative in every specification, but its precision depends on how provincial trajectories are modeled. With province fixed effects and linear trends alone, it is imprecise and compatible with no displacement as well as with substantial displacement. Once provinces with different initial education composition are allowed to follow different, non-linear trajectories, the native-born estimate becomes significantly negative, while the total-employment point estimate is much smaller than the foreign-born component but remains imprecisely estimated; controlling for baseline construction exposure, by contrast, does not matter. Unlike the native-born employment rate, this component also reflects changes in the size of the native-born working-age population, so part of the decline may operate through native in- or out-migration rather than through lower employment rates.

Third, in the separately estimated sectoral equations, the most robust result is a decline in construction's share of native-born employment. The manufacturing share also declines, but less robustly. Because sectoral composition differs widely across provinces and some sectors follow strong secular trends, the estimates for several sectors are sensitive to whether parallel trends are assumed for shares in levels or in logs. The sectors accounting for the offsetting increases vary across specifications. These estimates describe changes in employment composition, not direct movements of individual workers between sectors: sectoral shares can also change through entries into and exits from employment.

Exploratory estimates by gender and education describe how these responses differ across native-born groups. The unemployment coefficient is larger for women than for men in both levels and long differences, and it is significant throughout for women but only over long differences for men; we do not test whether the two differ. Participation responses are similar for men and women. By education, the unemployment point estimates are largest for workers with low education and smallest for the highly educated. Over five years, employment rates fall significantly within all three education groups, although the aggregate employment estimate remains imprecise and the subgroup regressions are not an exact decomposition of it.

Overall, the results show that annual changes in the native-born employment rate provide an incomplete picture of local labor-market adjustment. Unemployment, participation, and sectoral composition provide additional evidence, while comparisons across horizons reveal sensitivity to

both the length of the window and sample coverage. A recurring theme is that estimates for native-born employment, and for employment levels in particular, are sensitive to how differential provincial trajectories are modeled, whereas the unemployment response is more robust.

Related literature and contribution. Estimating the effects of immigration on native-born labor-market outcomes is methodologically challenging. Foreign-born individuals do not settle randomly across locations: they may be attracted to regions experiencing stronger labor demand, while native-born workers and firms may respond to immigration through geographical mobility, changes in labor-force participation, occupational specialization, production technologies, or sectoral composition. Moreover, the estimated effects may depend on the geographical and skill-level aggregation used, the time horizon considered, and the institutional characteristics of the labor market. As emphasized by Dustmann et al. (2016), differences in empirical design and identifying variation help explain why studies sometimes reach apparently conflicting conclusions.

The most popular research design estimates the effects of immigration by comparing local labor markets with different changes in immigrant exposure. Grossman (1982) provides an early application, and Altonji and Card (1991) introduce the strategy of instrumenting local immigrant inflows with the location of earlier immigrants from the same countries of origin. Card (2001) refines this instrument by combining historical settlement patterns with national population changes by country of birth, the form we adopt in Section 3. The spatial approach has subsequently become central to the literature. Beyond the endogeneity of immigrant location choices, its interpretation rests on two further assumptions: that historical settlement patterns are unrelated to persistent local shocks, and that native mobility does not diffuse the response beyond the geographical unit being studied (Borjas 1999). Where the second assumption fails, spatial estimates capture local effects and may understate aggregate ones.

A second group of studies exploits variation in immigration across education and experience groups. Borjas (2003) emphasizes competition between workers with similar observable skills, whereas Ottaviano and Peri (2012) allow for imperfect substitutability between foreign- and native-born workers within skill groups. The conclusions therefore depend partly on how competing groups are defined and on the assumed degree of substitutability between them. Adjustment may also occur through occupational and task specialization. Peri and Sparber (2009), for example, show that immigration can induce native-born workers to specialize in tasks in which they have a comparative advantage, attenuating direct competition between foreign- and native-born workers.

Evidence based on specific immigration-induced labor-supply shocks further shows that adjustment can differ substantially across contexts and groups. Using a commuting policy that generated a sharp inflow of Czech workers into German border regions, Dustmann et al. (2017) find a moderate decline in native wages and a considerably larger decline in native employment. The employment response operates mainly through lower entry into employment rather than greater job separation, illustrating that average effects may conceal important differences between workers already employed and those seeking work. Effects can also be concentrated in particular firms: Amior and Stuhler (2024) show that both the crowding-out of native employment and the wage effects of immigration are concentrated at the bottom of the firm pay distribution, since low-paying firms are the ones most likely to specialize in cheaper immigrant labor. More

generally, this literature cautions against treating any single estimate as a context-independent measure of the effects of immigration: effects may depend on the productive characteristics of the arriving immigrants, but also on their reservation wages or visa-related mobility restrictions, and on aggregate economic conditions.

For Spain, existing research has examined both employment effects and occupational adjustment. Carrasco et al. (2008) study the acceleration of immigration during the second half of the 1990s and find no significant negative effect on either the employment rates or wages of native-born workers. González and Ortega (2011) find that Spanish regions absorbed the large inflow of 2001–2006 mainly by raising the share of low-skilled labor within industries, with little effect on native wages or employment. Farré et al. (2011) show that immigration expanded the supply of household services and raised the labor supply of skilled native women, and Castellanos (2024) shows that the resulting expansion of domestic and childcare services reduced child penalties among native mothers. Focusing on task specialization, Amuedo-Dorantes and De la Rica (2011) examine how foreign- and native-born workers adjust the tasks they perform in response to immigration, highlighting occupational and task composition as margins of adjustment in the Spanish labor market. More recent studies have considered additional responses, including productivity and firm creation. For example, González-Pardo (2025) examines productivity responses in labor-intensive sectors, while Chaves-Bosch (2025) studies the relationship between immigration and native entrepreneurship. Taken together, this evidence underscores that there are many margins through which immigration may affect native-born employment and wages.

This paper contributes to this literature in three respects. First, it provides evidence on native-born labor-market adjustment that spans both Spanish immigration waves, examining employment, unemployment, and participation rates as well as employment levels within a common empirical framework. Estimating the effects on total, native-born, and foreign-born employment on a common scale lets us ask directly whether immigrant employment adds to total employment or displaces native-born workers. The sample spans two immigration waves and nearly three decades of varying macroeconomic conditions. Because the instrument has little predictive power for the second wave on its own, our estimates characterize adjustment over the whole period and do not separately identify the effects of each wave.

Second, we document how the estimates depend on two specification choices that spatial studies of immigration routinely face: how differential trajectories of local labor markets are modeled, and the horizon over which changes are measured. Estimates over three- and five-year windows are larger than those over annual changes, a pattern consistent with gradual adjustment, although other explanations cannot be ruled out. Local trajectories are usually modeled with linear trends. However, allowing provinces with different initial education composition to follow different, non-linear trajectories turns imprecise native-born employment estimates into significantly negative ones. This sensitivity to how trends are handled is more pronounced for employment levels than for employment, unemployment, or participation rates, which are bounded and can therefore diverge less across provinces. The change is consistent with provinces with higher predicted immigration having followed more favorable native employment trajectories, which may help explain why some earlier spatial estimates for Spain show less pronounced

employment effects.

Third, we examine who adjusts and how. We trace the sectoral composition of native-born employment and estimate the responses separately by gender and education. Native-born employment shifts out of construction and, less robustly, manufacturing, and the unemployment response is concentrated among women and among workers with low or medium education. These exploratory patterns indicate which native-born groups display larger estimated labor-market responses.

The remainder of the paper is organized as follows. Section 2 describes the data and the evolution of immigration exposure across origins and provinces. Section 3 presents the empirical strategy. Section 4 reports the results for native-born labor-market outcomes, the employment decomposition, sectoral composition, and heterogeneity. Section 5 concludes with a discussion of the findings and their implications.

2 Data and descriptive evidence

2.1 Data sources and sample

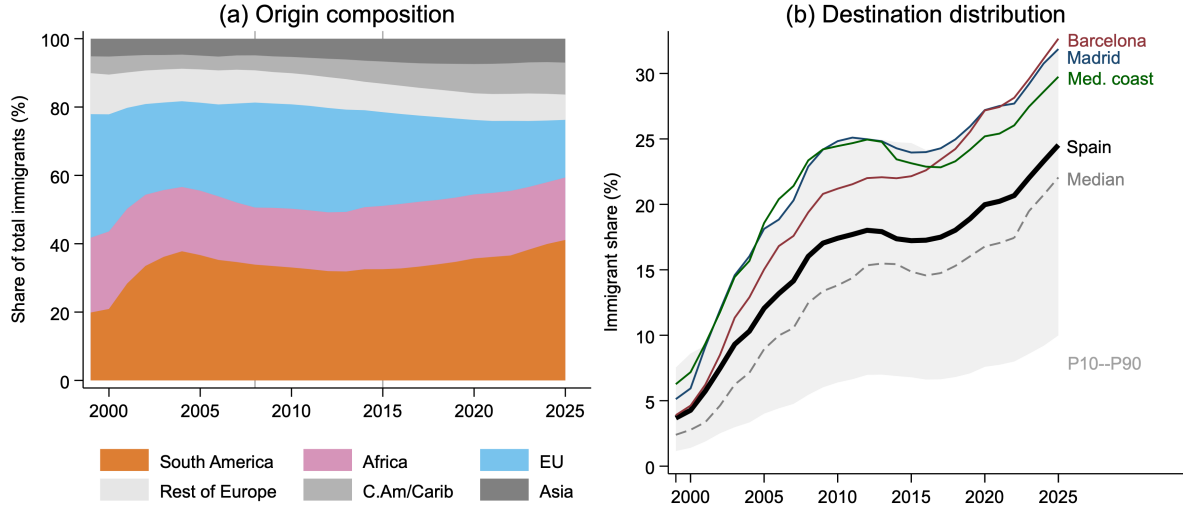
We combine information from the Spanish Labour Force Survey and the Municipal Population Register to construct an annual panel of Spanish provinces covering 1999–2025. The main levels sample is a balanced panel of 50 provinces observed over 27 years, yielding 1,350 province-year observations. Ceuta and Melilla are excluded because the empirical unit of analysis is the province and both are autonomous cities. The one-, three-, and five-year differenced samples contain 1,300, 1,200, and 1,100 observations, respectively. Unless otherwise indicated, population and labor-market measures refer to individuals aged 16–64. Appendix Table A1 reports summary statistics for the principal variables.

The Spanish Labour Force Survey (*Encuesta de Población Activa*, EPA) provides the information used to construct native-born employment, labor-force participation, and unemployment rates. We aggregate the individual-level data to annual province-level cells using the EPA sampling weights. The EPA also provides the demographic characteristics included as controls and the employment counts used in the employment decomposition and sectoral analysis. Survey weights are used to construct these provincial measures; the population weights used in the regressions are described in Section 3.

For the sectoral analysis, we classify native-born employment into five broad groups: agriculture and fishing, manufacturing, construction, trade and hospitality, and other services. The last category comprises the remaining service activities, including public and private services. This aggregation limits the fragmentation of provincial employment into small sectoral cells while distinguishing the main areas of economic activity. The sectoral shares use total native-born employment as their denominator, as defined in equation (14).

The Municipal Population Register (*Padrón*) provides population counts by province, age, and country of birth. We use these data to construct the provincial foreign-born share of the working-age population and the historical settlement shares and national origin-specific

Figure 2. Origin composition and provincial distribution of immigration, 1999–2025



Source: Municipal Population Register (*Padrón*).

Notes: Panel (a) reports the composition of the foreign-born population aged 16–64 by region of origin. EU denotes EU countries other than Spain, and Rest of Europe denotes non-EU European countries. Regional categories are used for presentation; the instrument is constructed at the country-of-birth level. Panel (b) reports the national foreign-born share (solid line), the median provincial share (dashed line), and the range between the 10th and 90th percentiles of the provincial distribution (shaded area). It also reports shares for Madrid and Barcelona and a population-weighted average for the selected Mediterranean provinces of Alicante, Murcia, Málaga, Almería, and Girona. Foreign-born shares are calculated relative to the total population aged 16–64.

populations underlying the shift–share instrument. Foreign-born status is determined by country of birth rather than nationality throughout the analysis.

The national foreign-born series in Figure 1 is constructed from the EPA, allowing immigration and unemployment to be displayed using a common data source. Provincial immigration exposure in the regressions is instead constructed from the population counts used for the shift–share instrument. The descriptive EPA series and the regression exposure measure therefore need not coincide exactly.

The Continuous Sample of Working Lives (*Muestra Continua de Vidas Laborales*, MCVL) supplies the additional descriptive comparison of employment by Social Security contribution group in Figure A3. This administrative comparison is separate from the EPA-based sectoral measures and does not enter the regression analysis. Contribution groups describe the classification of registered jobs rather than workers’ educational attainment.

2.2 Descriptive evidence

Figure 2 describes the origin composition and provincial distribution of Spain’s foreign-born working-age population. It complements the national trends in Figure 1 by showing how the composition of the foreign-born population and the geographical dispersion of immigration exposure evolved over the sample period.

Panel (a) shows a marked increase in South America’s share of the foreign-born working-age

population during the first immigration episode. South America remained a prominent origin region thereafter. The share originating in other EU countries declined, particularly during the second episode, while the African-origin share was comparatively stable. These are shares within the foreign-born population: a declining share for an origin region does not necessarily imply a decline in the number of individuals born there.

Appendix Figure A1 complements these stock compositions by displaying annual changes in the foreign-born population by origin region. It distinguishes the contribution of each region to population growth from its share of the accumulated foreign-born population. Appendix Figures A2 and A3 complement this origin-based comparison with the age, education, gender, and skill composition of foreign- and native-born workers.

Panel (b) of Figure 2 shows the rise in the national foreign-born share during the first immigration episode, its subsequent slowdown and partial reversal, and its renewed increase during the second episode. The provincial median and percentile range indicate that this evolution was not uniform across destinations. In particular, the widening gap between the 10th and 90th percentiles documents increasing dispersion in provincial foreign-born shares. The selected provincial series illustrate the different levels and trajectories of exposure within this distribution. Appendix Figure A4 maps this dispersion across all provinces in a single year, 2023.

These descriptive patterns are relevant to the empirical design in two respects. First, immigration exposure varies across provinces and over time. Second, national population changes differ across origin groups, generating different predictions for provinces with different historical settlement patterns. The figures display these ingredients of the shift–share construction, but not the identifying variation remaining after conditioning on controls, fixed effects, and trends. Nor do they establish that immigration exposure is exogenous: immigrants may select destinations with stronger labor demand or other favorable economic conditions. Section 3 describes the assumptions and specification comparisons used to address this concern.

3 Empirical strategy

This section describes the empirical strategy used to examine the relationship between provincial immigration exposure and native-born labor-market outcomes. We first introduce the shift–share instrument and the specifications for aggregate outcomes, including differences over alternative horizons. We then describe the employment decomposition and sectoral analysis. All population and labor-market measures refer to individuals aged 16–64 unless otherwise indicated.

3.1 Shift–share instrument

Let p denote provinces, o countries of birth (i.e., excluding Spain), t years, and $t_0 = 1999$ the base year. We construct the instrument as

$$Z_{pt} = \frac{100}{Pop_{p,t_0}^{16-64}} \sum_o \left(\frac{FB_{po,t_0}}{FB_{o,t_0}} \right) FB_{ot}, \quad (1)$$

where FB_{po,t_0} is the number of foreign-born working-age individuals born in country o residing

in province p in the base year; FB_{o,t_0} is the corresponding number residing in Spain in the base year; FB_{ot} is the number residing in Spain in year t ; and Pop_{p,t_0}^{16-64} is the total working-age population of province p in the base year.

The ratio $FB_{po,t_0}/FB_{o,t_0}$ captures the initial geographical distribution of each origin group. Applying these historical settlement shares to the subsequent national population of each group gives a predicted provincial foreign-born population. We normalize this prediction by the province’s working-age population in 1999 and multiply by 100. The instrument therefore measures predicted immigration exposure relative to a fixed provincial population.

Equivalently, the instrument can be written in share-shift form as

$$Z_{pt} = 100 \sum_o \underbrace{\frac{FB_{po,t_0}}{Pop_{p,t_0}^{16-64}}}_{\text{baseline exposure}} \times \underbrace{\frac{FB_{ot}}{FB_{o,t_0}}}_{\text{national growth factor}}. \quad (2)$$

This representation separates provincial exposure to each origin group in the base year from the subsequent national growth of that group. As discussed by Borusyak et al. (2025), the shift-share structure does not itself establish instrument validity: identification requires assumptions about the exposure shares, the national shifts, or their combination. Treating the national shifts as the source of exogenous variation requires many independent shocks across origin groups. Meeting this requirement can be challenging in immigration settings, including Spain: a few origin regions account for most of the change in the foreign-born population, and their national growth reflects common episodes (Figure 2 and Appendix Figure A1).

Our use of historical settlement patterns follows Card (2001). The identifying restriction is that, conditional on the included controls, fixed effects, and trends, the historical settlement patterns – and hence the variation predicted by the instrument – are unrelated to other determinants of native-born labor-market outcomes. While historical settlement shares are predetermined, this alone does not make the instrument exogenous. In particular, exogeneity may fail if historical settlement patterns are associated with persistent provincial shocks or if national changes in origin-specific populations respond to economic developments in particular Spanish provinces. More fundamentally, the instrument does not resolve the fact that high-immigration provinces differ systematically from low-immigration ones – in industrial structure, urbanization, and long-run growth prospects – because the same asymmetry is reflected in the historical settlement stocks on which the instrument is built. Immigrants typically locate in more urban and economically dynamic regions, a concern common in this literature but often left implicit. Provinces with high baseline foreign-born shares may therefore be on different economic trajectories, and the instrument would attribute these trajectories to immigration. Province-specific linear trends are the main safeguard we use against this concern, as they capture ongoing long-run changes in the spatial concentration of economic activity in Spain. This protection comes at a cost, discussed in Section 3.3.1: trends can also absorb part of a response that builds up gradually, which is why we report specifications with and without them.

Moreover, linear trends do not absorb trajectories that are not linear – for example, if the boom and bust of the 2000s affected provinces with a different initial composition differently.

We therefore also test how sensitive the estimates are to controlling for local composition, in two ways: the contemporaneous demographic composition of the native-born population, which may itself respond to immigration (Section 3.2), and predetermined 1999 characteristics of each province – its education composition and the construction share of native employment – interacted with year effects, which allow provinces with a different initial composition to follow different, possibly non-linear, paths (Sections 4.1 and 3.4). We cluster standard errors at the province level, allowing for within-province dependence. This additionally assumes sufficiently limited residual dependence across provinces, a condition distinct from the conditional exogeneity of historical settlement shares.

A further concern is the timing of adjustment. Persistent settlement patterns and serially correlated immigration flows can make it difficult to distinguish responses to current immigration from adjustment to earlier inflows (Jaeger et al. 2018). The Spanish setting features two major immigration waves – a large inflow in 1999–2008 and a more recent, still ongoing wave since 2015. The presence of these waves does not, by itself, resolve this concern or allow us to separate short-run from longer-run adjustment. We examine sensitivity to alternative demographic controls, province-specific linear trends, and differencing horizons.

3.2 First stage

Our measure of local immigration exposure is the foreign-born share of the working-age population:

$$ImmShare_{pt} = 100 \times \frac{FB_{pt}^{16-64}}{Pop_{pt}^{16-64}}, \quad (3)$$

where FB_{pt}^{16-64} is the foreign-born population aged 16–64 living in province p in year t , and Pop_{pt}^{16-64} is the total provincial population in that age range. Unlike the instrument, this measure uses the contemporaneous population as its denominator.

The first-stage equation for the levels specifications is

$$ImmShare_{pt} = \pi Z_{pt} + X'_{pt}\gamma + \alpha_p + \lambda_t + \tau_p t + u_{pt}, \quad (4)$$

where α_p and λ_t denote province and year fixed effects, respectively, and $\tau_p t$ denotes a province-specific linear trend. We also estimate specifications without the province-specific trends.

The basic control vector X_{pt} contains time-varying characteristics of the native-born working-age population: shares by age group, educational attainment, and gender, with reference categories omitted as appropriate. The extended control set adds gender-by-age and gender-by-education interactions. Demographic shares are expressed as proportions between zero and one. These controls account for observable changes in population composition. They may, however, themselves respond to immigration. For example, selective internal migration can change the demographic composition of the native-born population within a province. Conditioning on such variables could therefore absorb part of the adjustment associated with immigration. Comparing basic and extended controls assesses sensitivity to their specification, but does not eliminate this

concern.

We report Kleibergen–Paap F -statistics alongside the main estimates, first-stage coefficients in the Appendix, and examine first-stage strength separately for the two immigration episodes. The Kleibergen–Paap statistic is the first-stage F -statistic robust to heteroskedasticity and clustering by province; with a single instrument it equals the squared robust t -statistic on the instrument. Instrument relevance in the pooled sample need not imply comparable predictive power within each subperiod.

3.3 Native-born labor-market outcomes

For each native-born labor-market outcome, we estimate

$$y_{pt} = \beta ImmShare_{pt} + X'_{pt}\delta + \alpha_p + \lambda_t + \tau_pt + \varepsilon_{pt}, \quad (5)$$

using two-stage least squares, with $ImmShare_{pt}$ instrumented by Z_{pt} . We also report OLS estimates and specifications without province-specific linear trends. Regressions are weighted by the native-born working-age population of each province-year cell, and standard errors are clustered at the province level.²

The dependent variables are defined as follows:

$$EmpRate_{pt}^N = 100 \times \frac{Emp_{pt}^N}{Pop_{pt}^{N,16-64}}, \quad (6)$$

$$PartRate_{pt}^N = 100 \times \frac{LF_{pt}^N}{Pop_{pt}^{N,16-64}}, \quad (7)$$

$$UnempRate_{pt}^N = 100 \times \frac{Unemp_{pt}^N}{LF_{pt}^N}, \quad (8)$$

where Emp_{pt}^N is native-born employment, LF_{pt}^N is the native-born labor force, $Unemp_{pt}^N$ is native-born unemployment, and $Pop_{pt}^{N,16-64}$ is the native-born working-age population. The labor force comprises employed and unemployed individuals.

Employment and participation are measured relative to the native-born working-age population, whereas unemployment is measured relative to the native-born labor force. All three rates and $ImmShare_{pt}$ are expressed in percentage points. Thus, β measures the percentage-point change in the outcome associated with a one-percentage-point increase in the foreign-born share. In discussing the results, we also report the implied change associated with a ten-percentage-point increase.

The three outcomes satisfy the accounting identity

²As discussed by Solon et al. (2015), weighting can affect both the precision and the interpretation of regression estimates.

$$\frac{EmpRate_{pt}^N}{100} = \frac{PartRate_{pt}^N}{100} \left(1 - \frac{UnempRate_{pt}^N}{100} \right). \quad (9)$$

Estimating the outcomes separately allows us to examine participation and unemployment as distinct margins associated with employment-rate changes. Because the identity is nonlinear, it does not imply a simple additive relationship between the three estimated regression coefficients.

3.3.1 Differences over alternative horizons

We complement the levels analysis with specifications in one-, three-, and five-year differences. If a policy effect accumulates over several years rather than shifting the outcome at a point in time, the standard panel specification with a contemporaneous treatment term in levels is misspecified, and its estimate can depend on how many pre- and post-treatment years the sample contains. As illustrated by Meer and West (2016), the inclusion of jurisdiction-specific linear trends can further complicate interpretation: a response that builds up gradually may resemble a trend, allowing trend controls to absorb part of it and attenuate the estimate. Differencing over longer windows may alleviate both problems. A one-year difference may capture only part of a gradual response, whereas a k -year difference can capture adjustment over a longer period, so estimates may increase in magnitude as the window lengthens; and the larger the share of the response captured within the window, the less of it may be left for trend controls to absorb.

For each horizon $k \in \{1, 3, 5\}$, define

$$\Delta_k y_{pt} = y_{pt} - y_{p,t-k}, \quad \Delta_k ImmShare_{pt} = ImmShare_{pt} - ImmShare_{p,t-k}, \quad (10)$$

and define $\Delta_k Z_{pt}$ and $\Delta_k X_{pt}$ analogously. We estimate

$$\Delta_k y_{pt} = \beta_k \Delta_k ImmShare_{pt} + \Delta_k X'_{pt} \delta_k + \alpha_p^k + \lambda_t^k + \nu_{pt}^k, \quad (11)$$

instrumenting $\Delta_k ImmShare_{pt}$ with $\Delta_k Z_{pt}$. All specifications include year fixed effects, and we report versions with and without province fixed effects. Province fixed effects in the differenced equation allow provinces to have different average changes over the relevant horizon. They are the counterpart of province-specific linear trends in the levels specification: differencing a linear trend over a fixed window leaves a province-specific constant.

Each coefficient β_k relates the change in an outcome over k years to the change in the foreign-born share over the same interval; the changes are not annualized, and the controls and the instrument are differenced over the same window. For the extended control set, we difference the interaction variables themselves, rather than forming products of differenced shares. Regressions are weighted by the native-born working-age population at the beginning of each window. Standard errors are clustered at the province level, allowing for within-province dependence, including that induced by overlapping windows. Our main estimates use all available observations at each horizon, retaining coverage of the underlying 1999–2025 period. As a robustness check, we also estimate all three horizons using common endpoint years, 2004–2025. This holds the province-year endpoints constant, but not the periods covered by the windows or

the beginning-of-window weights. Differences across horizons may therefore reflect adjustment timing as well as changes in identifying variation and weighting. The coefficients should not be interpreted as tracing a dynamic response function.

3.4 Employment decomposition

We express total, native-born, and foreign-born employment relative to total provincial employment in the common base year, 1999. For $G \in \{\text{Total}, N, F\}$, define

$$EmpIndex_{pt}^G = 100 \times \frac{Emp_{pt}^G}{Emp_{p,1999}}, \quad (12)$$

where $Emp_{p,1999}$ is total provincial employment in 1999. Because all components use the same denominator,

$$EmpIndex_{pt}^{\text{Total}} = EmpIndex_{pt}^N + EmpIndex_{pt}^F \quad (13)$$

in every province and year.

We estimate equation (5) separately for each component, using the contemporaneous foreign-born share and the level shift-share instrument. All three regressions include province and year fixed effects and province-specific linear trends. They do not include the demographic controls of equation (5). Composition controls are natural for outcomes that vary systematically with workers' characteristics, such as employment rates, but employment counts are not rates, and the contemporaneous composition of the native-born population may itself respond to the native mobility that the native-born component is meant to capture. Instead, we report specifications that interact predetermined 1999 characteristics of each province – the construction share of native employment and the native-born education shares – with year effects. These interactions allow provinces with a different initial composition to follow different, possibly non-linear, trajectories without conditioning on contemporaneous composition. All specifications use the same sample and native-born working-age population weights. Consequently, the estimated native- and foreign-born coefficients sum to the total-employment coefficient, up to rounding.

A coefficient measures the employment change associated with a one-percentage-point increase in the foreign-born share, expressed as a percentage of total provincial employment in 1999. For the native- and foreign-born components, this is not a percentage change relative to each group's own initial employment.

3.5 Sectoral composition of native-born employment

To study employment composition, we define

$$Share_{pts}^N = 100 \times \frac{Emp_{pts}^N}{\sum_j Emp_{ptj}^N}, \quad (14)$$

where Emp_{pts}^N is native-born employment in sector s , province p , and year t . The denominator is total native-born employment in the corresponding province-year cell. The five sectoral shares

therefore sum to 100.

We estimate a separate equation for each sector:

$$g\left(Share_{pts}^N\right) = \beta_s ImmShare_{pt} + X'_{pt}\delta_s + \alpha_p^s + \lambda_t^s + \tau_p^s t + \eta_{pts}, \quad (15)$$

where $ImmShare_{pt}$ is instrumented with Z_{pt} . The terms α_p^s and λ_t^s denote province and year fixed effects specific to each sectoral regression, and $\tau_p^s t$ denotes its province-specific linear trends. Estimating the equations separately allows all coefficients, fixed effects, and trends to differ across sectors. We report specifications with and without the provincial trends.

The regressions use extended demographic controls and native-born working-age population weights. Standard errors are clustered at the province level. The choice of functional form is not innocuous here. Sectoral shares differ widely across provinces, and some sectors follow strong secular trends, so the parallel-trends assumption embedded in the province trends and fixed effects can hold approximately for shares in levels or for their logs, but generally not for both. We therefore consider two functional forms, $g(x) = x$ and $g(x) = \log(x)$. In the first case, β_s measures the percentage-point change in the sector's share of native-born employment associated with a one-percentage-point increase in the foreign-born share. In the second, β_s is a semi-elasticity, so that a one-percentage-point increase in the foreign-born share changes the sectoral share by approximately $100\beta_s$ percent of its level. For shares in levels (but not logs), coefficients across sectors sum to zero when the regressions use the same sample, weights, regressors, and instruments.³

These estimates concern the composition of native-born employment, not its aggregate level. They do not necessarily represent movements of the same workers between sectors: sectoral shares can also change through sector-specific entries into and exits from employment.

3.6 Heterogeneity by gender and education

We also estimate native-born labor-market outcomes separately by gender and educational attainment, using levels with province-specific trends and five-year differences with province and year fixed effects. Employment and participation rates use the corresponding group's working-age population as their denominator; unemployment rates use its labor force. The foreign-born share remains the aggregate provincial exposure measure, common to all groups.

The regressions use group-specific demographic controls and are weighted by the corresponding native-born working-age population, measured contemporaneously in levels and at the beginning of the window in differences. Standard errors are clustered at the province level. Because the group regressions differ in their outcomes, weights, and controls, their coefficients need not aggregate to the estimate for the full native-born population.

³Alternative stacked specifications, which impose common coefficients on some controls, are reported in Appendix Tables A9 and A10.

4 Results

This section presents the results in four steps. We first examine native-born employment, unemployment, and labor-force participation rates, focusing on the treatment of provincial trajectories and the horizon over which changes are measured. We then decompose provincial employment into native- and foreign-born components, examine sectoral composition, and explore heterogeneity by gender and education. Throughout, we emphasize the IV estimates and report OLS estimates as descriptive benchmarks.

4.1 Native-born labor-market outcomes

Table 1 reports the main IV estimates in levels and in one-, three-, and five-year differences. Columns (1) and (2) use basic and extended demographic controls without provincial trajectories. Column (3) adds province-specific linear trends in levels and province fixed effects in differences to the extended controls. All specifications include year effects; levels specifications also include province effects. The instrument is strong throughout: the first-stage coefficient is about 0.39 in levels (Appendix Table A3), and the Kleibergen–Paap F -statistics range from 22.1 to 38.6. These statistics concern instrument relevance in the pooled sample, not the validity of the exclusion restriction.⁴

The IV estimates of equation (5) with province-specific trends, reported in column (3) of Panel A, are our baseline. A ten-percentage-point increase in the foreign-born share is associated with a 5.5-percentage-point increase in the native-born unemployment rate and a 2.4-point increase in the participation rate, both significant at the 1% level. The employment-rate coefficient implies a decline of 1.6 points but is not statistically significant. Unemployment is measured relative to the native-born labor force, so these estimates describe a native workforce that grows and, at the same time, has more difficulty finding work, with no statistically detectable change in the employment rate.

Columns (1) and (2) show how these estimates depend on the treatment of provincial trajectories. The unemployment response is robust in sign: it is positive and significant at the 1% level in all three columns of Panel A. With basic controls and province-specific trends (Appendix Table A3), the IV coefficient is 0.403 and is significant only at the 10% level. The participation response, by contrast, is not robust: without trends, its coefficient is close to zero and insignificant, so it appears only once each province is allowed its own trajectory. For the employment rate, the coefficient is -0.298 with basic controls and -0.385 with extended controls but without trends, significant at the 10% and 1% levels; adding trends reduces it to -0.158 and renders it insignificant. The trends may be absorbing a confounding long-run trajectory or part of a gradual response to immigration; the comparison across horizons below speaks to this.⁵

⁴The relevance of the instrument in the pooled sample does not imply that it is equally informative in each immigration episode. Appendix Table A2 reports subperiod diagnostics showing substantially less predictive power during 2015–2025, both in levels and in annual differences. We therefore do not interpret the pooled results as separately identifying the effects of the recent immigration wave.

⁵Appendix Table A3 reports the baseline alongside OLS estimates and the variant with basic controls. OLS and IV estimates are close for unemployment, the IV participation estimate is somewhat larger than its OLS

Table 1. Native-born labor-market outcomes: levels and differences

	Employment			Unemployment			Participation		
	(1)	(2)	(3)	(1)	(2)	(3)	(1)	(2)	(3)
Controls	Basic	Extended	Extended	Basic	Extended	Extended	Basic	Extended	Extended
Province trajectory	No	No	Yes	No	No	Yes	No	No	Yes
<i>Panel A: Levels</i>									
Foreign-born share	−0.298*	−0.385***	−0.158	0.436***	0.523***	0.550***	−0.025	−0.056	0.240***
	(0.152)	(0.126)	(0.146)	(0.088)	(0.099)	(0.164)	(0.149)	(0.139)	(0.078)
KP <i>F</i>	22.1	24.8	38.6	22.1	24.8	38.6	22.1	24.8	38.6
Observations	1,350	1,350	1,350	1,350	1,350	1,350	1,350	1,350	1,350
<i>Panel B: Differences</i>									
<i>One-year differences</i>									
Δ_1 Foreign-born share	−0.109	−0.128	−0.112	0.239	0.281	0.270	0.042	0.054	0.102
	(0.216)	(0.187)	(0.251)	(0.216)	(0.178)	(0.284)	(0.087)	(0.090)	(0.095)
KP <i>F</i>	32.6	32.4	31.3	32.6	32.4	31.3	32.6	32.4	31.3
Observations	1,300	1,300	1,300	1,300	1,300	1,300	1,300	1,300	1,300
<i>Three-year differences</i>									
Δ_3 Foreign-born share	−0.157	−0.203	−0.205	0.322*	0.390***	0.488**	0.049	0.050	0.144*
	(0.185)	(0.152)	(0.203)	(0.165)	(0.132)	(0.223)	(0.096)	(0.093)	(0.078)
KP <i>F</i>	30.1	28.2	31.4	30.1	28.2	31.4	30.1	28.2	31.4
Observations	1,200	1,200	1,200	1,200	1,200	1,200	1,200	1,200	1,200
<i>Five-year differences</i>									
Δ_5 Foreign-born share	−0.256	−0.297**	−0.275	0.471***	0.531***	0.684***	0.059	0.058	0.220**
	(0.156)	(0.138)	(0.170)	(0.107)	(0.098)	(0.167)	(0.124)	(0.123)	(0.098)
KP <i>F</i>	27.4	27.1	36.7	27.4	27.1	36.7	27.4	27.1	36.7
Observations	1,100	1,100	1,100	1,100	1,100	1,100	1,100	1,100	1,100

Notes: IV estimates for native-born employment, unemployment, and participation rates. Panel A includes province and year fixed effects and instruments the foreign-born share with the level shift–share instrument. Panel B uses one-, three-, and five-year differences and instruments the change in the foreign-born share with the change in the instrument over the same horizon. Columns (1) and (2) use basic and extended demographic controls, respectively, without province-specific trajectories. Column (3) uses extended controls and adds province-specific linear trends in Panel A or province fixed effects in Panel B. All differenced specifications include year fixed effects. Levels are weighted by the contemporaneous native-born working-age population; differences use its value at the beginning of each window. Employment and participation are measured relative to the native-born working-age population; unemployment is measured relative to its labor force. Outcomes and exposure are expressed in percentage points. Standard errors are clustered at the province level. * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$.

Appendix Table A5 examines a different way of allowing for differential provincial trajectories: interacting predetermined 1999 characteristics of each province with year effects, so that provinces with a similar initial composition may share a common, possibly non-linear, path. Adding the 1999 construction share of native employment leaves the baseline estimates essentially unchanged. Adding the 1999 native-born education shares instead moves the employment-rate estimate from -0.16 to -0.31 , significant at the 1% level, and raises the unemployment estimate to 0.69; the participation estimate falls to 0.19 and remains significant. Including both sets of interactions gives similar results. This change is consistent with provinces with higher predicted immigration having followed more favorable native employment trajectories associated with their initial skill

counterpart, and the OLS employment estimate is more negative and more precise than the IV one. Appendix Table A4 normalizes the foreign-born population by the province's fixed 1999 working-age population instead of the contemporaneous one; signs and significance of the IV estimates are unchanged (among the OLS estimates, the participation coefficient falls from the 1% to the 10% level), although coefficient magnitudes are not directly comparable because the scale of the exposure measure changes.

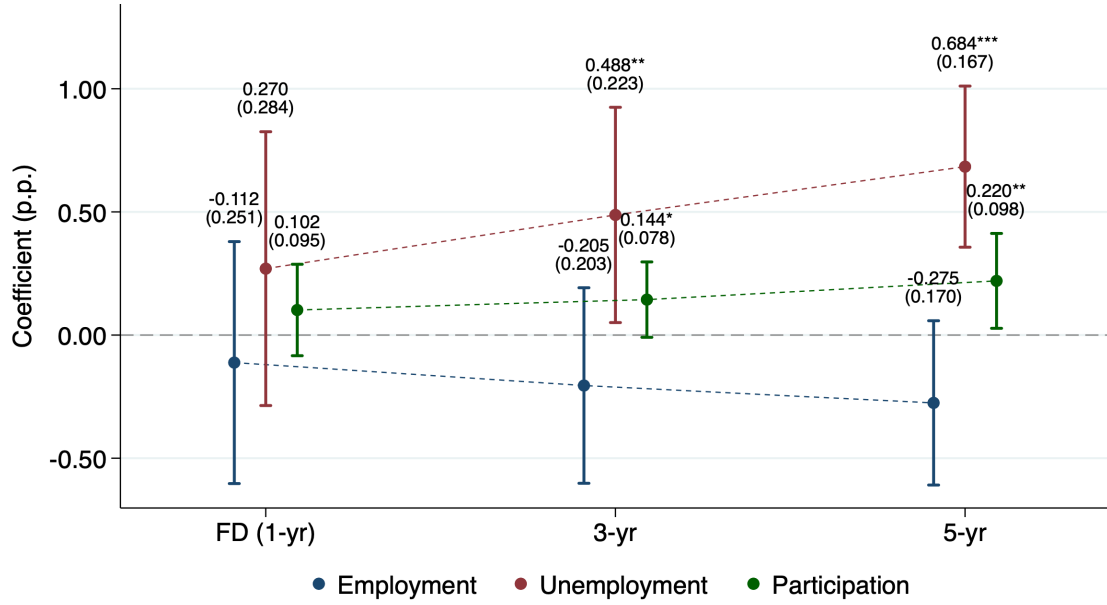


Figure 3. Native-born labor-market outcomes: differenced IV estimates across horizons

Notes: IV estimates relating changes in the foreign-born share to changes in native-born employment, unemployment, and participation rates over one, three, and five years. All specifications include extended demographic controls and province and year fixed effects. Outcomes, the foreign-born share, the instrument, and controls are differenced over the same horizon. Coefficients measure the percentage-point change in an outcome associated with a one-percentage-point change in the foreign-born share over the corresponding interval. Regressions are weighted by the native-born working-age population at the beginning of each window. Standard errors are clustered at the province level. Markers denote point estimates and vertical bars show 95% confidence intervals. Kleibergen–Paap F -statistics are 31.3, 31.4, and 36.7 for the one-, three-, and five-year specifications, respectively. Additional specifications are reported in Table 1.

composition, which province-specific linear trends may not fully capture.

Adjustment horizons We next turn to the differenced specifications of equation (11) in Section 3.3.1, which relate the change in each outcome over one, three, or five years to the change in the foreign-born share over the same interval. We first compare estimates using the full sample available at each horizon and then examine whether the pattern persists with common endpoint years. Figure 3 plots the IV estimates for the three horizons from the specification with extended controls and province and year fixed effects, which corresponds to column (3) of Panel B in Table 1.

The employment-rate coefficients are -0.112 , -0.205 , and -0.275 over one, three, and five years, respectively. Although the point estimates become more negative with the horizon, all three remain statistically indistinguishable from zero. At five years, a ten-percentage-point increase in the foreign-born share over the same interval is associated with an estimated 2.8-percentage-point decline in the native-born employment rate, but the estimate is imprecise.

The unemployment coefficient increases from 0.270 over one year to 0.488 over three years and 0.684 over five years. The latter two estimates are significant at the 5% and 1% levels, respectively, whereas the annual estimate is not statistically significant. Participation follows

a similar pattern: its coefficient increases from 0.102 to 0.144 and 0.220, with the three- and five-year estimates significant at the 10% and 5% levels, respectively.

Columns (1) and (2) of Panel B show how far these findings depend on the control set and on the province fixed effects. Positive unemployment coefficients are statistically significant across all reported three- and five-year specifications. Participation coefficients at these horizons are significant only when province fixed effects are included. The five-year employment coefficient is negative and significant with extended controls but without province fixed effects, and becomes statistically insignificant when these effects are added. The latter change reflects increased uncertainty as well as a small reduction in the coefficient’s magnitude.

The employment, unemployment, and participation estimates thus all grow in absolute magnitude with the length of the differencing window when each horizon uses its full available sample. Meer and West (2016) document a similar pattern for the employment effects of state minimum wages in the United States: their long-difference coefficients grow from a small and insignificant estimate over one year to a significant negative estimate over three years, whereas the conventional levels specification with state-specific trends yields an estimate close to zero. As discussed in Section 3.3.1, a gradual response may be partly missed by short windows and partly absorbed by linear trends, so that short differences with trend controls can understate an effect that longer windows reveal. In our full-sample estimates, with province fixed effects throughout, the five-year coefficients are between two and three times the one-year coefficients in absolute magnitude for all three outcomes.

As a robustness check, Appendix Table A6 restricts all horizons to common endpoint years, 2004–2025. This produces a flatter horizon pattern: unemployment coefficients still increase, participation is significant only over five years, and employment coefficients remain imprecise and are no longer monotonic. This restriction equalizes endpoint years rather than the periods covered by the windows, so we retain the full available samples as our main specification and interpret the comparison as evidence of sensitivity to the estimation period.⁶

4.2 Employment decomposition

Table 2 reports the employment decomposition defined in Section 3.4. Total, native-born, and foreign-born employment are each expressed relative to total provincial employment in 1999. Panel A includes province and year fixed effects and province-specific linear trends. Panels B to D add 1999 baseline characteristics of each province interacted with year effects: the construction share of native employment, the native-born education shares, or both. By construction, the native- and foreign-born coefficients sum to the total-employment coefficient in each panel; Table 3 reports the corresponding first stages.

The foreign-born employment component is positive and precisely estimated in all panels, with IV coefficients between 0.85 and 1.02. This largely reflects the mechanical link between the foreign-born population and foreign-born employment, although the coefficient is not one by construction – outcome and exposure have different denominators, and foreign-born employment

⁶The full samples begin in 2000 for one-year differences, 2002 for three-year differences, and 2004 for five-year differences; a five-year change ending in 2004 still reaches back to 1999.

also depends on the group’s employment rate – and should not be read as jobs per immigrant. The informative components are the native-born and total-employment responses.

In Panel A, the IV native-born coefficient is -0.207 , with a standard error of 0.537 . The estimate is imprecise: it is compatible with no displacement as well as with a decline in native-born employment of the same order of magnitude as the foreign-born gain. The total-employment coefficient, 0.807 (SE 0.701), is correspondingly imprecise. Adding the 1999 construction share interacted with year effects (Panel B) changes little. Adding the 1999 education shares (Panel C) changes the picture: the native-born coefficient becomes -0.755 (SE 0.267), significant at the 1% level, and the total-employment coefficient falls to 0.090 (SE 0.298). A similar result obtains when both sets of interactions are included (Panel D), where the native-born estimate is -0.738 (SE 0.276), significant at the 5% level, so the education result survives the construction adjustment. The OLS native-born estimates are negative and significant in all four panels and close to the IV estimates in Panels C and D.⁷ Unlike the employment rate in Table 1, this component also reflects changes in the size of the native-born working-age population, so that part of the negative response could operate through reduced native in-migration or increased out-migration.

The education interactions move the decomposition in the same direction as the employment rate in Appendix Table A5, but far more strongly: the native-born coefficient more than triples in absolute magnitude, whereas the employment-rate coefficient approximately doubles. This difference is intuitive. Rates are bounded, which limits how far the trajectories of different provinces can diverge. The change is again consistent with provinces with higher predicted immigration having followed more favorable native employment trajectories associated with their initial skill composition. Province-specific linear trends may not fully absorb such trajectories over a period that spans a boom, a deep recession, and a recovery. We therefore regard Panels C and D as the more credible specifications because they allow for these potentially non-linear trajectories, while noting that the first-stage F -statistic falls from 29.6 in Panel A to 23.6 in Panel D.

Overall, the native-born estimate is negative in every specification. The expansion of foreign-born employment is only partly reflected in total employment, and less so once differential trajectories by initial education composition are allowed for. More generally, this decomposition allocates the estimated employment response between population groups; it does not identify individual job creation or displacement mechanisms.

4.3 Sectoral composition of native-born employment

Immigration may change the sectoral composition of native-born employment even where its effect on the aggregate employment rate is small or imprecisely estimated. We therefore examine the share of native-born employment in each of five broad sectors.

Table 4 reports separate sectoral IV regressions with shares expressed in percentage points

⁷With the contemporaneous extended demographic controls of Table 1, the IV native-born coefficient is -0.665 (SE 0.237). We do not use this specification for the decomposition because contemporaneous native-born composition may itself respond to native mobility, which is part of the response the native-born component is meant to capture (Section 3.4).

Table 2. Employment decomposition relative to 1999 total employment: alternative specifications

	Total		Native-born		Foreign-born	
	OLS	IV	OLS	IV	OLS	IV
<i>Panel A: Baseline (province and year fixed effects, province trends)</i>						
Foreign-born share	0.677** (0.296)	0.807 (0.701)	-0.503* (0.263)	-0.207 (0.537)	1.180*** (0.117)	1.013*** (0.219)
KP F -statistic		29.59		29.59		29.59
<i>Panel B: Panel A + 1999 construction share $\times$ year effects</i>						
Foreign-born share	0.683** (0.289)	0.865 (0.725)	-0.492* (0.253)	-0.154 (0.578)	1.175*** (0.115)	1.019*** (0.211)
KP F -statistic		27.15		27.15		27.15
<i>Panel C: Panel A + 1999 education composition $\times$ year effects</i>						
Foreign-born share	0.520** (0.205)	0.090 (0.298)	-0.595*** (0.200)	-0.755*** (0.267)	1.114*** (0.118)	0.846*** (0.190)
KP F -statistic		24.89		24.89		24.89
<i>Panel D: Panel A + 1999 construction share and education composition $\times$ year effects</i>						
Foreign-born share	0.530** (0.217)	0.122 (0.327)	-0.584*** (0.209)	-0.738** (0.276)	1.114*** (0.117)	0.860*** (0.190)
KP F -statistic		23.62		23.62		23.62
Observations (each panel)	1,350	1,350	1,350	1,350	1,350	1,350

Notes: The dependent variables are total, native-born, and foreign-born employment in province p and year t , divided by total provincial employment in 1999 and multiplied by 100: $100 \times \text{Emp}_{pt}^G / \text{Emp}_{p,1999}$ for $G \in \{\text{Total}, N, F\}$. The explanatory variable is the contemporaneous foreign-born share of the population, in percentage points, instrumented with the level shift-share instrument (also in percentage points). A coefficient of 1 therefore means that a one percentage point increase in the foreign-born share changes employment by one percentage point of total provincial employment in 1999. All panels include province and year fixed effects and province-specific linear trends, and no contemporaneous demographic controls. Panels B to D add 1999 baseline characteristics of each province interacted with year dummies: the share of native employment in construction (B), the native-born education shares (C), or both (D). All panels use the same sample and are weighted by the native-born working-age population. The native- and foreign-born coefficients sum to the total-employment coefficient, up to rounding. Standard errors are clustered at the province level. * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$.

Table 3. First stage for the employment decomposition: alternative specifications

	(A) Baseline	(B) + constr. $\times$ year	(C) + educ. $\times$ year	(D) + both $\times$ year
Instrument	0.367*** (0.068)	0.366*** (0.070)	0.424*** (0.085)	0.439*** (0.090)
KP F -statistic	29.59	27.15	24.89	23.62
Observations	1,350	1,350	1,350	1,350

Notes: First-stage regressions of the foreign-born share on the level shift-share instrument, with the fixed effects, trends and 1999 characteristics $\times$ year controls of the corresponding panel of Table 2. Weighted by the native-born working-age population; standard errors clustered at the province level. * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$.

(Panel A) and in logs (Panel B). Both columns include province and year fixed effects and extended demographic controls. Column 2 additionally includes province-specific linear trends, and thus corresponds to the baseline specification of Table 1. The corresponding first-stage

Kleibergen–Paap F -statistics are 24.8 without trends and 38.6 with trends.

The patterns are most robust for construction. A one-percentage-point increase in the foreign-born share is associated with a decline in construction’s share of native-born employment of 0.257 percentage points without provincial trends and 0.286 percentage points with them. Both estimates are significant at the 1% level. The corresponding log coefficients imply approximate declines of 3.6% and 2.4% in the sectoral share and are also significant at the 1% level.

Appendix Table A7 additionally controls for the 1999 construction share of native-born employment interacted with year effects, allowing provinces with different initial construction exposure to follow different trajectories. The construction result remains significant at the 1% level in both percentage-point and log specifications, with and without province-specific trends. The percentage-point coefficients become slightly more negative, at -0.281 without trends and -0.324 with trends, indicating that the finding is robust to this additional control for differential exposure to the construction cycle.

The manufacturing coefficients are negative in all four specifications. They are statistically insignificant when shares enter in percentage points but significant when shares enter in logs. The evidence for manufacturing is therefore consistent in sign but more dependent on functional form than the evidence for construction.

Agriculture and fishing is the clearest case of the functional-form sensitivity discussed in Section 3.5: its coefficients are positive and statistically significant in the percentage-point specification (Panel A), whereas the log coefficient is negative and significant without trends and positive but insignificant with trends. The agricultural share declines strongly over the sample period from widely different provincial baselines. Where it is already very low it cannot fall much further in absolute terms, so parallel trends are unlikely to hold in percentage points, but this does not establish that the log specification is the better approximation.

Trade and hospitality show no statistically significant coefficients in the reported specifications. Other services have a positive coefficient significant at the 10% level only in the percentage-point specification with provincial trends. This estimate becomes smaller and statistically insignificant when baseline construction exposure is interacted with year effects (Appendix Table A7). Because the percentage-point coefficients sum to zero across sectors, the decline in construction’s share must be offset elsewhere, but the results do not consistently identify which sectors account for the offsetting increase.

As a benchmark, Appendix Table A8 reports the sectoral estimates previously published in the Banco de España’s 2025 Annual Report, while Appendix Table A9 revisits the corresponding specification and shows how the estimates change when applying the population weights used in this paper. Appendix Table A10 considers progressively richer stacked specifications, introducing province-by-sector fixed effects, sector-by-year fixed effects, and differential trends by initial sectoral composition. Unlike the separate sectoral regressions in Table 4, these stacked specifications impose common coefficients on the demographic controls across sectors. They also contain five endogenous regressors, so their joint first-stage statistics are not directly comparable to the single-regressor statistics in Table 4. We therefore use the separate equations as our main sectoral specification, since they allow all coefficients, fixed effects, and province-specific trends

Table 4. Foreign-born share and the sectoral composition of native-born employment

	(1) No province trends	(2) Province trends
<i>Panel A: Sectoral shares in percentage points</i>		
Agriculture and fishing	0.324*** (0.086)	0.306*** (0.076)
Manufacturing	-0.060 (0.111)	-0.101 (0.075)
Construction	-0.257*** (0.077)	-0.286*** (0.093)
Trade and hospitality	0.030 (0.076)	-0.080 (0.082)
Other services	-0.036 (0.132)	0.161* (0.094)
KP <i>F</i> -statistic	24.81	38.56
Observations	1,350	1,350
<i>Panel B: Log sectoral shares</i>		
Agriculture and fishing	-0.035*** (0.012)	0.019 (0.014)
Manufacturing	-0.024*** (0.007)	-0.014** (0.007)
Construction	-0.036*** (0.010)	-0.024*** (0.007)
Trade and hospitality	0.000 (0.004)	-0.004 (0.003)
Other services	-0.007 (0.005)	0.001 (0.003)
KP <i>F</i> -statistic	24.81	38.56
Observations	1,350	1,350

Notes: Each coefficient comes from a separate regression of a sector's share of native-born employment (Panel A) or its log (Panel B) on the foreign-born share, instrumented with the shift-share instrument. Both columns include province and year fixed effects and extended demographic controls. Column 2 additionally includes province-specific linear trends. Regressions are weighted by the native-born working-age population, and standard errors are clustered at the province level. Panel A coefficients give the percentage-point change in a sectoral share associated with a one-percentage-point increase in the foreign-born share. Panel B coefficients are semi-elasticities per one-percentage-point increase in the foreign-born share. * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$.

to differ across sectors. Across these alternatives, the decline in construction's share remains the most robust finding, whereas the sectors accounting for the offsetting increase vary with the specification and weighting.

4.4 Heterogeneity

Appendix Tables A11 and A12 report IV estimates by gender and education, comparing levels with province-specific trends and five-year differences with province and year fixed effects, the two column-(3) specifications of Table 1.

Among native-born women, the unemployment coefficient is positive and significant at the 1%

level in both levels and five-year differences, with estimates of 0.864 and 0.898. The corresponding coefficients for men are smaller, at 0.329 and 0.502, and only the five-year estimate is significant (5% level). We do not test whether the male and female coefficients differ, and given their standard errors the gap should not be overstated. Participation estimates are positive and of similar size for both groups, between 0.17 and 0.25; they are significant for men in both specifications (5% level) and for women only in levels (10% level). Employment-rate estimates are negative but statistically insignificant for both men and women. The aggregate levels participation coefficient in Table 1 (0.240) exceeds both the male (0.166) and female (0.201) estimates, which likely reflects the different control sets in the aggregate and subgroup regressions and suggests some sensitivity of this estimate to the demographic controls.

By education, the unemployment coefficients are positive for all three groups and smaller for higher education, from 0.739 for low to 0.270 for high education in levels and from 0.628 to 0.361 over five years; all are significant at the 1% level except the levels estimate for high education (10%). We do not test whether these differences across groups are statistically significant. The employment-rate coefficient is significant only for the medium-education group in levels, but over five years it is negative and significant for all three groups: -0.392 for low, -0.563 for medium, and -0.221 for high education. Participation estimates are mostly insignificant: the exceptions are a positive coefficient for low education in levels and a negative one, significant at the 10% level, for medium education over five years.

The significant five-year employment estimates within education groups contrast with the imprecise aggregate estimate. The subgroup regressions are not an exact decomposition of the aggregate regression (Section 3.6). The aggregate five-year unemployment (0.684) and participation (0.220) coefficients lie above all three education-group estimates, but these comparisons alone do not identify the source of the differences. Differences in control sets and in the weighting implicit in 2SLS may contribute. In addition, education is measured contemporaneously and may itself respond to immigration, so the within-group estimates may partly reflect compositional change.

5 Conclusion

By 2025, foreign-born individuals accounted for nearly one-quarter of Spain’s working-age population. This paper examines labor-market adjustment during this immigration expansion, combining provincial data from the Spanish Labour Force Survey and the Population Register for 1999–2025. We use a shift–share instrument based on historical settlement patterns and the national evolution of foreign-born populations by country of birth, and compare estimates across specifications and adjustment horizons.

The findings highlight several margins of adjustment. In the differenced specifications with province and year fixed effects, unemployment and participation point estimates are larger over longer horizons when each horizon uses its full available sample. This pattern is consistent with gradual adjustment, although the horizon comparisons do not identify a dynamic response to a common immigration shock. Employment-rate estimates are sensitive to how provincial trajectories are modeled.

The employment decomposition yields a negative native-born component in every specification. With province fixed effects and linear trends alone it is imprecise and compatible with no displacement as well as with substantial displacement; once provinces with different initial education composition are allowed to follow different trajectories, it becomes significantly negative, while the total-employment point estimate is much smaller than the foreign-born component but remains imprecisely estimated.

The sectoral evidence points most consistently to a decline in construction's share of native-born employment. Manufacturing coefficients are also negative across the separately estimated sectoral specifications, although their statistical significance depends on the functional form. The sectors accounting for the offsetting increases vary across specifications.

The subgroup estimates provide a more differentiated picture. Unemployment point estimates are larger for women than men and decline with education. At the five-year horizon, employment coefficients are negative and statistically significant within all three education groups, despite the imprecision of the aggregate estimate.

An important limitation concerns the two immigration episodes covered by the sample. The instrument has substantial predictive power in the pooled specifications, but is considerably less informative when 2015–2025 is examined separately, both in levels and in annual differences. The pooled findings should therefore not be interpreted as separately identifying the effects of the recent immigration wave. More generally, comparisons across controls, trends, and horizons characterize the sensitivity of the estimates but do not eliminate the identification concerns inherent in historical-settlement instruments.

Taken together, the results show the value of examining employment composition, participation, and unemployment alongside aggregate native-born employment rates. The declining construction share is among the most consistent findings, while conclusions about native-born employment depend on the specification, horizon, and population group considered. More broadly, the horizon pattern suggests that spatial studies relying on annual variation and local trend controls may understate responses that build up over several years, and the sensitivity to baseline composition shows that estimates for native-born employment levels can be biased when local labor markets with different skill composition follow different growth paths. The direction of that bias depends on where immigrants settle; in Spain, where provinces with higher predicted immigration appear to have been on more favorable trajectories, it works toward understating negative effects. Longitudinal worker-level data would help distinguish individual employment and sectoral transitions from changes in workforce composition and clarify which workers bear the costs of adjustment.

References

- Altonji, J. G. and D. Card (1991). “The Effects of Immigration on the Labor Market Outcomes of Less-skilled Natives”. In: *Immigration, Trade, and the Labor Market*. Ed. by J. M. Abowd and R. B. Freeman. Chicago: University of Chicago Press, pp. 201–234.
- Amior, M. and J. Stuhler (2024). *Immigration, Monopsony and the Distribution of Firm Pay*. CEP Discussion Paper 1971. Centre for Economic Performance, LSE.
- Amuedo-Dorantes, C. and S. De la Rica (2011). “Complements or Substitutes? Task Specialization by Gender and Nativity in Spain”. In: *Labour Economics* 18.5, pp. 697–707.
- Borjas, G. J. (1999). “The Economic Analysis of Immigration”. In: *Handbook of Labor Economics*. Ed. by O. C. Ashenfelter and D. Card. Vol. 3A. Amsterdam: Elsevier. Chap. 28, pp. 1697–1760.
- (2003). “The Labor Demand Curve Is Downward Sloping: Reexamining the Impact of Immigration on the Labor Market”. In: *Quarterly Journal of Economics* 118.4, pp. 1335–1374.
- Borusyak, K., P. Hull, and X. Jaravel (2025). “A Practical Guide to Shift-Share Instruments”. In: *Journal of Economic Perspectives* 39.1, pp. 181–204. DOI: 10.1257/jep.20231370.
- Card, D. (2001). “Immigrant Inflows, Native Outflows, and the Local Labor Market Impacts of Higher Immigration”. In: *Journal of Labor Economics* 19.1, pp. 22–64.
- Carrasco, R., J. F. Jimeno, and A. C. Ortega (2008). “The Effect of Immigration on the Labor Market Performance of Native-Born Workers: Some Evidence for Spain”. In: *Journal of Population Economics* 21.3, pp. 627–648. DOI: 10.1007/s00148-006-0112-9.
- Castellanos, M. A. (2024). “Immigration, Parenthood and Child Penalties”. Job market paper, Universidad Carlos III de Madrid.
- Chaves-Bosch, G. (2025). “Creating Opportunity: The Impact of Immigration on Native Entrepreneurship”. In: *Working Paper*. Queen Mary University of London.
- Dustmann, C., U. Schönberg, and J. Stuhler (2016). “The Impact of Immigration: Why Do Studies Reach Such Different Results?” In: *Journal of Economic Perspectives* 30.4, pp. 31–56. DOI: 10.1257/jep.30.4.31.
- (2017). “Labor Supply Shocks, Native Wages, and the Adjustment of Local Employment”. In: *The Quarterly Journal of Economics* 132.1, pp. 435–483. DOI: 10.1093/qje/qjw033.
- Farré, L., L. González, and F. Ortega (2011). “Immigration, Family Responsibilities and the Labor Supply of Skilled Native Women”. In: *The B.E. Journal of Economic Analysis & Policy* 11.1, Article 34. DOI: 10.2202/1935-1682.2875.
- González, L. and F. Ortega (2011). “How Do Very Open Economies Absorb Large Immigration Inflows? Evidence from Spanish Regions”. In: *Labour Economics* 18.1, pp. 57–70.
- González-Pardo, B. (2025). “The Productivity Effects of Large Immigration Waves: Evidence from Spanish Regions”. In: *Working Paper*. Universidad de Alicante.
- Grossman, J. B. (1982). “The Substitutability of Natives and Immigrants in Production”. In: *The Review of Economics and Statistics* 64.4, pp. 596–603.

- Jaeger, D. A., J. Ruist, and J. Stuhler (2018). *Shift-Share Instruments and the Impact of Immigration*. NBER Working Paper 24285. National Bureau of Economic Research. DOI: 10.3386/w24285.
- Meer, J. and J. West (2016). “Effects of the Minimum Wage on Employment Dynamics”. In: *Journal of Human Resources* 51.2, pp. 500–522. DOI: 10.3368/jhr.51.2.0414-6298R1.
- Ottaviano, G. I. P. and G. Peri (2012). “Rethinking the Effect of Immigration on Wages”. In: *Journal of the European Economic Association* 10.1, pp. 152–197.
- Peri, G. and C. Sparber (2009). “Task Specialization, Immigration, and Wages”. In: *American Economic Journal: Applied Economics* 1.3, pp. 135–169.
- Solon, G., S. J. Haider, and J. M. Wooldridge (2015). “What Are We Weighting For?” In: *Journal of Human Resources* 50.2, pp. 301–316. DOI: 10.3368/jhr.50.2.301.

A Appendix

A.1 Additional descriptive evidence

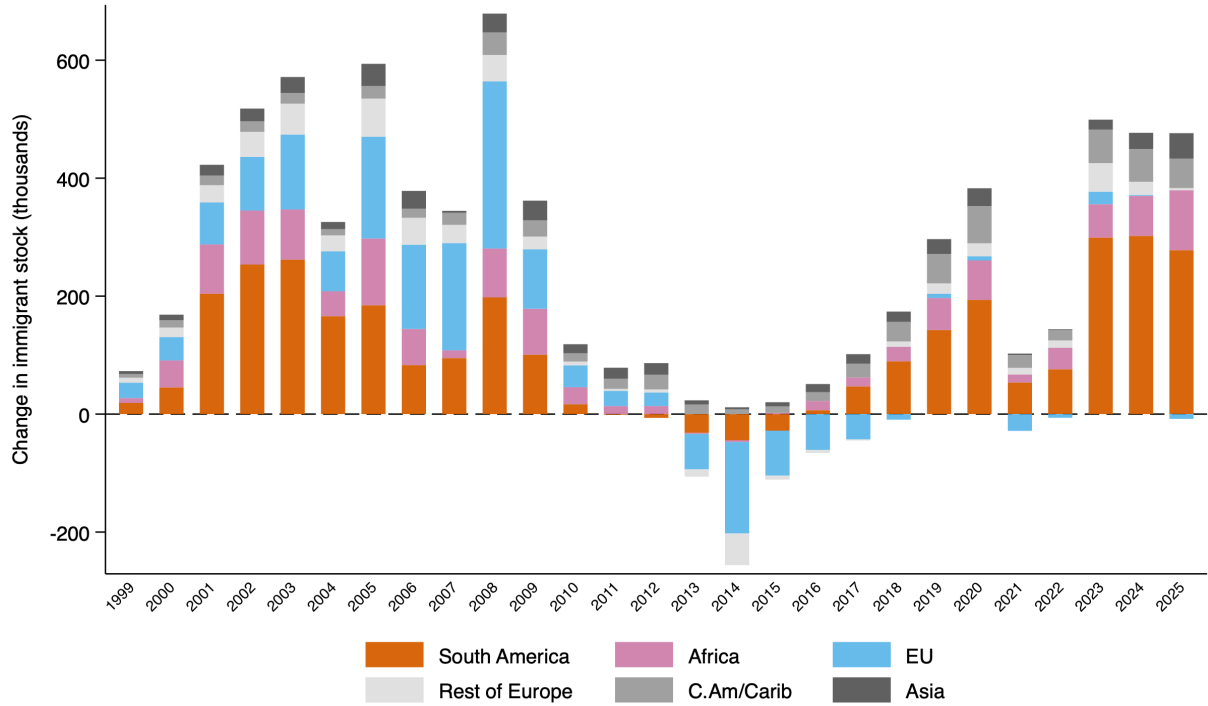
Table A1. Summary statistics

	Mean	SD	Min	Max	N
<i>Panel A: Foreign-born exposure</i>					
Foreign-born share	15.8	8.6	0.6	34.7	1,350
Shift-share instrument	18.8	13.4	0.6	65.6	1,350
<i>Panel B: Native-born labor-market outcomes</i>					
Employment rate	62.3	7.2	40.2	76.9	1,350
Unemployment rate	14.2	7.1	3.0	42.7	1,350
Participation rate	72.5	4.7	55.4	81.4	1,350
<i>Panel C: Demographic controls (native working-age population)</i>					
Share female	49.3	0.9	44.8	51.4	1,350
Share aged 25–34	20.1	3.8	9.8	30.9	1,350
Share aged 35–44	22.8	2.0	15.5	30.6	1,350
Share aged 45–54	22.4	2.8	14.1	30.5	1,350
Share aged 55–64	19.3	3.4	11.2	32.9	1,350
Share medium education	32.6	5.6	16.9	48.5	1,350
Share high education	21.8	7.3	8.3	40.3	1,350

Notes: Sample is the province-year panel used in the main regressions, 1999–2025, excluding Ceuta and Melilla (50 provinces $\times$ 27 years = 1,350 observations). Statistics are weighted by the native-born working-age population of each province-year cell, matching the weighting used in the paper’s baseline specifications. The foreign-born share and the shift-share instrument are constructed as in equations (3) and (1), respectively; native-born labor-market rates are defined as in Section 3. Demographic shares are computed among the native-born working-age (16–64) population. All shares and rates are expressed as percentages. The shift-share instrument is scaled by 100, as in the regressions.

Source: Spanish Labour Force Survey (EPA) and Population Register (Padrón), 1999–2025.

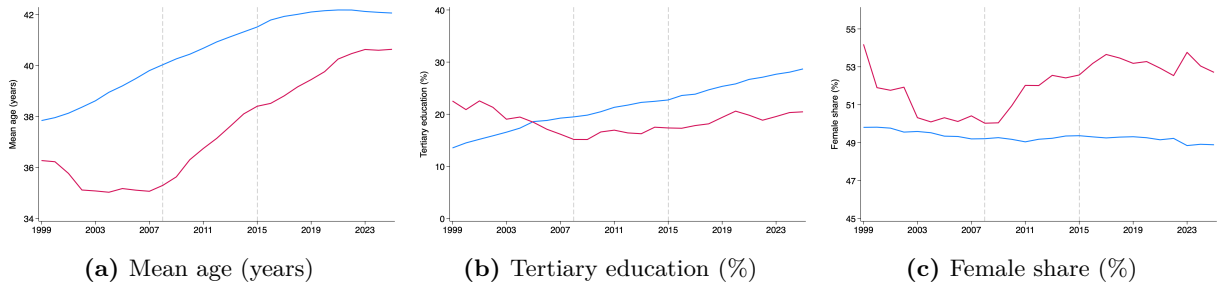
Figure A1. Origin composition of annual changes in the foreign-born population



Source: Municipal Population Register (*Padrón*).

Notes: The figure shows annual changes in the national foreign-born population aged 16–64, in thousands, by region of origin. Positive contributions are stacked above zero and negative contributions below zero. The six components sum to the total annual change in the foreign-born population. These are net changes in population stocks, not gross immigration flows. Regions aggregate the country-of-birth groups used to construct the shift-share instrument. Colors correspond to those used in Figure 2.

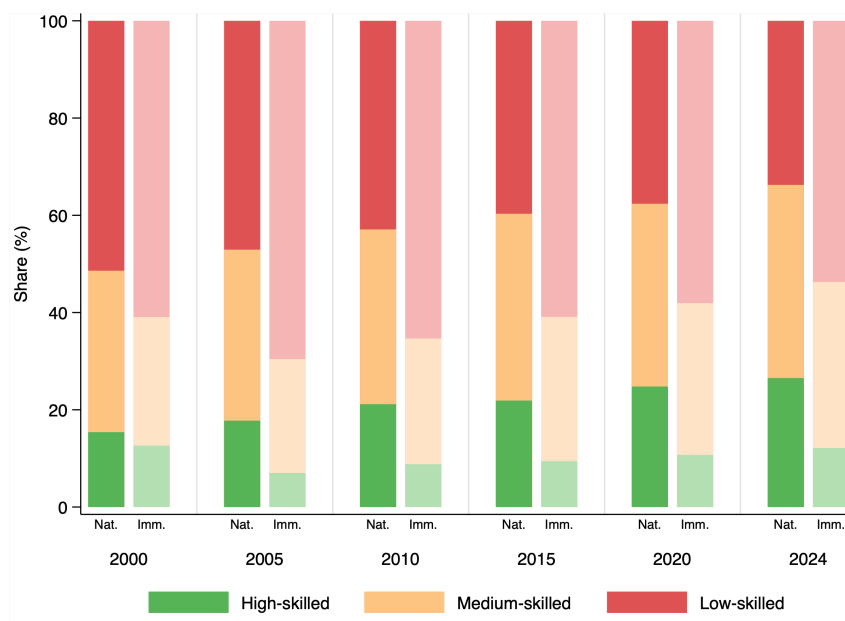
Figure A2. Characteristics of the foreign-born and native-born working-age population, 1999–2025



Notes: Working-age population (16–64), excluding Ceuta and Melilla. Blue lines denote the native-born population; red lines denote the foreign-born (immigrant) population. Dashed vertical lines indicate 2008 (financial crisis) and 2015 (start of the second immigration wave).

Source: Spanish Labour Force Survey (EPA).

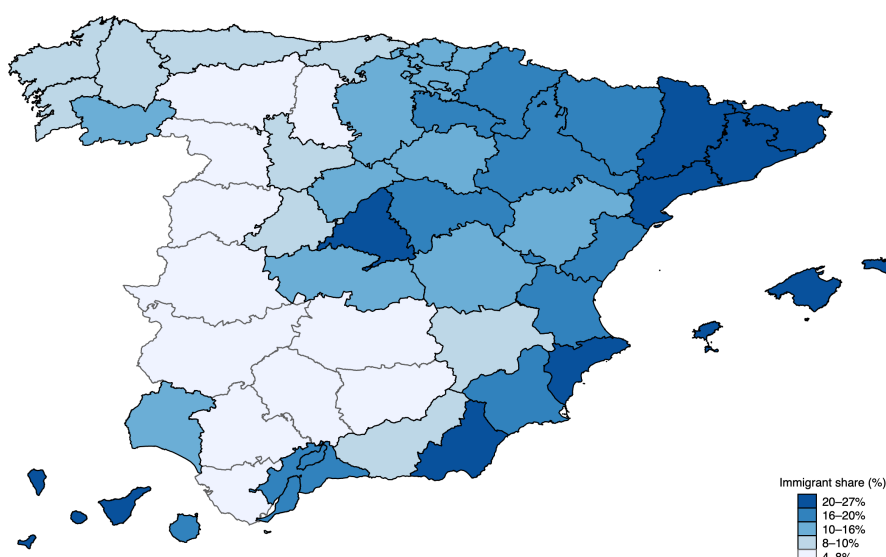
Figure A3. Skill composition of employment, native-born vs. foreign-born workers, 2000–2024



Notes: The figure shows the skill composition of employed native-born and foreign-born workers in selected years (2000, 2005, 2010, 2015, 2020, and 2024). Skill groups are based on Social Security contribution groups (*grupos de cotización*): high-skilled corresponds to groups 1–3, medium-skilled to groups 4–7, and low-skilled to groups 8–10. Shares are computed separately for natives and immigrants within each year and sum to 100. Provinces are restricted to the same sample as the main analysis, excluding Ceuta and Melilla.

Source: Continuous Sample of Working Lives (*Muestra Continua de Vidas Laborales*, MCVL).

Figure A4. Provincial foreign-born share, 2023



Notes: The map shows the foreign-born share of the working-age (16–64) population by province in 2023, excluding Ceuta and Melilla. Provinces are grouped into five bins by quantile of the foreign-born share. The Canary Islands are repositioned for legibility and not shown to scale.

Source: Municipal Population Register (*Padrón*).

A.2 Identification and specification checks

Table A2 reports first-stage diagnostics for the two immigration episodes. The statistics are substantially smaller during 2015–2025 than during the first episode, both in levels and in annual differences. With province-specific trends and only eleven years of data, the 1999 settlement shares have essentially no predictive power for 2015–2025 changes, which is why the Kleibergen–Paap statistic for the levels specification with trends rounds to 0.00 in the second period.

Table A2. First-stage strength by immigration period

	First wave	Second wave
<i>Panel A: Levels</i>		
Estimation period	1999–2008	2015–2025
Province and year fixed effects	43.86	2.46
Province and year fixed effects + province trends	14.89	0.00
Observations	500	550
<i>Panel B: One-year differences</i>		
Estimation period	2000–2008	2015–2025
Year fixed effects	45.98	4.20
Province and year fixed effects	73.21	4.71
Observations	450	550

Notes: Entries in the specification rows are Kleibergen–Paap F -statistics from first-stage regressions estimated separately for the two immigration periods. Panel A instruments the foreign-born share with the level shift–share instrument based on 1999 settlement patterns. Panel B instruments its annual change with the first difference of that instrument. Both panels include demographic controls and use population weights. Standard errors are clustered at the province level. Province fixed effects in Panel B allow provinces to have different average annual changes and absorb the constants obtained by differencing province-specific linear trends in levels. Periods refer to the outcome year t ; the 2015 annual difference uses the 2014 observation as its starting point. The value 0.00 is rounded to two decimal places.

Table A3 reports OLS and IV levels estimates with province-specific trends and alternative demographic controls.

Table A3. Foreign-born share and native-born labor-market outcomes, 1999–2025

	Native-born labor-market outcomes					
	Employment		Unemployment		Participation	
	OLS	IV	OLS	IV	OLS	IV
<i>Panel A: Basic controls</i>						
Foreign-born share	-0.185*	-0.047	0.496***	0.403*	0.155**	0.250***
	(0.092)	(0.200)	(0.098)	(0.209)	(0.059)	(0.086)
First stage: $\hat{\pi} = 0.383^{***}$ (0.063), KP $F = 37.0$						
<i>Panel B: Extended controls</i>						
Foreign-born share	-0.222***	-0.158	0.555***	0.550***	0.159***	0.240***
	(0.072)	(0.146)	(0.086)	(0.164)	(0.058)	(0.078)
First stage: $\hat{\pi} = 0.387^{***}$ (0.062), KP $F = 38.6$						
Observations	1,350	1,350	1,350	1,350	1,350	1,350

Notes: The dependent variables are employment, unemployment, and labor-force participation rates among native-born individuals aged 16–64. Employment and participation are measured relative to the native-born working-age population; unemployment is measured relative to the native-born labor force. Outcomes and the foreign-born share are expressed in percentage points. Each coefficient therefore gives the percentage-point change in the outcome associated with a one-percentage-point increase in the foreign-born share. Both panels include province and year fixed effects and province-specific linear trends. Panel A controls for age, education, and gender shares. Panel B adds gender-by-age and gender-by-education interactions. Regressions are weighted by the native-born working-age population. Standard errors are clustered at the province level. $\hat{\pi}$ is the coefficient on the shift–share instrument in the corresponding first stage, common across outcomes within each panel. * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$.

Table A4 examines an alternative normalization of immigration exposure.

Table A4. Native-born labor-market outcomes with a fixed 1999-population denominator

	Employment		Unemployment		Participation	
	OLS	IV	OLS	IV	OLS	IV
Foreign-born share	-0.175*** (0.045)	-0.104 (0.095)	0.372*** (0.059)	0.364*** (0.107)	0.081* (0.045)	0.159*** (0.056)
KP F -statistic		35.07		35.07		35.07
Observations	1,350	1,350	1,350	1,350	1,350	1,350

Notes: The specification corresponds to Panel B of Table A3, replacing the contemporaneously normalized foreign-born share with $100 \times FB_{pt}^{16-64} / Pop_{p,1999}^{16-64}$. The instrument remains the level shift-share instrument. Employment and participation are measured relative to the native-born working-age population; unemployment is measured relative to the native-born labor force. All outcomes are expressed in percentage points. Regressions include extended demographic controls, province and year fixed effects, and province-specific linear trends. They are weighted by the native-born working-age population. Standard errors are clustered at the province level. * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$.

Table A5 interacts predetermined 1999 characteristics of each province with year effects.

Table A5. Native-born labor-market outcomes: 1999 characteristics $\times$ year controls

	Employment		Unemployment		Participation	
	OLS	IV	OLS	IV	OLS	IV
<i>Panel A: Baseline specification</i>						
Foreign-born share	−0.222*** (0.072)	−0.158 (0.146)	0.555*** (0.086)	0.550*** (0.164)	0.159*** (0.058)	0.240*** (0.078)
KP F		38.6		38.6		38.6
<i>Panel B: Panel A + 1999 construction share $\times$ year</i>						
Foreign-born share	−0.231*** (0.066)	−0.168 (0.147)	0.554*** (0.080)	0.507*** (0.180)	0.142** (0.056)	0.184*** (0.068)
KP F		32.7		32.7		32.7
<i>Panel C: Panel A + 1999 education composition $\times$ year</i>						
Foreign-born share	−0.259*** (0.064)	−0.307*** (0.097)	0.573*** (0.079)	0.691*** (0.135)	0.128** (0.055)	0.191** (0.086)
KP F		21.4		21.4		21.4
<i>Panel D: Panel A + 1999 construction share and education composition $\times$ year</i>						
Foreign-born share	−0.265*** (0.064)	−0.331*** (0.094)	0.573*** (0.078)	0.668*** (0.135)	0.119** (0.057)	0.142* (0.081)
KP F		19.5		19.5		19.5
Observations (each panel)	1,350	1,350	1,350	1,350	1,350	1,350

Notes: Native-born employment, unemployment, and participation rates, as in Table 1. Panel A is the baseline levels specification of that table (column 3 of Panel A): province and year fixed effects, province-specific linear trends, extended demographic controls, and the foreign-born share instrumented with the level shift–share instrument. Panels B to D add 1999 baseline characteristics of each province interacted with year dummies: the share of native employment in construction (B), the native-born education shares (C), or both (D). Employment and participation are measured relative to the native-born working-age population; unemployment relative to its labor force. Units and weights are as in Table 1. Standard errors are clustered at the province level. * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$.

Table A6 uses common endpoint years, 2004–2025.

Table A6. Native-born labor-market outcomes at different horizons: common endpoint years

	Employment			Unemployment			Participation		
	1-yr	3-yr	5-yr	1-yr	3-yr	5-yr	1-yr	3-yr	5-yr
<i>Panel A: Second stage (IV)</i>									
Δ_k Foreign-born share	−0.212 (0.350)	−0.318 (0.236)	−0.275 (0.170)	0.438 (0.310)	0.644*** (0.228)	0.684*** (0.167)	0.143 (0.201)	0.151 (0.123)	0.220** (0.098)
KP F	20.7	24.5	36.7	20.7	24.5	36.7	20.7	24.5	36.7

<i>Panel B: First stage (identical for all outcomes)</i>			
	1-yr	3-yr	5-yr
Δ_k Instrument	0.253*** (0.056)	0.288*** (0.058)	0.354*** (0.058)
F -statistic	20.7	24.5	36.6
Observations	1,100	1,100	1,100

Notes: One-, three-, and five-year differences ($k = 1, 3, 5$) in native-born employment, unemployment, and participation rates, regressed on the change in the foreign-born share over the same horizon, instrumented with the change in the shift-share instrument. Specification as in column (3) of Panel B of Table 1 and Figure 3: extended demographic controls (in k -year changes), province and year fixed effects, weights equal to the native-born working-age population at the beginning of each window. Unlike that table and figure, which use the full sample available for each horizon, all horizons here use the same endpoint years, 2004–2025 (the first year for which the five-year difference is available), so differences across horizons do not reflect different endpoint-year coverage; the five-year estimates are therefore identical. Panel B reports the first stage once, since it is the same for all three outcomes; its F -statistic is virtually identical to the KP F in Panel A. Units as in Table 1. Standard errors are clustered at the province level. * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$.

A.3 Additional sectoral estimates

Table A7 assesses the sensitivity of the sectoral estimates to allowing year-specific effects of initial construction exposure.

Table A7. Foreign-born share and the sectoral composition of native-born employment: 1999 construction share $\times$ year controls

	No province trends		Province trends	
	(1) No	(2) Yes	(3) No	(4) Yes
<i>Panel A: Sectoral shares in percentage points</i>				
Agriculture and fishing	0.324*** (0.086)	0.362*** (0.103)	0.306*** (0.076)	0.416*** (0.102)
Manufacturing	-0.060 (0.111)	-0.086 (0.094)	-0.101 (0.075)	-0.109 (0.076)
Construction	-0.257*** (0.077)	-0.281*** (0.073)	-0.286*** (0.093)	-0.324*** (0.087)
Trade and hospitality	0.030 (0.076)	0.024 (0.066)	-0.080 (0.082)	-0.080 (0.083)
Other services	-0.036 (0.132)	-0.019 (0.113)	0.161* (0.094)	0.096 (0.100)
KP <i>F</i> -statistic	24.81	33.26	38.56	32.70
Observations	1,350	1,350	1,350	1,350
<i>Panel B: Log sectoral shares</i>				
Agriculture and fishing	-0.035*** (0.012)	-0.034*** (0.010)	0.019 (0.014)	0.027* (0.015)
Manufacturing	-0.024*** (0.007)	-0.022*** (0.007)	-0.014** (0.007)	-0.013* (0.007)
Construction	-0.036*** (0.010)	-0.029*** (0.008)	-0.024*** (0.007)	-0.026*** (0.007)
Trade and hospitality	0.000 (0.004)	-0.000 (0.003)	-0.004 (0.003)	-0.003 (0.003)
Other services	-0.007 (0.005)	-0.006 (0.004)	0.001 (0.003)	-0.001 (0.003)
KP <i>F</i> -statistic	24.81	33.26	38.56	32.70
Observations	1,350	1,350	1,350	1,350

Notes: Columns (1) and (3) are columns 1 and 2 of Table 4. Columns (2) and (4) add the 1999 share of native employment in construction, interacted with year dummies, to columns (1) and (3). Each coefficient comes from a separate regression of a sector's share of native-born employment (Panel A) or its log (Panel B) on the foreign-born share, instrumented with the shift-share instrument. All columns include province and year fixed effects and extended demographic controls; columns (3) and (4) additionally include province-specific linear trends. Regressions are weighted by the native-born working-age population, and standard errors are clustered at the province level. Panel A coefficients give the percentage-point change in a sectoral share associated with a one-percentage-point increase in the foreign-born share. Panel B coefficients are semi-elasticities per one-percentage-point increase in the foreign-born share. * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$.

Table A8 records the estimates published in Figure 1.28.b of Banco de España’s 2025 Annual Report, rounded to four decimals. The first row concerns the native-born employment rate; the remaining rows concern sectoral shares of native-born employment.

Table A8. Native-born employment-rate and sectoral estimates

	Estimate	95% confidence interval	
		Lower	Upper
Native-born employment rate	-0.3710	-1.5999	0.8579
<i>Shares of native-born employment</i>			
Agriculture	-0.3714	-0.4929	-0.2498
Manufacturing	-0.1712	-0.3320	-0.0104
Construction	-0.2637	-0.3449	-0.1826
Trade and hospitality	0.2482	0.0697	0.4267
Other services	0.5581	0.3013	0.8149

Notes: All estimates are unweighted province-year IV regressions for 1999–2025 with basic demographic controls and standard errors clustered by province, in percentage points per one-percentage-point increase in the foreign-born share. The first row is the native-born employment rate (“Total” in the published figure), estimated in levels with province and year fixed effects and province-specific trends. The sectoral shares use separate (non-interacted) province, sector, and year fixed effects and no trends; see Table A9.

Table A9 reports the corresponding sectoral specification with separate province, sector, and year fixed effects, without and with population weights. Its unweighted column reproduces the published sectoral point estimates up to rounding.

Table A9. Sectoral composition under the Annual Report specification: unweighted vs. weighted

	(1) Unweighted	(2) Weighted
Agriculture and fishing	-0.371*** (0.062)	-0.304*** (0.043)
Manufacturing	-0.171** (0.082)	-0.240*** (0.076)
Construction	-0.264*** (0.041)	-0.299*** (0.053)
Trade and hospitality	0.248*** (0.091)	0.013 (0.143)
Other services	0.558*** (0.131)	0.830*** (0.252)
KP F -statistic	5.27	4.50
Observations	6,750	6,750
R-squared	0.134	0.198

Notes: Stacked sectoral IV with separate (additive) province, sector, and year fixed effects, basic demographic controls, and the foreign-born share interacted with sector indicators and instrumented. Column (1) is unweighted; column (2) adds population weights, matching the convention used elsewhere in this paper. Standard errors clustered by province in parentheses. This specification (additive fixed effects, no province $\times$ sector interaction) differs from the alternative stacked specification in Table A10 and is reported here for comparability with the published Annual Report figure. * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

The specification in Table A10 contains five endogenous regressors. Its joint first-stage statistic is not directly comparable to the single-regressor statistics reported in the main text.

Table A10. Sectoral composition of native-born employment: stacked specification

	(1)	(2)	(3)
<i>Panel A: Sectoral shares in levels</i>			
Agriculture and fishing	-0.129*** (0.039)	0.319*** (0.082)	0.157** (0.070)
Manufacturing	-0.246*** (0.035)	-0.173** (0.082)	-0.197*** (0.056)
Construction	-0.443*** (0.033)	-0.126* (0.070)	-0.141** (0.070)
Trade and hospitality	-0.042** (0.021)	-0.101 (0.086)	-0.074 (0.115)
Other services	0.860*** (0.060)	0.082 (0.114)	0.255*** (0.072)
<i>Panel B: Log sectoral shares</i>			
Agriculture and fishing	-0.060*** (0.006)	-0.059*** (0.013)	-0.056*** (0.013)
Manufacturing	-0.025*** (0.005)	-0.026*** (0.005)	-0.026*** (0.005)
Construction	-0.038*** (0.005)	-0.019** (0.007)	-0.019** (0.007)
Trade and hospitality	-0.005 (0.005)	-0.004 (0.004)	-0.005 (0.004)
Other services	0.015*** (0.006)	-0.004 (0.005)	-0.007 (0.006)
Province-by-sector fixed effects	Yes	Yes	Yes
Year fixed effects	Yes	No	No
Sector-by-year fixed effects	No	Yes	Yes
Baseline sector shares $\times$ trend	No	No	Yes
KP F -statistic	4.50	4.43	4.59
Observations	6,750	6,750	6,750

Notes: Each column stacks five sectors, 50 provinces, and 27 years. The foreign-born share is interacted with sector indicators, and each interaction is instrumented with the corresponding interaction between the shift-share instrument and the sector indicator. All specifications include basic demographic controls and population weights. Column (3) additionally interacts the province's 1999 sectoral shares with a linear trend. In Panel A, both sectoral shares and immigration exposure enter as fractions; coefficients also give the percentage-point change in a sectoral share per one-percentage-point increase in the foreign-born share. Panel B coefficients are semi-elasticities per one-percentage-point increase in the foreign-born share. Standard errors are clustered at the province level. The reported Kleibergen–Paap statistics refer to the system of five endogenous sector interactions. Assessing instrument strength in this system requires diagnostics appropriate to multiple endogenous regressors; a direct comparison with the single-regressor statistics from the separate sectoral equations is not sufficient. * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$.

A.4 Heterogeneity

Tables A11 and A12 report the group-specific IV estimates discussed in Section 4.4.

Table A11. Native-born labor-market outcomes by gender: levels and five-year differences

	Employment		Unemployment		Participation	
	Men	Women	Men	Women	Men	Women
<i>Panel A: Levels IV estimates</i>						
Foreign-born share	-0.141 (0.244)	-0.265 (0.159)	0.329 (0.249)	0.864*** (0.184)	0.166** (0.071)	0.201* (0.115)
KP F	36.67	38.07	36.67	38.07	36.67	38.07
Observations	1,350	1,350	1,350	1,350	1,350	1,350
<i>Panel B: Five-year-difference IV estimates</i>						
Δ_5 Foreign-born share	-0.261 (0.240)	-0.245 (0.252)	0.502** (0.244)	0.898*** (0.202)	0.187** (0.073)	0.245 (0.185)
KP F	33.29	32.46	33.29	32.46	33.29	32.46
Observations	1,100	1,100	1,100	1,100	1,100	1,100

Notes: IV estimates for native-born men and women aged 16–64. Employment and participation rates use the corresponding group’s working-age population as their denominator; unemployment rates use its labor force. Immigration exposure is the foreign-born share of the total provincial working-age population, common to both groups. Outcomes and exposure are expressed in percentage points. Panel A includes province and year fixed effects and province-specific linear trends. Panel B uses five-year differences with province and year fixed effects. The foreign-born share is instrumented with the level shift–share instrument in Panel A and its five-year difference in Panel B. Specifications include gender-specific demographic controls. Levels are weighted by the corresponding native-born working-age population; differences use its value at the beginning of the five-year window. Standard errors are clustered at the province level. * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$.

Table A12. Native-born labor-market outcomes by education: levels and five-year differences

	Employment			Unemployment			Participation		
	Low	Medium	High	Low	Medium	High	Low	Medium	High
<i>Panel A: Levels IV estimates</i>									
Foreign-born share	-0.197 (0.175)	-0.409** (0.165)	-0.105 (0.188)	0.739*** (0.214)	0.601*** (0.152)	0.270* (0.155)	0.366*** (0.099)	-0.008 (0.127)	0.112 (0.094)
KP F	40.16	30.32	34.87	40.16	30.32	34.87	40.16	30.32	34.87
Observations	1,350	1,350	1,350	1,350	1,350	1,350	1,350	1,350	1,350
<i>Panel B: Five-year-difference IV estimates</i>									
Δ_5 Foreign-born share	-0.392*** (0.142)	-0.563*** (0.126)	-0.221** (0.107)	0.628*** (0.159)	0.560*** (0.086)	0.361*** (0.073)	0.016 (0.085)	-0.213* (0.116)	0.069 (0.085)
KP F	37.23	28.66	29.66	37.23	28.66	29.66	37.23	28.66	29.66
Observations	1,100	1,100	1,100	1,100	1,100	1,100	1,100	1,100	1,100

Notes: IV estimates for native-born individuals aged 16–64 by educational attainment. Low education corresponds to ISCED 0–2, medium education to ISCED 3–4, and high education to ISCED 5–8. Employment and participation rates use the corresponding group’s working-age population as their denominator; unemployment rates use its labor force. Immigration exposure is the foreign-born share of the total provincial working-age population, common to all groups. Outcomes and exposure are expressed in percentage points. Panel A includes province and year fixed effects and province-specific linear trends. Panel B uses five-year differences with province and year fixed effects. The foreign-born share is instrumented with the level shift-share instrument in Panel A and its five-year difference in Panel B. Specifications include age and gender controls. Levels are weighted by the native-born working-age population of each education group; differences use its value at the beginning of the five-year window. Standard errors are clustered at the province level. * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$.