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Eurasian Economic Review

Provided in Cooperation with:
Springer Nature

Suggested Citation: Erol, Isil; Unal, Umut (2022) : Employment effects of immigration to Germany in the period of migration policy liberalization, 2005–2018, Eurasian Economic Review, ISSN 2147-429X, Springer International Publishing, Cham, Vol. 12, Iss. 3, pp. 531-565, https://doi.org/10.1007/s40822-022-00199-4

Eurasian Economic Review (2022) 12:531–565
https://doi.org/10.1007/s40822-022-00199-4

ORIGINAL PAPER

Employment effects of immigration to Germany in the period of migration policy liberalization, 2005–2018

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Received: 12 June 2021 / Revised: 12 August 2021 / Accepted: 9 September 2021 /
Published online: 22 February 2022

Abstract

Germany has undergone a significant migration policy shift since the early 2000s. This paper examines the total employment effect of immigration during the liberalization of migration policies from 2005 to 2018 using a regional approach. A set of methods, along with static and dynamic macro-econometric models, were applied on a balanced panel formed by a unique and first-hand-collected data for 156 statistical regions based on the definition of the German Federal Employment Agency. We find suggestive evidence that there has been a significant adverse impact of new immigrants on the overall employment rate, and this negative effect is substantially larger than those reported in previous studies on the employment effect of immigration in the German labor market. In a further step, we divide our sample into two subsamples to capture the employment effect of the massive humanitarian inflows that began in 2015. Our results indicate that, in addition to the new immigrants' lower rate of integration into the local labor markets, a sudden influx of asylum seekers may possibly lead to a substantial fall in the employment rates, because asylum seekers are not immediately allowed to work in the country.

Keywords Immigration · Labor market · Employment · Labor economics · Asylum seekers

JEL Classification J00 · J15 · J61

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1 Introduction

Migration is a reality in today's world and particularly in the European Union (EU). According to the latest available data on international migration stock provided by the United Nations, Department of Economic and Social Affairs (UN-DESA, 2019), as of mid-2019, 50.1 million residents of the 443.8 million (11.3%) people living in the EU-27—excluding Cyprus, for which data is unavailable—were non-nationals. Among the EU countries, there has been widespread discussion concerning the eastern enlargement of the EU, and the further introduction of transitional measures to restrict labor migration from the new Member States. Besides, citizens also concern that immigrants may compete in the labor market for the same jobs and reduce job opportunities for native workers (Glitz, 2012). Immigration and integration issues across Europe have been politically sensitive, especially in the aftermath of increased refugee flows over the last few years. As the Standard Eurobarometer (2017) survey results reveal, immigration is considered the EU's most important problem, according to about 40% of survey respondents.[1]

A considerable amount of research, including theoretical and empirical studies, has examined the labor market impacts of immigration for many countries since the early 1980s. As highlighted by Okkerse (2008), the effect of immigration on labor market remains uncertain as the theoretical models are susceptible to changes in the model's assumptions. Okkerse (2008) emphasizes that if the immigrants are perfect substitutes, they may lower the price of factors, whereas if they are complements, they may raise them.[2] The lack of consensus between the theoretical models revealed the need for quantitative work. However, empirical studies do not provide a common picture, either. This is mainly due to the lack of readily available, robust, and timely data. Empirical studies use different datasets for different countries over different periods with different empirical specifications and sometimes end up with conflicting results. The majority of studies in the related literature are focused on the United States (US), whereas the number of studies for the individual European countries is limited.[3]

Germany has been the most immigrant-receiving EU-27 Member State in 2019 as the country had 13.1 million international migrant stock according to the UN-DESA dataset. The share of immigrants in the total population increased from 7.5% in 1990 to 15.7% in 2019. There are several reasons for such an increase.

[1] https://ec.europa.eu/commfrontoffice/publicopinion/index.cfm/ResultDoc/download/DocumentKy/82537.

[2] For a detailed discussion, please see Johnson (1980), Chiswick (1982), Greenwood and McDowell (1994), Borjas (1999), Rivera-Batiz (1983) and Kuhn and Wooton (1991).

[3] See Altonji and Card (1991), Butcher and Card (1991), Butcher (1998), Camarota (1998), Easton (2001), Zorlu and Hartog (2005), La Londe and Topel (1991), Card (2001), and Card (2004), Fairlie and Meyer (2003), Winegarden and Khor (1991, 1993) for the US studies. The European studies include but not limited to Dolado et al. (1996) for Spain; Gavosto et al. (1999) for Italy; Hofer and Huber (2003), Winter-Ebmer and Zweimuller (1996, 2000) for Austria; Zorlu and Hartog (2005) for the UK, Norway and the Netherlands; Pischke and Velling (1997), Borjas (2003), Bonin (2005), Steinhardt (2011), Dustmann et al. (2005), Longhi et al., (2008, 2010), Glitz (2012), Braun and Mahmoud (2014) for Germany.

First, as indicated by Glitz (2012), the Berlin Wall fall allowed ethnic Germans living in Eastern Europe and the former Soviet Union to migrate to Germany. Second, there has been an accelerated liberalization of migration policies in Germany starting from 2000. Additionally, the 2004 EU Qualifications Directive and 2011 EU Asylum Procedures Directive obligated Germany to gradually abolish many of the restrictions introduced by the 1992 asylum agreement. Third, Germany has been leading macroeconomic indicators to most of the EU countries and exhibits persistently low unemployment rates, which can be considered a significant pull factor for immigrants. It is, therefore, timely to investigate the impact of immigration on the German labor market, which has been untouched for the last years.

This paper uses a regional approach and employs unique and first-hand-collected data for 156 agency districts or statistical regions across ten States of Germany during the period of 2005–2018. The statistical districts are defined according to the Federal Employment Agency's (Bundesagentur für Arbeit) classification of "territorial structure." Compared to "political-administrative structure," such a dataset kindly allows us to construct more unified labor market regions in line with our goal of securing economically meaningful regional units without sacrificing too much of the interregional variation in the data.[4] According to the Federal Employment Agency data, the share of foreign-born population or immigrants[5] in the working-age population climbed from 10.63% in 2009 to 15.64% in 2018, increased by 5.01 percentage points in the last decade. The highest increase in immigrants' share was observed in 2015 when the massive humanitarian inflows began.

Labor markets are linked to each other so that natives may respond to the entry of immigrants in a market by moving their capital and labor to another area (Borjas, 1999). If such a movement occurs, it will bias the estimates of immigration effects towards zero because labor market effect will be diffused throughout the economy. Therefore, following the leading studies in the literature, the present study assumes that the internal economy of Germany is far from the Heckscher-Ohlin world of factor price equalization theorem. As highlighted by Friedberg and Hunt (1995), cross-sectional studies using regional variation and aggregate time-series studies resulted in very similar estimates of the labor market impact of immigration for the case of the US. Furthermore, Decressin and Fatas (1995) showed that labor market adjustments in Europe and the US take a similar amount of time. Such an outcome makes us more confident in exploiting regional variation in the German case as well.

One of the main difficulties of the regional approach is the immigrants' self-selection endogeneity problem; immigrants may choose to locate in areas that have a strongly growing labor market, thus creating an endogeneity problem in the estimation. Following the leading studies in the literature (e.g. Altonji & Card, 1991; Bartel, 1989; Pischke & Velling, 1997), we argue that the location

[4] Unlike the political-administrative structure, which is based on sixteen federal states, the dataset based on the classification of Federal Employment Agency provides us also with the data on the unemployment rate of foreign-born population. This is another reason we prefer to use this data.

[5] In this paper, we use foreigners and immigrants interchangeably to define the share foreign-born population in total population.

decisions are based on the past labor market conditions, which can be easily controlled by using lagged immigrants share as an instrument variable. Furthermore, in line with the previous research of Noja et al. (2018) and McKenzie and Rapoport (2006), a possible exogenous labor supply shock in a district (or the divergence in demand for labor) is proxied through the unemployment rate of the foreign-born population and the percentage of unemployed foreigners in the working-age population as the instrument variables.

The contributions of the present paper are twofold. First, we investigate the total employment effect of immigration in the rapid liberalization of migration policies in Germany from 2005 to 2018. We ask the question, 'To what extent has immigration policy shift from the early-2000s to the mid-2010s affected the local labor markets through the changes in employment rates across the country?' Second, we divide the sample period into two subsamples in order to explore the possible impacts of massive humanitarian inflows that began in 2015 on the overall employment rate.

German states have experienced substantial and sustained differences in employment growth rates during the last fourteen years. While East Germany has consistently grown at rates entirely above the national average, states across the southern and western parts of the country have experienced employment growth rates that are considerably below the national average.

Our full sample regression results show that there has been a significant negative effect of new immigrants on overall employment rates between 2005 and 2018, and this negative impact is substantially larger than those reported in previous studies using data from the 1980s to the early-2000s for Germany. Apart from the displacement effect induced by newcomers, the new immigrants' lower rate of integration into the local labor markets may possibly explain the adverse effects of new migrants on the total employment rate. The German vocational training system hinders immigrants, especially those whose Facharbeiter certificate is not accepted, from moving upwards to qualified work. Our finding is in line with Pischke and Velling's study (1997), which stated that labor force participation rates for immigrants might have been lower than for those foreigners already in the country, leading to falling employment rates overall. The results also indicate that the recent migrants in the 2015–2018 period had a lower labor force participation rate (or higher unemployment rate) in comparison to those in the period 2005–2014, which led to a substantially falling employment rate overall. The arrival of significant numbers of asylum seekers along with the possible displacement effect of immigrants and their lower rate of integration into local labor markets resulted in a substantial reduction in the total employment rate.

The next section outlines a review of studies on the labor market effects of immigration to Germany. In Sect. 3, we provide a brief discussion on the country's immigration policy shift since 2000. We then describe the data and methodology in Sect. 4. Section 5 provides empirical results and discusses the findings, with conclusions following in the final section.

2 Review of studies on the labor market effects of immigration in Germany

Studies of the economic impact of immigration typically focus on immigration on the host country's labor market, particularly on wages and employment of natives, and Table 1 provides a summary of the extant literature. Academic research on the employment effects of immigration in Germany has started with the empirical study of DeNew and Zimmermann (1994), in which the national labor market was divided into industry labor markets, and the white- and blue-collar workers were differentiated as a proxy for different skill groups. The study results revealed that a 1% increase in the share of foreign workers leads to a 4.1% decline in native wages—by far the strongest effect that can be found in the literature for Germany (Steinhardt, 2011). Almost all empirical studies analyzing the labor market outcomes of immigration for Germany up until 2005 were based on the regional (or spatial correlation) approach with the estimation of reduced-form equations, which relate wages and/or employment variables to the immigrant share in specific geographic areas or industries (see, among others, Card, 1990; Dustmann et al., 2005; Hunt, 1992). A well-known application of the regional approach is Pischke and Velling's (1997) study that analyzed the impact of immigration on native labor market outcomes by using aggregate variables at the level of 328 counties and 167 larger statistical regions in Germany and showed that there is little evidence for displacement effects due to immigration. Overall, empirical research within the regional correlation framework has found only minimal wage and employment effects (see Longhi et al., 2008, 2010).[6]

The spatial correlation approach has been criticized because estimation results are spurious if immigrants are not randomly distributed across local labor markets or if other factors standardize/homogenize labor market conditions across geographical areas (Borjas, 2003). The workers with the same level of education participate in a national labor market but are imperfect substitutes if they are endowed with different work experience levels. Under this assumption, there may be sufficient exogenous variation to identify an effect on competing natives if the immigrant supply shock is not evenly balanced across schooling and experience cells and over time (Bonin, 2005). Therefore, several subsequent studies followed the skill group approach of Borjas (2003), which has used national-level variation in immigrant shares across education/experience or different skill groups based on the assumption that the allocation of immigrants across skill groups is exogenous.

In the related literature for Germany, Bonin (2005) is the first study to analyze the impact of immigrant supply shocks on the labor market opportunities of native German workers via skill groups (Table 1). According to the author, if skill groups

[6] Longhi et al. (2008) found that following a 1% increase in the number of immigrants, the 'consensus estimate' of the decline in native-born employment is only 0.24%. This result is based on the simple average of the 165 estimates from six European and three US studies. Longhi et al. (2010) showed that the predicted average percentage change in employment of natives following a 1 percentage point increase in the share of foreign born is 0.03% for the native born in the US, and −0.84% in countries other than the US. Therefore, the employment effects are very small.

Table 1 Review of literature on the labor market effects of immigration in Germany

Study	Time period	Data set	Data sources	Measure/definition of immigration	Dependent variables	Methodology
Pischke and Velling (1997)	1985 and 1989	County-level and regional data: 328 counties and 167 larger regions	County-level data from the Federal Statistical Office and Official Employment News—aggregate variables at the level of county and statistical regions	1.Change in the share of foreigners (number of foreign citizens divided by working-age population (15–64 years old) between 1985 and 1989 2. One-year gross/net flows of immigrants to an area	Employment rate for all residents and for Germans and unemployment rate (employment covered by social security)	Spatial approach: mean-reversion model (unemployment rate); First-differenced OLS; Differenced OLS with IV variables
Bonin (2005)	1975–1997	Native and migrant workers with 28 different skill groups West Germany	Regional File of the IAB Employment Subsample (IABS-R)[a]	Immigrant is identified on the basis of non-German citizenship (it is not possible to distinguish foreign citizens who are born abroad from those born in Germany)	The mean of log wages and the unemployment rate of the native population in a skill group (educational attainment, experience and periods)	Skill group approach Borjas (2003)[b]: linear fixed effects regression

Table 1 (continued)

Study	Time period	Data set	Data sources	Measure/definition of immigration	Dependent variables	Methodology
D'Amuri et al. (2010)	1987–2001	The workers and trainees liable to make social security contributions West Germany	1. German Institute for Employment Research (IAB)[c] administrative data-set for total private sector (social-security-paying) employment 2.German Socio-Economic Panel (GSOEP)—a panel of individuals started in 1984, then in 1994/1995, 1998 and 2000	IABS—foreign-born plus those living in East Germany in 1989 GSOEP—foreign-nationals plus those who report having started to work in East Germany	Yearly change in total (immigrant) employment in an education-experience cell as a percentage of the initial employment in the cell	Labor market equilibrium model: the estimates of elasticities of substitution between natives and foreigners across education/experience cells
Steinhardt (2011)	1975–2001	National-level data using qualifications and occupations as classification criteria	German Institute for Employment Research (IAB) Employment Sample[d]	The status of an immigrant in the IABS is exclusively defined by nationality	The average log wage in skill groups/occupational groups—(educational attainment and labor market experience)	Skill group approach: least squares dummy variable regression
Brücker and Jahn (2011)	1980–2004	Individual-level data for employed and unemployed in West Germany	Institute for Employment Research employment sample (IABS)—2% random sample of all employees registered with social security system	Foreigners are defined by nationality or on the basis of citizenship. Ethnic Germans are also defined as foreigners	Log wage—the elasticity between the wage and unemployment that differs across education-experience groups	Labor market general equilibrium framework: wage-setting curve approach in different segments of labor market

Table 1 (continued)

Study	Time period	Data set	Data sources	Measure/definition of immigration	Dependent variables	Methodology
Glitz (2012)	1996–2001	Employer level data for 460,000 individuals in West Germany (excluding Berlin)	1. The Federal Administration Department annual (Bundesverwaltungsamt) publication on the ethnic German immigrants—regional inflows from the Federal admission centers in West Germany's 10 federal states. 2. IAB Employment Subsample, 1975–2001	*Ethnic German immigrants* who used to live in central and eastern Europe and the former Soviet Union	The annual change in the skill-specific employment/labor force rate and the average log daily wage of full-time employees—five occupation groups 112 labor market regions	Forced migration: spatial correlation approach OLS regression; OLS regressions with instrumental variable (IV) strategy
Bauer et al. (2013)	1939–1950 1950–1960 1960–1971	Individual-level data in post-war West Germany	German 1971 supplementary micro-census (national-wide survey) for forced migrants and native West Germans	*Displaced* individuals with an official displacement identification card—Germans who migrated from the Soviet occupation zone to West Germany are excluded from the analysis	The log of income, house ownership, labor force status, or sectoral affiliation for first- and second-generation forced/displaced migrants	Forced migration: OLS regressions

Table 1 (continued)

Study	Time period	Data set	Data sources	Measure/definition of immigration	Dependent variables	Methodology
Braun and Mahmoud (2014)	1950 and 1953	Individual/worker level data in post-war West Germany. The total and expellee labor force in 88 state-occupation cells[e]	The German Population and Occupation Census of 13 September 1950—education data from the census of May 1970	*Expellees* are defined as German nationals or ethnic Germans who on 1 September 1939 lived in the former German territories east to the Oder-Neisse line, the Saarland or abroad, but only if their mother tongue was German	The native employment rate and total employment (natives and expellees) rate	Forced migration: spatial correlation between labor market outcomes across local labor markets (states) or state-skill/occupation cells OLS regressions with instrumental variable (IV) strategy
The present study	2005–2018	Statistical district-level data: 156 agency districts (Agenturbezirke) from 10 states	The Federal Employment Agency (Bundesagentur für Arbeit) data	Immigrant is identified on the basis of non-German citizenship	Total employment rate: the proportion of employees aged 15 to under 65 who are subject to social security contributions	Spatial (correlation) approach: first-differenced OLS; Differenced OLS with IV variables; pooled-OLS and panel data regressions; the GMM estimations

[a]IABS-R is based on 1% random sample drawn from West German Social Security records, to which all employers are obliged to report at least once a year. The IABS-R is generally representative for both the native and the foreign population in Germany

[b]Borjas (2003) introduces the skill group approach, which identifies the impact of immigration at the national level on the basis of qualification groups

[c]The self-employed, civil servants and students enrolled in higher education are not included in the German Institute for Employment Research (IAB) dataset

[d]The data are a 2% random sample of all employees covered by social security. The data set has more than double the size of the data used by Bonin (2005)

[e]Eleven states times eight one-digit occupations

are defined both in terms of educational attainment and the level of labor market experience, a significant variation in the share of migrants/foreigners in the labor force can be observed across different skill groups. The results of the study showed that penetration of migrants or foreigners into education-experience cells did not have a substantial negative impact on the earnings and employment opportunities of native men in Germany—i.e., a 10% rise of the immigrant share in the labor force at most reduces natives' wages by less than 1% and does not increase unemployment. Although adverse effects of immigration appear somewhat sharper for less qualified and older workers, empirical evidence provided by Bonin (2005) revealed that the adverse wage effects of immigration are much smaller in the German labor market than in the US labor market (Borjas, 2003). Steinhardt (2011) employed the skill group approach in the 1975–2001 period and found that immigration had no adverse negative effect on the wages of native employees in Germany. This result was in line with previous findings for Germany that indicate that immigration has no negative or even a slightly positive impact on native labor market outcomes. In an extended analysis, the study highlighted that immigrants and natives within one education-work experience cell are no longer close substitutes in Germany as they are likely to work in different occupational segments and claimed that the classical skill group approach based on formal education is likely to yield biased estimates. The estimations based on the occupational level approach produced significant adverse effects for native wages—i.e., a 10% supply increase through immigration reduces wages of natives by 1.34% within an occupational group. Furthermore, within basic service occupations (such as cleaning or retail trade), a 10% increase in the labor force through immigration reduces relative wages by approximately 4%.

Some studies, such as D'Amuri et al. (2010) and Brücker and Jahn (2011), have adopted the general equilibrium model to estimate the impact of immigration on labor market outcomes. D'Amuri et al. (2010) found that the substantial immigration of the 1990s (or new immigration) harmed the employment of old immigrants and no impact on the employment of natives, suggesting closer competition between new and old immigrants than between immigrants and natives. The estimated wage effects of new immigrants are, on average, minimal for natives and small and negative for old immigrants. Brücker and Jahn (2011) argued that immigration could either increase or decrease unemployment, depending on the education and experience structure of the immigrant influx and the wage flexibility in different segments of the labor market. The authors concluded that as the foreign labor supply shift has mainly affected the high-skilled labor market segment, a 4% increase of the labor force through immigration has not increased either aggregate or foreign unemployment. The gains from immigration are unusually large if immigrants are educated and if they are young, as the flexibility of the labor market is high in these segments.

Mass displacement of ethnic Germans has recently gained the attention of economists. With the fall of the Berlin Wall, ethnic Germans living in Eastern Europe and the former Soviet Union were allowed to migrate to Germany. As a result, 2.8 million individuals had migrated to Germany within 15 years (Glitz, 2012). Several researchers have studied the effect of the forced migration on native employment by using different terms such as ethnic German immigrants (Glitz, 2012), displaced individuals (Bauer et al., 2013), and expellees (Braun & Mahmoud, 2014). Glitz

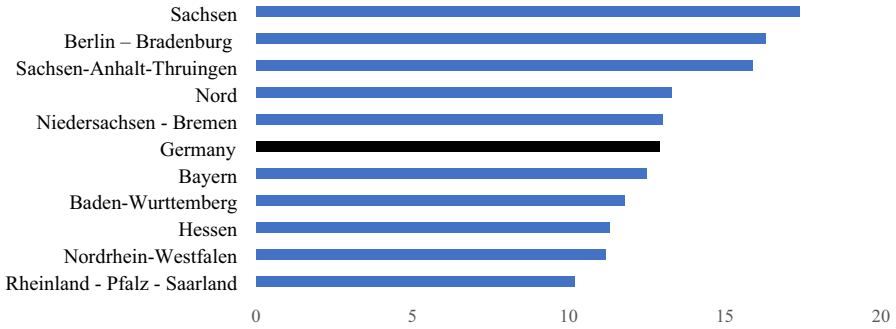
(2012) examined the labor market effects of the large-scale immigration of ethnic Germans as a natural experiment, based on the spatial correlation approach. The author defined skill groups based on broad occupational groups and then estimated how changes in these relative supplies affect the skill-specific employment rates and wages of the resident population (effects on men and women as well as native Germans and foreign nationals) in a locality. Glitz (2012) found that for every ten immigrant workers finding employment, about 3.1 resident workers lose their jobs (when the instrumental variable estimates based on the exogenous ethnic German immigrant inflows) and that there is no systematic evidence of significant detrimental effects on relative wages. These findings are in contrast to earlier research for Germany by Pischke and Velling (1997), Bonin (2005), D'Amuri et al, (2010), and Brücker and Jahn (2011).

Bauer et al. (2013) analyzed the medium and long-run economic integration of the displaced or the first- and second-generation forced migrants in post-war West Germany. They found that displaced Germans are, on average, still economically disadvantaged relative to their native peers as the first-generation displaced men have 5.1% lower incomes than native men and displaced women 3.8% lower incomes than native women. Another study by Braun and Mahmoud (2014) has focused on the employment effects of expellee inflows for native West Germans. The study results revealed that a 10-percentage point increase in the share of German expellees in a state-occupation cell is associated with a reduction of the native employment rate in the same cell by 2.6 percentage points. The results also showed that the adverse employment effect of the expellee inflows on the overall employment rate was already much smaller in 1953 than in 1950—i.e., a 10% increase in the share of expellees reduced the overall employment rate by 1.7% in 1953 compared to 3.8% in 1950.

Empirical studies that have focused on the estimates of the effect of immigration on employment or unemployment outcomes of the native-born population are fewer than the estimates of the impact of immigration on wages (Longhi et al., 2008, 2010).

3 Germany's immigration policy shift: 2000 present

It was only 1999 when The Economist depicted Germany as "the sick man of Euro." There have been several reasons behind; however, the most substantial ones among others were low GDP growth rates, inadequate capacity of job creation, high unemployment rates as well as sluggish structural change (Ehmke & Lindner, 2015). Nevertheless, Germany's transformation from "the sick man of Europe" to its European countries' leadership in most of those economic indicators has not taken so long. As of 2019, Germany leads most European countries in GDP growth, possesses outstanding trade surplus occurrence, and exhibits persistently low unemployment rates. Besides, during the financial crisis of 2008–2009, the performance of the German labor market represents an astounding phenomenon by weathering the recession without an increase in the unemployment rate.



Note: The Federal Employment Agency is composed of the head office in Nuremberg, 10 Regional Directorates (Regionaldirektionen), 176 Employment Agencies and approximately 610 branch offices. Moreover, the Federal Employment Agency is an active player in 303 out of 408 job centers which have been jointly established by local employment agencies and individual states and urban and rural districts. The head office is responsible for the strategic, conceptual and contextual framework for the Agency and controls the Regional Directorates. The Regional Directorates are responsible for the success of regional labor market policies and they work closely with l ocal governments to coordinate labor market and structural and economic policies.

Fig. 1 Employment Growth (cumulative change in percentage points) across States of Germany, 2005–2018. Authors' calculations

Over the fourteen years during the period under consideration in this study, German states have experienced substantial and sustained differences in employment growth rates. While some states have barely grown with rates up to 2.7 percentage points below the national average, some other states have consistent growth rates at 3–4.5 percentage points above the national average (Fig. 1). Concerning the regional characteristics, while Easter German states, namely Sachsen-Anhalt-Thüringen, Berlin-Brandenburg, and Sachsen, have consistently grown at rates entirely above the national average, two Northern states (Nord and Niedersachsen-Bremen) have grown at the national average. In contrast, the remaining five states across the southern and western parts of the country have experienced employment growth rates that are considerably below the national average.

Asia and Europe have the most significant shares of the world's international migration stock by having 30.8% and 30.3% shares, respectively, in mid-2019. The 2019 UN-DESA data show that Germany was the most immigrant-receiving European country in 2019 as the country had 13.1 million international migrant stock, which was being followed by the Russian Federation in Eastern Europe (11.6 million), United Kingdom (9.5 million), France (8.3 million), Italy (6.3 million), Spain (6.1 million), Ukraine (4.96 million), Switzerland (2.6 million), Netherlands (2.3 million) and Sweden (2 million).[7]

In order to present some features of the dynamics of employment growth across states in our sample, Fig. 2 depicts the average rate of growth of employment rate

[7] Concerning the immigrant stocks to the size of the receiving country's population, the case is as follows: Germany 15.6%, Russia 7.9%, UK 14.2%, Italy 12.8%, Spain 10.5%, Ukraine 13%, Switzerland 28.9%, Netherlands 13.5% and Sweden 20%.

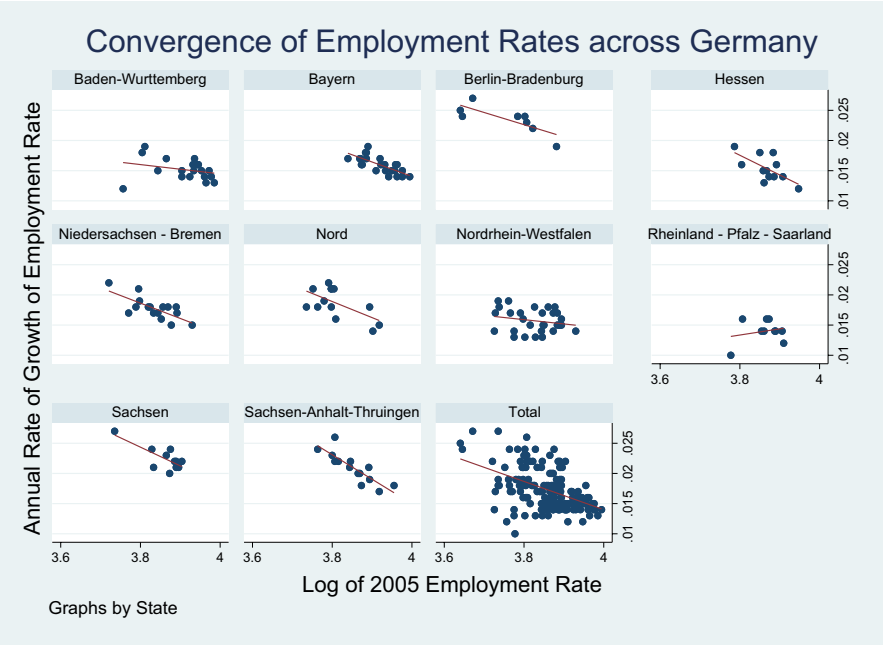


Fig. 2 Convergence of Employment Rates across ten States of Germany, 2005–2018. Authors' calculations

from 2005 to 2018 against their log value in 2005 for the German states. The lines are the regression lines with their specific slope and standard errors obtained by regressing the average rate of growth of employment on the logarithm of employment rate in 1950. The graph "total" represents a combined figure of the state-wise graphs. Overall, for Germany, we have a coefficient of −0.018 with a standard error of 0.003 and an R^2 of 0.76, which indicates that a state initially experiences lower-than-average (higher-than-average) employment rates has a higher (lower) rate of growth of employment during the period under consideration. In other words, states with a higher employment rate had lower employment growth during the period under consideration. This is legitimate for all states except Rhineland-Pfalz-Saarland, which indicates the opposite, however, with an insignificant coefficient and a quite-low R^2 (Table 2).

From 2000 to the mid-2010s, Germany has experienced an accelerated liberalization of migration policies. A succession of reforms has reshaped Germany's migration system over the past decade, and the country has undergone a significant policy shift toward becoming a country that emphasizes the integration of newcomers and the recruitment of skilled labor migrants. First, at the beginning of 2000, the liberalization of citizenship law, which replaced a pre-World War I law, made it easier for migrants and their children to become German, and for natives and migrants to hold dual citizenship. Second, the 2001 report prepared by an immigration commission delivered a comprehensive migration policy reform plan for skilled labor

Table 2 Regression Results for Convergence of Employment Rates

Variables	(1) Baden-Wurttemberg	(2) Bayern	(3) Berlin-Bradenburg	(4) Hessen	(5) Niedersachsen-Bremen	(6) Nord	(7) Nordrhein-Westfalen	(8) Rheinland-Pfalz-Saarland	(9) Sachsen	(10) Sachsen Anhalt Thruingen	(11) Germany
Log of emp rate in 2005	−0.008 (0.011)	−0.024*** (0.004)	−0.020** (0.007)	−0.033*** (0.008)	−0.025*** (0.007)	−0.027** (0.009)	−0.007 (0.006)	0.010 (0.023)	−0.031*** (0.006)	−0.041*** (0.007)	−0.018*** (0.003)
Constant	0.045 (0.043)	0.109*** (0.017)	0.099** (0.028)	0.142*** (0.032)	0.115*** (0.027)	0.120*** (0.036)	0.043* (0.022)	−0.025 (0.088)	0.142*** (0.022)	0.177*** (0.028)	0.087*** (0.014)
R-squared	0.080	0.534	0.625	0.425	0.526	0.370	0.048	0.053	0.578	0.720	0.759

Robust standard errors in parentheses

***p < 0.01, **p < 0.05, *p < 0.1

migration, humanitarian migration and asylum, and integration of temporary and permanent migrants. Third, the immigration law of 2005 or The Migration Act[8] radically altered the migration landscape and focused on long-term permanent residency for migrants, particularly skilled workers, and on integration measures. Fourth, the European Union's introduction of the EU Blue Card in 2009, and its subsequent adoption into German law in 2012, facilitated skilled labor migration of non-EU migrants. Fifth, the 2012 Recognition Act guaranteed migrants the right to have their qualifications and degrees recognized in Germany, making it easier for them to use their skills.

In parallel to these profound changes to German migration laws, the country significantly changed its asylum policies. This is because two EU directives, namely the 2004 EU Qualifications Directive and the 2011 EU Asylum Procedures Directive, obligated Germany to gradually abolish many of the restrictions introduced by the 1992 asylum agreement. Accordingly, massive humanitarian inflows began in 2015, when almost half a million people requested asylum in Germany, and half of the asylum seekers were permitted to stay. Germany, like other European countries, noticeably tightened its asylum policies through two packages of asylum laws, which were ratified in October 2015 and February 2016. The government limited the benefits asylum seekers receive, moving away from cash payments towards in-kind benefits; expanded the list of safe countries to include Albania, Kosovo, and Montenegro; and fast-tracked applications from citizens of these countries (Rietig & Muller, 2016). The latest amendment to the German migration legal framework has been the Integration Act of 2016, which aims to facilitate the integration of refugees into German society. Refugees who show the potential to integrate and have a good chance of staying permanently in Germany are provided with easier and faster access to integration classes and employment opportunities, while refugees who refuse to cooperate face a reduction in benefits (Gesley, 2017).

The Federal Employment Agency (Bundesagentur für Arbeit) data show that the average annual share of the foreign-born population in total population during the 2005–2018 period has been 8.25% and that 72 out of 156 statistical districts (46.15%) have hosted a more-than-average share of foreigners. The share of immigrants in the working-age population climbed from 10.63% in 2009 to 15.64% in 2018, increased by 5.01 percentage points in the last decade (Fig. 3). After removing Nord, Sachsen, and Sachsen-Anhalt-Thüringen, which have the three lowest immigrant shares, immigrant share in the working-age population increased from 13.22 to 18.63% in the same period—a 5.41 percentage point increase.[9] It is worth noting that an increase in the immigrant share of the working-age population was highest (1.9 percentage points) in 2015 when the massive humanitarian inflows began.

[8] The immigration law of 2005 includes both the Residence Act governing immigration of third-country nationals and the EU Freedom of Movement Act governing immigration of EU citizens.

[9] D'Amuri et al. (2010) showed that the share of immigrants in total employment as obtained from Employment Research (IAB) administrative dataset, including Ethnic and East–West moving Germans, increased from about 9% in 1987 to 14% in 2001.

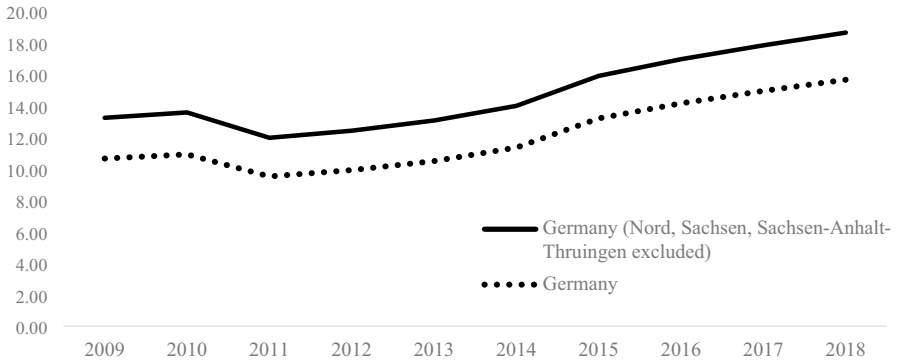


Fig. 3 Immigrants as a Share of Working-age Population

4 Data and methodology

This study uses a unique and first-hand-collected dataset at the statistical regions level according to the Federal Employment Agency's (Bundesagentur für Arbeit) classification. The data is hierarchical and dividing Germany into ten states and 156 agency districts (Agenturbezirke) supported by 741 branch offices[10] for the years from 2005 to 2018 and called the "territorial structure of the Federal Employment Agency." There are, of course, several advantages of employing territorial structure data rather than "political-administrative structure" data such that the latter may include a large number of commuters between counties. We equally know that a county is not likely to be the ideal definition of a local labor market as it will coincide with the city boundaries, which are usually surrounded by one or more suburban counties. Foreigners tend to live in cities rather than in the suburbs, but their presence can nevertheless impact native commuters. To consider this issue, following a similar strategy to Pischke and Velling (1997) and Eckey and Klemmer (1991), we believe that studying with a more aggregate dataset secures our objective of obtaining economically significant urban areas or statistical regions along with preserving much of the interregional variation in the data.

Our dependent variable is the total employment rate, which measures the proportion of employees aged 15 to under 65 who are subject to social security contributions in the same age population. Civil servants, the self-employed, and other employees not subject to social security contributions are not included. Separate employment rate data are not available for immigrants and natives in our dataset, and therefore, the impact of new newcomers on the total employment rate in a district will be including natives and existing immigrants already in the country. Our key independent variable is the share of immigration level, measured by the percentage of the foreign-born population. Such a measure is the only available option in

[10] Such a dataset kindly allows us to construct more unified labor market regions compared to political-administrative division consisting of 401 districts and independent cities, and 10.798 municipalities.

European countries, including but not limited to Germany as these nations provide citizenship based on ethnicity rather than the place of birth (Table 3).

We include the relative migration balance indicator as a covariate in our model to control for possible migratory patterns of young people—those aged between 18 and 24 years. The variable is defined as the net migration (immigration minus departure) for young adults divided by the youth population in each district. A positive relative migration balance in a district indicates that the local job market offers prospects for younger people through a matching job or training position. Accordingly, more moves are to be assessed as an indicator of a low job offer and few opportunities for future individual planning of younger people. We also employ several covariates to capture the composition of the local labor force, including the working-age population ratio, the share of youth in total population, female employment rate, and the employment rate for older workers aged 55–64 years (Table 3).

Following the leading studies in the related literature, the present paper does not examine wages as it is widely known that German unions are plausibly effective in introducing standardized wages across country regions. Thus, changes in regional salaries are more likely to reflect compositional effects that cannot be monitored so that little can be learned from the wage data we have available (Pishcke & Velling, 1997). As also highlighted by Braun and Mahmoud (2014), wages may be somewhat sticky, and immigration is more likely to affect the employment opportunities of the native-born rather than their wages. The results of several studies in the literature are in line with this finding. Among those, Bonin (2005) concluded that the adverse wage effects of immigration are much smaller in the German labor market compared to the US labor market (Borjas, 2003). Similarly, employing the skill group approach in the 1975–2001 period, Steinhardt (2011) observed that immigration had no adverse negative effect on the wages of native employees in Germany.

Table 4 provides some descriptive statistics for the main variables of interest. In our data set, agency-districts include big cities like Hamburg, Munich, Frankfurt; inner-city statistical areas like Berlin Sud, Berlin Nord, and Berlin Mitte; and small towns like Sangerhausen, Bernburg, and Weiden. Hence, we have statistical districts with a population ranging from 1.84 million in Hamburg, 1.84 million in Munich, 3.64 million in Berlin (Berlin Sud, Berlin Nord, and Berlin Mitte in state 3) 136,249 in Sangerhausen. It is again clear from Table 4 that the share of foreigners indicates a high variation and ranges from as low as 0.8 in Anneberg-Buchalz to as high as 29.3 in Frankfurt, stating almost one-third of the entire population in the district, for our sample during the period under consideration. Similarly, on the one hand, we have Berlin Sud that has an employment rate of 37.2 in 2005; on the other hand, the Zwickau district has the highest employment rate of 67.4 in 2018 in our sample. Indeed, we have the same variation in other variables, as well.

Our study uses a regional approach, in which local employment measures—the level of employment rate and a one-year difference in employment rate—in a given area is regressed on the relative immigrants share in that same area and appropriate

Table 3 Definition and calculation of model variables

Variables	Calculation formula	Indicator/variable type
Total employment rate	$\frac{\text{Employees subject to social security contributions (15 to under 65 − year olds)}}{\text{Population from 15 to under 65 years old}}$	Employment/dependent variable
Female employment rate	$\frac{\text{Female employees subject to social security contributions (15 to under 65 − year − olds)}}{\text{Female population from 15 to under 65 years old}}$	Employment/control variable
Employment rate for workers aged 55–64 years	$\frac{\text{Employees subject to social security contributions between the ages of 55 and under 65}}{\text{Population from 55 to under 65 years old}}$	Employment/control variable
Share of immigrants[a]	$\frac{\text{Foreign population}}{\text{Total population}}$	Immigration/explanatory variable
Relative migration balance	$\frac{\text{Balance from immigration and departure of 18 to under 25 − year olds}}{\text{Populationf from 18to under 25 years}}$	Net migration of the young/control variable
Working-age population rate	$\frac{\text{Population aged between 15 to 64 − year olds}}{\text{Total population}}$	Population/control variable
Youth-age ratio in the population	$\frac{\text{Population aged under 25 years old}}{\text{Population aged55years and older}}$	Population/control variable
Lagged employment rate	$Employment\ Rate_{t-1}$	Control variable/default in GMM approach
Lagged immigrant shares	$\text{Share of Immigrants}_{t-1}$; $\text{Share of Immigrants}_{t-2}$	Immigrants' self-selection endogeneity problem/instrumental variables
Immigrants share 2005 (level)	$\text{Share of Immigrants}_{2005}$	
Immigrants share (squared term)	$(\text{Share of immigrants}_{2005})^2$	
Change in foreigners' share 2005–2018	$\text{Share of Immigrants}_{2018} - \text{Share of Immigrants}_{2005}$	
Unemployment rate of immigrants[b]	$\frac{\text{Unemployed Immigrants' Population}}{\text{Immigrants' Population from 15to under 65 years old}}$	Exogenous labor shock endogeneity problem/instrument variables
Share of unemployed immigrants in overall working age-population	$\frac{\text{Immigrants' Population}}{\text{Overall Population from 15 to under 65 years old}}$	

[a]Immigrants are defined as non-German citizenship and everyone who resides in Germany with a right of residence counts to the population (except for tourists). Refugees also have a right to reside here and are part of the population. Since they do not have German citizenship, they are among the foreigners. All persons who are not German within the meaning of Article 116.1 GG, i.e., do not have German citizenship. This also includes stateless persons and people with undeclared citizenship. Germans who are also foreign nationals are not part of the foreign population. The members of the deployment forces, as well as the diplomatic and consular representations in the Federal Republic of Germany and their families, are not subject to the provisions of the Residence Act and are not statistically recorded. The data source is Statistisches Bundesamt /Statistische Landesämter

[b]This data is available monthly from 2010 to 2018. We only have number of unemployed population of foreigners and their working-age population across our sample. To convert monthly series to annual, we use the averages of the series

Table 4 Descriptive statistics of model variables

Model variables	Mean	Standard dev	Minimum	Maximum	No of observations
Dependent variable: total employment rate	53.82	5.28	37.2	67.4	2182
Explanatory/control variables					
Share of immigrants	8.25	4.88	0.8	29.3	2184
Female employment rate	48.99	6.27	5.9	68.4	2182
Employment rate for workers aged 55–64 years	48.65	7.21	11.3	64.3	2182
Relative migration balance (18–24 years old)	0.67	3.65	−7.2	17.4	2181
Working-age population rate	0.65	0.02	0.58	0.73	1558
Youth-age ratio in the population	42.12	4.45	15.3	56.2	2184
Total population	523,663.6	247,758.8	136,249	1,841,179	1559
National employment rate (simple average)	53.81	3.98	47.35	60.33	2184
National employment rate (pop-weighted average)	53.40	3.95	47.20	59.90	2184
Number of immigrants divided by working-age population	12.89	7.35	1.27	41.97	1559
1-year lagged employment growth	0.97	0.67	−2.0	5.5	1870
Instrumental variables for the immigrants' self-selection endogeneity problem					
Lagged immigrant share (1-year lag)	8.07	4.80	0.8	29.0	2026
Lagged immigrant share (2-year lag)	7.87	4.73	0.8	28.2	1872
Immigrants share 2005	7.74	4.65	1.1	22.5	2184
Immigrants share 2005 Squared	81.54	94.18	1.21	506.25	2184
Instrument variable for an exogenous labor supply shock					
Unemployment rate of immigrants	17.18	6.94	4.02	43.30	1404
Share of unemployed immigrants in overall working-age population	12.89	7.35	1.26	41.97	1559

controls (Glitz, 2012).[11] One of the key criticisms of this approach stems from the immigrants' self-selection endogeneity problem. Immigrants may choose to locate in areas that have the best existing labor market prospects, usually contributing to underestimating the tangible impact that they have on the local population's labor market outcomes. Alternatively, when they self-select their location based on some measurable variables, then it will be necessary to eliminate the self-selection biased regressions by conditioning on those variables. For this purpose, some studies (e.g., Altonji & Card, 1991; Pischke & Velling, 1997) have used instrumental variables based on past concentrations of immigrants, namely the lagged foreign-born population share, leveraging the fact that these are reliable estimators of contemporary immigrant inflows. It is, therefore, assumed that they are uncorrelated with current unobserved shocks in the market for labor.[12] Following Altonji and Card (1991) and Pischke and Velling (1997), we control for the past labor market conditions as it is clear from our data that immigrant inflows have a strong correlation with the previous fraction of immigrants in a city. They are, therefore, plausibly reliable estimators of a shift in the fraction of immigrants. For this purpose, we used the first and second lags of foreigners share as an instrument variable, interchangeably.

Should we account for the aforementioned endogeneity problem inherent in immigration modeling, we will need to consider revealing the impacts of an exogenous increase in local jobs, as they may likely increase not only participation and employment rates but also in-migration. Moreover, the possibility of reverse causality may also occur and may bias estimates (Bartik, 1993). In this regard, Bartik (1993) suggests using the variables of local job growth predicted based on the area's industrial mix and national industry growth and lagged local job growth as instruments. However, both of these variables are not available for our dataset. Therefore, we followed the approach of Noja et al. (2018) and McKenzie and Rapoport (2006), which state that to proxy divergence in demand for labor, one can use the unemployment rate of the foreign population as the instrumental variable. Accordingly, we attempted to instrument the demand for labor in a district with the unemployment rate of foreign-born population and the percentage of unemployed foreigners in the working-age population in our regression analysis.

[11] Glitz (2012) provides a comprehensive review of the literature regarding the European studies that have used spatial correlation approach.

[12] Altonji and Card (1991) used information from the 1970 and 1980 Censuses on labor market outcomes in 120 major cities and instrumented change in the share of foreigners between 1970 and 1980 with its 1970 level and its square. The idea underlying this strategy is that foreigners tend to locate in cities where large number of foreigners live already. In line with Bartel's (1989) work, the authors used the fraction of immigrants in a city in 1970 to predict the change in the fraction of immigrants over the following decade (page 219). The present study attempted to use the foreigners' share 2005 (level) as the initial fraction of immigrants in our statistical districts and its squared term to instrument the change in the share of foreigners between 2005 and 2018. However, when we perform Wooldridge's (1995) robust score tests with these variables, we cannot treat the change in the share of foreigners between 2005 and 2018 as exogenous. In other words, both the foreigners' share in 2005 and its squared term fail to pass the robustness tests. Such a result is not surprising as finding a well-grounded instrument is extremely difficult.

Besides the endogeneity problem, the models that use employment rates as dependent variables are likely to lead to biased estimators due to unobserved heterogeneity. Two alternative approaches are frequently used in the literature to avoid this bias: (i) including fixed effects in the estimation (ii) eliminating fixed effects by first differencing all variables. According to Greenwood and McDowell (1992) and Noja et al. (2018), employing the former technique alters the estimated effects of local job growth. Identically, using the latter technique Altonji and Card (1991) and Pischke and Velling (1997),[13] obtained consistent estimates in their study. However, we have to note that incorporating fixed effects and first differencing are likely to absorb the permanent factors. Due to the involvement of these effects, our variable of interest has very little identifying variation left, allowing any sampling error in this variable to play a disproportionately big influence. Even minor sampling errors are amplified, and the remaining variation in the migrant share is outweighed with ease, which is called as attenuation bias (Aydemir & Borjas, 2011).

All in all, estimating a causal relationship between the employed models requires specific attention to both endogeneity and unobserved heterogeneity problems. To overcome these issues, we implemented several approaches in this study. To obtain unbiased estimators as well as coping with endogeneity, we not only confirm our results with IV estimators (Two-stage least squares–2SLS) but also with the generalized method of moments (GMM) techniques. Following the leading studies in the related literature, we also employ fixed effects in both pooled OLS and panel data regressions; moreover, if this is not the case, we eliminated fixed effects by first differencing variables.

4.1 Empirical specification

First of all, we pooled our data over the period under consideration to estimate the following model via ordinary least squares (OLS):

$$emp_{it} = \theta + \gamma f_{it} + X'_{it}\beta + e_{it} \quad (i = 1, \ldots N; t = 1, \ldots, N), \tag{1}$$

where emp_{it} is a measure of employment rate, i represents agency districts denoting the cross-section dimension, and t represents time denoting the time-series dimension. e_{it} is a measure of employment rate, f_{it} is the change in the number of foreigners divided by the total population in the local labor market, and X_{it} is a K-dimensional vector of explanatory variables.β is a K×1 matrix. Should there be an aforementioned endogeneity problem inherent in immigration modeling, we correct the bias associated with the serial correlation of the share of immigrants by applying IV regression. The first stage results, as well as the results of weak instrument tests, suggest that the first and second lag of the relevant variable is a strong

[13] Even though Pischke and Velling (1997) used a differenced dependent variable and lagged independent variables, they pointed out that entering covariates in differences does not affect their conclusions. In our study, we employed the original method of first difference analysis.

instrument for it (see, among others, Altonji & Card, 1991; Bartel, 1989). So, when we run IV regressions, we could re-write Eq. (1) as follows:

$$f_{it} = \eta_0 + \eta_1 p_{it} + \lambda_{it} \quad (i = 1, \ldots N; t = 1, \ldots, N), \tag{2}$$

$$emp_{it} = \theta + \gamma f_{it} + X'_{it}\beta + e_{it} \quad (i = 1, \ldots N; t = 1, \ldots, N), \tag{3}$$

which here happens to be recursive as f_{it} appears in the equation for emp_{it} but emp_t does not appear in the equation f_{it}. Simultaneous equation structures are usually not recursive, however. As this method is recursive, we can individually fit the two equations through OLS, if we would assume that λ_{it} and e_{it} are independent.[14]

Following Pischke and Velling's approach, our first differenced estimating equations have the form:

$$\Delta emp_{it} = \gamma \Delta f_{it} + \Delta X'_{it}\beta + \Delta e_{it} \quad (i = 1, \ldots N; t = 1, \ldots, N). \tag{4}$$

It is important to note that the differencing will eliminate any potential bias of fixed effects, as suggested by Altonji and Card (1991) and Hunt (1992).

To run our regression with the fixed effect panel data approach, Eq. 1 will turn into the following:

$$emp_{it} = \theta + \gamma f_{it} + X'_{it}\beta + \mu_i + u_{it} \quad (i = 1, \ldots N; t = 1, \ldots, N). \tag{5}$$

where i represents agency districts denoting the cross-section dimension, and t represents time denoting the time-series dimension. emp_{it} is a measure of employment rate, f_{it} is the change in the number of foreigners divided by the total population in the local labor market, and X_{it} is a K-dimensional vector of explanatory variables, without a constant term.β is a $\mathrm{K} \times 1$ matrix. u_{it} represents the effects of the omitted variables that will change across the individual units and periods, whereas μ_i is a 1×1 scalar intercept representing the unobserved effects, which are the same over time. The random error term is assumed to be uncorrelated with X'_{it}, and distributed independently identically with mean zero and constant variance. Panel FE models, as described by Baltagi (2013), follow the specific linear representation of panel data regression models to properly analyze the impact of immigration on macroeconomic indicators of receiving countries.

Not all orthogonal conditions are considered by the instrumental variable approach, as suggested by Anderson and Hsiao (1981). The first-differenced instrumental variable (IV) estimation method can produce consistent estimates, but these estimates are not necessarily efficient as the IV method does not utilize all the available moment conditions. The use of lagged differences as an instrument may result in an inefficient estimator (Arellano, 1989). For this purpose, a dynamic panel data model was developed by Arellano and Bond (1991) in order to take into account orthogonality conditions between the lagged values of the dependent variable and the disturbances. By taking into more instruments available, Arellano and Bond

[14] In Eq. (2), we instrument f_{it} with p_{it}. η_0 is a constant term, λ_{it} is the error term.

(1991) derived the GMM estimator for the parameters of a dynamic panel data model (see Das, 2019 for a detailed discussion on the estimation technique). This present study also employs this technique as a further methodology.

5 Results

This paper examines whether and to what extent the growing share of immigrants has affected the total employment rate in Germany during the last 14 years, from 2005 to 2018. Based on the empirical specification developed in Sect. 4, we have estimated eleven different models with 2,179 observations for the full sample period.[15] The overall period covers the accelerated liberalization of migration policies and the massive humanitarian inflows that began in 2015; therefore, we carry out further subsample analysis to explore the overall employment effects of new immigrants before and after the massive humanitarian inflows to Germany.

Table 5 presents the regression results for the full sample period from 2005 to 2018. Estimation results of the first-difference models (models 1, 2, and 3) indicate that a 10-percentage point increase in the share of immigrants reduces the total employment growth rate (both for natives and existing immigrants) by 0.31–0.57 percentage points. Estimation results of level-level regression models (models 4–10) reveal that if the share of immigrants rises by 10 percentage points, the total employment rate falls by 1.21–2.04 percentage points (pooled OLS level model with fixed effects and level models with IVs), and that total employment rate falls by 1.81–2.54 percentage points according to panel fixed effects and panel IV models. To distinguish between these results, first, it should be noted that models 5 and 6 and models 4 and 7 are identical in terms of the variables included. The main difference is that in models 6 and 7, we employ the IV approach.[16] So, the more negative effect associated with the instrumental variable estimation scheme is consistent with the hypothesis that endogenous immigration inflows positively bias the OLS estimate. Such an interpretation is also valid for panel models 8 and 10.[17] Second, we find that our cross-sectional estimates of the impact of immigration on employment rates are larger than the differenced estimates. These findings are in line with the results of Altonji and Card's (1991) study, which states that the differences between

[15] Due to the unavailability of employment rate data for Magdeburg and Dessau-Rosslau-Wittenberg in 2005 and lack of relative net migration data for Berlin Sud, Berlin Nord and Berlin Mitte for the year of 2014, we have 2179 observations instead of 2184 observations (156 districts $$\times $$ 14 years).

[16] We attempted to instrument these variables in our models 6 and 7; however, as the instruments fail to pass Wooldridge's robust score tests, we cannot treat them as exogenous. The only exception is a difference model with IV in which the share of immigrants' coefficient is again able to capture a slightly insignificant ($p < 0.13$) negative impact and succeed to pass the Wooldridge's robust score tests. The results of the relevant model are available upon request. It should be noted that our results remain unchanged across our different models, even in Arellano Bond GMM estimation technique which accounts for reverse causality (Leszczensky and Wolbring, 2018).

[17] It is clear from Table 5 that this impact is reflected in all coefficients of our models. The coefficients of the independent variables in models 4, 5 and 8 are greater than those 6, 7 and 10, respectively.

Table 5 Regression results for the full sample period from 2005 to 2018

Variables	(1) Difference equation model[b]	(2) Difference equation model[b]	(3) Difference equation model[b]	(4) POLS level model with fixed effects[a,b,e]	(5) POLS level model with fixed effects[a,b]	(6) Level model and IV[a,b,c]	(7) Level model and IV[a,b,c]	(8) Panel fixed effects[a]	(9) Panel IV model fixed effects[a,d]	(10) Panel IV model fixed effects[a,d]	(11) Dynamic GMM[b]
First difference of share of immigrants	**−0.031*** (0.019)	**−0.018** (0.016)	**−0.057**** (0.025)								
First difference of relative net migration	**0.060***** (0.008)	**0.067***** (0.007)	**0.059***** (0.008)								
First difference of female employment rate	**0.068***** (0.025)										
First difference of employment rate of workers (55–64-years old)		**0.174*** (0.091)									

Table 5 (continued)

Variables	(1) Difference equation model[b]	(2) Difference equation model[b]	(3) Difference equation model[b]	(4) POLS level model with fixed effects[a,b,e]	(5) POLS level model with fixed effects[a,b]	(6) Level model and IV[a,b,c]	(7) Level model and IV[a,b,c]	(8) Panel fixed effects[a]	(9) Panel IV model fixed effects[a,d]	(10) Panel IV model fixed effects[a,d]	(11) Dynamic GMM[b]
First difference of working age population ratio			**0.274***** (0.084)								
Share of immigrants				**−0.121**** (0.052)	**−0.181***** (0.051)	**−0.204***** (0.040)	**−0.190***** (0.049)	**−0.181***** (0.025)	**−0.217***** (0.041)	**−0.254***** (0.037)	**−0.166***** (0.045)
Relative net migration				**0.181***** (0.023)	**0.195***** (0.020)	**0.135***** (0.017)	**0.118***** (0.019)	**0.195***** (0.015)	**0.160***** (0.016)	**0.171***** (0.014)	**0.029**** (0.012)
Female employment rate				**0.196***** (0.075)			**0.145**** (0.059)		**0.155***** (0.009)		
Employment rate of workers (55–64-years old)					**0.484***** (0.173)	**0.357**** (0.143)		**0.484***** (0.016)		**0.417***** (0.016)	**0.368*** (0.189)
First lag of employment rate											**0.527**** (0.269)
Working age population ratio											**−0.108** (0.071)

Table 5 (continued)

Variables	(1) Difference equation model[b]	(2) Difference equation model[b]	(3) Difference equation model[b]	(4) POLS level model with fixed effects[a,b,e]	(5) POLS level model with fixed effects[a,b]	(6) Level model and IV[a,b,c]	(7) Level model and IV[a,b,c]	(8) Panel fixed effects[a]	(9) Panel IV model fixed effects[a,d]	(10) Panel IV model fixed effects[a,d]	(11) Dynamic GMM[b]
Hausman test results								482.72	267.14	1812.13	
								$p=0.000$	$p=0.000$	$p=0.000$	
Arellano bond test (zero-autocorrelation in FD errors)											$z_2=0.8435$ $p=0.3989$
Wooldridge's (1995) robust score test p value						0.360	0.151				
Kleibergen–Paap F test						19.42	19.55		16.38	16.38	
District level fixed effect	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	
Time fixed effect	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	
Observations	2020	2020	1396	2179	2179	1869	1869	2179	2025	2025	1396

Table 5 (continued)

Variables	(1) Difference equation model[b]	(2) Difference equation model[b]	(3) Difference equation model[b]	(4) POLS level model with fixed effects[a,b,e]	(5) POLS level model with fixed effects[a,b]	(6) Level model and IV[a,b,c]	(7) Level model and IV[a,b,c]	(8) Panel fixed effects[a]	(9) Panel IV model fixed effects[a,d]	(10) Panel IV model fixed effects[a,d]	(11) Dynamic GMM[b]
R-squared	0.741	0.753	0.771	0.978	0.982	0.984	0.982	0.969	0.963	0.969	

[a]Constant terms included but suppressed

[b]Robust standard errors in parentheses

[c]Instrument variable is the first lag of share of immigrants, city-specific dummies and year dummies included

[d]Instrument variable is the second lag of share of immigrants and year dummies included

[e]In another model (4) we used "Youth-age ratio in the population" as a control variable instead of "female employment rate" The results are almost identical, so we do not report them here

***p < 0.01, **p < 0.05, *p < 0.1

the cross-sectional and differenced model results are mainly due to the correlation between city-specific effects and immigrant shares that are all eliminated in first differences.

In our model specification, we also include control variables at the district level to account for relative net migration, working-age population ratio, female employment rate and the employment rate for older workers aged between 55 and 64 years as well as youth employment rate. Among them, relative net migration ratio is implemented to explore the effect of young people's net migration flows on employment growth, whereas the other variables are interchangeably included to control for the change in various aspects of population and change in shares of females and old workers in labor force on overall employment rate as a robustness check. The results obtained with this alternative specification of population measures are not far from each other. The differences are minimal in the sense that there is a slight change in point estimates of the coefficient of share of immigrants.

Finally, according to the dynamic GMM estimation results, the highly significant coefficient estimates of −0.166 (at 1% significance level) indicates that a 10-percentage point increase in the share of new immigrants in a statistical district is associated with a reduction of the overall employment rate by 1.66 percentage points both for native workers and existing immigrants already in the same district. Thus, the full sample results show that there has been a significant negative effect of new immigrant inflows on overall employment rates between 2005 and 2018. One possible explanation for the adverse effects of new migrants on the total employment rate is the displacement of existing workers (natives or older immigrants) by newcomers. The second reason may be the new immigrants' lower rate of integration into the local labor market. The German vocational training system defines a clear segmentation line for income and working conditions which hinders immigrants who are no Facharbeiter or whose Facharbeiter certificate is not accepted, from moving upwards to qualified work; this is an obstacle that blocked upward occupational mobility especially for first-generation immigrants. More recent studies on occupational upward mobility (Kohlmeier & Schimany, 2005) show, however, that migrants from the second and third generation have often improved their position on the labor market. During the last thirty years, educational standards of second and third-generation immigrants have indeed approached the level of German children but have not reached it yet (Gogolin, 2000; Hunger & Thränhardt, 2004). This is insofar of importance as the social and cultural integration—mainly conveyed by language skills and educational achievement—are fundamental preconditions for structural integration to society, the local community, and the labor market. Our results are in line with previous research by Pischke and Velling (1997), which has stated that labor force participation rates for immigrants may have been lower than for those foreigners already in the country, leading to falling employment rates overall.

Our findings regarding a significant adverse impact of new immigrants on the overall employment rate in the period of migration policy liberalization, from 2005 to 2018, is substantially larger than those reported in previous studies using data from the 1980s to the early-2000s for Germany. For example, Pischke and Velling (1997) showed little evidence for displacement effects due to immigration by presenting insignificant coefficients of −0.20 from the difference OLS model and 0.54

from the first-difference model with IV specifications. Brücker and Jahn (2011) concluded that a 4% increase in the labor force through immigration had not increased either aggregate or foreign unemployment. Similarly, D'Amuri et al. (2010) found no evidence of adverse effects of new immigration on the total employment levels of long-term immigrants plus natives, while long-term immigrants seem negatively affected by newcomers. Our full sample regression results are similar to those provided by Braun and Mahmoud's (2014) study, which showed that a 10-percentage point increase in the share of expellees or ethnic German immigrants reduced the overall employment rate in West Germany by 1.7 percentage points in 1953 and 3.8 percentage points in 1950. While Braun and Mahmoud (2014) studied the forced migration in the 1950s, our study provides an updated empirical evidence on the overall employment effect of forced and voluntary migration to Germany during the period 2005–2018.

The regression results for three different subsamples are presented in Table 6. In the first subsample analysis, we re-run all regressions excluding Frankfurt from our full sample as Frankfurt is a global city, which is not only at the center of major transportation networks in Europe but also has been a final destination for many immigrants with a significant share of immigrants in its population and labor force.[18] However, excluding Frankfurt does not yield any change in our results to those provided for the full sample in Table 5. For instance, the dynamic GMM estimation result indicates that a 10-percentage point increase in the share of new immigrants in a statistical district is associated with a reduction of the overall employment rate in the same district by 1.71 percentage points, which was recorded as a 1.66 percentage point reduction for the full-sample estimation (Table 6).

Furthermore, in order to capture the employment effect of the massive humanitarian inflows that began in 2015 we divide our full sample period into the following subsample periods: (i) before the mass humanitarian inflows of 2015, from 2005 to 2014 and (ii) after the mass humanitarian inflows of 2015, from 2015 to 2018. The results for the 2005–2014 subsample reveal that the first difference models are able to capture the negative effect of an increase in the share of immigrants on total employment rate; however, this effect is not statistically significant and varies from −0.022 to −0.036. On the contrary, estimation results of level models are indicating statistically significant negative impacts on overall employment rate ranging from −0.08 to −0.217. These results are in line with the full sample findings regarding their magnitude in the sense that the cross-sectional estimates of the impact of immigration on employment rates are larger than the difference models.[19]

The estimation results for the period 2015–2018 show that difference models have higher significant impacts in absolute terms compared to level models and panel models except for Panel IV models which indicates 0.231–0.514 percentage

[18] As stated by Sassen (2018), 24 percent of the labor force in Frankfurt is foreign-born, including significant shares of top-level professionals.

[19] We did not carry out a GMM model for the 2005–2014 subsample because our sample period is not long enough to capture dynamic impacts keeping in mind that the "ratio of working age population to total population" variable is only available after 2009, so the first subsample will turn out to be 2009–2014 for a GMM model.

Table 6 Regression results for the full sample and subsample periods

Time periods	Definition	Static models					Dynamic model
		Difference models	Level models				
		First-differenced models	Pooled OLS models	Pooled OLS IV models	Panel fixed effects model	Panel IV model fixed effects	Dynamic GMM
Full sample							
2005 to 2018	Full sample	−0.031* to −0.057**	−0.121** to −0.181***	−0.190*** to −0.204***	−0.181***	−0.217*** to −0.254***	−0.166***
2005 to 2018	Full sample (Frankfurt excluded)	−0.032* to −0.056**	−0.112** to −0.170***	−0.196***	−0.170***	−0.232*** to −0.244***	−0.171***
Sub-samples							
2005 to 2014	Before humanitarian inflow of 2015	−0.022 to −0.036	−0.07 to −0.08*	−0.156* to −0.227**	−0.08**	−0.192** to −0.217**	
2015 to 2018	After humanitarian inflow of 2015	−0.148** to −0.202***	−0.019 to 0.033	−0.095 to 0.072	−0.019	−0.231** to −0.514***	

***p < 0.01, **p < 0.05, *p < 0.1

points decrease in employment rate in response to a 1 percentage point increase in the share of immigrants. One possible explanation for high coefficient estimates in difference models (−0.148 to −0.202) compared to those for the full sample (−0.031 to −0.057) would be the impact of a sudden influx of asylum seekers after 2014. As highlighted by Pischke and Velling (1997, p. 601):

> *Labor force participation rates for immigrants may have been lower than for those foreigners already in the country, for example, because asylum seekers are not immediately allowed to work. This may lead to falling employment rates overall.*

It is, therefore, possible to argue that the recent migrants in the 2015–2018 period had a lower labor force participation rate (or higher unemployment rate) in comparison to those in the period 2005–2014, which led to a substantially falling employment rate overall. The arrival of significant numbers of humanitarian immigrants along with the displacement effect of immigrants and their lower rate of integration into local labor markets resulted in a substantial reduction in the total employment rate. In Germany, an asylum seeker is not allowed to work for three months after arrival. Then, they only have a chance if no German and the EU citizen is in the running for the job. Even after 15 months of being in Germany, the refugee requires the permission of the municipality's immigration bureau before accepting a job. Only after four years, there is no restriction for an asylum seeker to get a job (Hamann, 2015).

As seen in Table 6, level regression models (except for Panel IV model) do not provide statistically significant estimates for a short period of time, from 2015 to 2018. When cross-sections are available for two or more years, first difference estimations prevent possible omitted variables biases that arise when there are regional-specific fixed effects that correlate with the fraction of migrants or the labor market performance of natives (Okkerse, 2008). In other words, estimating first difference models solves the omitted variables bias, and it is subtracted away when the problem is considered in changes in variables rather than in levels of variables (Friedberg and Hunt, 1995).

6 Conclusion

Germany has undergone a significant migration policy shift toward becoming a country that emphasizes the integration of newcomers and the recruitment of skilled labor migrants during the period from 2000 to the mid-2010s. Moreover, based on the EU directives, the country significantly changed its asylum policies, as a result of which, the massive humanitarian inflows began in 2015 when almost half a million people requested asylum in Germany. This paper contributes to the existing literature by analyzing how regional labor markets in Germany have been affected by the implementation of migration policy changes between 2005 and 2018 with unique and first-hand-collected data by using a regional approach.

Overall, our findings confirm the critical impact of immigration on labor markets, some of which have already been emphasized in relevant published literature but are

entirely incorporated in this study. We find suggestive evidence that there has been a negative impact of new immigrants on overall employment rates for our full sample, and that this negative effect is substantially larger than those reported in previous studies using data from the 1980s to the early-2000s for Germany. The adverse effects of new immigrants on the employment rate of existing workers could possibly be explained not only by the displacement effect but also the new immigrants' lower rate of integration into the local labor markets. All the estimation results obtained throughout different econometric procedures are consistent in sign in the presence of statistical significance but slightly different in size. In particular, level models tend to yield positively biased estimators due to endogenous immigration inflows. We resolved this issue by instrumenting the past labor market conditions with the lagged share of immigrants. Our results are, therefore, robust to immigrants' self-selection problem if they base their location decisions on past values.

Our results also shed light on the labor market impacts of one of the most significant forced humanitarian movements after the Second World War. We argue that the recent migrants in the 2015–2018 period had a lower labor force participation rate than those in the period 2005–2014 (before the mass humanitarian inflows of 2015), which led to a substantially falling employment rate overall. The arrival of significant numbers of asylum seekers, coupled with the possible displacement effect of immigrants and their lower rate of integration into local labor markets, gave rise to a substantial reduction in the total employment rate in Germany.

Funding The authors did not receive support from any organization for the submitted work.

Declaration

Conflict of interest The corresponding author states that there is no conflict of interest.

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