Discussion Paper

EU enlargement and (temporary) migration: Effects on labour market outcomes in Germany

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Non-technical summary

Research Question

Starting in May 2011, Germany stepwise lifted the restrictions to free movement of workers for nationals from the "new" Central and Eastern European (CEE) EU-member states. This elicited an immediate rise in CEE immigration rates to Germany, exceeding ex-ante forecasts by 50% and more. These immigration flows were characterized by two special features. First, we observe that most CEE immigrants are labour market oriented who typically have received a job offer already before immigration (Straubhaar 2014). This kind of positive selection implies that they bring along skill profiles wanted by domestic employers. Second, we note that temporary and/or return migration are very common among CEE immigrants. Importantly, those immigrants tend to stay whose first career years proceed satisfactory. Thus, selective outmigration entails that the composition of stayers is even more closely geared to the needs of domestic employers than the one of newly arrived immigrants. This implies that current and past immigration flows exert different, potentially opposing effects on the German labour market. The main aim of the current paper therefore is to quantify the resulting labour market effects of these migration flows, taking selective in- and outmigration explicitly into consideration.

Contribution

To capture the potentially opposing impacts of current vs. past immigration, our estimation strategy explicitly distinguishes between EU immigrants who are "new arrivals" and those who are "stayers", i.e. a (positively selected) subset of previous new arrivals who remain in the German labour market. This novel approach allows us to identify not only the short- but also the medium-run effects of recent EU immigration on labour market outcomes (i.e. wage and employment dynamics) in Germany.

Results

We find that "new arrivals" exert a significantly negative effect on mean wages of full-time employed German nationals, whereas the impact of "stayers" is significantly positive. The former effect is consistent with the predictions of the canonical partial equilibrium model, according to which an expansion of labour supply dampens wage growth. The latter effect confirms the hypothesis that past immigration captures those migration-related effects that mitigate the initial negative effects (Jaeger et al. 2018). Jointly, the two effects imply that EU immigration triggers a temporary negative effect on the wage level among German nationals, which remains significant for about five years. Along the wage distribution of German nationals, the effects are particularly strong in the lowest two deciles — where most recent EU immigrants are located. With respect to employment among German as well as permanent foreign nationals, we show that there are a permanent positive effects.

Nichttechnische Zusammenfassung

Fragestellung

Die schrittweise Aufhebung der Zugangsbeschränkungen zum deutschen Arbeitsmarkt für die Staatsangehörigen der 11 „neuen" Mittel- und Osteuropäischen (MOE) Mitgliedsstaaten ab Mai 2011 führte zu einem starken Anstieg der Zuwanderung aus diesen Staaten nach Deutschland. Dabei hatten arbeitsmarktorientierte Zuwanderer aus MOE-Staaten typischerweise bereits vor dem Zuzug ein Stellenangebot aus Deutschland vorliegen (Straubhaar 2014). Die Mehrzahl derart vorausgewählter Zuwanderer wies somit ein in Deutschland nachgefragtes Qualifikationsprofil auf. Zudem ist temporäre Migration oder Rückkehrmigration unter MOE-Staatsangehörigen weit verbreitet und es bleiben tendenziell diejenigen Zuwanderer dauerhaft in Deutschland, denen die berufliche Integration in Deutschland geglückt ist. Daraus lässt sich schließen, dass sich „new arrivals" und „stayers" (frühere new arrivals, die sich im deutschen Arbeitsmarkt bewährt haben) in ihrer Komposition teils erheblich unterscheiden und sich daher möglicherweise sogar gegensätzlich auf den deutschen Arbeitsmarkt auswirken. Die vorliegende Studie untersucht empirisch, wie sich dieses Zuwanderungsgeschehen – insbesondere die damit zusammenhängenden Kompositionseffekte – auf den Arbeitsmarkt in Deutschland ausgewirkt hat.

Beitrag

Um die Kompositionseffekte unter den Zuwanderern zu berücksichtigen, wird – anders als in bisherigen Analysen – explizit zwischen „new arrivals" und „stayers" unterschieden. Dieser neuartige Ansatz ermöglicht es, nicht nur die kurz-, sondern auch die *mittelfristigen* Effekte der EU-Zuwanderung auf den deutschen Arbeitsmarkt (hinsichtlich der Entwicklung von Löhnen und Beschäftigung) im vergangenen Jahrzehnt zu identifizieren.

Ergebnisse

Der Zustrom von „new arrivals" aus anderen Mitgliedsstaaten der EU dämpfte signifikant die Wachstumsrate der Durchschnittslöhne unter deutschen vollzeitbeschäftigten Arbeitnehmern. Dieser empirische Befund ist konsistent mit theoretischen Modellen, wonach sich eine Ausweitung des Arbeitsangebots negativ auf das Lohnwachstum auswirkt. Dagegen erhöhte der Bestand an „stayers" signifikant die Wachstumsrate der Durchschnittslöhne unter deutschen vollzeitbeschäftigten Arbeitnehmern. Dieser empirische Befund bestätigt die Hypothese, dass vergangene Zuwanderungsströme solche zuwanderungsbezogene Effekte erfassen, welche die ursprünglichen negativen Effekte abmildern (Jaeger et al. 2018). Per saldo generieren beide Effekte einen temporär negativen Effekt auf das Lohnniveau. Etwa fünf Jahre nach einem Zuwanderungsschub hat sich der negative Effekt mehr oder weniger abgebaut. Entlang der Lohnverteilung deutscher Staatsangehöriger sind die Effekte insbesondere in den untersten beiden Einkommensdezilen relativ stark – also in denjenigen Einkommensgruppen, in denen EU-Zuwanderer besonders häufig beschäftigt sind. Darüber hinaus wirkte sich die EU-Zuwanderung dauerhaft signifikant positiv auf das Beschäftigungsniveau deutscher Staatsangehöriger sowie von Personen mit Migrationshintergrund aus.

EU Enlargement and (Temporary) Migration: Effects on Labour Market Outcomes in Germany[*]

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Abstract

EU Eastern Enlargement elicited a rise in (temporary) labour market oriented immigration to Germany starting in May 2011. Taking into account that not all immigrants stay permanently and that outmigration flows are selective, this paper classifies recent EU immigrants into "new arrivals" and "stayers" drawing on administrative social security data (2005-2017). This novel strategy allows us to separately identify their potentially opposing short- and medium-run effects on labour market outcomes in Germany. We find a transitory negative wage effect among German nationals, particularly at the bottom of the wage distribution; and a permanent positive effect on full-time employment.

Keywords: EU Eastern Enlargement, immigration, wages, employment, Germany

JEL classification: E24, F22, J31, J61.

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1   Introduction

In the course of EU Eastern Enlargement, eleven countries from Central and Eastern Europe (CEE) joined the EU single market since 2004. Germany, the largest EU economy, however maintained restrictions on free movement of workers for CEE nationals until May 2011 (and beyond).[1] The lifting of these restrictions elicited an immediate rise in CEE immigration, which exceeded ex-ante forecasts by 50% and more.[2] Over the period 2011-2019, a net total of 1.7 million CEE nationals migrated to Germany (Destatis, 2022), thereby increasing the CEE share in the German labour force from 1.1% to 3.9% (BA Statistik, 2020).[3] The main aim of the current paper therefore is to quantify the short- and medium run effects of this strong, only partially anticipated migration inflow on labour market outcomes in Germany.

Recent CEE immigration to Germany was characterized by two special features. First, we observe that, despite large inflows, the unemployment rate among CEE nationals in Germany fell by about 40% (as among Germans) over the past decade and stood at only 7.5% in late 2019,[4] while the CEE employment rate in Germany almost doubled from 35% to 59% (BA Statistik, 2020).[5] These figures indicate that CEE immigrants are *labour market oriented* who typically have received a job offer already before immigration (Straubhaar, 2014). This kind of positive selection also implies that most CEE immigrants hold skill profiles wanted by domestic employers. Second, we note that — facilitated by free movement of workers, which allows EU nationals to reside and work in any EU member state — *temporary and/or return migration* are very common among CEE immigrants: behind the large net migration inflow an even larger gross inflow of more than 5.1 million persons and a corresponding gross outflow of more than 3.4 million persons are hiding (Destatis, 2022).[6] Importantly, those immigrants tend to leave whose first career years in Germany proceeded unsatisfactory (Lehmer and Ludsteck, 2013). This kind of selective out-migration (see also Borjas and Bratsberg, 1996) entails that the composition of migrants who stay (henceforth "stayers") is even more closely geared to the needs of domestic employers than the one of newly arrived EU immigrants (henceforth "new arrivals").

With this in mind, we set out our estimation strategy based on a dynamic shift-share

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[1]The restrictions expired first in May 2011 for nationals from the 2004 CEE accession states, and further in January 2014 (July 2015) for nationals from Bulgaria and Romania (Croatia). See Kahanec and Zimmermann (2009, 2010), De la Rica, Glitz, and Ortega (2015), Bodnár and Veiga (2018) and Bonin, Krause-Pilatus, Rinne, and Brücker (2020) for literature reviews and extensive background information on migration within and into the EU before and after enlargement. Brenke, Yuksel, and Zimmermann (2010) document immigration restrictions in Germany prior to 2011.

[2]Schäfer (2011) expected a net inflow of about 1.2 million until the end of the decade, whereas Baas and Brücker (2011) projected a net inflow of 100.000 persons per year in their baseline scenario.

[3]Since Destatis (2022) only publishes annual data on migration flows by nationality and since the CEE share in the German labour force shows some seasonality, the figures here refer to the period between the full years 2011 and 2019, i.e. including the first four months of the year 2011.

[4]Compared to 12.2% among all foreign nationals in Germany (BA Statistik, 2020). By contrast, up to the mid 2000s, the unemployment rate among (male) CEE immigrants used to be above-average (Kogan, 2011).

[5]Among all foreign nationals in Germany, the employment rate rose "only" from 40% to 52% over the past decade (BA Statistik, 2020). High employment rates among CEE immigrants are also recorded in other EU destination countries (Kahanec and Zimmermann, 2016).

[6] These out-migration rates thus far exceed the rates in the US (Borjas and Bratsberg, 1996) and in the UK, both before (Dustmann and Weiss, 2007) and after (Blanchflower and Shadforth, 2009) EU Eastern Enlargement.

instrumental variable (IV) approach (Jaeger, Ruist, and Stuhler, 2018). In contrast to the conventional shift-share IV estimator (see, e.g., Card, 2009), this estimator is designed to capture those dynamic adjustment processes, which typically mitigate the initial, presumably negative, wage effect of immigration.[7] For this purpose, both current and lagged immigration inflows are considered and both variables are instrumented appropriately. The conventional shift-share IV estimator, instead, considers only current immigration and hence likely conflates the potentially opposing effects of current vs. past immigration. In the following, we adopt the approach of Jaeger et al. (2018), but measure past immigration by stocks of stayers from previous immigration cohorts rather than by lagged immigration inflows. We thus capture that only a (positively selected) subset of new arrivals continues its careers in Germany. This novel strategy allows us to separately identify the short- and medium-run effects of recent EU (particularly, CEE) migration on labour market outcomes in Germany. We then estimate the effects on wages of German nationals and of permanent foreign nationals with no recent migration experience (henceforth "permanent foreign nationals") along their wage distributions (akin to Dustmann et al., 2013) — and the effects on employment among part-time and full-time employees — across 75 spatial planning regions (so-called *Raumordnungsregionen*, henceforth ROR) in West Germany[8] between the years 2005-2017 using SIAB social security data.

Our main contribution is to provide a framework to study the labour market effects of EU immigration in Germany in times of free movement — when both migration in- and outflows are large and selective. In particular, we find that new arrivals from other EU member states exert a significantly negative effect on mean wages of full-time employed German nationals, whereas the impact of stayers is significantly positive. The former effect is consistent with the predictions of the canonical partial equilibrium model (see, e.g., Dustmann et al., 2013), according to which an expansion of labour supply dampens wage growth. The latter effect confirms the hypothesis that past immigration captures those migration-related effects that mitigate the initial negative effects (Jaeger et al., 2018). Jointly, the two effects imply that EU immigration triggers a transitory negative effect on the wage level, which remains significant for about five years. By contrast, the conventional shift-share IV estimate — which captures both, the opposing short- and medium-run effects — implies that the impact is weaker, but permanent. Along the wage distribution of German nationals, the effects are particularly strong in the lowest two deciles — where most recent EU immigrants are located (in terms of gross wages). Among permanent foreign nationals, the negative wage effect at the bottom of the wage distribution is borderline insignificant. In addition, there is a permanent positive employment effect among both groups, German nationals and permanent foreign nationals.

Transitory negative wage effects among German nationals, along with positive employment effects contribute to reconcile the German "wage puzzle" (Bulligan and Viviano, 2017; Springford, 2018), i.e. a period of relative low wage growth, but strong employment growth in the

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second half of the 2010s. By comparison, the literature on immigration to Germany in the 1990s typically finds rather adverse employment effects, particularly among permanent foreign nationals (see, for example, D'Amuri, Ottaviano, and Peri 2010, Felbermayr, Geis, and Kohler 2010, or Brücker and Jahn 2011). We assert that the following two reasons are important in this context. First, the German labour market has become more flexible over the past 20 years. In particular, newly emerged sectors such as subcontracted labour pay low wages, but may also offer immigrants opportunities to gain experience in the German labour market. Second, the extension of the right to free movement to CEE nationals facilitated (temporary) *labour market oriented* immigration closely geared to the needs of domestic employers. In this way, we argue that CEE immigrants effectively "filled the gaps" in domestic labour supply — which explains why crowding-out effects on German nationals did not occur. On the contrary, the immigration inflow likely helped German nationals to find newly created (full-time) jobs, complementary to those (rather low-paid) jobs found by recent immigrants.

The remainder of this paper is structured as follows: Section 2 presents the data and descriptive statistics, Section 3 outlines the estimation strategy, and Section 4 discusses the results and their robustness. Finally, Section 5 concludes.

2 Data and measurement

2.1 Data source

We quantify the labour market impact of (temporary) migration of EU citizens using data from the Sample of Integrated Labour Market Biographies (SIAB).[9] The SIAB is a 2 percent random sample drawn from an administrative database which covers all dependent employees (i.e., excluding civil servants and self-employed persons) in Germany as well as those who receive unemployment benefits and/or are registered as job seekers with the Federal Employment Agency.[10] In our sample, over the years 2005-2017, the database covers in total about 85 percent of the labour force in Germany (BA Statistik, 2021).[11] For each covered individual, SIAB data provide the employment status exact to the day. For each individual employment spell, employers are obliged to report the average gross daily wage (up to the social security

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[9]This study uses the weakly anonymous Sample of Integrated Labour Market Biographies (Years 1975-2017). Data access was provided via on-site use at the Research Data Centre (FDZ) of the German Federal Employment Agency (BA) at the Institute for Employment Research (IAB) and subsequently remote data Access: https://doi.org/10.5164/IAB.SIAB7517.de.en.v1. Data documentation: Antoni, Schmucker, Seth, and vom Berge (2019).

[10]The SIAB does not cover so-called posted workers, i.e., employees who temporarily work in Germany on behalf of firms registered in other EU member states (European Parliament, 2021). Åslund and Engdahl (2019) and Kuosmanen and Meriläinen (2020) find that inflows of posted workers exerted sizeable effects in some segments of the Finish and Swedish labour markets. In Germany, we also observe a rise from 170.000 to 430.000 incoming postings per year over the period 2008-2017 (European Commission, 2011, 2018). However, given that workers can be posted multiple times during a reference year, the European Commission (2017) estimates that the actual number of posted workers is about 40% smaller. The labour market impact of posted workers is thus likely small compared to the one due to the large inflow of EU nationals into the German social security system.

[11]Section 2 presents descriptive statistics for German nationals in East and West Germany, and for permanent foreign nationals in West Germany. The regression analysis in Section 4 is based on West Germany only.

contribution assessment ceiling) once per year.[12] Given that employment relationships in Germany are relatively stable (see, e.g., Hertweck and Sigrist 2015), we typically observe only one wage notice per employee/year (Merkl and Stüber, 2017). For this reason, we construct an annual sample from the raw daily SIAB data.[13] In this regard, note that we observe only the incidence of part-time work, but not the average number of hours worked per employee. All figures on wages therefore draw on the sub-sample of full-time employees. Other individual characteristics available in the SIAB include, e.g., gender, age, educational background, job complexity level, place of work, occupation, or industry. In particular, the SIAB records only an individual's nationality, but no other immigration-related variables (like "place of birth" or "place of graduation"). Similar to Brücker and Jahn (2011), we focus on prime-age workers (18-59 years of age in each year).

2.2 Identification of recent immigrants

Due to the lack of immigration-related characteristics, we only observe an individual's nationality, so that non-naturalised "permanent foreign nationals" and "recent immigrants" in the SIAB are almost observationally equivalent. Both appear in the SIAB as foreign nationals when they take up their first job or start looking for it as a registered job seeker. To estimate the labour market impact of immigration, we therefore first need to distinguish these two groups. This is an important issue, because naturalisation rates in Germany are relatively low — particularly among EU citizens from traditional immigration countries in Southern Europe (see Table 1). Those nationals enjoy close to equal rights, and thus have low incentives for naturalisation — even among third or fourth generation immigrants with a German educational background. For this reason, we classify an individual with a foreign nationality in the year she appears for the first time in the SIAB as "recent immigrant" if (i) depending on gender and educational attainment,[14] the individual's labour market history in Germany starts relatively late in her life cycle — more precisely: later than 70% of her peer group, i.e. German nationals and foreign nationals who fail criterion (ii) — and (ii) the individual does not become a naturalised German citizen faster than the nationality-of-origin-specific median (with a minimum latency of five years). Criterion (i) is based on the notion that "recent immigrants" start their careers in Germany later than "permanent foreign nationals" with a German educational background. The 70% threshold implies that, for instance, a male foreign national with a university degree who starts his career at the age of 24 or later will be classified as "recent immigrant" and vice versa (see Figure 1 and Table 2). We choose a threshold above the median in an attempt to

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[12]We impute wages above the social security contribution assessment ceiling following the imputation procedure laid out in Card, Heining, and Kline (2015) and Schmucker, Seth, Ludsteck, Eberle, and Ganzer (2016).

[13]More precisely, we take the average gross daily wage over the employment spell which covers the month of November as reference for the annual average.

[14]We first impute educational attainment following Fitzenberger, Osikominu, and Völter (2006). We thank Sebastian Geiger for kindly sharing his code and bringing this issue to our attention. We then classify each single individual according to the highest degree achieved in her entire career, not the grade held at the time of labour market entry. Otherwise, all individuals that enter the SIAB before academic/vocational graduation would be classified as low-educated.

avoid misclassification of "permanent foreign nationals" as "recent immigrants" (but this type I error may still happen, e.g., in the case of perpetual students). On the other hand, the 70% threshold implies that some "recent immigrants" (for instance, recent graduates from abroad who completed their degrees quickly) are mistakenly classified as "permanent foreign nationals" (type II error). In addition, criterion (*ii*) is based on the legal fact that, under normal circumstances, naturalisation requires a latency of at least five years (where actual time to naturalisation differs substantially across nationalities, see Table 1). Hence, fast naturalisation indicates a pre-existing nexus to Germany. Naturally, the power of criterion (*ii*) becomes smaller towards the end of our sample, given that its application requires information from future years. We also note that the first-time consideration of spells in marginal employment, as registered job seeker not entitled to benefits, and spells in active labour market policies severely biased SIAB entry ages around the turn of the millennium. For this reason, our identification procedure starts in the year 2001. Moreover, consistent with evidence presented in Section 2.3.2, we assume that five years after labour market entry "recent immigrants" become "permanent foreign nationals". Our final sample thus starts in the year 2005, where all persons who once had or still have a foreign nationality and entered the SIAB before the year 2001 are treated as "permanent foreign nationals". Based on this procedure, Table 3 shows that — as expected — most CEE entrants are classified as "recent immigrants", whereas most Turkish entrants are classified as "permanent foreign nationals".

Despite these data limitations, cross-checks with official Destatis (2022) migration statistics reveal a close fit between official and in-sample migration patterns (see Figures 2a,b,c). By construction, SIAB data (which capture labour market entries) lag behind official figures (which capture actual immigration inflows to Germany of all persons, including children and pensioners). Even though our paper focuses on EU (and particularly on CEE) migration flows, we apply the procedure described above to individuals of all nationalities included in the SIAB for cross-checking purposes. For instance, due to higher labour market barriers for refugees, we observe that the large inflow of immigrants from Arab League and other Asian countries since the year 2015 appears in SIAB data with a delay of one year and more. Moreover, heightened immigration rates from the Western Balkans in early 2015 did not lead to a corresponding rise in SIAB data, as a large share of those immigrants were deported back to their home countries within the same or the following year.[15] The gradual increase of employees from the Western Balkans in more recent years is due to the facilitation of labour market oriented immigration from these countries since late 2015 (Brücker and Burkert, 2017). Overall, we observe that the bulk of immigration inflows in the 2010s can be attributed to nationals from the "new" CEE countries. The country-specific immigration dynamics align well with the stepwise introduction of the right to free movement to nationals from these countries: immigration rates rise abruptly in 2011 (2014/15) for the eight (three) CEE countries that acceded in 2004 (later on).[16] Refugees appear in significant numbers in SIAB data only in the years 2016 and 2017.

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[15]See Deutscher Bundestag (2019) and the illustration by Bundeszentrale für politische Bildung (2019).

[16]In the case of the 2004 accession countries we already observe heightened gross (but much less net) migration inflows between the years 2004 and 2010 in official Destatis (2022) statistics, which do not result in heightened

2.3 Descriptive statistics

The classification scheme allows us to distinguish three different groups among the individuals included in the SIAB: "German nationals" (German nationals who never had another nationality), "permanent foreign nationals" (individuals who once had or still have a foreign nationality, but either entered the German labour market at a typical age, were naturalised relatively fast, or entered the German labour market at least five years ago), and "recent immigrants" (all other individuals). This classification scheme allows us to track labour market biographies of recent immigrants over their first few years after arrival in Germany.

Given that recent immigrants are underrepresented among (full-time) employees, we further distinguish between the "full sample" — which captures actual migration processes more comprehensively — the "employment sample" and the "full-time employment sample" — as gross daily wages can only be compared among full-time employees.

2.3.1 Overview on group-specific characteristics

In the following, we focus on EU nationals only, who are subject to free movement of workers and, thus, represent a relatively homogeneous group.[17] Tables 4 and 5a,b present descriptive statistics on these individuals included in the full, the employment, and the full-time employment sample, respectively. For example, on average over the years 2005-2017, about 87% of all annual observations in the full sample are German nationals, about 12% permanent foreign nationals, and about 2% recent immigrants. Due to the rising inflow of recent immigrants, their share increases substantially towards the end of our sample. As expected, recent immigrants in the SIAB are on average younger than permanent foreign nationals, who are in turn younger than German nationals. Part-time employment is more prevalent among both types of migrants than among German nationals. This implies that, among migrants, the full-time employment sample is more selective. Moreover, we note that the share of females is lower (*i*) among migrants (relative to German nationals) and (*ii*) among full-time employees (relative to the full sample, irrespective of the immigration status). Overall, the sample size is sufficiently large to estimate reliable measures of migration densities in all 96 ROR regions in Germany. Yet, as permanent foreign nationals are almost exclusively located in West Germany — and our IV procedure is based on settlement patterns in 1998 — all descriptive statistics on permanent foreign nationals in Section 2 and all regressions in Section 4 are based on the 75 ROR regions in West Germany. Another challenging issue is the high share of recent immigrants with missing

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SIAB entries. This could indicate a rising inflow of seasonal workers, posted workers and/or solo self-employed. Among these forms of employment, only worker postings from CEE countries show a substantial rising trend in this time period (Wagner and Hassel, 2015) and thus may contribute to explain some part of the discrepancy. Following Adamopoulou and Kaya (2020), the discrepancy could also be caused by CEE immigrants working in the informal (formal) sector before (after) 2011. However, as the informal sector in Germany is dominated by self-employment (Hazans, 2011), this channel unlikely plays a dominant role in this context. We thus conclude that a large fraction of the CEE migration inflow before 2011 is likely not due to labour market oriented motives.

[17]To be precise, we include additionally all non-EU nationals subject to free movement of workers/persons agreements between the EU and their country of origin in our sample period, i.e. Norway, Iceland, Liechtenstein, and Switzerland (as well as the United Kingdom). See https://www.sem.admin.ch/sem/en/home/themen/fza_schweiz-eu-efta.html and https://ec.europa.eu/social/main.jsp?langId=en&catId=457.

educational information.[18] Moreover, we observe that the fraction of recent immigrants performing "un- or semi-skilled work" is far higher than among German nationals or permanent foreign nationals. Unsurprisingly, the same applies to employment shares in low pay industries.

2.3.2 Immigrant downgrading

The finding that recent immigrants perform more often "un- or semi-skilled work" should not come as a surprise. As is well known since Chiswick (1978b), newly arrived immigrants frequently take up jobs below their qualification levels acquired abroad as their imported human capital is valued less in the host country (see Friedberg 2000 or Eckstein and Weiss 2004). Due to this "qualification mismatch", newly arrived immigrants typically suffer from a substantial wage gap relative to German nationals (Chiswick, 1978a). Important factors contributing to this so-called phenomenon of "immigrant downgrading" include the lack of complementary language skills (Dustmann et al., 2013), a smaller social network, or lack of eligibility for unemployment insurance benefits (Chassamboulli and Palivos, 2014). This phenomenon can also be observed among CEE immigrants in Ireland and the United Kingdom in the late 2000s.[19] In the following, we first examine the extent of qualification mismatch in SIAB data and then assess the consequences for the wage structure.

Qualification mismatch   To illustrate the extent of qualification mismatch, Table 6 displays the bivariate distribution of "educational background" and "job complexity" among employed individuals (separately for German nationals, permanent foreign nationals, and recent immigrants). An instructive indicator for the extent of qualification mismatch is the share of workers who hold a job of the least complex category "un- or semi-skilled work". Among German nationals, we observe that "skilled work" is by far the most frequent job complexity category and only 11% conduct un- or semi-skilled work. As expected, the fraction of workers conducting un- or semi-skilled work is highest among persons with missing educational information (26%), followed by those without vocational training (19%) — whereas the shares are substantially lower among those with vocational training (11%) and even more so among those holding a university degree (3%). A similar pattern — at generally higher levels — can be observed among permanent foreign nationals. By contrast, among recent immigrants, "un- or semi-skilled" work is the most frequent category — not only among those with missing educational information and those without vocational training, but also across the entire group. These figures indicate that a substantial fraction of recent immigrants works in jobs below their abilities.

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[18]As pointed out by Fitzenberger et al. (2006), SIAB entrants and/or employees in low-skilled jobs frequently lack educational information. Thus, recent immigrants with missing educational information likely have either low educational attainment or suffer from qualification mismatch (see below).

[19]See Barrett and Duffy (2008), Barrett, McGuinness, and O'Brien (2012), and Voitchovsky (2014) for Ireland as well as Drinkwater, Eade, and Garapich (2009), McKay (2009), and Blanchflower and Lawton (2010) for the UK. In contrast to Germany, these two countries (as well as Sweden, but EU migration flows to Sweden remained relatively low, see Gerdes and Wadensjö 2010, 2016) granted immediate and almost unrestricted freedom of movement to workers from the 2004 accession countries. Pohl (2007) discusses the implications of the UK experience for Germany.

The fact that the qualification mismatch among permanent foreign nationals is less pronounced indicates that this phenomenon is — at least partly — of temporary nature. To examine this hypothesis, we inspect the qualification mismatch among recent immigrants over their first five years in the German labour market (see Table 7). Among all recent immigrants observed in their first calendar year in Germany, more than 48% conduct un- or semi-skilled work. Unsurprisingly, the shares are highest among those with missing educational information (55%) and those without vocational training (50%). But also among those with vocational training (41%) and those holding a university degree (12%), the shares remain remarkable high. Four years later, among recent immigrants observed in their fifth calendar year in Germany, the shares have declined within each educational category, resulting in a share of 38% across the entire group.[20] We thus conclude that recent immigrants slowly sort into jobs according their qualification levels. After five years in Germany, at least among those holding a university degree, the distribution of recent immigrants over job complexity levels has converged to the one of permanent foreign nationals.[21]

Immigrant wage gap   To assess whether a marked qualification mismatch is associated with a large wage gap, we draw on evidence from the sub-sample of full-time employees. Indeed, Table 8 suggests a substantial unconditional wage gap relative to German nationals, among both, permanent foreign nationals (-15%) as well as recent immigrants (-33%). Part of the unconditional wage gap can be attributed to differences in observable characteristics such as age or less (formal) vocational training. However, the lower share of females among recent immigrants and the higher share of workers located in West Germany work in the other direction.

In the first years after arrival, we observe that the (otherwise unconditional) wage gap relative to German nationals shrinks — particularly so from the first (40%) to the second year (33%).[22] In other words, immigrants' wages catch up and thus experience relatively high growth rates starting from low levels.[23] After five years in the German labour market, the wage gap relative to German nationals (permanent foreign nationals) narrows to 21% (7%). This confirms our choice to treat immigrants with more than five years of experience in the German labour market as permanent foreign nationals.[24]

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[20]Note that the analysis of these dynamics is complicated by the fact that the share of recent immigrants with missing educational information decreases substantially over the first five years spent in Germany.

[21]Note that such observed assimilation profiles may be partly due to selective out-migration, see Borjas and Bratsberg (1996), Dustmann (2000), and the following two paragraphs.

[22]Note, however, that 1st year immigrants in the SIAB are on average 7.4 years younger than the reference group of German nationals. While the average age of the German reference group remains constant by construction, the average age of immigrants rises with time spent in the German labour market. Hence, some fraction of the shrinking wage gap is due to the rising relative age of immigrants.

[23]Further evidence on the catching-up process can be found in Dustmann (1993), Zibrowius (2012), Elsner and Zimmermann (2016), Beyer (2019), or Brunow and Jost (2019) for Germany, Eckstein and Weiss (2004) for Israel, and Dustmann and Preston (2012) for the UK. Fernández and Ortega (2008) do not find evidence of a catching-up process of immigrants in Spain. Borjas (1985) argues that the speed of the catching-up process estimated by Chiswick (1978a) for the United States is likely upward biased, due to a secular decline in immigrant "quality".

[24]Consistent with this, Brücker, Hauptmann, and Vallizadeh (2015) find that most of the rise in employment rates of non-refugee immigrants in the IAB-SOEP Migration Sample happens within the first five years since immigration.

2.3.3 Temporary and return migration

Figures 3a,b show that, on average in our sample,[25] 31% (47%) of all newly arrived EU immigrants have left Germany again by the beginning of the next (but one) calendar year.[26] Moreover, only about 35-40% of those ever registered in the SIAB since 2001 are still present in 2017. Some stays in Germany were planned to be temporary from the beginning, other migrants may have decided later on to return to their country of origin or to move on to another country. In any case, these large out-migration rates far exceed the rates in the US (Borjas and Bratsberg, 1996) and in the UK, both before (Dustmann and Weiss, 2007) and after (Blanchflower and Shadforth, 2009) EU Eastern Enlargement.[27]

More specifically, Figure 4 illustrates that current immigrants who have left Germany again within the same calendar year ("1st year leavers") are those who have experienced a particularly large wage gap relative to German nationals (more than 45%) during their short stay. By comparison, the wage gap among 2nd year leavers was still sizeable (more than 35%), but substantially lower. However, during their second calendar year, the gap even widened slightly. In addition, Figures 5a,b show that 1st and 2nd year leavers neither suffer from a higher incidence of (registered) unemployment nor from higher employment exit rates than others. In fact, the majority of immigrants — and particularly so CEE nationals — hold a job upon SIAB entry. This indicates that most CEE immigrants are labour market oriented,[28] who typically have received a job offer already before immigration (Straubhaar, 2014), e.g., by the help of online job search engines. This kind of positive selection implies that most CEE immigrants have skill profiles wanted by domestic employers. But when their wage remains too low, discouraged immigrants tend to leave very soon. We thus conclude that, for 1st and 2nd year leavers, the size of the wage gap is likely the key factor for out-migration.

Among 3rd and 4th year leavers, the picture is somewhat different. During their first few years in Germany, we observe that their wage gap relative to German nationals remained roughly constant (slightly above 20%) and close to the one among those recent immigrants who stayed at least five years in Germany (see Figure 4). In their last year in Germany, however, their wage gap suddenly rises. As can be seen from Figure 5a, the widening wage gaps are associated with rising group-specific unemployment rates, particularly so in the third year since immigration. Such a pattern (or similar) can neither be observed among recent immigrants who stayed at least five calendar years in Germany, nor among those who stayed their full potential duration.[29] Also employment exit rates are higher among 3rd and 4th year leavers than among others (from the second year onwards, see Figure 5b). This evidence indicates that out-migration decisions

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[25]These averages are based on a sample starting in 2001 (see section 2.2 for further information).

[26]Strictly speaking, our data capture only (non-)/participation in the German social security system. Dropouts therefore include also persons who launched their own business, left the labour force, or became civil servants (which is feasible for EU nationals). Yet, the close alignment between our data and official Destatis (2022) statistics indicates that most dropouts indeed left Germany.

[27]Some migrants even move repeatedly back and forth. In Germany, this phenomenon is particularly common among EU nationals (see Constant and Zimmermann 2012, who confirm previous evidence by Boehning 1981).

[28]The same conclusion is reached by Blanchflower and Shadforth (2009) for the UK after EU enlargement.

[29]This alternative control group consists of all recent immigrants who entered the SIAB 2014 or later (and thus were unable to complete five calendar years), but still stayed in Germany until the year 2017.

at these career stages are triggered by an unfortunate event — such as a job loss, followed by an unemployment spell and a new job with worse conditions than before.[30]

To sum up, the decision to stay or leave is not random. Rather, those immigrants decide to leave whose first career years in Germany proceeded unsatisfactory (Lehmer and Ludsteck, 2013). This kind of selective out-migration entails that the composition of stayers is even more closely geared to the needs of domestic employers than the one of new arrivals (Borjas and Bratsberg, 1996). In this paper, we argue that ignoring these effects not only generates a bias in estimated assimilation profiles (Dustmann, 2000), but also in the estimated impact on labour market outcomes in Germany.

2.3.4 Quantile characteristics of German and permanent foreign nationals

In Section 3, we quantify the impact of immigration on wages of German nationals and permanent foreign nationals along their wage distributions — and the impact on employment separately for total employment, full-time employment, and part-time employment. For this reason, we present descriptive statistics along these dimensions in the following.

Table 9 summarises descriptive statistics of full-time employed German nationals per decile of the regional wage distribution in West Germany. Strikingly, on average over the years 2006-2017, annual nominal wage growth was by far highest in the first decile (2.6%). In the remaining deciles, we observe a u-shaped pattern, i.e. nominal wage growth was above-average (below-average) in the second and the top three wage deciles (middle wage deciles). Higher wage growth among low-earners in our sample can be attributed — at least in part — to the introduction of the generally binding minimum wage in January 2015. To capture the associated effects, we construct for each employee a "minimum wage bite" indicator, equal to one if her daily wage in November 2014 was below the hourly minimum wage (introduced two months later) and zero otherwise (Bossler and Schank, 2020). As expected, we note that the density of affected employees in November 2015 is highest in the lowest decile and then decreases monotonously. According to this indicator, 14% of all employees were directly affected.[31] All other trends along the German nationals' wage distribution follow largely expected patterns, i.e. the average age per decile increases (except for the very bottom of the wage distribution), the share of women decreases, the fraction of employees holding a university degree increases, and the fraction of employees having completed vocational training follows a hump-shaped pattern.

In the same vein, Table 10 summarises descriptive statistics for the sample of full-time employed permanent foreign nationals in West Germany.[32] All trends follow the same (expected) patterns as those seen along the wage distribution of German nationals.

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[30]In a similar vein, Brenzel and Reichelt (2018) find that involuntary labour market transitions increase the immigrant wage gap.

[31]Due to wage changes at the individual level, however, some employees (e.g. young professionals) may have earned an hourly wage below the minimum wage in late 2014, but a substantially higher hourly wage one year later (and vice versa). This explains why we observe sizeable shares of affected individuals up to the fifth decile (as well as shares clearly below 100% in the lowest two deciles). Another reason behind this phenomenon might be that the deciles refer to the regional wage distribution, but the minimum wage is fixed at the national level.

[32]Note that this sub-sample covers 98% of all full-time employed permanent foreign nationals, see Table 5b.

Finally, Table 11 shows that, in our sample, employment growth among permanent foreign nationals was stronger than among German nationals. Moreover, among both groups, the number of part-time jobs grew faster than the number of full-time jobs. Indeed, the number of full-time jobs among German nationals decreased even slightly, reflecting incipient demographic change in recent years.[33]

3 Estimation strategy

We estimate the effects of EU immigration on wages of German/permanent foreign nationals along their wage distributions (akin to Dustmann et al., 2013) — and the effects on employment among part-time and full-time employees. In particular, we account for the potentially opposing effects of current vs. past immigration and therefore explicitly distinguish between 1st year immigrants (henceforth "new arrivals") and 2nd-5th year immigrants (henceforth "stayers").

3.1 Theoretical background

The channels through which immigration affects labour market outcomes among domestic residents are commonly studied through the lens of a partial equilibrium model, where a representative profit-maximising firm uses capital and labour to produce output.[34] There are I different worker types i which represent, e.g., various skill levels. All workers of the same type i, irrespective of their origin and their length of stay in the host country, are perfect substitutes and equally productive; workers of different types differ (potentially) in their productivity factors and are imperfect substitutes in the production process, which can be modelled using a (nested) CES function (Borjas, Friedman, and Katz, 1997). Under these assumptions, the impact of a change in the ratio of new arrivals to domestic residents, m^1, and a change in the ratio of stayers to domestic residents, m^2, respectively, on the percentage change in wages of domestic residents of the ith type can be characterized as:

$$\left. \frac{d \ln w_i}{dm^k} \right|_{m^1=0, m^2=0} = -\frac{1}{\eta} \left(\frac{\pi_i^k}{\pi_i^0} - \phi \sum_{j=1}^{I} \omega_j \frac{\pi_j^k}{\pi_j^0} \right), \text{ for } k = 1, 2 \qquad (1)$$

where $\eta > 0$ is the elasticity of substitution among different labour types i, π_i^0 is the fraction of resident labour of the ith type, π_i^1 is the fraction of new arrivals of the ith type, π_i^2 is the fraction of stayers of the ith type, ω_i is the weight of the ith type in aggregate labour, and ϕ is a parameter depending on the capital-labour ratio, the degree of capital mobility across labour types, and capital-labour substitutability. Consequently, equation (1) implies that the response of wages of domestic residents of the ith type is negative if, and only if, the relative density of immigrants and domestic residents, π_i^k/π_i^0, exceeds an appropriately weighted average of these relative densities across the distribution of labour types (and vice versa). In addition, the

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[33]Note that we measure employment growth among persons below the age of 60 years.

[34]The current subsection largely follows the chapters 2.1.1, 2.1.2 and 5.4 in Dustmann et al. (2013). Domestic residents can be either German nationals or foreign permanent nationals.

amplitude of the response decreases when the degree of substitutability among labour types is higher. Under very mild conditions — namely, capital is essential for production, imperfectly mobile across labour types, and imperfectly substitutable with labour — it can be shown that $\phi < 1$. In this case, immigration exerts a negative first-order effect on mean wages of domestic residents — even if the distribution of immigrants matches the distribution of domestic residents over all I labour types. Moreover, relative wage losses can be expected within those labour types i, where the immigration inflow is relatively strong (and vice versa).

Beyond the canonical model, immigration might exert positive effects on domestic wages if immigration generates a "surplus" which is then redistributed to domestic residents.[35] Such a surplus may arise if wages respond only sluggishly to productivity differentials and hence provide "settled" residents insufficient incentives for relocation, but less "settled" immigrants tend to move where productivity is high. Alternatively, a surplus may occur if immigrants receive lower wages than domestic residents of the same type (see also Section 2.3.2 on immigrant downgrading). Chassamboulli and Palivos (2014) study this case in an extended general equilibrium model with search and matching frictions. They argue that reduced expected employment costs provide firms incentives for additional job creation. Heightened market tightness then increases wages of both, immigrants and domestic residents as well as employment rates among all affected worker types. This "indirect channel" may counteract the adverse "canonical channel" described above. In a model version calibrated to the US, the authors show that wages of those domestic residents tend to fall where immigrants are over-proportionally located (and vice versa), whereas employment effects are positive across all types of domestic residents.

3.2 Empirical approaches

Two main strands can be distinguished within the empirical literature on the labour market impact of immigration.[36] The key difference between them is whether different labour types i represent (i) workers in different regions (the so-called "pure spatial approach", see e.g., Altonji and Card 1991) or rather (ii) workers of different education-experience combinations (the so-called "national skill-cell approach" following Borjas 2003).[37] The notion behind modelling choice (i) is that immigrants mainly compete with German/permanent foreign nationals from the same region. Therefore, the "pure spatial approach" uses the variation in immigration inflows across different regions. As is well-known, estimates based on this approach may be affected by endogeneity issues resulting, i.a., from self-selection of immigrants into prosperous regions (we elaborate on this in Section 3.3.2 below). On the other hand, the notion behind modelling choice (ii) is that immigrants mainly compete with residents of the same skill level.

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[35]In addition, an "immigration surplus" (Borjas, 1992) may arise within the canonical model when the labour supply expansion shifts the equilibrium down along the labour demand curve. As explained by Dustmann et al. (2013), however, this effect is second order.

[36]The current subsection largely follows Dustmann, Schönberg, and Stuhler (2016), who provide a detailed discussion of the empirical literature and provide further references.

[37]The "pure spatial approach" originates in works by Grossman (1982), Borjas (1983, 1987), and Card (1990). In addition, the "mixture approach" (see, e.g., LaLonde and Topel 1991 or Card 2001) combines the two approaches described above.

Therefore, the "national skill-cell approach" exploits the variation in immigration inflows across different education-experience combinations at the national level. Thus, issues arising from endogenous location choices are avoided at the outset. Based on this classification scheme, the "national skill-cell" approach identifies the wage effect of immigration on experienced *relative* to inexperienced German nationals in the same education group, whereas the "pure spatial approach" identifies the *total* (partial equilibrium) wage effect of immigration on a particular labour type i of German nationals. Owing to these conceptual differences, these two approaches typically reach very different results (Dustmann et al., 2016).

Which of the two approaches is more appropriate depends on the characteristics of the labour market under consideration. In the presence of "immigrant downgrading", however, the "national skill-cell approach" carries the risk of misclassification when German/permanent foreign nationals and recent immigrants of the same (formal) education-experience combination are treated as of the same type — even though they actually do not compete with each other.[38] Moreover, the catching-up processes described above render this problem time-varying. For this reason, we adopt a variant of the "pure spatial approach" (akin to Dustmann et al., 2013).

3.3 Instrumental variable estimation

As already mentioned, the "pure spatial approach" is prone to endogeneity issues. These issues may arise, i.a., from self-selection of immigrants into prosperous regions.[39] If regional labour demand shocks are serially correlated, regional wage growth may continue to be above-average even after the endogenous rise in regional immigration. The simultaneous occurrence of above-average regional wage growth and regional immigration then leads to upward-biased OLS coefficients. The standard approach to address this concern is to instrument current immigration inflows using "past settlement" patterns. This Bartik (1991) type shift-share IV is based on the observation that migrants tend to settle in regions with large existing migrant populations (Altonji and Card, 1991), particularly from the same country of origin (Card, 2001).

3.3.1 The conventional short-run IV approach

The standard approach to estimate the labour market effects of immigration considers only current, but no past immigration inflows.[40] In this case, the current regional migration inflow relative to total regional employment in the previous year, $m_{r,t}^1$, is instrumented as follows:

$$\tilde{m}_{r,t}^1 = \sum_{o=1}^{O} \frac{M_{o,r,T}}{M_{o,T}} \frac{F_{o,t}^1}{L_{r,t-1}}, \tag{2}$$

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[38]For the same reason, also estimates based on the structural approach, e.g., Ottaviano and Peri (2012) and Manacorda, Manning, and Wadsworth (2012) are likely biased.

[39]For evidence on this pattern, see Borjas (2001), for the US, or Gathmann, Keller, and Monscheuer (2014), for Germany.

[40]Note that, e.g., Dustmann et al. (2013) defines current immigration as all inflows in the past two years.

where the first ratio under the sum is the share of foreign nationals from country o in Germany who live in region r at some base year T and the second ratio under the sum is the total inflow of immigrants from country o at time t at the national level — the so-called national shift — relative to the population in region r at time $t-1$. In other words, the instrument-implied inflow of immigrants from country o in region r is given by the associated *national shift* multiplied with the *regional share*, i.e. the fraction of immigrants from country o who typically settle down in region r. The validity of this "past settlement" instrument is based on the assumption that inflows at the national level are less endogenous to regional labour market conditions than inflows at the regional level (Card, 2009).

However, as firstly noted by Borjas (1999) and further elaborated by Aydemir and Borjas (2011), Llull (2018) and Jaeger et al. (2018), this instrument may violate the exclusion restriction if regional labour demand shocks (and thus regional wage dynamics) are serially correlated, inducing a positive correlation between the initial regional shares and subsequent regional wage dynamics. This concern can be addressed by lagging the base year, T, as far as possible.[41,42]

Moreover, Jaeger et al. (2018) argue that immigration triggers dynamic (general equilibrium) adjustment processes, such as internal migration, capital reallocation (Borjas, 1999), or — as argued in Section 2.3.2 — immigrant downgrading and the subsequent catching-up processes. These adjustment processes typically mitigate the initial (negative) wage effects of immigration. However, these processes are time-consuming and hence likely still ongoing in the subsequent observation period(s).[43] As national shifts in Germany are serially correlated — even though weaker than in the US (see below) — the standard past settlement IV helps not only to predict current immigration inflows (as intended), but also past immigration inflows (which is problematic). Thus, the standard "short-run" IV is likely conflated by the potentially opposing effects of current vs. past immigration inflows and thus biased towards zero (Jaeger et al., 2018).

3.3.2 Dynamic shift-share IV

To disentangle the effects, Jaeger et al. (2018) propose a "dynamic shift-share" approach, where both current as well as past immigration inflows are explicitly taken into account. In the following, we adopt their approach but measure past immigration by stocks of stayers from past immigration cohorts rather than by lagged immigration inflows. We thus capture that, owing to the large extent of temporary migration in Germany, only a subset of past immigrants continues its careers in Germany over the first few years after immigration (see Section 2.3).

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[41]See also Hunt and Gauthier-Loiselle (2010), who use 1940 as base year in their study.

[42]Another concern relates to the fact that the denominator of $m_{r,t}^1$, i.e. total regional employment in the previous year, and the size of the regional population at the same time, $L_{r,t-1}$, are likely correlated. To rule out that our IV strategy is biased by such a spurious correlation, we replace national shifts by random numbers in our first stage regressions. None of these placebo IVs turns out to be significant (see Table 12a), which indicates that our IVs are not "blunt". See Clemens and Hunt (2019) and the references therein for more details.

[43]For instance, heightened labour supply in popular immigration regions provides incentives for local residents to move to less affected regions and/or incentives to invest in regional physical capital. Both channels help to align the capital-labour ratio across regions (Borjas, 1999), but tend to be slow (Jaeger et al., 2018).

Next, we instrument both immigration measures using past settlement patterns:

$$\tilde{m}_{r,t}^i = \sum_{o=1}^{O} \frac{M_{o,r,T}}{M_{o,T}} \frac{F_{o,t}^i}{L_{r,t-1}}, \text{ for } i = 1, 2. \tag{3}$$

For $i = 1$, we instrument the measure of new arrivals. In this case, equation (3) is identical to equation (2). For $i = 2$, we instrument the stock of stayers. In this case, the national shift, $F_{o,t}^2$, is given by the national inflow of immigrants from country o between the years $t - 1$ and $t - 4$.[44] All other terms are identical. In particular, both IVs are constructed using the same base year, $T = 1998$.

However, the two instruments are only able to separately identify the impact of current vs. past immigration if they show sufficient variation between each other. The original "dynamic shift-share" specification (Jaeger et al., 2018) therefore requires sufficient variation between national shifts of new arrivals, $F_{o,t}^1$, and their own first lags, $F_{o,t-1}^1$ — which is unlikely the case (as argued above). Indeed, we observe that the autocorrelation coefficient of $\tilde{m}_{r,t}^1$ is close, even though significantly below unity (0.97) at any conventional level.[45] By contrast, our modified approach requires sufficient variation between national shifts of new arrivals, $F_{o,t}^1$, and national shifts of stayers, $F_{o,t}^2$. The resulting correlation coefficient between $\tilde{m}_{r,t}^1$ and $\tilde{m}_{r,t}^2$ then turns out to be significantly lower (0.92).[46] We therefore choose to modify the "dynamic shift-share" approach along these lines in our baseline specification.

3.4 Estimation specification

Following Dustmann et al. (2013), we identify different labour types, i, with full-time employees in the same decile (quartile) of the German nationals' (permanent foreign nationals') wage distribution, p, in region r at time t.[47] This approach is agnostic to which sub-group of German nationals immigrants are actually competing with and thus avoids the risk of misclassification in the presence of immigrant downgrading. As regional entity, r, we use the 75 official spatial planning units (*Raumordnungsregionen*, ROR) in West Germany including Berlin.[48] We then

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[44]The assumption underlying our approach is that not only new arrivals, but also stayers are attracted by prosperous regions where wage growth is above-average and that also the potential bias arising from endogenous location choices of stayers can be appropriately addressed by a shift-share IV based on past settlements.

[45]As in Jaeger et al. (2018), we report the autocorrelation coefficient of $\tilde{m}_{r,t}^1$, given that all variation between the two instruments comes from variation in national shifts when they are both constructed using the same base year. Moreover, we first compute the autocorrelation coefficient of the instrument for each region over the sample period and then average across regions — since we are concerned about serial correlation of the instrument at the regional level. By comparison, Jaeger et al. (2018) report estimates of up to 0.99 for the pairwise correlation between the instrument in the present and the past decade across different US regions.

[46]To be precise, the 95% confidence intervals of the two estimates do not overlap.

[47]Appendix A shows that immigration does not change ranks in the German nationals' wage distribution.

[48]These ROR regions are aggregates of the 401 NUTS-3 regions (*Kreise*) in Germany. Note that NUTS-2 regions (*Regierungsbezirke*) do not exist in all 16 German NUTS-1 regions (*Länder*). For a map of all ROR regions in Germany, see: https://www.bbsr.bund.de/BBSR/DE/Raumbeobachtung/ Raumabgrenzungen/deutschland/regionen/Raumordnungsregionen/download-karte-grenzen.jpg?__ blob=publicationFile&v=18.

estimate the following wage growth equation over the annual sample period 2006-2017:

$$\Delta \ln W_{p,r,t} = a_p + b_r + c_p X_{r,t} + d_p Y_t + e_p^1 m_{r,t-1}^1 + e_p^2 m_{r,t-1}^2 + \epsilon_{p,r,t}, \tag{4}$$

where a_p is a constant; b_r is a ROR region fixed effect; $X_{r,t}$ is a vector of regional controls capturing changes in the demographic composition (i.e. age, educational background, and gender) among all employed German/permanent foreign nationals in a given ROR region as well as the region-specific "minimum wage bite" (see Section 2.3.4); Y_t is a vector of national-level control variables, i.e. the CPI-based inflation rate as well as a linear and a quadratic time trend;[49] $m_{r,t}^1$ is the ratio of new arrivals and $m_{r,t}^2$ is the ratio of stayers relative to total regional employment in the previous year, respectively;[50] and $\epsilon_{p,r,t}$ is a random error term. We lag both immigration measures by one year to account for delays in the transmission from immigration on wage growth. The estimates e_p^1 and e_p^2 then identify the *total* wage effect of current and past immigration, respectively, on a particular wage decile (quartile) of German/permanent foreign nationals. To facilitate comparison with previous studies, we also report the "conventional IV estimate", i.e. the value of $m_{r,t-1}^1$ when $m_{r,t-1}^2$ is restricted to 0, as well as the corresponding OLS estimates.

4 Estimation Results

The current section quantifies the impact of recent EU immigration on labour market outcomes in West Germany among German/permanent foreign nationals. Following the empirical strategy outlined in Section 3, we estimate the effects using a two stage least squares procedure.

4.1 Wage effects

We first focus on the wage effects among full-time employed German nationals.[51] In the first stage, we regress both immigration measures, $m_{r,t-1}^1$ and $m_{r,t-1}^2$, separately on the two dynamic shift-share instruments (see equation 3) and all explanatory variables included in equation (4).[52] Table 14a shows that both instrumental variables are statistically significant and have the expected sign when new arrivals are instrumented. In other words, past settlement patterns indeed positively affect location choices of new arrivals. On the other hand, a large stock of stayers (as implied by the corresponding instrument $\tilde{m}_{r,t-1}^2$) discourages new arrivals to locate in

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[49]Note that, following Brücker and Jahn (2011), we do not include time dummies such that the coefficients are identified by the variance of immigration over time.

[50]As our regional classification is based on place of work (instead of place of residence), both immigration measures draw on the employment sample; i.e., they capture all immigrants who hold a job either in their 1st (2nd-5th) year after labour market entry in Germany. See Figure 6 and Table 13 for annual averages at the national level. Note that seasonal migration plays only a minor role in our sample (see also Section 4.4).

[51]The following regressions consider only those full-timers with an employment spell in the month of November (see Footnote 13) whose real gross daily wage amounts to at least 30 Euro (measured in 2015 consumer prices).

[52]Following the quantile regression literature (Koenker and Hallock, 2001), neither the explanatory variables nor the two instrumental variables are decile-specific, but are based on all sample observations (Schindler-Rangvid, 2003), representing the joint population of German nationals and permanent foreign nationals in a specific region. For this reason, the first stage regressions are identical across all quantiles of both groups.

that region — likely, to avoid heightened competition for jobs suitable for recent immigrants. When stayers are instrumented (see Table 14b), only $\tilde{m}_{r,t-1}^2$ is positive and significant (and $\tilde{m}_{r,t-1}^1$ is not). This means that location choices of past immigrant cohorts are affected by past settlement choices combined with nation-wide location trends, but not by current immigration inflows (as implied by $\tilde{m}_{r,t-1}^1$). Moreover, we note that both F-statistics are sufficiently high.

4.1.1 Wage effects among German nationals

Impact on mean wages Consistent with the hypothesis based on the canonical partial equilibrium model (see Section 3.1), Table 15 shows that, if the density of new arrivals amounts to 1%, growth of mean wages of German nationals significantly slows down by 1.23 percentage points. On the other hand, if the density of stayers amounts to 1%, growth of mean wages of German nationals is significantly enhanced by 0.35 percentage points — which confirms the hypothesis that this measure captures those effects that mitigate the initial negative effects (Jaeger et al., 2018). Moreover, we note that the new arrivals coefficient in our dynamic specification is indeed substantially more negative — and estimated with a higher level of accuracy — than the conventional short-run IV estimate based on current immigration only (-0.82, see Panel A of Table 16, last column). This result is not surprising, given that the conventional short-run IV estimate is likely conflated by the opposing short- and medium-run effects (Jaeger et al., 2018) and hence biased towards zero (see also Figure 7a).

In addition, note that a negative one-time shock to wage growth (as estimated using the conventional short-run IV estimator) implies a permanent negative effect on the wage level — whereas our dynamic estimates suggest that the initial one-time shock to wage growth is (partially) offset in the following years. To quantify the transitory impact of a one percent inflow of newly arrived EU migrants on the level of mean wages among German nationals, we perform the following two exercises. First, we assume that the entire immigration cohort stays in Germany for at least five years.[53] As can be seen from Figure 8a, the level of mean wages among German nationals remains significantly below the zero immigration scenario until and including the third year since immigration. Second, we additionally take into account that, year by year, a fraction of the original cohort leaves the German labour market again with a certain probability.[54] Figure 8b shows that — owing to the downward-adjusted wage enhancing effect associated with stayers — mean wages of German nationals now remain significantly below the zero immigration scenario until and including the fifth year since immigration.

Moreover, we quantify the joint impact of current and past immigration on the growth rate of mean wages among German nationals over the entire sample period using actual migration densities (see Figure 9a).[55] Between the years 2006 and 2011, we observe that the dampening

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[53]In each of the first five years, $t \in [1,5]$, the gap between the actual wage level and the counterfactual zero immigration scenario is given by the sum of the current immigration coefficient, e^1, and a multiple of the past immigration coefficient, $(t-1)e^2$. The associated confidence intervals are based on Wald tests, where we test the restriction $e^1 + (t-1)e^2 = 0$.

[54]To capture the impact of a representative one percent inflow of EU migrants, we adjust e^2 at $t = 2, \ldots, 5$ for the extent of out-migration (see Section 2.3.2).

[55]For every year in our sample, we therefore compute the sum of the two immigration coefficients, each

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effect on annual wage growth remains below 0.2 percentage points and then suddenly rises first to 0.6 percentage points in 2012 and then further to 0.9 percentage points in 2015. These dynamics align well with the rising number of new arrivals at that time (see Figure 6 and Table 13). Towards the end of our sample, owing to the counteracting impact of stayers, the effect gradually declines to 0.8 percentage points in 2017.[56] On average between the years 2006 and 2017, the joint impact of current and past immigration thus points to a slowdown of about 0.5 percentage points per year. In addition, Figure 9a also shows that, until and including the year 2015, the joint impact of current and past immigration on mean wages among German nationals remains essentially unchanged when estimated using the conventional short-run IV estimator. After the year 2015, however, the conventional short-run IV based estimate does not start to decline gradually. On the contrary, we observe that the implied wage dampening effect rises (in absolute value) even above 1 percentage point. We thus conclude that the conventional short-run IV estimator overestimates the persistence of the wage dampening effect — given that the counteracting impact of stayers is not taken into account.

Impact along the wage distribution We then estimate the impact along the wage distribution of German nationals. As above, we find it instructive to visualize the estimated coefficients (see Table 16) using the concept of a representative one percent EU immigration cohort. Figure 10a shows that the wage dampening effect is clearly significant only in three deciles: the two bottom deciles and the very top.[57] Around the median of the wage distribution, the effects are at most borderline significant and rather short-lived. This leads us to the conclusion that the wage dampening effect of immigration is concentrated at the bottom of the wage distribution of German nationals.

The same conclusion is reached when we examine the joint impact of current and past immigration over the entire sample period (see Figure 10b). We observe that the significantly negative effect on mean wages among German nationals is driven mostly by the first, the second, and the tenth decile (again, note Footnote 57). In the first decile, the wage growth dampening effect peaks in 2015 at 2.8 percentage points and amounts to about 1.4 percentage points on average over the entire sample period. In the second and the tenth decile, the amplitude is about half as large. Across all other deciles, we observe no significant effects.

The pattern found aligns well with the relative density of recent EU immigrants in the wage distribution of German nationals; i.e., the share of recent EU immigrants earning a wage within decile $x \in [1, 10]$ of the wage distribution of German nationals. For both, new arrivals and stayers, the relative density is by far highest in the lowest two deciles (where about 3/4 of them are located), is lowest around the median, and then slowly starts rising again (see Figure 11a).[58]

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weighted with the corresponding lagged aggregate immigration density: $e^1 m_{t-1}^1 + e^2 m_{t-1}^2$. As above, the associated confidence intervals are based on Wald tests.

[56]Beyond that, we note that the out-of-sample forecast for the year 2018 (determined by lagged immigration densities observed in 2017) implies a wage growth dampening effect of about 0.7 percentage points.

[57]Note that individual wages above the social security contribution assessment ceiling are imputed (see also Footnote 12). This affects roughly the upper 15 percent of wage earners. Therefore, our estimates for the upper two deciles — also note the low (adjusted) R^2 values, see Table 16 — should be interpreted with caution.

[58]Figure 11b shows the relative density of recent EU immigrants in the wage distribution of permanent foreign

Following Dustmann et al. (2013), we test this relationship more formally, i.e. we first regress the decile-specific coefficients of new arrivals (see Table 16) on the natural logarithm of their relative immigration density (see Figure 12a). Second, we average the estimated decile-specific effects of a representative one percent EU immigration cohort between the second and the fifth year in Germany (see Figure 10a) and then regress these values on the natural logarithm of the relative immigration density of stayers (see Figure 12b). Under the assumption that capital supply is perfectly elastic ($\phi = 1$), the slope coefficients of these regressions can be interpreted as estimates of the negative inverse of the elasticity of substitution between different labour types i, η (Dustmann et al., 2013). Figures 12a,b show that the two estimated slope coefficients are not significantly different from zero, which implies that also η is about one. Moreover, we note that the close alignment between the relative immigration densities and the estimated coefficients along the wage distribution of German nationals (as captured by the coefficients of determination) is fully consistent with the prediction of equation (1). Accordingly, wage growth is dampened exactly in those deciles of the wage distribution of German nationals where immigrants are disproportionally often located.

Original dynamic shift-share estimates We then compare our results with the original dynamic shift-share estimates akin to Jaeger et al. (2018). More precisely, we capture the impact of past immigration inflows using lagged immigration inflows, not stocks of stayers. We thus disregard that many immigrants stay only for a limited time period in Germany. Another disadvantage of this strategy is that, as documented in Section 3.3.2 for our sample, the autocorrelation coefficient of the instrument of new arrivals is significantly higher than the correlation coefficient between the instrument of new arrivals and the instrument of stayers, which makes it more difficult to separately identify the impact of current vs. past immigration.

Panel C of Table 16 shows that, across most deciles of the wage distribution, both coefficients increase in absolute magnitude. As expected, the coefficients capturing the effects of past immigration rise stronger — given that the mitigating impact of past immigration is effective only for one year, instead of up to four years as in our baseline specification. As a result, in absolute value, even in the first decile the 60% confidence intervals of the two coefficients overlap. This implies there is indeed a significant wage dampening effect of current immigration (which materialises with a delay of one year), but just after one additional year the effect has largely disappeared. Around the median of the wage distribution of German nationals, we note that the mitigating impact of past immigration even dominates the initial dampening effect. We thus conclude that the results are qualitatively similar to our baseline specification. However, as our baseline coefficients additionally account for the impact of out-migration, we judge that our estimates capture the dynamics of the effects more appropriately.

OLS estimates Panel D of Table 16 shows that the OLS new arrivals coefficients are in general less negative and estimated with a lower level of accuracy. The expected upward bias can be attributed, e.g., to the phenomenon that EU immigrants tend to settle down in prosperous

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nationals.

regions where wage growth is above-average (see Footnote 39). Other endogeneity issues emphasized in the literature include internal migration or capital reallocation (see Footnote 43). Both of these channels are time-consuming and hence affect mainly the stayers coefficients. However, we note that the OLS stayers coefficients are not necessarily upward-biased. This suggests that the endogeneity impact is ambiguous. On the one hand, both internal migration and capital reallocation tend to enhance regional wage growth and, thus, induce an upward-bias in the OLS stayers estimate. On the other hand, the OLS stayers coefficients capture also those immigration-related effects that mitigate the initial negative effects. As our IV new arrivals coefficients are more negative than the corresponding OLS estimates, also the IV stayers coefficients may be larger in absolute value than the corresponding OLS estimates. According to our results, the latter effect dominates the former in the present sample.

4.1.2 Wage effects among permanent foreign nationals

Owing to a substantially smaller amount of observations, we estimate the wage effects of recent EU immigration among full-time employed permanent foreign nationals not for each decile of their wage distribution, but for each quartile. Panel B of Table 17 shows that we are neither able to find statistically significant effects on mean wages nor across the four quartiles (even though the new arrivals coefficient in the first quartile is only borderline insignificant, with a p-value close to 0.1, see also Figure 7b). The coefficients above the median appear to have a positive sign. Moreover, we note that all but one of the conventional short-run IV coefficients are insignificant (see Panel A). The overall pattern changes only little when we follow the original shift-share approach (see Panel C) or estimate the coefficients using OLS (see Panel D). The fact that the estimates among permanent foreign nationals are generally less precise is likely caused by the less granular classification of permanent foreign nationals into quartiles instead of deciles (which in turn is due to the lower number of observations, see Tables 9 and 10).

4.2 Employment effects

In contrast to the wage effects of immigration, the employment effects are not estimated along the wage distribution, but separately for the whole employment sample, all part-time employees, and all full-timers (see Table 18). The IV procedure remains largely unchanged.[59,60]

4.2.1 Among German nationals

The main result of this exercise is that current immigration exerts a significantly positive effect on employment growth among full-time employed German nationals (see the left panel of Table 18). The coefficient capturing the impact of stayers is insignificantly negative and

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[59]In the sample of permanent foreign nationals, we additionally control for the share of "entrants", i.e. those permanent foreign nationals who were classified as 5th year recent immigrants in the previous year.

[60]Note further that the outcome variable, regional employment growth, and the instrumented immigration inflow rates share the same denominator. As in Footnote 42, we therefore run placebo regressions to rule out that the estimated relationship is biased by such a spurious correlation (see Table 12b).

comparably small in magnitude. This implies that the effect on German full-timers is quite persistent. On the other hand, there is a counteracting negative effect on part-time employment among German nationals. With regards to total employment of German nationals, we note that the positive effect on full-time employment dominates the negative effect on part-time employment.[61] Given that the average growth rate of full-time (part-time) employment relationships among German nationals in our sample is negative (positive), we conclude that immigration counteracted these general trends (see Table 11).

4.2.2 Among permanent foreign nationals

Table 18 shows that the effects of new arrivals on full- and part-time employment among permanent foreign nationals are positive, but insignificant. However, the impact on total employment is significantly positive. In other words, there is a clear positive impact on total employment, but it is less clear whether the impact works through full- or part-time employment relationships. As among German nationals, there are no significant employment effects of stayers, which implies that the positive impact on total employment is quite persistent.

4.3 Discussion

In summary, we find transitory negative wage effects among German nationals, particularly at the bottom of the wage distribution. On the other hand, we show that there is a positive and persistent employment effect among German nationals (and also among permanent foreign nationals), which is driven by a rising number of full-time employment relationships. The former finding is consistent with the predictions of the canonical partial equilibrium model discussed in Section 3.1, according to which an expansion of labour supply dampens wage growth — particularly in those wage deciles where immigrants are located. However, the canonical partial equilibrium model is not designed to explain (neither positive nor negative) employment effects as it rests on the assumption that the labour market clears. The latter finding can be rather reconciled by an extended general equilibrium model with search and matching frictions Chassamboulli and Palivos (2014) where immigrants generate a "surplus", which is then redistributed to German and/or foreign permanent residents in terms of higher employment rates (see Section 3.1). Potential sources of the "surplus" are lower reservation wages among immigrants or higher spatial/occupational mobility (Dustmann et al., 2013) which allows immigrants to "fill the gaps" in domestic labour supply. Such beneficial employment effects require that the skills profiles of immigrants and domestic residents are complementary and that the immigrant population's skill profile is relatively scarce. Thus, the immigration-induced expansion of labour supply helps to explain why Germany experienced a period of relatively low wage growth, but strong employment growth in the second half of the 2010s.[62]

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[61]Note that, consistent with the insignificant stayers coefficients, the conventional IV coefficients and the stayers IV coefficients are of similar magnitude.

[62]Springford (2018) refers to this pattern as the German "wage puzzle". In a similar vein, Bulligan and Viviano (2017) conclude that the wage Phillips curve in Germany has become weaker in recent years. On the other hand, Klinger, Musayev, Natal, and Weber (2019), who do not follow an IV approach, even find positive

By comparison, the literature on immigration to Germany in the 1990s finds that wage and employment effects among German nationals were rather small, but there were clearly negative wage and employment effects among permanent foreign nationals (see, for example, D'Amuri et al. 2010, Felbermayr et al. 2010, or Brücker and Jahn 2011).[63] Our paper instead shows that the outcomes in the 2010s are more favourable, particularly along the employment margin. We argue that the following two reasons are important in this context. First, the German labour market has become more flexible over the past 20 years. In particular, newly emerged sectors such as subcontracted labour pay low wages, but may also offer immigrants opportunities to gain experience in the German labour market.[64] Second, in the 1990s, immigration was driven by refugee immigration (mainly originating from former Yugoslavia) and ethnic German emigrants from the former Soviet Union and other former Eastern bloc countries ("Spätaussiedler"). At that time, refugees were usually not permitted to work[65] and were often required to return to their home countries after the end of combat operations in the late 1990s.[66]

Instead, in the 2010s, job search was the main immigration motive. Low unemployment rates among CEE nationals indicate that most of them are labour market oriented, who typically have received a job offer already before immigration (Straubhaar, 2014). This kind of positive selection implies that most CEE immigrants hold skill profiles wanted by domestic employers. In addition, newly emerged (low-pay) sectors may have helped them to effectively "fill the gaps" in domestic labour supply. For this reason, crowding-out effects on German/permanent foreign nationals did not occur. On the contrary, the immigration inflow likely helped German nationals and permanent foreign nationals to find newly created (full-time) jobs, complementary to those (rather low-paid) jobs found by recent immigrants.

Our findings are also in line with the labour market impact of post-enlargement migration in the UK, which granted immediate and almost unrestricted labour market access to workers from the 2004 accession countries, whereas Germany lifted these restrictions not before May 2011.[67] Hence, the UK experience in the late 2000s may serve as benchmark to evaluate the

wage effects of immigration in Germany at that time.

[63]Moreover, Bauer (1998, Chapter 8), Bonin (2005), and Steinhardt (2011) focus on labour market outcomes among German nationals. In contrast to the former two, the latter author emphasizes negative effects in certain occupational clusters. Other contributions on Germany in the 1990s investigating particular immigration episodes include, e.g., Velling (1995) and Priesack (2018) on the early 1990s, Glitz (2012) on ethnic Germans after 1995, Dustmann and Glitz (2015) on refugees, Prantl and Spitz-Oener (2014) on East German immigrants, and Dustmann, Schönberg, and Stuhler (2017) on a border region in south-east Germany. Studies focussing on the 1970s and 1980s include Winkelmann and Zimmermann (1993), De New and Zimmermann (1994), and Pischke and Velling (1997).

[64]Even though Kvasnicka (2009) finds little support in favour of the stepping-stone hypothesis among all workers included in the SIAB (formerly known as IABS), Kogan (2011), de Graaf-Zijl, van den Berg, and Heyma (2011), Hveem (2013), and Jahn and Rosholm (2013) provide evidence that the effects among foreigners/immigrants may be more beneficial, see Jahn and Rosholm (2018, Table 1) for an overview.

[65]Work permit restrictions for asylum seekers have been imposed at least since the early 1980s (Schueler, 1982). Between the years 1997 and 2000, in general no work permits for newly arrived asylum seekers were issued by German authorities (Deutscher Bundestag, 2000).

[66]According to Jäger and Rezo (2000), about 350,000 persons from Bosnia and Herzegovina were granted refugee status in Germany by the end of the year 1995. By the end of the year 1999, only slightly less than 40,000 of those were still registered in Germany.

[67]Note that also Ireland (and Sweden, see Footnote 19) followed a similar liberal immigration policy. However, the Great Recession hit the Irish economy relatively harder, resulting in net emigration from Ireland to the EU

German experience one decade later. Evidence on the wage effects among British natives are reported by Nickell and Saleheen (2017), who estimate a (small) negative effect, particularly among un- or semi-skilled service occupations. Also Reed and Latorre (2009) find a small negative effect on average wages. With regards to (un)employment, Lemos and Portes (2013) argue that there is little evidence of a rise in claimant unemployment,[68] whereas the Migration Advisory Committee (2012) finds no statistically significant impact on native employment.[69]

In addition, transitory negative wage effects among German nationals, along with positive employment effects — as found in our study — appear consistent with the findings of Blanchflower and Shadforth (2009) for the UK. Accordingly, immigration inflows may increase the "fear" of unemployment among natives. To test this hypothesis in our sample, Figure 13a and Table 19a show the estimated evolution of consumers' misperceptions of unemployment risk (see the caption for details). We observe that this series reached an all-time (overly optimistic) high in late 2010 and then trended downwards until early 2016. Moreover, Figure 13b and Table 19b illustrate that, since the extension of free movement of workers to CEE nationals in 2011, consumers' misperceptions of unemployment risk depend negatively on the number of new arrivals (i.e. perceptions become more pessimistic), but positively on the number of stayers (i.e. perceptions become more optimistic). This indicates that new arrivals indeed increase the "fear" of unemployment among German nationals. The "fear" of unemployment then disappears over time when the negative employment effects — in line with our results — do not materialise. This is captured by the positive coefficient of stayers on consumers' misperceptions. Thus, despite having no adverse effects on (un)employment, immigration inflows may still drag down wages temporarily while the "fear" of unemployment remains at elevated levels.[70]

4.4   Robustness checks

We perform a large number of robustness tests to check the sensitivity of our results. First, Table 20 displays alternative estimates on the wage effects among German nationals. To begin with, we estimate the effects when the sample period ranges from 2007-2017; i.e., we drop the year 2006. This choice is motivated by the fact that the last element of the so-called Hartz reforms was implemented not before February 2006. More specifically, the German Federal Government lowered the maximum unemployment benefit duration for older workers from 32

(Barrett, Bergin, Kelly, and McGuinness, 2016). As this makes the case of Ireland in the 2000s less comparable to in Germany in the 2010s, we focus on the situation in the UK (see Clark, Drinkwater, and Robinson 2016 for a literature overview) in the following.

[68]Lemos and Portes (2013) also report insignificantly positive wage effects. In contrast to the unemployment effects, however, the wage effects are not instrumented.

[69]Based on a large international migration database (drawing on OECD and Eurostat data), Kahanec and Pytlikova (2017) even find small, but statistically significant positive effects of migration flows from new EU member states on employment rates in old EU member states. Moreover, Furlanetto and Robstad (2019) estimate the short-run effects of immigration based on a BVAR using Norwegian macro data. They find a negative effect on real wages and a (more persistent) negative effect on the unemployment rate.

[70]Beyond that, Blanchflower and Shadforth (2009) argue that immigration even reduces the natural rate of unemployment, as it raises supply more than demand. See Blanchflower and Lawton (2010) for further references.

to 18 months (Dlugosz, Stephan, and Wilke, 2014) in an attempt to increase labour supply of affected cohorts (Dietz and Walwei, 2011). This policy measure likely dampened wage growth in the year 2006 — which cannot be appropriately captured by our estimation strategy. At the same time, the starting point of the reduced sample marks the end of the so-called "wage moderation", a period characterized by relatively low wage growth between the years 1997-2007.[71] Column (2) shows that, at the bottom of the wage distribution, both coefficients grow in absolute magnitude and level of significance when estimated using the reduced sample. On the other hand, at the very top of the wage distribution, the estimated impact of new arrivals is substantially lower and estimated with a lower level of accuracy (again, see Footnote 57). The resulting new arrivals coefficient on mean wages of German nationals thus falls slightly. In columns (3) and (4), we exclude new arrivals and stayers classified as seasonal migrants (see Table 13) and migrants employed in agriculture, respectively, from the sample. In both cases, all estimated coefficients remain essentially unchanged. Moreover, in column (5), we additionally control for changes in regional employment shares in low and high pay industries to capture the impact of structural change at the regional level. We now observe that, at the bottom of the wage distribution, the coefficients grow in absolute value and level of significance. In all other deciles of the wage distribution of German nationals, we are unable to note marked changes. In column (6), we alternatively include the regional unemployment rate. This variable reflects the Phillips curve relationship that wage growth tends to be higher in regions where labour supply is scarce. As a result, in the second and the third (but not in the first!) decile of the wage distribution of German nationals, both coefficients decrease somewhat in absolute magnitude and level of significance. By contrast, at the top of the wage distribution, we observe the opposite effect. Qualitatively, however, the overall pattern does not change. In column (7), we estimate the effects jointly for all 96 ROR regions in East- and West-Germany. We note that, at the bottom (top) of the wage distribution, both coefficients (the new arrivals coefficient) rise(s) moderately in absolute magnitude. Finally, in column (8), we classify all 1st-2nd year immigrants as new arrivals and all 3rd-5th year migrants as stayers to allow for a different assimilation scheme. We observe that, as expected, the new arrivals (stayers) coefficient shrinks (rises) somewhat in absolute magnitude across most deciles. Figure 9b illustrates that the implied dampening effect on wage growth among German nationals becomes slightly weaker and somewhat less persistent (particularly towards the end of our sample). The overall pattern, however, remains remarkably robust.

Second, Table 21 displays the corresponding sensitivity tests on the wage effects among permanent foreign nationals in West-Germany. The main result of this exercise is that the borderline insignificant new arrivals coefficient in the lowest quartile of the wage distribution turns significantly negative in most (but not all) alternative specifications. All other (insignificant) coefficients remain insignificant across all robustness checks.

In summary, we find that transitory negative wage effects at the bottom of the wage distribution of German nationals are a robust feature of the data. As expected, the negative impact

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[71]See Deutsche Bundesbank (2018) on the exact timing of the wage moderation as well as contributions by Boysen-Hogrefe and Groll (2010), Gartner and Klinger (2010), and Burda and Hunt (2011).

of new arrivals on wages at the very top of the wage distribution of German nationals is less robust. The negative impact of new arrivals on wages of permanent foreign nationals in the lowest wage quartile is significant in some, but not all specifications.

5   Conclusion

The main contribution of this paper is to provide a framework to study the labour market effects of EU immigration in Germany. In times of free movement of workers, both in- and outflows of migrants are large and selective. To capture the resulting dynamic adjustment processes, we consider not only current immigration, but also the stock of stayers from past immigration cohorts. This novel strategy allows us to separately identify the opposing short- and medium-run effects on labour market outcomes in Germany.

We find that new arrivals from other EU member states exert a significantly negative effect on mean wages of full-time employed German nationals, whereas the impact of stayers is significantly positive. The former effect is consistent with the predictions of the canonical partial equilibrium model, according to which an expansion of labour supply dampens wage growth. The latter effect confirms the hypothesis that past immigration captures those migration-related effects that mitigate the initial negative effects (Jaeger et al., 2018). Jointly, the two effects imply that EU immigration triggers a transitory negative effect on the wage level, which remains significant for about five years. Along the German nationals' wage distribution, the effects are particularly strong in the lowest two deciles — where most recent EU immigrants are located.

With respect to employment of German nationals, we show that there is a permanent positive effect. Thus, our results contribute to reconcile the German "wage puzzle" (Bulligan and Viviano, 2017; Springford, 2018), i.e. a period of relative low wage growth, but strong employment growth in the second half of the 2010s. By comparison, the literature on immigration to Germany in the 1990s typically finds rather adverse employment effects, particularly among permanent foreign nationals (see, for example, D'Amuri et al. 2010, Felbermayr et al. 2010, or Brücker and Jahn 2011). We assert that the following two reasons are important in this context. First, the German labour market has become more flexible over the past 20 years. In particular, newly emerged sectors such as subcontracted labour pay low wages, but may also offer immigrants opportunities to gain experience in the German labour market. Second, the extension of the right to free movement to CEE nationals facilitated (temporary) *labour market oriented* immigration closely geared to the needs of domestic employers. In this way, we argue that CEE immigrants effectively "filled the gaps" in domestic labour supply — which explains why crowding-out effects on German nationals did not occur. On the contrary, the immigration inflow likely helped German nationals to find newly created (full-time) jobs, complementary to those (rather low-paid) jobs found by recent immigrants.

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Appendix

A Rank invariance

We identify skill types with the position in the wage distribution. This approach is only valid if immigration does not change ranks in the wage distribution of German nationals. The following equation gives a necessary and sufficient condition to test this assumption:[72]

$$\eta \left(\frac{\ln(w_i/w_j)}{m} \right) \geq - \left(\frac{\pi_i^1}{\pi_i^0} - \frac{\pi_j^1}{\pi_j^0} \right), \tag{5}$$

whenever $w_i > w_j$. First of all, note that — if the impact of immigration on wage growth is negative — ranks in the wage distribution of German nationals can only change when the slope of the relative immigrant density is negative (see Figure 11a).[73] Thus, equation (5) requires that the absolute value of the negative slope of the relative immigration density from decile j to decile j is (weakly) less than the corresponding percentage wage difference, adjusted for the elasticity of substitution between different labour types i, η, and the overall immigration rate, m. A high degree of complementarity (small values of η) and/or large immigration inflows (large values of m) increase the probability that the condition may be violated. On the other hand, a large percentage wage difference between two deciles increases the probability that the condition holds. Intuitively, if the currently observed percentage wage difference is large, it is unlikely that the sign has changed since the recent immigration inflow.[74]

To test if equation (5) holds in our sample, we re-arrange terms and additionally account for the impact of stayers. In particular, for new arrivals and stayers, we weight the difference between the relative immigration densities at decile i and decile j with the corresponding total immigration inflow, i.e, the sum of the absolute immigration densities over the years 2005-2016 (see Figure 6 and Table 13), and then sum up both expressions:

$$\frac{\left[m^1 \left(\frac{\pi_i^1}{\pi_i^0} - \frac{\pi_j^1}{\pi_j^0} \right) + m^2 \left(\frac{\pi_i^2}{\pi_i^0} - \frac{\pi_j^2}{\pi_j^0} \right) \right]}{\ln(w_i/w_j)} \geq -\eta, \tag{6}$$

As can be seen from Figure 14, the left hand side of Equation 6 reaches its minimum at about -0.15 between the first and the second wage decile. Put differently, rank invariance holds if η is equal to 0.15 or more. As discussed in Section 4.1.1, both our estimates of η are close to one and thus significantly above the critical threshold.

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[72]Note that the current section largely follows Dustmann et al. (2013).

[73]If both, the current wage level and the relative immigration density at decile i are higher than at decile j, the wage level at decile i must have been greater than at decile j already before the immigration inflow.

[74]Note that we difference the log wage distribution observed in 2017.

B   Figures

Labour market entry ages
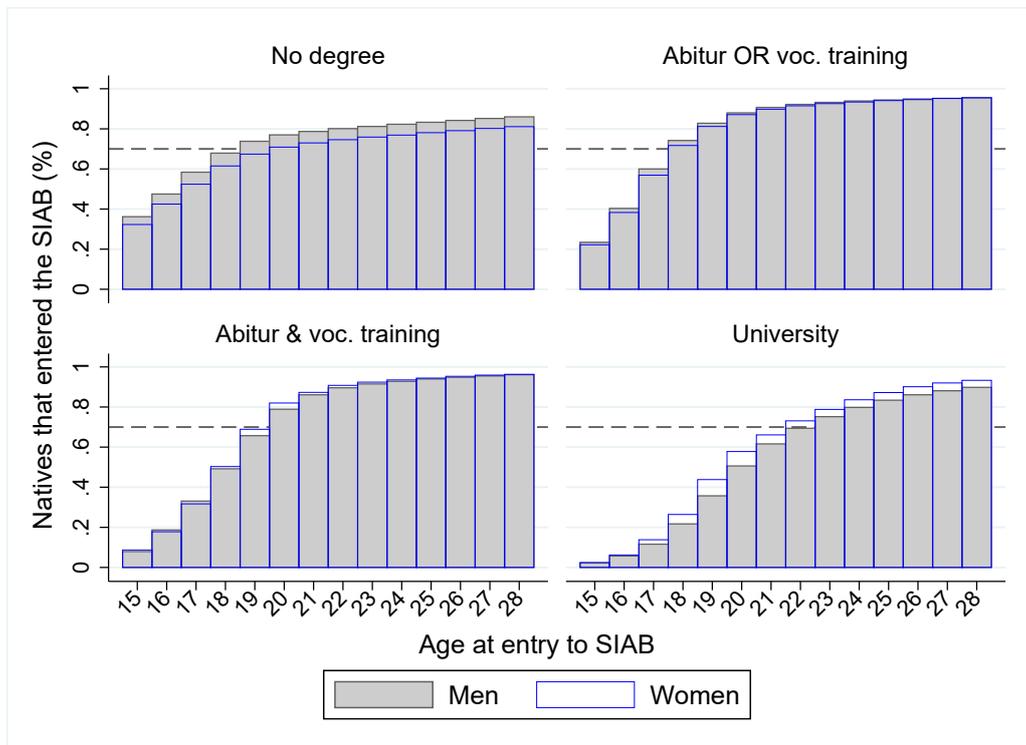
Figure 1: The figure depicts the labour market entry age among the domestic peer group, i.e. German nationals and migrants that were naturalised sufficiently fast, for different demographic groups. The level of educational attainment refers to the highest degree achieved in an individual's career, not the grade held at labour market entry. The dashed horizontal line indicates the 70th percentile.

Aggregate immigration headcounts
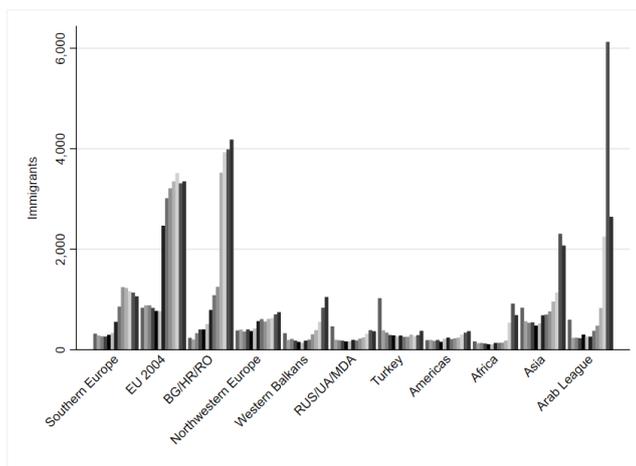
(a) Full sample
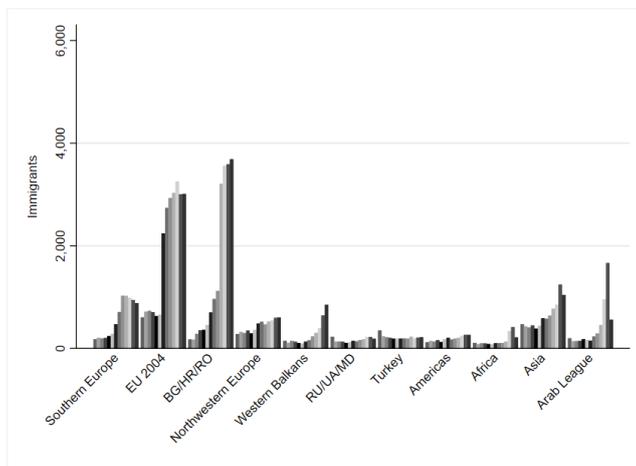
(b) Employment sample
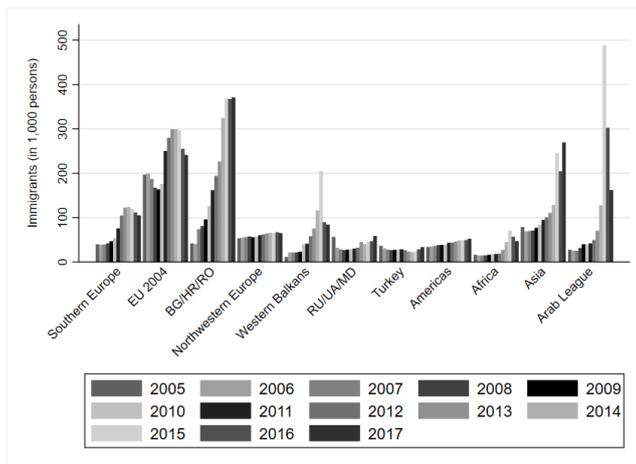
(c) Official absolute headcount by Destatis (2022)

Figure 2: Panel (a) depicts the number of newly arrived recent immigrants in the full SIAB sample between the years 2005 and 2017. Panel (b) depicts the corresponding subset of employed individuals. Panel (c) depicts the total number of newly arrived immigrants in Germany drawn from Destatis (2022) official migration statistics (in 1,000 persons).

The dynamics of in- and out-migration

(a) Headcount dynamics by immigration cohort

(b) Migration survival curves
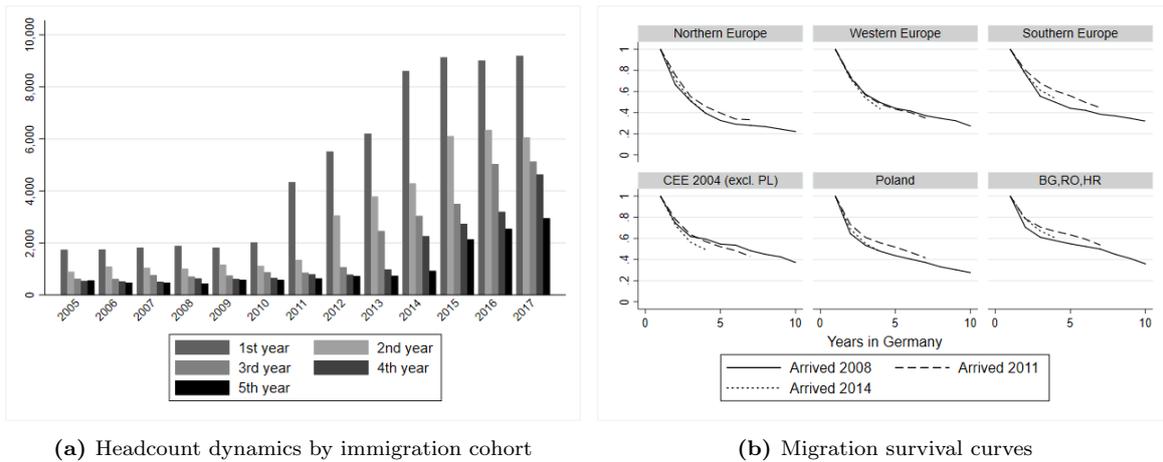
Figure 3: Panel (a) depicts immigrant headcount dynamics by year of SIAB entry. Panel (b) depicts the share of recent immigrants still registered in the SIAB database by year since entry. We separately display the survival curves for nationals from Northern, Western, and Southern EU member states. Among CEE nationals, we separately show the curves for nationals from the CEE 2004 accession states (excluding Poland); Polish nationals; and nationals from Bulgaria (BG), Romania (RO), and Croatia (HR).

Immigrant wage gap dynamics by out-migration cohort
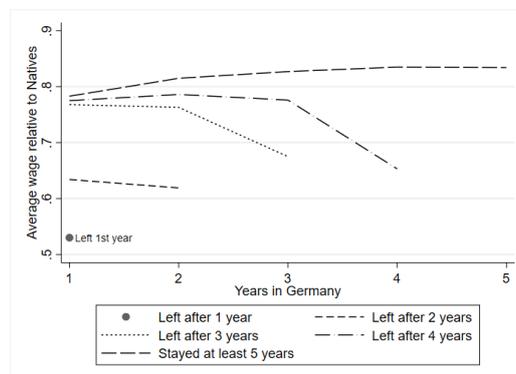
Figure 4: The figure depicts the evolution of the immigrant wage gap by years of stay before leaving Germany.

Labour market dynamics by out-migration cohort

(a) Incidence of unemployment

(b) Employment status transitions
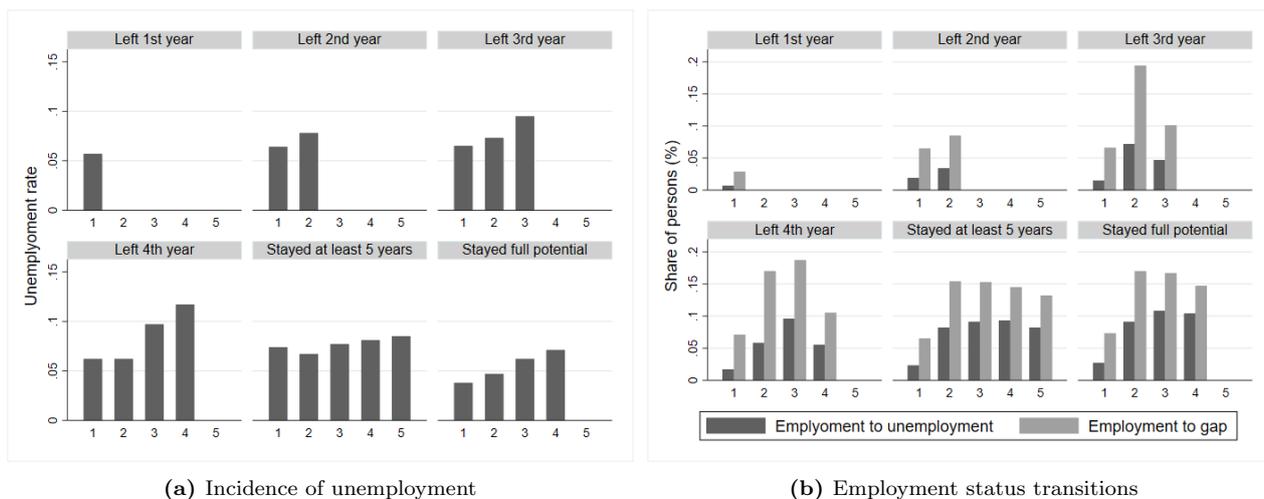
Figure 5: Panel (a) depicts the incidence of unemployment among recent immigrants by years of stay before leaving Germany. The status is measured in % of the calendar year. Panel (b) depicts the corresponding incidence of transitions from employment to unemployment and SIAB gaps, respectively.

Migration densities at the national level
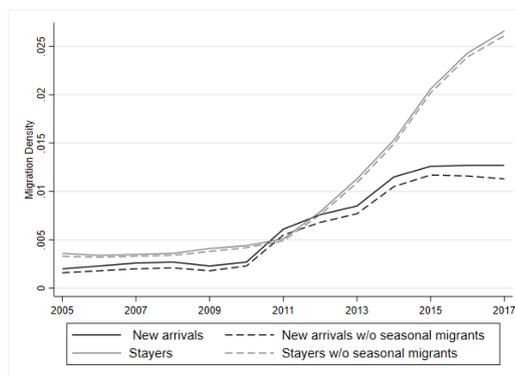
Figure 6: The figure depicts the national average of the density of new arrivals and stayers, respectively, relative to the domestic workforce in West Germany, with and without seasonal migrants. Both immigration measures draw on the employment sample; i.e., they capture all immigrants who hold a job either in their 1st (2nd-5th) year in Germany.

Estimated immigration coefficients on wages

(a) Along the wage distribution of German nationals

(b) Along the wage distribution of permanent foreign nationals
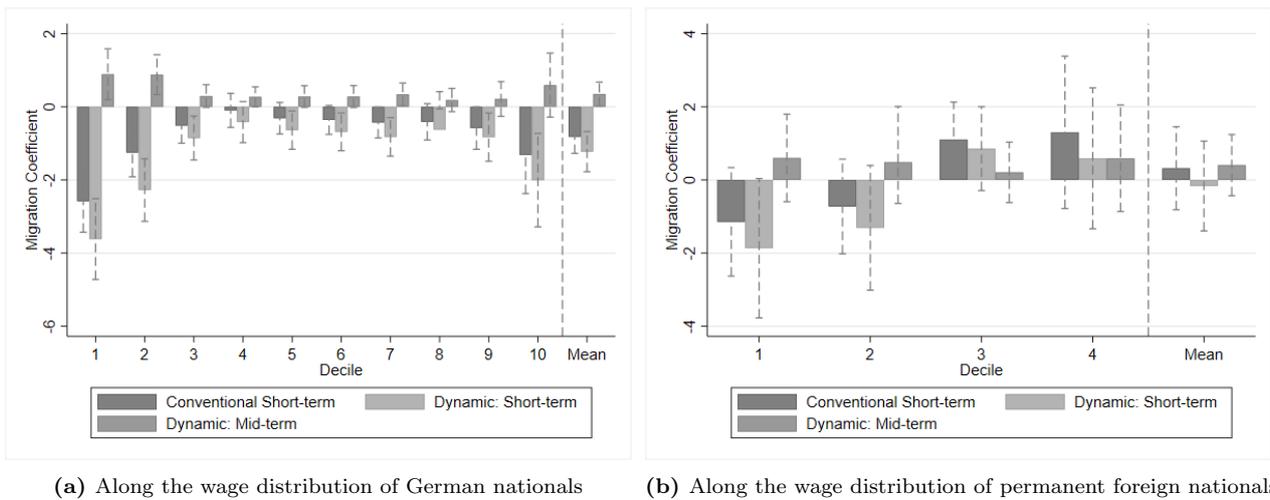
Figure 7: Panel (a) shows the estimated immigration coefficients on wages along the German nationals' wage distribution with 90% confidence intervals. Panel (b) shows the estimated immigration coefficients on wages along the wage distribution of permanent foreign nationals with 90% confidence intervals.

The dynamic impact on mean wages of German nationals

(a) Inflow of EU immigrants who stay at least five years

(b) Representative inflow of EU immigrants
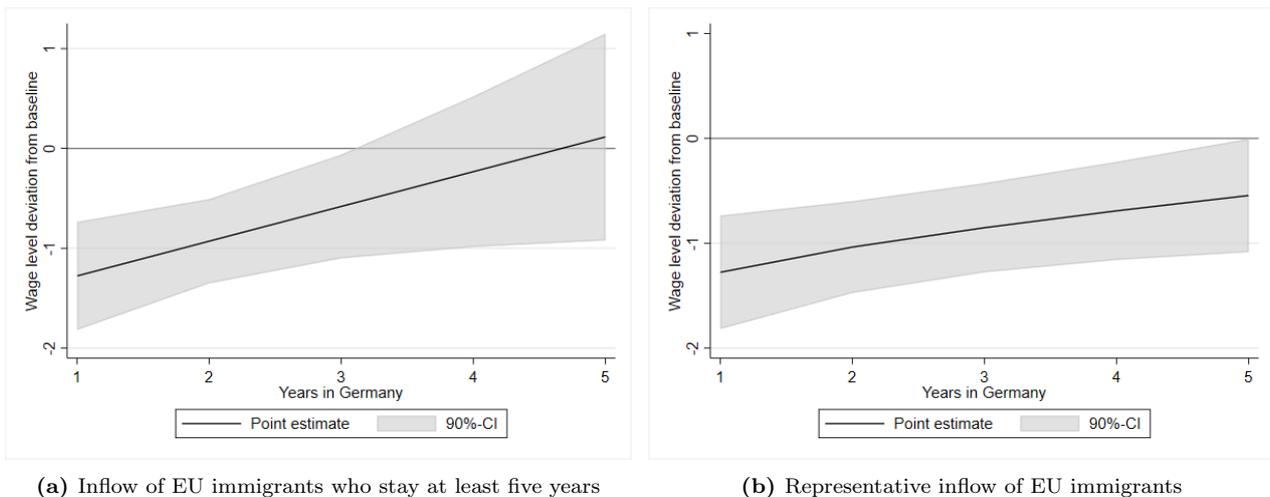
Figure 8: Panel (a) illustrates the dynamic impact of a one percent inflow of EU immigrants who stay at least five years in Germany on the level of mean wages of German nationals relative to the zero immigration baseline scenario in percent. Panel (b) illustrates the dynamic impact of a representative one percent inflow of EU immigrants, i.e. here we account for the fact that year-by-year a certain fraction leaves Germany again (in line with the survival rates estimated above), on mean wages of German nationals relative to the zero immigration scenario in percent. Confidence intervals are based on Wald tests.

The joint effect on mean wages of German nationals over time

(a) Dynamic vs. short-run estimates

(b) Two alternative dynamic estimates
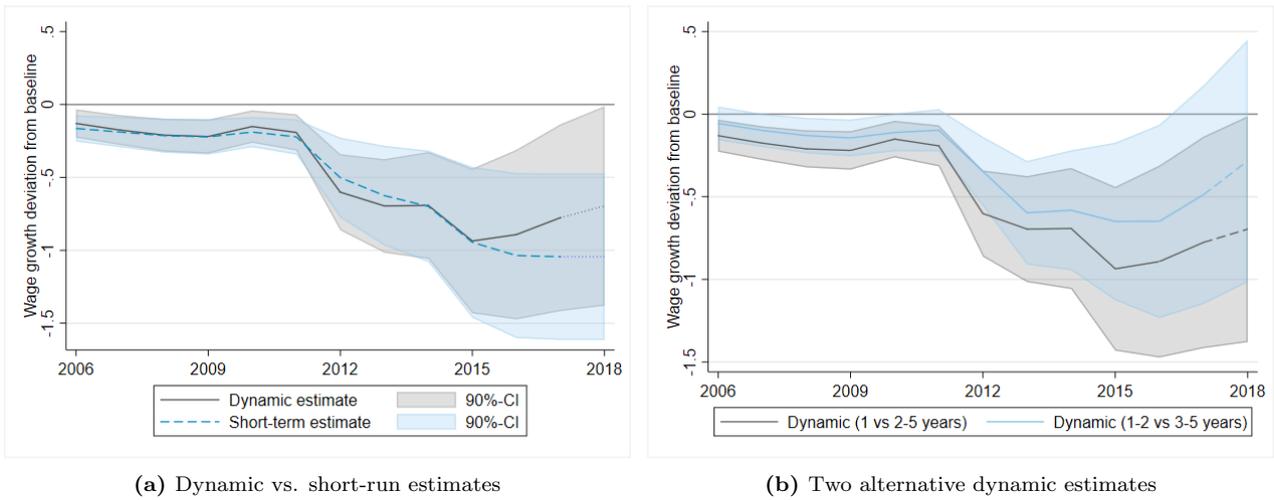
Figure 9: Panel (a) illustrates the joint impact of current and past immigration on growth of mean wages of German nationals over our sample period (2006-2017). The deviation from the zero immigration baseline scenario is given in percentage points. The black solid line and the associated grey area represent our baseline point estimate and the associated 90% confidence interval. The blue dashed line and the associated blue area represent the point estimate and the associated 90% confidence interval based on the conventional short-run IV estimator. Both confidence intervals are based on Wald tests. In addition, the dotted lines represent the out-of-sample forecast for the year 2018. Panel (b) compares the estimated dynamic effects based on the benchmark classification of new arrivals vs. stayers with the alternative classification of 1st-2nd year immigrants as new arrivals and all 3rd-5th migrants as stayers.

The dynamic impact along the German nationals' wage distribution

(a) Representative inflow of EU immigrants

(b) Joint impact of actual current and past EU immigration
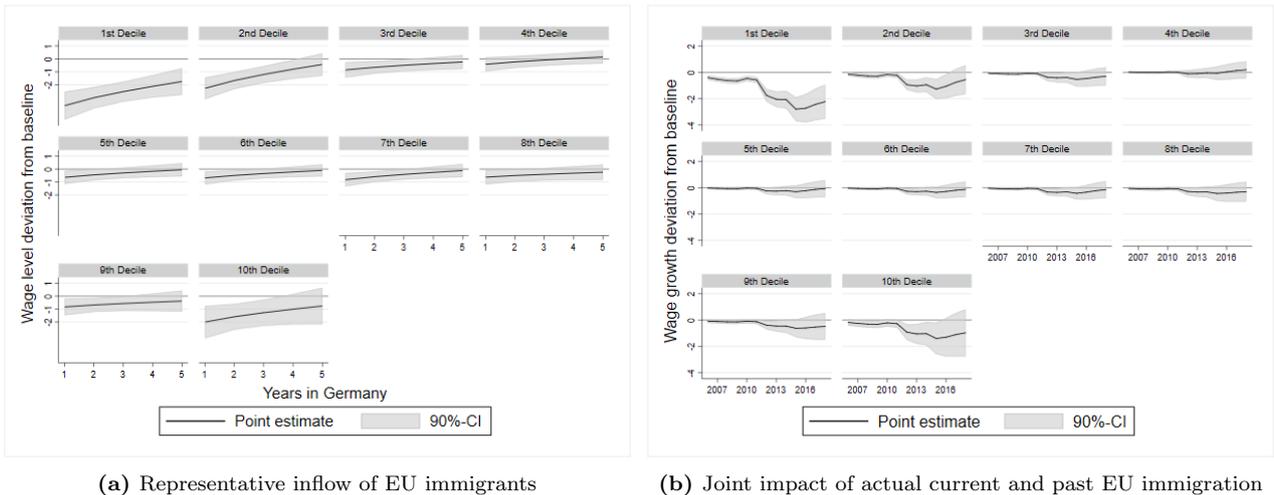
Figure 10: Panel (a) illustrates the dynamic impact of a representative one percent inflow of EU migrants, i.e. we account for the fact that year-by-year a certain fraction leaves Germany again (in line with the survival rates estimated above), by year since labour market entry along the wage distribution of German nationals. The wage level deviation from the zero immigration baseline scenario is given in percent. Panel (b) illustrates the joint impact of actual current and past immigration densities on growth of wages of German nationals over the entire sample period (2006-2017) along the wage distribution of German nationals. The wage growth deviation from the zero immigration baseline scenario is given in percentage pointsd. Confidence intervals are based on Wald tests.

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Density of recent immigrants along the wage distribution
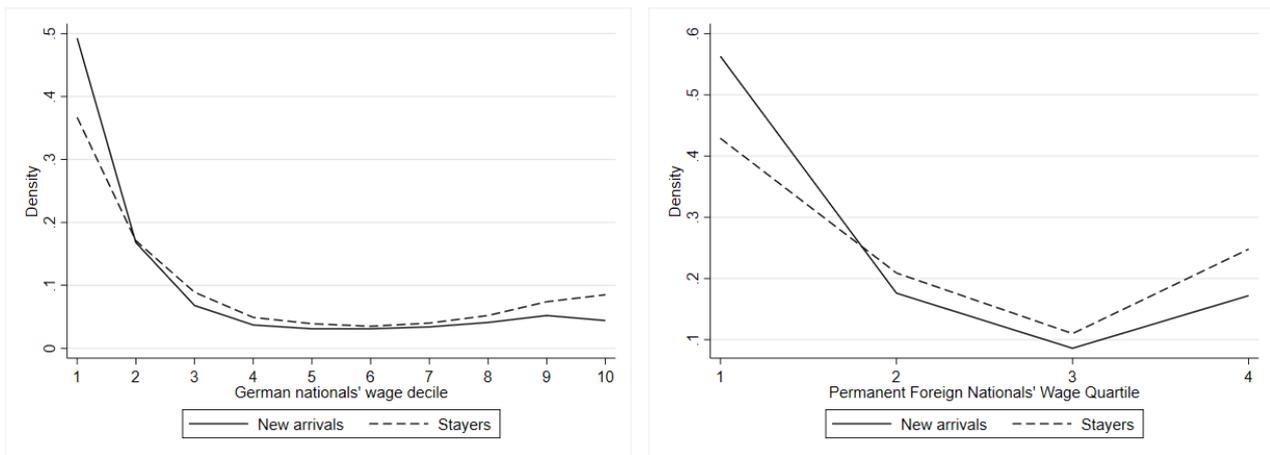
(a) Along the wage distribution of German nationals

(b) Along the wage distribution of permanent foreign nationals

Figure 11: Panel (a) shows the densities of new arrivals and stayers, respectively, in each decile of the regional wage distribution of German nationals; i.e., the share earning a wage within decile $x \in [1, 10]$ of the wage distribution of German nationals. Panel (b) shows the corresponding densities in each quartile of the permanent foreign nationals' regional wage distribution.

Elasticity regressions
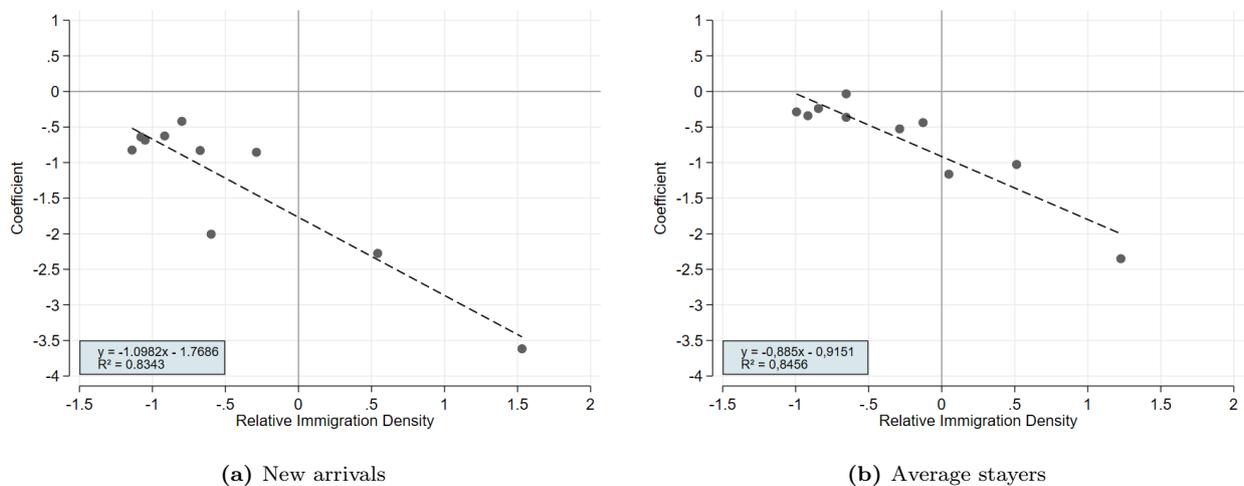
(a) New arrivals

(b) Average stayers

Figure 12: Panel (a) shows the OLS regression of the decile-specific new arrivals coefficients on the natural logarithm of their relative immigration density. Panel (b) shows the OLS regression of the decile-specific effect of a representative one percent EU immigration cohort, averaged over the second to the fifth year in Germany (see Figure 10a), on the natural logarithm of the relative immigration density of stayers.

The fear of unemployment

(a) Perceived unemployment risk

(b) EU immigration and misperception
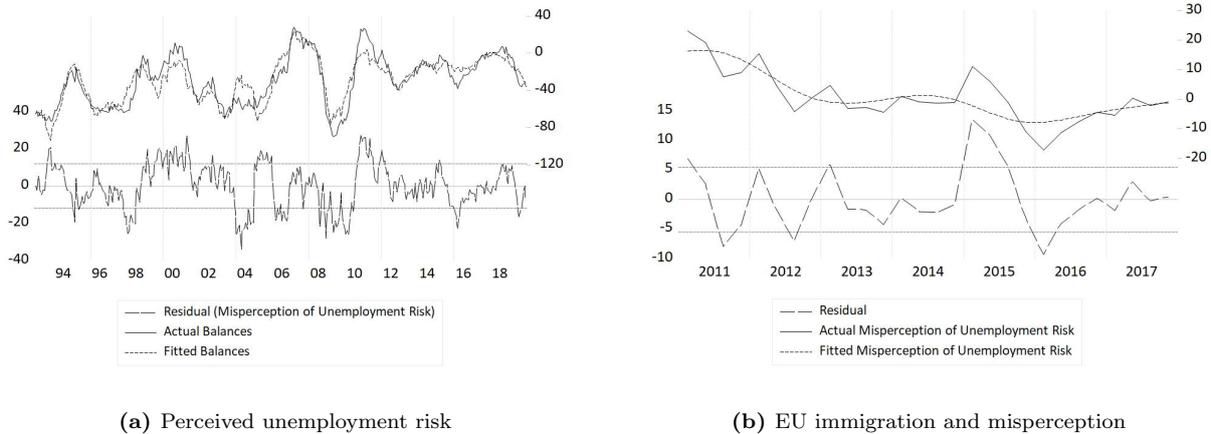
Figure 13: Panel (a) illustrates the OLS regression of seasonally adjusted balances of answers to the question "How do you expect the number of people unemployed in this country to change over the next twelve months?" (European Commission, 2021) on the current seasonally adjusted unemployment rate (Deutsche Bundesbank, 2021), the previous year's seasonally adjusted unemployment rate (to control for backward-looking expectations among consumers), lagged seasonally adjusted ifo business expectations in manufacturing (ifo Institut 2021, to control for forward-looking expectations among firms/labour demand), the current country-level indicator of financial stress, and the previous year's country-level indicator of financial stress (European Central Bank 2021 to control for the global financial crises and the European sovereign debt crisis) over the period 1992M12-2019M12, see also Table 19a. Panel (b) illustrates the OLS regression of time-aggregated residuals obtained from the regression in Panel (a) on lagged new arrivals and lagged stayers, both interpolated using the Litterman method, over the period 2011Q1-20017Q4, see also Table 19b.

Weighted immigration-wage ratio
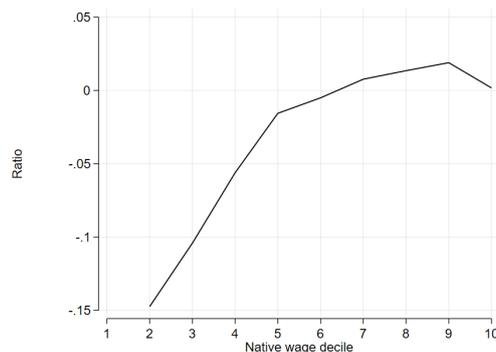
Figure 14: The figure shows for each decile of the wage distribution of German nationals the weighted immigration-wage-ratio as defined in Equation (6).

C Tables

Naturalisation rates by country of origin

| | Years to naturalisation | | | Fraction |
| | SIAB 7517 | SIAB 7517 | Destatis 2017 | naturalised |
	Average	Median	Average	"too fast"
Southern EU	10.7	8	28.4	12%
CEE 2004	5.9	4	16.5	7%
BG/RO/HR	4.9	3	17.3	6%
Western Balkans	11.1	8	17.9	19%
RU/UA/MD	4.8	4	13.5	18%
Rest of Europe	10.8	8	20.3	9%
Turkey	9.8	7	21.2	24%
Americas	7.5	5		11%
Africa	6.6	5	13.9	10%
Asia	7.3	5		11%
Arab League	7.2	6		8%

Table 1: Based on SIAB 7517 data (years 1975-2017), the table presents the average (column 2) and the median (column 3) duration to naturalisation among persons who acquired German citizenship by country of origin. Column 4 displays unweighted averages from Destatis (2017). Note that there is only one average value for the latter four areas. Column 5 shows percentage shares of foreign nationals, who entered the SIAB between the years 2000-2017 and were identified as permanent foreign nationals based on the naturalisation criterion.

70th percentiles of the labour market entry age

	Men	Women
No Abitur AND no voc. training	19	20
Abitur OR voc. training	18	18
Abitur AND voc. training	20	20
University degree	23	22

Table 2: Based on SIAB 7517 data (years 2008-2012), the table presents the 70th percentiles of the labour market entry age among the domestic peer group, i.e. German nationals and migrants that were naturalised sufficiently fast, for different demographic groups. The level of educational attainment refers to the highest degree achieved in an individual's career, not the grade held at labour market entry.

Migration statistics by country of origin

	Permanent foreign nationals	Recent immigrants	Persons
Southern EU	0.63	0.37	20,988
CEE 2004	0.22	0.78	32,421
BG/RO/HR	0.23	0.77	24,647
Western Balkans	0.67	0.33	11,671
RU/UA/MD	0.54	0.46	5,929
Rest of Europe	0.52	0.48	13,004
Turkey	0.85	0.15	3,804
Americas	0.39	0.61	4,380
Africa	0.44	0.56	3,900
Asia	0.39	0.61	15,290
Arab League	0.42	0.58	9,984
Average	0.47	0.53	166,936

Table 3: Based on SIAB 7517 data (employed persons between the years 2005-2017), the table shows the percentages of permanent foreign nationals (column 2) and recent immigrants (column 3) among persons who once had or still have a foreign nationality by country of origin. Column 4 displays the number of individuals by country of origin.

Descriptive statistics: full sample

	German nationals	Permanent foreign nationals	Recent immigrants
Average age	39.6	38.3	34.6
Women	0.49	0.46	0.40
Unemployment	0.08	0.12	0.06
Employment	0.86	0.77	0.85
Work in West Germany	0.82	0.97	0.94
No vocational training	0.11	0.23	0.14
Vocational training	0.60	0.39	0.19
University degree	0.13	0.08	0.09
No education information	0.16	0.30	0.58
Average years observed	13.9	12.5 (13.1)	3.7 (4.3)
Annual observations	8,263,894	1,099,745	158,219

Table 4: Based on SIAB 7517 data (2005-2017), the table presents descriptive statistics for the full sample. Average years observed refer to the mean duration of permanent foreign nationals (recent immigrants) observed as permanent foreign nationals (recent immigrants) in the data set. Corresponding values in parenthesis refer to the mean duration of permanent foreign nationals (recent immigrants) observed in the data set in total, i.e. years as permanent foreign nationals and years as recent immigrant.

Descriptive statistics: all employees and full-timers only

	German nationals	Permanent foreign nationals	Recent immigrants
Average age	39.6	38.3	34.6
Women	0.49	0.45	0.37
Part-time	0.31	0.36	0.33
Work in West Germany	0.84	0.97	0.92
No vocational training	0.12	0.29	0.16
Vocational training	0.70	0.51	0.23
University degree	0.15	0.11	0.11
No education information	0.03	0.09	0.50
Un-/semiskilled task	0.11	0.24	0.45
Skilled tasks	0.63	0.57	0.40
Complex task	0.10	0.05	0.04
Highly complex task	0.12	0.07	0.08
No entry	0.04	0.06	0.03
Low pay industries	0.07	0.16	0.33
High pay industries	0.07	0.03	0.03
Average years observed	10.7	9.7 (10.0)	3.2 (4.1)
Observations	7,516,234	927,343	141,586

(a) Employment sample

	German nationals	Permanent foreign nationals	Recent immigrants
Average age	40.2	39.1	34.6
Women	0.34	0.29	0.27
Work in West Germany	0.84	0.98	0.91
No vocational training	0.08	0.24	0.14
Vocational training	0.73	0.57	0.25
University degree	0.18	0.13	0.13
No education information	0.01	0.06	0.47
Low pay industries	0.05	0.13	0.33
High pay industries	0.08	0.04	0.03
Average years observed	11.0	10.1 (10.4)	3.3 (4.1)
Observations	5,166,132	589,087	95,051

(b) Sample of full-time employees

Table 5: Based on SIAB 7517 data (2005-2017), panel (a) and (b) present descriptive statistics for the employment and the full-time employment sample, respectively. The task complexity level refers to the fifth digit of the KldB2010 code. Low (high) pay industries are defined as the ones with a median wage within the first (fourth) wage quartile based on all observed wages in the full-time employment sample between the years 2005-2017. Low pay sectors include Agriculture, Forestry and Fishing (A), Accommodation and Food Service Activities (I), Activities of Households as Employers; Undifferentiated Goods and Services Producing Activities of Households for Own Use (T), Temporary Employment Agency Activities (782), and Other Human Resources Provision (783). High pay sectors include Electricity, Gas, Steam and Air Conditioning Supply (D), Information and Communication (J), an Financial and Insurance Activities (K). NACE Rev.2 codes are provided in parenthesis. Average years observed refer to the mean duration of permanent foreign nationals (recent immigrants) observed as permanent foreign nationals (recent immigrants) in the data set. Corresponding values in parenthesis refer to the mean duration of permanent foreign nationals (recent immigrants) observed in the data set in total, i.e. years as permanent foreign nationals and years as recent immigrant.

The qualification mismatch

	Task level				
	Un-/semiskilled	Skilled	Complex	Highly complex	No entry
Education					
German nationals					
No training	0.19	0.62	0.04	0.06	0.09
Vocational training	0.11	0.71	0.09	0.05	0.04
University	0.03	0.29	0.19	0.48	0.02
Missing	0.26	0.49	0.04	0.04	0.16
All	0.11	0.63	0.10	0.12	0.04
Permanent foreign nationals					
No training	0.32	0.55	0.02	0.02	0.08
Vocational training	0.20	0.66	0.05	0.03	0.05
University	0.07	0.32	0.15	0.43	0.03
Missing	0.42	0.46	0.02	0.03	0.07
All	0.24	0.57	0.05	0.07	0.06
Recent immigrants					
No training	0.50	0.39	0.02	0.03	0.06
Vocational training	0.40	0.51	0.04	0.03	0.03
University	0.10	0.24	0.15	0.50	0.02
Missing	0.53	0.38	0.02	0.03	0.03
All	0.45	0.40	0.04	0.08	0.03

Table 6: Based on SIAB 7517 data (annual employment sample 2005-2017), the table presents the share of persons with education type X doing work with task level Y. The task complexity level refers to the fifth digit of the KldB2010 code.

Qualification mismatch dynamics

	Educational background				
	No training	Voc. training	University	Missing	All
1st SIAB year	0.50	0.41	0.12	0.55	0.48
5th SIAB year	0.47	0.36	0.07	0.51	0.38

Table 7: Based on SIAB 7517 data (annual employment sample, 2005-2017), the table presents the share of persons performing un- or semiskilled work by educational background and by years since labour market entry in Germany. The task complexity level refers to the fifth digit of the KldB2010 code.

Wages of recent immigrants by duration since labour market entry

Year in Germany	Mean age	Wage gap to		Observations
		Perma. foreign nationals	*German nationals*	
First	33.6	0.29 (0.30)	0.40 (0.37)	22,151
Second	34.4	0.22 (0.23)	0.33 (0.30)	15,294
Third	35.2	0.18 (0.18)	0.30 (0.26)	11,898
Fourth	35.7	0.13 (0.13)	0.26 (0.22)	9,055
Fifth	36.3	0.07 (0.07)	0.21 (0.17)	6,877
Average	34.7	0.21 (0.21)	0.33 (0.29)	65,275

Table 8: Based on SIAB 7517 data (full-time employment sample, 2005-2017), column 2 reports the mean age of recent immigrants by years since labour market entry in Germany. The average age of German nationals and permanent foreign nationals is 41.0 and 39.7, respectively. Columns 3 and 4 show the wage gap of recent immigrants to permanent foreign nationals and German nationals, respectively. The corresponding wage gap to a comparable age group of 27 to 41 year old (the interquartile-range of the age of recent immigrants) permanent foreign nationals and German nationals, respectively, is displayed in parentheses.

Descriptive statistics per wage decile of German nationals

Decile	Wage growth	Age	Women	University	Voc. train.	Min. wage bite	Employees
1	2.61%	37.33	0.61	0.05	0.80	0.68	368.4
2	2.10%	36.66	0.46	0.05	0.85	0.48	367.0
3	1.90%	37.86	0.37	0.05	0.87	0.13	367.3
4	1.88%	39.00	0.33	0.06	0.87	0.04	366.7
5	1.95%	40.25	0.31	0.08	0.87	0.02	366.5
6	2.02%	41.38	0.29	0.10	0.85	0.01	366.7
7	2.11%	42.25	0.26	0.13	0.83	0.01	366.5
8	2.22%	43.01	0.23	0.19	0.78	0.00	366.4
9	2.26%	43.98	0.19	0.29	0.69	0.00	366.9
10	2.18%	45.84	0.12	0.56	0.43	0.00	365.5
All	2.12%	40.75	0.32	0.14	0.71	0.14	3,667

Table 9: Based on SIAB 7517 data, the table presents descriptive statistics per wage decile of German full-time employees in West Germany. The values refer to the averages over all ROR regions between the years 2005-2017 (the last column indicates the average number of employees per ROR). The annual wage distributions of German nationals were calculated per ROR region.

Descriptive statistics per permanent foreign nationals' quartile

Quartile	Wage growth	Age	Women	University	Voc. train.	Min. wage bite	Employees
1	2.09%	37.8	0.40	0.04	0.55	0.63	115.9
2	1.53%	39.2	0.26	0.05	0.65	0.30	115.1
3	1.73%	40.9	0.20	0.07	0.68	0.04	115.3
4	2.32%	41.8	0.18	0.30	0.56	0.01	114.7
Total	1.98%	39.9	0.26	0.11	0.58	0.24	461.0

Table 10: Based on SIAB 7517 data, the table presents descriptive statistics for the sample of full-time workers in West Germany that are identified as permanent foreign nationals. The values refer to averages over all ROR regions between the years 2005-2017 (the last column indicates the average number of employees per ROR). The corresponding annual wage distributions were calculated per ROR region.

Employment growth rates

	German nationals	Permanent foreign nationals
Part-time employment	1.8%	5.4%
Full-time employment	-0.5%	2.3%
Total employment	0.3%	3.4%
Average No. of employees	6107.0	889.2

Table 11: Based on SIAB 7517 data, the table presents average employment growth measures among German nationals and permanent foreign nationals, respectively.

Placebo tests

Instrument	New Arrivals	Stayers
$\tilde{m}_1$	2.141***	-0.191
	(0.246)	(0.287)
$\tilde{m}_{2.5}$	-0.323***	0.976***
	(0.096)	(0.201)
Placebo $\tilde{m}_1$	0.035	0.011
	(0.035)	(0.009)
Placebo $\tilde{m}_{2.5}$	0.070	0.018
	(0.056)	(0.012)

(a) For spurious correlation of IVs

	Total	Part-Time	Full-Time
New arrivals	4.297	-5.733	6.782
	(4.941)	(6.451)	(7.584)
Stayers	2.260	-1.694	3.163
	(7.673)	(9.858)	(11.762)

(b) For spurious correlation of employment measures

Table 12: Panel (a) displays the placebo tests for spurious correlation of IVs. The upper two rows show the IV coefficients of the first stage regressions in our baseline specification. The lower two rows display the corresponding coefficients when we replace nationals shifts (i.e. the numerator of the IVs) by random numbers (see Footnote 42). Panel (b) displays the placebo tests for spurious correlation of employment measures, i.e. the employment coefficients among German nationals (corresponding Table 18, Panel B) when observed regional employment growth of German nationals is replaced by random numbers in our 2SLS estimation (see Footnote 60). Asterisks (*,**,***) indicate significance at the 10%, 5%, and 1% level, respectively.

Immigration densities: annual averages at the national level

Year	New arrivals	New arrivals w/o seasonal migrants	Stayers	Stayers w/o seasonal migrants
2005	0.20%	0.16%	0.36%	0.33%
2006	0.23%	0.18%	0.34%	0.32%
2007	0.26%	0.20%	0.35%	0.33%
2008	0.27%	0.21%	0.36%	0.34%
2009	0.23%	0.18%	0.41%	0.38%
2010	0.27%	0.23%	0.44%	0.42%
2011	0.61%	0.55%	0.51%	0.49%
2012	0.76%	0.68%	0.79%	0.76%
2013	0.85%	0.77%	1.13%	1.09%
2014	1.15%	1.05%	1.53%	1.49%
2015	1.26%	1.17%	2.06%	2.02%
2016	1.27%	1.16%	2.43%	2.39%
2017	1.27%	1.13%	2.66%	2.61%
Average	0.66%	0.59%	1.03%	1.00%

Table 13: Based on SIAB 7517 data (employment sample, 2005-2017): Annual averages of our two migration density measures in West Germany, i.e. the share of new arrivals (stayers) relative to total regional employment in the previous year. Both immigration measures draw on the employment sample; i.e., they capture all immigrants who hold a job either in their 1st (2nd-5th) year in Germany. A migrant is classified as a *seasonal migrant* if he/she never worked more than four months per year and is employed either in hospitality or in the agricultural sector. This applies to around 7% of the immigrants who arrived between to 2001 and 2017.

First stage results: average wage effects among German nationals

	Coef.	Std. Err.	P-Value
Instrumental variables			
$\tilde{m}_1$	2.1417***	0.2463	0.000
$\tilde{m}_{2,5}$	-0.3628***	0.0961	0.000
Regional control variables			
$\overline{age}_{t-1}$	0.0022*	0.0012	0.067
$\Delta\overline{age}$	0.0018**	0.0008	0.029
Δ Share vocational degree	0.1222	0.0843	0.148
Δ Share university degree	-0.0493	0.2170	0.820
Δ Share of females	0.0153	0.0166	0.357
MW_{2015}	0.0035**	0.0017	0.045
National control variables			
Inflation rate	-0.0010	0.0092	0.914
Linear trend	-0.0013***	0.0003	0.000
Quadratic trend	0.0001***	0.0000	0.000
Summary statistics			
No. of observations		900	
F(11, 814)		79.0	
R^2		0.87	

(a) Instrumented Variable: 1st year recent immigrants (new arrivals)

	Coef.	Std. Err.	P-Value
Instrumental variables			
$\tilde{m}_1$	-0.1908	0.2867	0.506
$\tilde{m}_{2,5}$	0.9755***	0.2013	0.000
Regional control variables			
$\overline{age}_{t-1}$	0.0063***	0.0018	0.001
$\Delta\overline{age}$	0.0032***	0.0011	0.001
Δ Share vocational degree	-0.1757*	0.1024	0.087
Δ Share university degree	0.2987	0.2826	0.291
Δ Share of females	-0.0395	0.0248	0.111
MW_{2015}	-0.0017	0.0016	0.295
National control variables			
Inflation rate	-0.0063	0.0113	0.577
Linear trend	-0.0031***	0.0004	0.000
Quadratic trend	0.0002***	0.0000	0.000
Summary statistics			
No. of observations		900	
F(11, 814)		62.4	
R^2		0.89	

(b) Instrumented Variable: 2nd-5th year recent immigrants (stayers)

Table 14: The tables display the 1st-stage regression results for the two endogenous variables, i.e. the regional density of (a) 1st year recent immigrants (new arrivals) and (b) 2nd-5th year recent immigrants (stayers), to estimate the wage effects among full-time employed German nationals in West Germany. The regressions additionally include ROR region fixed effects. Standard errors are clustered by ROR region. Asterisks (*,**,***) indicate significance at the 10%, 5%, and 1% level, respectively.

Second stage results: average wage effects among German nationals

	Coef.	Std. Err.	P-Value
Instrumented immigration variables			
new arrivals	-1.227***	0.3299	0.000
stayers	0.3479*	0.1958	0.076
Regional control variables			
$\overline{age}_{t-1}$	-0.0029	0.0027	0.280
$\Delta\overline{age}$	0.0017	0.0037	0.652
Δ Share vocational degree	-1.5939**	0.6336	0.012
Δ Share university degree	1.3303	1.2048	0.270
Δ Share of females	-0.1118	0.0821	0.173
MW_{2015}	0.0457***	0.0087	0.000
National control variables			
Inflation rate	0.9240***	0.0657	0.000
Linear trend	0.0060***	0.0001	0.000
Quadratic trend	-0.0002***	0.0001	0.009
Summary statistics			
No. of observations	900		
No. of clusters	75		
R^2	0.36		

Table 15: The table displays the 2$^{\text{nd}}$-stage regression results on the average wage effects among full-time employed German nationals in West Germany. The regression additionally includes ROR region fixed effects. Asterisks (*,**,***) indicate significance at the 10%, 5%, and 1% level, respectively.

Effects along the wage distribution of German nationals

Decile	1st	2nd	3rd	4th	5th	6th	7th	8th	9th	10th	Average
					2SLS Estimation						
Panel A. Results accounting for current immigration only											
New arrivals	-2.581***	-1.254**	-0.514*	-0.099	-0.313	-0.360	-0.429*	-0.412	-0.582*	[-1.316**]	-0.822***
	(0.511)	(0.398)	(0.290)	(0.280)	(0.260)	(0.238)	(0.255)	(0.299)	(0.350)	[(0.637)]	(0.273)
Panel B. Results accounting for current and past immigration											
New arrivals	-3.617***	-2.276***	-0.855**	-0.420	-0.639**	-0.685**	-0.824***	-0.626*	-0.830**	[-2.006***]	-1.227***
	(0.665)	(0.515)	(0.361)	(0.337)	(0.314)	(0.311)	(0.317)	(0.342)	(0.397)	[(0.769)]	(0.330)
Stayers	0.889**	0.877***	0.293	0.271*	0.280	0.279	0.339*	0.184	0.213	[0.592]	0.348*
	(0.418)	(0.329)	(0.187)	(0.165)	(0.178)	(0.181)	(0.187)	(0.191)	(0.286)	[(0.527)]	(0.196)
R2	0.37	0.48	0.54	0.55	0.55	0.51	0.41	0.30	0.24	[0.07]	0.36
R2 (adj.)	0.31	0.42	0.49	0.50	0.50	0.46	0.34	0.23	0.16	[-0.02]	0.29
					2SLS Estimation according to Jaeger et al. (2018)						
Panel C. Results accounting for current and past immigration											
New arrivals	-4.644***	-3.001***	-1.767***	-1.305***	-1.370***	-1.455***	-1.594***	-1.331***	-1.109*	[0.046]	-1.287***
	(1.000)	(0.678)	(0.462)	(0.414)	(0.395)	(0.418)	(0.456)	(0.488)	(0.595)	[(1.186)]	(0.424)
Lag new arrivals	2.671**	2.425***	1.554***	1.739***	1.704***	1.624***	1.670***	1.199**	1.002	[-1.067]	0.881*
	(1.356)	(0.930)	(0.564)	(0.515)	(0.476)	(0.518)	(0.544)	(0.609)	(0.827)	[(1.613)]	(0.525)
					OLS Estimation						
Panel D. Results accounting for current and past immigration											
New arrivals	-1.354***	-0.737**	-0.281	-0.202	-0.215	-0.280	-0.198	-0.076	-0.116	[-0.436]	-0.311*
	(0.416)	(0.296)	(0.240)	(0.207)	(0.154)	(0.173)	(0.166)	(0.188)	(0.202)	[(0.427)]	(0.173)
Stayers	0.315	0.337*	0.167	0.243**	0.234**	0.197**	0.104	0.006	-0.040	[0.288]	0.158
	(0.231)	(0.174)	(0.124)	(0.103)	(0.092)	(0.098)	(0.125)	(0.138)	(0.151)	[(0.298)]	(0.119)

Table 16: Dependent variable is growth in wages per wage decile in the sample of German full-time employees in West Germany including Berlin. The new arrivals (stayers) coefficient refers to recent EU immigrants who are in their first (second to fifth) year in the German labour market. Standard errors are clustered per ROR region and reported in parentheses. Asterisks (*,**,***) indicate significance at the 10%, 5%, and 1% level, respectively. 2SLS and OLS regressions use 900 observations (12 years in 75 ROR regions), the Jaeger et al. (2018) specification requires one additional lag and is therefore based on 825 observations. Given that wages above the social security contribution assessment ceiling are imputed (see also Footnotes 12 and 57), our estimates for the upper two deciles should be interpreted with caution. Estimates for the particularly affected 10th decile are therefore shown in squared brackets.

Wage effects among permanent foreign nationals

Wage Quartile	1st	2nd	3rd	4th	Average
2SLS Estimation					
Panel A. Results accounting for current immigration only					
New arrivals	-1.145	-0.725	1.104*	1.301	0.319
	(0.893)	(0.779)	(0.617)	(1.255)	(0.683)
Panel B. Results accounting for current and past immigration					
New arrivals	-1.866	-1.307	0.856	0.591	-0.166
	(1.147)	(1.027)	(0.691)	(1.16)	(0.739)
Stayers	0.601	0.486	0.208	0.593	0.405
	(0.721)	(0.68)	(0.498)	(0.877)	(0.504)
2SLS Estimation according to Jaeger et al. (2018)					
Panel C. Results accounting for current and past immigration					
New arrivals	-1.998	-2.082	-1.231	0.682	-0.655
	(1.616)	(1.318)	(0.988)	(1.729)	(1.055)
Lag new arrivals	0.101	1.053	2.280*	1.360	1.084
	(1.997)	(1.644)	(1.249)	(2.862)	(1.32)
OLS Estimation					
Panel D. Results accounting for current and past immigration					
New arrivals	-1.716**	-0.504	0.231	-0.564	-0.584
	(0.795)	(0.766)	(0.556)	(0.787)	(0.592)
Stayers	0.889*	0.417	0.121	0.005	0.270
	(0.479)	(0.391)	(0.298)	(0.477)	(0.331)

Table 17: Dependent variable is growth in wages per wage decile in the sample of full-time employed permanent foreign nationals in West Germany including Berlin. The new arrivals (stayers) coefficient refers to recent EU immigrants who are in their first (second to fifth) year in the German labour market. Standard errors are clustered per ROR region and reported in parentheses. Asterisks (*,**,***) indicate significance at the 10%, 5%, and 1% level, respectively. 2SLS and OLS regressions use 900 observations (12 years in 75 ROR regions), the Jaeger et al. (2018) specification requires one additional lag and is therefore based on 825 observations.

Employment effects among German/permanent foreign nationals

	German nationals			Permanent foreign nationals		
	Total	Part-Time	Full-Time	Total	Part-Time	Full-Time
Panel A. Results accounting for current immigration only						
New arrivals	1.222***	-1.669***	1.94***	2.986	2.970	1.245
	(0.395)	(0.637)	(0.508)	(1.171)	(2.085)	(1.344)
Panel B. Results accounting for current and past immigration						
New arrivals	1.214***	-1.996***	2.031***	2.974***	1.817	1.632
	(0.349)	(0.651)	(0.441)	(1.153)	(2.423)	(1.527)
Stayers	0.007	0.281	-0.078	0.01	0.963	-0.324
	(0.26)	(0.391)	(0.369)	(0.707)	(1.589)	(0.864)

Table 18: Dependent variable is employment growth in the sample of employed German nationals and permanent foreign nationals, respectively, in West Germany including Berlin. The new arrivals (stayers) coefficient refers to recent EU immigrants who are in their first (second to fifth) year in the German labour market. Standard errors are clustered per ROR region and reported in parentheses. Asterisks (*,**,***) indicate significance at the 10%, 5%, and 1% level, respectively. All regressions use 900 observations (12 years in 75 ROR regions).

Fear of unemployment

	Coef.	S.E.	P-Val.
Independent variables			
Unemployment rate	-22.87	0.97	0.000
Unemployment rate(-12)	19.91	1.05	0.000
ifo(-3)	0.56	0.06	0.000
CLIFS	-34.81	8.83	0.000
CLIFS(-12)	-48.69	7.72	0.000
Constant	2.91	3.32	0.381
Summary statistics			
No. of observations	325		
R^2	0.80		

(a) Misperception

	Coef.	S.E.	P-Val.
Independent variables			
New arrivals(-5)	-14802.6	2920.9	0.000
Stayers(-5)	4319.4	1526.8	0.009
Constant	19.1	2.9	0.000
Summary statistics			
No. of observations	28		
R^2	0.66		

(b) Role of immigration

Table 19: Panel (a) shows the OLS regression of seasonally adjusted balances of answers to the question "How do you expect the number of people unemployed in this country to change over the next twelve months?" (European Commission, 2021) on the current seasonally adjusted unemployment rate (Deutsche Bundesbank, 2021), the previous year's seasonally adjusted unemployment rate (to control for backward-looking expectations among consumers), lagged seasonally adjusted ifo business expectations in manufacturing (ifo Institut 2021, to control for forward-looking expectations among firms/labour demand), the current country-level indicator of financial stress, and the previous year's country-level indicator of financial stress (European Central Bank 2021 to control for the global financial crises and the European sovereign debt crisis) over the period 1992M12-2019M12. Panel (b) shows the OLS regression of time-aggregated residuals obtained from the regression in Table 19a on lagged new arrivals and lagged stayers, both interpolated using the Litterman method, over the period 2011Q1-20017Q4.

Robustness: wage effects among German nationals

		(1) Benchm.	(2) 2007	(3) w/o SEA	(4) w/o Agr	(5) Sectors	(6) UE	(7) Germ.	(8) 12 vs 35
1st	New arrivals	-3.617*** (0.665)	-4.206*** (0.755)	-3.669*** (0.67)	-3.568*** (0.652)	-4.347*** (0.763)	-3.734*** (0.738)	-4.026*** (0.641)	-2.172*** (0.394)
	Stayers	0.889** (0.418)	1.236** (0.492)	0.928** (0.432)	0.938** (0.42)	1.323*** (0.487)	0.922* (0.444)	1.404* (0.858)	1.92*** (0.616)
2nd	New arrivals	-2.276*** (0.515)	-2.403*** (0.536)	-2.312*** (0.521)	-2.258*** (0.506)	-2.514*** (0.576)	-1.554*** (0.505)	-2.658*** (0.49)	-1.201*** (0.302)
	Stayers	0.877*** (0.329)	0.958*** (0.349)	0.901*** (0.336)	0.899*** (0.325)	1.059*** (0.377)	0.673** (0.314)	1.085* (0.649)	1.506*** (0.493)
3rd	New arrivals	-0.855** (0.361)	-1.147*** (0.367)	-0.868** (0.366)	-0.847** (0.355)	-0.929** (0.379)	-0.354 (0.354)	-1.139*** (0.35)	-0.413* (0.211)
	Stayers	0.293 (0.187)	0.421** (0.215)	0.302 (0.191)	0.302* (0.186)	0.371* (0.213)	0.151 (0.176)	0.324 (0.457)	0.448 (0.284)
4th	New arrivals	-0.416 (0.337)	-0.484 (0.34)	-0.423 (0.342)	-0.417 (0.332)	-0.406 (0.348)	-0.069 (0.318)	-0.428 (0.319)	-0.069 (0.202)
	Stayers	0.271* (0.165)	0.366** (0.191)	0.276* (0.167)	0.272* (0.163)	0.276 (0.182)	0.174 (0.156)	0.416 (0.625)	0.247 (0.251)
5th	New arrivals	-0.639** (0.314)	-0.536* (0.316)	-0.649** (0.318)	-0.635** (0.309)	-0.545* (0.323)	-0.323 (0.288)	-0.495 (0.363)	-0.201 (0.183)
	Stayers	0.28 (0.178)	0.335* (0.187)	0.286 (0.18)	0.285* (0.175)	0.222 (0.192)	0.19 (0.158)	0.437 (0.623)	0.283 (0.262)
6th	New arrivals	-0.416 (0.337)	-0.484 (0.34)	-0.423 (0.342)	-0.417 (0.332)	-0.406 (0.348)	-0.069 (0.318)	-0.428 (0.319)	-0.069 (0.202)
	Stayers	0.271* (0.165)	0.366** (0.191)	0.276* (0.167)	0.272* (0.163)	0.276 (0.182)	0.174 (0.156)	0.416 (0.625)	0.247 (0.251)
7th	New arrivals	-0.824*** (0.317)	-1.005*** (0.348)	-0.837*** (0.321)	-0.818*** (0.312)	-0.787** (0.344)	-1.045*** (0.316)	-0.763*** (0.284)	-0.391** (0.176)
	Stayers	0.339* (0.187)	0.515** (0.206)	0.347* (0.188)	0.346* (0.184)	0.295 (0.204)	0.401** (0.198)	0.527 (0.371)	0.518* (0.27)
8th	New arrivals	-0.626* (0.342)	-0.956** (0.377)	-0.636* (0.346)	-0.619* (0.336)	-0.531 (0.358)	-1.047*** (0.363)	-0.947** (0.395)	-0.364* (0.198)
	Stayers	0.184 (0.191)	0.409* (0.229)	0.191 (0.193)	0.191 (0.188)	0.063 (0.208)	0.303 (0.213)	-0.002 (0.26)	0.366 (0.264)
9th	New arrivals	-0.83** (0.397)	-0.797* (0.425)	-0.842** (0.401)	-0.819** (0.392)	-0.867** (0.423)	-0.913** (0.398)	-1.358*** (0.528)	-0.493** (0.224)
	Stayers	0.213 (0.311)	0.343 (0.323)	0.222 (0.315)	0.224 (0.307)	0.165 (0.326)	0.237 (0.28)	0.016 (0.35)	0.448 (0.18)
10th	New arrivals	-2.006*** (0.769)	-0.452* (0.865)	-2.036* (0.784)	-1.983*** (0.767)	-2.18** (0.82)	-2.475*** (0.835)	-2.783*** (0.809)	-1.276*** (0.435)
	Stayers	0.592 (0.527)	-0.229 (0.647)	0.613 (0.531)	0.616 (0.519)	0.624 (0.586)	0.725 (0.553)	0.382 (0.533)	1.334* (0.756)
Aver.	New arrivals	-1.227*** (0.33)	-0.976*** (0.321)	-1.245*** (0.334)	-1.213*** (0.325)	-1.287*** (0.352)	-1.298*** (0.336)	-1.506*** (0.323)	-0.699*** (0.192)
	Stayers	0.348* (0.196)	0.272 (0.2)	0.361* (0.198)	0.363* (0.191)	0.354* (0.213)	0.368* (0.197)	0.374 (0.265)	0.674** (0.293)
No. of Observations		900	825	900	900	900	900	1,152	900

Table 20: The table shows 2SLS estimates for the dynamic specification. In Column (2), we use the years 2007-2017 only. Column (3) excludes seasonal migrants. Column (4) excludes migrants employed in agriculture. Column (5) adds the growth rates of regional employment shares in low- and high-wage sectors. Column (6) alternatively adds the regional unemployment rate. Column (7) uses all 96 ROR regions in Germany, and column (8) uses the alternative classification of 1st to 2nd year migrants as new arrivals, and 3rd to 5th year migrants as stayers. Asterisks (*,**,***) indicate significance at the 10%, 5%, and 1% level.

Robustness: wage effects among permanent foreign nationals

Quartile		(1) Benchmark	(2) 2007-2017	(3) w/o SEA	(4) w/o Agr	(5) Sectors	(6) UE
1st	New arrivals	-1.866* (1.147)	-3.027** (1.336)	-1.897* (1.168)	-1.847* (1.137)	-2.703** (1.248)	-1.879 (1.365)
	Stayers	0.601 (0.721)	0.857 (0.836)	0.621 (0.728)	0.622 (0.713)	1.004 (0.838)	0.605 (0.768)
2nd	New arrivals	-1.307 (1.027)	-1.889 (1.093)	-1.330 (1.046)	-1.297 (1.02)	-1.734 (1.086)	-0.817 (1.019)
	Stayers	0.486 (0.68)	0.445 (0.721)	0.500 (0.687)	0.499 (0.67)	0.745 (0.737)	0.349 (0.684)
3rd	New arrivals	0.856 (0.691)	-0.517 (0.795)	0.866 (0.701)	0.829 (0.684)	0.478 (0.701)	-0.055 (0.713)
	Stayers	0.208 (0.691)	0.732 (0.795)	0.199 (0.701)	0.185 (0.684)	0.429 (0.701)	0.462 (0.713)
4th	New arrivals	0.591 (1.16)	0.791 (1.215)	0.595 (1.18)	0.557 (1.147)	0.371 (1.246)	0.494 (1.344)
	Stayers	0.593 (0.877)	0.683 (1.091)	0.586 (0.881)	0.564 (0.856)	0.721 (0.911)	0.620 (0.893)
Average	New arrivals	-0.166 (0.739)	-0.654 (0.827)	-0.172 (0.752)	-0.178 (0.734)	-0.513 (0.788)	-0.277 (0.828)
	Stayers	0.405 (0.504)	0.611 (0.518)	0.407 (0.508)	0.397 (0.496)	0.593 (0.526)	0.436 (0.521)
No. of Observations		900	825	900	900	900	900

Table 21: The table shows 2SLS estimates for the dynamic specification. In Column (2), we use the years 2007-2017 only. Column (3) excludes seasonal migrants. Column (4) excludes migrants employed in agriculture. Column (5) adds the growth rates of regional employment shares in low- and high-wage sectors. Column (6) alternatively adds the regional unemployment rate. Asterisks (*,**,***) indicate significance at the 10%, 5%, and 1% level, respectively.