The impact of immigration on native internal migration – Evidence for Germany (2008-2018)

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Abstract

This paper analyses the impact of immigration on the mobility of native citizens in Germany. Immigration to Germany has increased significantly over the last few years, driven in particular by a large and sudden influx of refugees during the so-called European refugee crisis. We make use of the quasi-experimental nature of this sudden influx to investigate its causal effect on internal migration decisions of native citizens, applying an instrumental variable (IV) estimation strategy that isolates the supply-side effects of refugee immigration through historical information on the spatial distribution of ethnic population groups across German NUTS3 regions. These effects are expected to act as a pull factor for new immigration inflows into these regions. We find that higher refugee immigration into a region leads to a significant decrease in the internal net migration rate of native citizens. Regarding the mechanism of this substitution effect, our IV estimates provide evidence that it is mainly driven by native "flight" rather than "avoidance", with the observed effect varying greatly across age groups.

Keywords: Immigration; internal migration; quasi experiment; instrument variable; Germany

JEL codes: F22; J15; R23

Introduction

In late August 2015, Germany's immigration policy took a sudden shift when chancellor Angela Merkel opened the door for hundreds of thousands of refugees fleeing from the Syrian civil war. Her words "*Wir schaffen das!*" ("We can do it!") became a symbol for Germany's *Willkommenskultur* (welcoming culture) which differed from highly restrictive immigration policies in most other EU countries. The political willingness to take in a large

number of refugees was linked to the hope that their successful labour market integration would help overcome some of the socio-economic challenges of Germany's ageing society (Seidelsohn et al. 2020). Opponents of this open-door policy feared that this integration would lead to job losses for native citizens[1] and that urban areas with a high inflow of refugees would turn into deprived areas.

The question of whether and how immigrant inflows affect the behaviour of native citizens has been at the core of a lively debate lasting over 30 years among economists, demographers, geographers and social scientists. In this paper, we analyse the effect of immigration on the migration patterns of native citizens as one of the core issues within the scholarly debates on the labour market effects of immigration (Borjas, 2006; Borjas, Freeman, & Katz, 1996; Card, 2001; Card & DiNardo, 2000) and on large-scale ethnic and demographic segregation between metropolitan areas with high immigrant inflows and regions where the resident population is dominated by nationals of the country in question (Ellis & Wright, 1998; Frey, 1995; Frey & Liaw, 1998; Wright, Ellis, & Reibel, 1997).

Though the hypothesis that immigration into an area leads to the increased out-migration of native citizens has been tested in numerous empirical studies, the results are highly ambiguous, with still no clear consensus on the causal relationship between immigration and internal migration flows. A common methodical problem in most empirical studies is that the identification of causal effects is far from trivial, with immigrants possibly attracted to certain locations by the same socio-economic pull factors (jobs and amenities) as those driving the residential location choices of native citizens (Lehmann & Nagl, 2018; Tanis, 2018).

This simultaneity gives rise to a potential bias in the estimated effect of immigration on internal migration. Though some of the above-mentioned studies apply instrumental variable (IV) approaches to account for potential endogeneity problems, most empirical contributions are unable to establish meaningful causal effects. Moreover, almost all prior studies have examined the immigration-internal migration nexus in a North American context, with only very few studies taking a European perspective (Andersson, Berg, & Dahlberg, 2018; Bråmå, 2006; Rathelot & Safi, 2014). A large part of scholarly work in this

[1] We use the term "native citizens" in reference to the resident population with German citizenship, although not all residents, who were born in Germany have German citizenship.

context is based on a finely granulated level of spatial units to address problems of intra-urban segregation instead of the interregional segregation emphasized in the abovementioned debates.

The main contribution of this paper is thus to provide new evidence on the relationship between immigration and internal (interregional) migration in Germany, one of the major destination countries for immigrants in the last decade. Between 2008 and 2018, the number of foreigners residing in Germany grew from 6.7 to 10.9 million, with immigration now the primary source of population growth and a major determinant of interregional disparities in population development (Heider, Stroms, Koch, & Siedentop, 2020). The increase in the immigration rate was strongly driven by the inflow of refugees, in particular from Syria and other Middle Eastern countries, peaking in 2015/2016 when around 1 million refugees entered Germany.

We make use of the quasi-experimental character of these recent refugee inflows to estimate the effect of immigration on the internal migration of native citizens using panel data covering 394 German NUTS-3 districts (*Kreise*) over the period 2008-2018. To control for potential endogeneity problems, we make use of a shift-share instrument combining historical information on the spatial location of certain ethnic groups in Germany with the sudden and drastic influx of members of these ethnic groups in recent years. One major improvement of our empirical identification strategy compared to previous studies using similar approaches is that the observed new immigrant inflows can be regarded as "sudden shocks" at national level. The estimated effects are therefore not biased by the long-term effects of previous waves of immigration. In addition, similar to the quasi-experimental estimation approach for Sweden reported in Andersson et al. (2018), historical location patterns of refugees in Germany were to a large extent regulated by distribution policies implemented at national and federal state level. Thus, the spatial patterns of refugee immigration can be viewed as exogenous with regard to the location choices of internal migrants.

Our estimates indicate that increasing refugee inflows into a NUTS-3 district lead to a significant decrease in the migration balance of native citizens in this district. The observed net effect is driven more by increased native out-migration than decreased native in-migration, though figures vary greatly between age groups of native citizens. The effect is

particularly strong for family- and job entry-related migration (age groups under 18 years and 25-30 years), while educational migration is not significantly affected by refugee inflows.

Literature Review

As mentioned above, there is no clear consensus in the empirical literature on whether increasing immigration rates lead to increasing out-migration rates ("native flight") or decreasing in-migration rates ("native avoidance"). Wright et al. (1997) have pointed out that the estimation of this effect is extremely sensitive to model specification and the scale and sample of the observed spatial units. Furthermore, studies looking at the immigration-internal migration nexus differ not only in their results and methodological approach, but also in their theoretical framework, especially regarding the different causal links ("channels") between immigration and internal migration. Three main channels are discussed and analysed in the literature: (1) the labour market, (2) the housing market, and (3) the resident population's preferences for ethnic and social homogeneity.

Economists have often used regional variation in immigrant inflows to study the impact on the wage structure and employment opportunities of native citizens. Since many of these studies found only modest effects (Butcher & Card, 1991; Card, 1990), Borjas et al. (1996) argued that native workers might move away from high immigration areas, fearing rising competition. Internal migration might thus bias the estimated labour market effect of immigration. In this context, low-skilled and/or low-income native citizens are seen to be most negatively affected, potentially being displaced by immigrants since their skill levels are assumed to be comparable. Evidence of this displacement effect is again very mixed. No evidence was reported by Card and DiNardo (2000) and Card (2001), while Borjas (2006) found a significant impact. For Canada, Beine and Coulombe (2018) found significant displacement effects through temporary foreign workers but not through permanent immigrants selected via the Canadian points system, concluding that the labour market effects of immigrant inflows depended greatly on immigration policies.

One of the first authors to explicitly discuss the housing market as a potential channel of displacement was Ley (2007), though his argument is, at least at first sight, somewhat counterintuitive: because immigrants are commonly supposed to have on average lower incomes and often face discrimination on the housing market, it seems relatively unlikely that they will displace native citizens on regional housing markets. However, he argues that

typical immigrant gateway cities are usually characterized by high housing prices and low vacancy rates. Rising housing costs could therefore force native households with lower incomes to move to cheaper (suburban or rural) locations. Immigrants, on the other hand, are greatly dependent on networks of co-ethnics providing important economic and social opportunities, yet rarely existing outside those "arrival cities" (Saunders, 2011). Their dependence on ethnic networks forces them to tolerate lower-quality housing and more crowding than would be acceptable to native citizens. Hence, they have a higher elasticity towards local changes in rental prices than low-income native citizens. Indirect evidence of the housing market acting as a potential channel of the immigration-internal migration link was found by scholars who estimated that the impact of immigrant inflows on regional housing markets is substantially larger than their impact on labour markets (Gonzalez & Ortega, 2013; Saiz, 2003, 2007). In this field, Mussa, Nwaogu, and Pozo (2017) found spatial spill-over effects to housing markets in neighbouring districts, possibly caused by people moving out of immigrant gateway areas.

Perhaps the most controversially discussed channel in the literature, preferences for ethnic and social homogeneity or cultural avoidance among the resident population are much discussed in the literature on ethnic segregation and "white flight" in the post-war US. In this context, Boustan (2010) found that exogenously determined south-to-north migration of African Americans resulted in a significant decline in the white population of affected core cities in northern metropolitan areas. Cultural avoidance can be explained by a high persistence of ethnic and racial prejudices among native citizens and negative racial stereotypes (Semyonov, Glikman, & Krysan, 2007)[2]. In addition, economists argue that immigration may affect the quality of any locally provided public good due to the experience of crowding or peer effects (Boustan, 2010; Saiz & Wachter, 2011). In this respect, school choice plays a special role. Increasing numbers of minority schoolchildren from lower income families may lead to the perception of a lower quality of education (Fairlie & Resch, 2002; Rathelot & Safi, 2014), resulting in white families moving out of or avoiding areas where schools are characterized by significant numbers of minority children. Public education policies play a major role in this context since they can both reinforce and mitigate

[2] Some authors argue that this kind of avoidance is more closely related to socio-economic differences than to ethnic or cultural differences (see e.g. Andersson et al., 2018; Boustan, 2010)

incentives to move to less diverse neighbourhoods (Bernelius & Vilkama 2019; Ramos Lobato & Groos 2019).

Both Frey (1995) and Frey and Liaw (1998) transposed the expression "white flight" to countervailing immigration and domestic migration flows between states and metropolitan areas in the US in the 1990s. Frey also introduced the controversial term "demographic balkanization"[3] to describe a form of segregation on a broader geographical scale, with certain gateway cities becoming younger and ethnically more diverse, in contrast to the rest of the country where the population is dominated by white middle-class households. Since most of the empirical research interested in the spatial consequences of cultural avoidance measures intra-urban migration (Andersson et al., 2018; Bråmå, 2006; Rathelot & Safi, 2014), evidence of inter-urban or inter-regional "white flight" as meant by Frey is rare. Examining the internal migratory response of native-born non-Hispanic white men and foreign-born men in the US to immigration from different regions of origin, Kritz and Gurak (2001) found no evidence supporting the cultural avoidance hypothesis. Ali, Partridge, and Rickman (2012), on the other hand, found that internal state-to-state migration among the native-born population responds to changes in the foreign-born population share, but not to the net immigration rate, indicating that cultural avoidance is a more plausible channel than the labour market.

We can conclude that the empirical evidence on the causal relationship between immigrant inflows and domestic migration patterns is highly ambiguous. In addition, many of the above-mentioned studies suffer from endogeneity problems and thus fail to establish causal effects. We go on to present our empirical strategy for identifying the effects of immigration on the internal migration choices of native citizens in Germany.

Estimation

We are interested in the effects of refugee immigration on the internal migration patterns of German citizens This form of immigration can be seen as a source of exogenous variation to Germany's internal economic geography, being strongly driven by specific events and conditions in the immigrants' countries of origin, such as the Syrian civil war. Therefore, refugee immigration is assumed to be greatly exogenous to interior socio-economic

[3] For a critique of the term "demographic balkanization" see Ellis and Wright (1998).

conditions and hence to the migration choices of native citizens between German NUTS-3 districts.

In order to identify the potential effects of refugee immigration, we start by estimating a series of reduced-form regression equations in the following form:

$$(1) \quad \text{Migration rate}_{i,t} = \delta RM_{i,t-1} + \beta' X_{i,t-1} + U_{i,t} + \mu_i + \lambda_t + \varepsilon_{i,t},$$

where the model's outcome variable Migration rate$_{i,t}$ is a measure of a region *i*'s gross in-, out- or net internal migration rate of German citizens at time t. These rates are defined as shown in equation (2) to equation (4):

$$(2) \quad \text{In-migration rate}_{i,t} = \frac{I_{i,t}}{P_{i,t-1}},$$

$$(3) \quad \text{Out-migration rate}_{i,t} = \frac{O_{i,t}}{P_{i,t-1}},$$

$$(4) \quad \text{Net migration rate}_{i,t} = \frac{(I_{i,t} - O_{i,t})}{P_{i,t-1}},$$

where $I_{i,t}$ is the number of German (internal) in-migrants in region i during year t, $O_{i,t}$ the number of out-migrants, and $P_{i,t-1}$ the total population in the baseline year $t-1$. Our parameter of interest in equation (1) is δ, which indicates the response of German (internal) migrants to a change in the region's net immigration rate of refugees.

$$(5) \quad RM_{i,t} = \frac{(R_{i,t} - R_{i,t-1})}{P_{i,t-1}},$$

where the numerator represents the change in the population (stock) of immigrants between two consecutive time periods t and $t-1$.

To control for confounding factors in the relationship between the internal migration of German citizens and refugee immigration, we include $X_{i,t}$ in equation (1), a vector of time-varying variables measuring local economic activity such as a district's unemployment rate, population density, as well as the share of the manufacturing and the services sectors in terms of a district's total employment. Since European labour migration to Germany also greatly increased during the observed period, $X_{i,t}$ also includes the net increase in immigration from non-refugee countries. In addition, $U_{i,t}$ represents a vector of space-time

interaction effects $\sigma_t(urban_i * \lambda_t)$, where $urban_i$ is equal to one when a district is classified as urban and has at least 500.0000 inhabitants, while λ_t comprises a set of binary dummies for individual sample years. Those interaction effects account for the decelerating trend of re-urbanization in Germany (Stawarz & Sander, 2019; Heider et al., 2020). While arguing that this recent trend of sub- and counter-urbanization can – at least partly – be ascribed to increasing immigrant inflows (mainly concentrated in large cities), we also have to control for the alternative hypothesis that decreasing rural-urban migration was caused by a general shift in the residential preferences among the German population towards less urbanized areas. Finally, μ_i are region-fixed effects, while $\varepsilon_{i,t}$ is an idiosyncratic error term.

Although the inflow of refugees during the observed period fulfils certain features constituting an exogenous shock to German regions, there may still be unresolved endogeneity concerns. Whereas the spatial allocation of refugees was regulated by a nation-wide system, the respective distribution policies were not similarly implemented across all German federal states throughout our sample period 2008-18. The distribution of asylum applicants is, in a first step, determined by the so-called '*Königsteiner Schlüssel'*, a formula by which allocation quotas are set at federal level. The suballocation within a federal state is then regulated at state level. Persons with pending asylum applications must usually comply with a three-year residence requirement (*Wohnsitzauflage*) as long as they are unemployed and/or dependent on social welfare. While this rule is strictly applied in some German federal states, others are less strict. It should also be noted that this three-year requirement was abandoned in 2008, only to be reimplemented in 2016. Thus, non-regulated internal migration may have played a significant role in the regional distribution of refugees in our sample period. Finally, even with regulations strictly applied, there might still be the possibility of refugees moving internally to take up job opportunities. In this case their location choices might be endogenous to the location choices of the native population, leading to a downward bias in the estimated effect of refugee immigration on native internal migration.

To account for this kind of endogeneity, we make use of the fact that the location choices of new immigrants are to a large extent path-dependent, relying on the initial spatial distribution of their compatriots (Bartel, Ann, P., 1989; Nowotny & Pennerstorfer, 2018; Tanis, 2018). Therefore, we estimate the following two-stage least squares model (2SLS):

$$(6) \quad \text{Migration rate}_{i,t} = \delta\overline{RM}_{i,t-1} + \beta' X_{i,t-1} + U_{i,t} + \mu_i + \lambda_t + \varepsilon_{i,t},$$

with the first stage regression models specified as

$$(7) \quad \overline{RM}_{i,t} = \gamma RMIV_{i,t-1} + \beta' X_{i,t} + U_{i,t} + \mu_i + \lambda_t + \varepsilon_{i,t},$$

where $RMIV_{i,t-1}$ represents an instrumental variable, defined as[4]

$$(8) \quad RMIV_{i,t} = \sum_c RMIV_{c,i,t} = \sum_c (\emptyset_{c,i,t2000} * RM_{c,ger,t}),$$

where $RM_{c,ger,t}$ is the total net migration from country c at time t to Germany and

$$(9) \quad \emptyset_{c,i,t} = \frac{R_{c,i,t}}{R_{c,ger,t}}.$$

Thus, our instruments can be interpreted as the projected net migration rate in region i if the distribution of new immigrants at time t would have been exactly the same as that of the year 2000[5]. This kind of 'shift-share-instrument' has been successfully used in previous studies on the regional impacts of immigration. However, in line with Andersson et al. (2018), we argue that our identification strategy can be seen as an improved version of previous approaches since we focus on a specific kind of immigration that was new and to a large extent driven by push factors in the immigrants' regions of origin. Moreover, the exogeneity of our instrument is further strengthened by the fact that the historical distribution of refugees before 2008 was largely regulated by distribution policies and the above-mentioned legal framework.

Data

Data on annual migration flows across internal NUTS III district borders ("Kreise" and "Kreisefreie Städte") is published by the Federal and State Statistical Offices of Germany (Federal and State Statistical Offices of Germany, 2020). This data source allows us to distinguish between German and foreign citizens, as well as between external and internal migration. Since we are interested in the internal migration response of native citizens to

[4]The instrument was introduced to the equation with an additional one-year lag to reflect the fact that the spatial allocation of refugees within Germany follows a kind of redistribution procedure. In the first phase, asylum applicants are obliged to reside within the region assigned by the state authorities. Once asylum has been granted, they are free to move to their preferred location within Germany.

[5]In order to provide a measure of the historical location of immigrants, we used the average distribution between 1999 and 2001.

immigration, we use the internal in- and outflows of German citizens at NUTS III district level to construct our set of dependent variables as described above. In addition, published migration data allow us to distinguish between six different age groups of internal migrants: children and young people (under 18 years), educational migrants (18-24 years), young professionals (25-29 years), middle-aged migrants (30-49 years), early retirement migrants (50-64 years), and late retirement migrants (older than 65 years). This distinction allows us to estimate if there are heterogeneous migratory responses to immigration among German citizens belonging to different age groups.

Unfortunately, the official statistics on migration flows do not allow us to distinguish between different countries of origin. To construct the above-described measure of refugee immigration, we have therefore used data on annual changes in the population stock of respective ethnic groups as a proxy. Although these changes also include natural population developments, the resulting aggregates are much more precise than any potential alternative from migration statistics. Moreover, a native migration response to immigration is expected to occur in response to every change in the immigrant population, regardless of whether it was due to migration or natural population development. Our measure of refugee immigration is based on the foreigner statistics published by the federal statistical office (Federal Statistical Office of Germany [DESTATIS], 2020a, 2020b). Our aggregate of refugee immigration $RM_{i,t}$ and the corresponding instrument $RMIV_{i,t}$ are based on the annual population stocks of all eight major countries of origin throughout the observed sample period (Afghanistan, Albania, Eritrea, Iran, Iraq, Pakistan, Syria and Ukraine)[6]. All further control variables were taken from the INKAR database provided by the Federal Institute for Building, Urban Affairs and Spatial Development (Federal Office for Building and Regional Planning [BBSR], 2020).

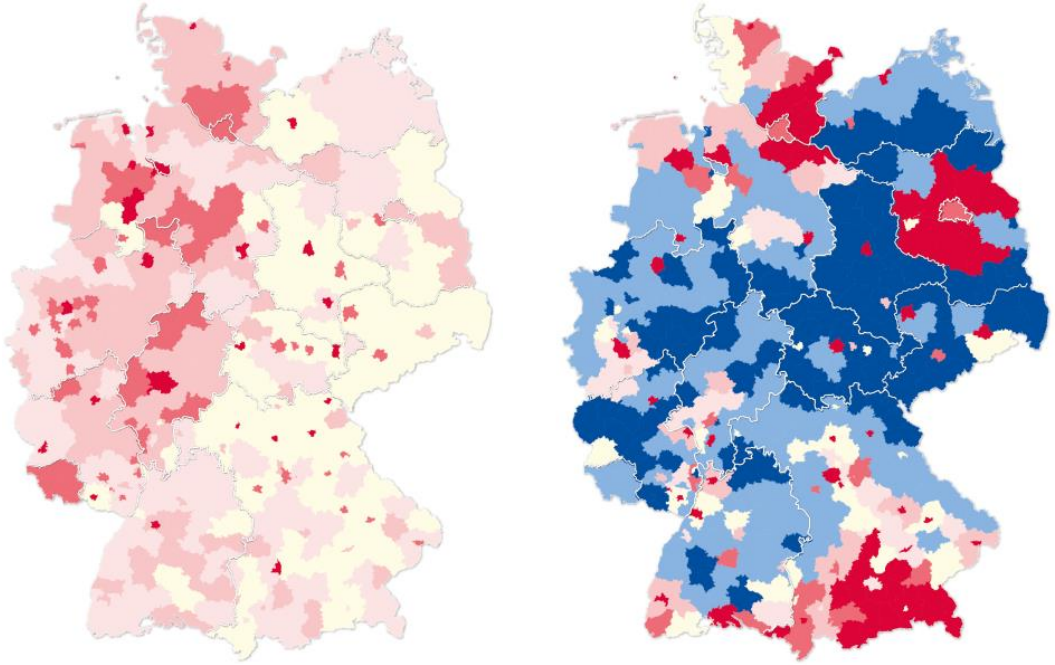
Unlike these variables, foreigner statistics are not available for all 401 German NUTS-3 districts, as several share a single immigration authority[7]. In addition, we had to adjust our data to take account of certain territorial reforms (local-level administrative mergers) during the observed period. We ended up with a dataset consisting of 394 NUTS-3 districts. The spatial patterns and descriptive statistics of both refugee and German net migration rates

[6] These countries accounted for more than 78.7% of refugees coming to Germany throughout the observed period.

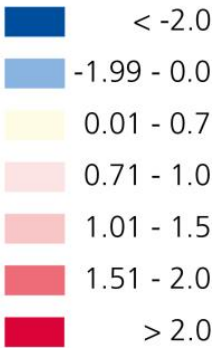
[7] This applies to all districts of the federal state Saarland, the city of Cottbus and the Spree-Neiße district as well as the city of Kassel and the surrounding district.

are shown in Figure 1. With regard to immigration, there is a clear difference between Western and Eastern Germany, with refugee immigration strongly directed towards Western Germany and also concentrated in urban areas. As regards the internal net migration of Germans, we observed no great differences between East and West, but a concentration on several urban and suburban suburban districts around the largest German cities (Berlin, Hamburg, and Munich). In conclusion, the average annual net migration rates illustrated in Figure 1 do not hint at any particularly negative correlation between immigration and the internal net migration of Germans.

Figure 1: Average annual net-migration rates (2007-2018) per 1,000 inhabitants for refugees (left) and internal German migrants (right)



Statistics	**Refugees**	**Germans**
N	394	394
MEAN	1.140	-.281
SD	.577	2.485
MIN	.089	-7.035
MAX	6.411	11.545



Source: Authors' illustration based on DESTATIS (2020a, 2020b).

Results

Baseline and IV results: Native "flight" or "avoidance"?

Table 1 presents the results for the baseline equation (1) and the respective 2nd stage IV estimation as expressed in equation (6). The results for the first stage IV estimation can be found in the appendix. The baseline results without IVs hint at a small but significant negative association (-0.078) between refugee immigration and the internal net migration rate of German natives. The estimated net effect can be decomposed to almost equal parts into a negative effect on in-migration and a statistically insignificant positive effect on out-migration. In addition, we find a similarly sized correlation between non-refugee immigration and German native migration rates.

Table 1. Fixed effects estimates and IV estimates: Impact of immigration on the internal migration of German citizens (2008-2018)

MODEL	(I)	(II)	(III)	(IV)	(V)	(VI)
		Fixed Effects			2SLS	
VARIABLE	Net-Migration	In-Migration	Out-Migration	Net-Migration	In-Migration	Out-Migration
Refugee Immigration	-0.0776***	-0.0466*	0.0310	-0.472***	-0.0908	0.381***
	(0.0198)	(0.0193)	(0.0164)	(0.110)	(0.0735)	(0.0892)
Non-Refugee Immigration	-0.0794***	-0.0426**	0.0368*	-0.0425	-0.0385*	0.00404
	(0.0205)	(0.0160)	(0.0165)	(0.0326)	(0.0172)	(0.0259)
GDP per Capita	0.00211	0.00227	0.000156	0.00180	0.00223*	0.000435
	(0.00150)	(0.00126)	(0.00149)	(0.00115)	(0.000983)	(0.000972)
Unemployment	0.00211	0.00227	0.000156	-0.00287***	0.000855	0.00373***
	(0.00150)	(0.00126)	(0.00149)	(0.000557)	(0.000533)	(0.000524)
Population Density	-0.00345***	0.000791	0.00424***	-0.0427***	-0.0395***	0.00324
	(0.000825)	(0.000694)	(0.000693)	(0.00347)	(0.00335)	(0.00277)
Manufacturing Employment	0.0000885	0.000102	0.0000134	-0.000184	0.0000713	0.000255
	(0.0000551)	(0.0000796)	(0.0000531)	(0.000223)	(0.0000834)	(0.000230)
Service Employment	0.00266	0.00921***	0.00656*	0.00113	0.00904***	0.00791***
	(0.00262)	(0.00268)	(0.00266)	(0.00221)	(0.00203)	(0.00190)
Region FE	Yes	Yes	Yes	Yes	Yes	Yes
Year FE	Yes	Yes	Yes	Yes	Yes	Yes
Urban × Year FE	Yes	Yes	Yes	Yes	Yes	Yes
F				66.73	66.73	66.73
Critical value				16.38	16.38	16.38
N	3546	3546	3546	3546	3546	3546

Notes: Control variables have been log-transformed. F refers to the Kleibergen-Paap Wald F-statistic for weak identification. Critical value refers to the Stock-Yogo 10% maximal IV size threshold. Cluster robust standard errors in parentheses * $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

Estimating the same parameters via 2SLS changes the empirical picture obtained. Again, we find significant negative net effects of refugee immigration on the internal net migration of native citizens. The estimated effect is however distinctly larger than in the baseline model, showing that 1% of total population growth attributable to refugee immigration is

associated with a 0.47% net migration loss of German citizens. The net effect of non-refugee immigration is statistically insignificant although there is a small yet statistically relevant negative effect (5%) on in-migration.

The quantitative differences between the baseline estimates and the IV estimates raise doubts about instrument significance, i.e. a weak instrument problem, though the Kleibergen-Paap Wald F-statistic is distinctly larger than the commonly accepted critical value of 10 (Staiger & Stock, 1997) and the 10% maximal IV size threshold as proposed by Stock and Yogo (2005). There are two reasons for these quantitative deviations. First, immigrants' destination choices in the baseline model are likely to be influenced by unobserved factors similar to native citizens' migration choices, leading to a downward bias in the estimated parameters. Second, the estimates in the baseline model are average treatment effects (ATEs) across the entire sample, while the estimates in the IV model represent local average treatment effects (LATEs) for a subsample that receives the treatment if and only if it is induced by the IV. Since the distribution of immigrants was strongly concentrated before 2008, it is highly plausible that the LATEs distinctly deviate from the ATEs and that the negative effect of immigration inflows into these concentration areas is quantitatively larger than the revealed average effects.

In addition, in order to validate the exclusion restriction for our instrument, we implement the indirect evaluation procedure proposed by Altonji, Elder and Taber (2005). Whereas the exclusion restriction is in general not testable, the authors propose estimating the 2SLS model for subsamples where the instruments have no influence on the treatment. Since the exclusion restriction states that the instruments should affect the outcome by no other means than the treatment, in this case there should be zero direct (reduced-form) effects of the instruments on the dependent variable.

Making use of the fact that immigrants in Germany are unequally distributed between West and East Germany (the former German Democratic Republic) as well as between urban and rural areas, we focus on two different subsamples: Large cities (with more than 200.000 inhabitants) in West Germany which have been important immigrant destinations for a long time, and rural areas in East Germany, the least attractive destination regions for immigrants. In both cases, the shift-share instrument exerts no significant effect on the

immigration variable. In addition, we cannot reject the null hypothesis that the reduced-form effects on the internal net migration rates of Germans are significantly higher or lower than zero (detailed regression results are reported in Table A2 in the appendix). Hence, based on our two different subsamples, we can reject the hypothesis that our instruments affect the outcome by any other means than refugee immigration.

In conclusion, our IV estimates show that refugee immigration exerts significant and relevant effects on the net migration of German citizens. Further, the estimates indicate that the net effect is driven by "native flight" rather than by "native avoidance".

Heterogenous effects across different age groups

Various studies have shown that residential preferences diverge greatly across life-cycle stages (for Germany see Goetzke & Rave, 2013 and Siedentop et al., 2018). Hence, the migration response to immigration might also differ across age groups. As far as we know, heterogenous effects across age groups have not yet been analysed in the existing literature on the effects of immigration on internal migration.

To estimate heterogeneous effects across age groups, we define net migration rates as follows:

$$(13) \quad \text{Net migration rate}_{age,i,t} = \frac{(I_{age,i,t} - O_{age,i,t})}{P_{age,i,t-1}},$$

where age refers to the age groups defined above. For the sake of simplicity, we only focus on the results for the IV models with net migration as a dependent variable.

The results (see Table 3) show that the estimated effects of refugee immigration vary greatly across age groups. Particularly high effects can be found for Germans under 18 (a proxy for families), young professionals (25-29 years) and the age group between 30 and 49 years. This can be interpreted as indirect evidence that residential preferences associated with family formation (e.g. school choice and the preference to live in larger dwellings) are especially sensitive to immigration. However, since the migration choices of young adults are also supposed to be greatly influenced by economic opportunities, the labour market as a potential channel cannot be totally ruled out. Moreover, from the age of 25 upwards the estimated effects seem to decline with age. Surprisingly, a significant positive coefficient was to be found among retirees older than 65 years.

We find no significant effect of refugee immigration on the internal migration of young adults between 18 and 24 years. This could be explained by the fact that, against a background of rising rents in most immigrant gateway areas, native citizens in this age group (especially students) are – similar to immigrants — willing to accept lower quality housing and less living space per person (e.g. shared flats). In addition, residential preferences in this age group might be less influenced by ethnic prejudices and school choice considerations.

Table 3. IV Estimates: Impact of immigration on the internal net-migration of German citizens by age group (2008-2017).

	(I)	(II)	(III)	(IV)	(V)	(VI)
AGE GROUP	<18	18-24	25-29	30-49	50-64	>65
Refugee Immigration	-0.786***	0.0929	-1.515***	-0.894***	-0.200**	0.185**
	(0.180)	(0.354)	(0.355)	(0.180)	(0.0680)	(0.0659)
Non-Refugee Immigration	-0.0757	-0.147	-0.00407	-0.0726	0.00360	0.00796
	(0.0513)	(0.0831)	(0.106)	(0.0541)	(0.0196)	(0.0164)
GDP per Capita	0.00135	0.00267	0.0158***	0.00369*	-0.00107	-0.000764
	(0.00163)	(0.00487)	(0.00465)	(0.00153)	(0.000667)	(0.000689)
Unemployment	-0.00119	-0.0105***	-0.00489*	-0.00205**	-0.0000245	-0.0000859
	(0.000811)	(0.00241)	(0.00223)	(0.000750)	(0.000343)	(0.000338)
Population Density	-0.0472***	-0.0496**	-0.132***	-0.0407***	-0.0163***	-0.00604***
	(0.00424)	(0.0185)	(0.0122)	(0.00430)	(0.00175)	(0.00159)
Manufacturing Employment	-0.000475	0.000225	-0.00129*	-0.000384	-0.000212**	0.000251
	(0.000488)	(0.000453)	(0.000554)	(0.000400)	(0.0000739)	(0.000140)
Service Employment	0.00470	-0.00155	0.00427	0.00377	-0.000469	0.00143
	(0.00388)	(0.00873)	(0.00891)	(0.00317)	(0.00133)	(0.00139)
Region FE	Yes	Yes	Yes	Yes	Yes	Yes
Year FE	Yes	Yes	Yes	Yes	Yes	Yes
Urban × Year FE	Yes	Yes	Yes	Yes	Yes	Yes
F	66.73	66.73	66.73	66.73	66.73	66.73
Critical value	16.38	16.38	16.38	16.38	16.38	16.38
N	3546	3546	3546	3546	3546	3546

Notes: Control variables have been log-transformed. F refers to the Kleibergen-Paap Wald F-statistic for weak identification. Critical value refers to the Stock-Yogo 10% maximal IV size threshold. Cluster robust standard errors in parentheses. * $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

Conclusions

In the so-called European refugee crisis in 2015/16, Germany received a sudden and large inflow of immigrants. Despite the political conviction that the refugees can be successfully integrated into the German labour market and society, little is known about the short- to mid-term impact on the German economy. In this paper, we have addressed the question of whether the location choices of immigrants have affected the internal migration decisions of German citizens. We studied this potential linkage for a sample of 394 NUTS-3 districts over the sample period 2008-18. Accounting for potential endogeneity concerns in the

immigration-internal migration nexus, our IV estimations show that the increase in refugee numbers has led to a significant decline in the internal net migration of Germans. The estimated net effect is driven in particular by increased out-migration, i.e. native "flight", and is seen to differ significantly across different age groups. While young professionals and families are particularly affected, we did not find any significant effects on the internal migration of young adults between 18 and 24 years, and even noted a positive effect on the internal net migration of retirees.

Whereas our results clearly indicate that immigration matters for native citizens' internal migration patterns, they are less conclusive on the question *why* immigration matters. The fact that family migration is particularly sensitive to immigration might be indicative in this context. Cultural avoidance in school choice behaviour as well as the housing market and the need for affordable larger dwellings among young family households are plausible channels. Empirical studies have found considerable evidence of residential mobility as the most important strategy for avoiding school districts with a high share of students from disadvantaged backgrounds. Therefore, social segregation and school segregation are closely interlinked (Bernelius & Vilkama 2019). The influx of refugees into neighbourhoods with already high proportions of foreign populations could reinforce the "flight strategy" of native families.

Turning to the housing market in Germany, recent studies have reported a massive increase in housing costs in metropolitan areas and a corresponding suburbanisation of families into less expensive suburban and rural areas (Stawarz & Sander 2019; Stawarz, Sander & Sulak, 2020). The in-migration of refugees into metropolitan cores can be seen as one factor amongst others leading to higher rents and property prices, making larger cities less attractive for family households with larger space needs. However, it is important to state here that the displacement of families toward the urban fringe tends – at least in the German context – to be discussed more as an outcome of public and private upgrading policies and practices – especially in pre-war neighbourhoods (Bernt 2012) – than of immigration and diversification processes.

In addition, based on our empirical results, we cannot rule out the labour market as a potential channel. There are, however, two important arguments against the labour market hypothesis. First, the observed spatial units are distinctly smaller than local labour market

regions. This means that a large proportion of the observed internal migration might occur within labour market regions and might not be influenced by the regional labour market impact of immigration. Second, the observed period can generally be characterized by decreasing unemployment rates and a shortage of labour. Hence, it seems plausible that immigrants were regarded as complementing rather than displacing native workers. Particularly with regard to refugee immigration, labour market displacement as a potential channel seems to be rather implausible. Since the integration of refugees into the German labour market usually takes relatively long, it seems unlikely that refugees constitute serious and immediate competition for German workers (Kosyakova & Sirries, 2017). Alternatively, we would suggest that the estimated net effect is likely to be driven by a mix of different economic and non-economic channels.

In conclusion, our results indicate that immigration and its effect on native internal migration may reinforce ethnic and demographic segregation on a broader geographical scale. As a result, traditional immigrant gateway areas become ethnically more diverse, while the demographic structure of other mostly sub- and ex-urban areas will be dominated by native family households. Since the displacement channels are not clear and since we have no information on the socio-economic characteristics (e.g. education, income and migrant background) of native citizens affected by the observed effect, it is rather difficult to derive any clear policy recommendations from these findings. However, our results show that immigration has major and complex follow-up effects on a regional scale in destination countries. Those spatial effects of immigration have strong implications for immigration policies – in particular, spatial distribution schemes for refugees – as well as regional and urban development strategies. Moreover, we argue for a better integration of the research on international and internal migration. Since they are not independent of each other and since the role of immigration is increasing in most developed countries, a comprehensive analysis of the two forms of migration and their interlinkages is needed to gain an adequate understanding of recent spatial development phenomena such as re- and suburbanization.

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Appendix

Table A1. First Stage Estimates (2009-2018)

VARIABLE	Refugee Immigration	
Shift-Share-Instrument	0.343***	(0.0420)
Non-Refugee Immigration	0.0911	(0.0588)
GDP per Capita	-0.0000168	(0.000754)
Unemployment	0.000839*	(0.000338)
Population Density	-0.00322	(0.00346)
Manufacturing Employment	-0.000661	(0.000481)
Service Employment	-0.00260	(0.00188)
Region FE	Yes	
Year FE	Yes	
Urban × Year FE	Yes	
F	66.73	
Critical value	16.38	
N	3546	

Notes: Control variables have been log-transformed. F refers to the Kleibergen-Paap Wald F-statistic for weak identification. Critical value refers to the Stock-Yogo 10% maximal IV size threshold. Cluster robust standard errors in parentheses * $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

Table A2. 1st Stage, 2nd Stage IV and Reduced Form Estimates for Urban West German Counties and Rural East German Counties (2008-2018)

SAMPLE	Urban West Germany		Rural East Germany	
1st Stage Estimates (Dep. Variable: Refugee Immigration)				
Shift-Share IV	-0.0833	(0.103)	-0.00678	(0.122)
2nd Stage Estimates (Dep. Variable: Internal Net-Migration of Germans)				
Refugee Immigration	0.707	(0.965)	-21.87	(385.3)
Reduced Form Estimates (Dep. Variable: Internal Net-Migration of Germans)				
Shift-Share IV (Refugees)	-0.0589	(0.0842)	0.148	(0.197)
Region FE	Yes		Yes	
Year FE	Yes		Yes	
Urban × Year FE	Yes		Yes	
Controls	Yes		Yes	
F	0.651		0.00307	
Critical value	16.38		16.38	
N	153		522	

Notes: Control variables have been log-transformed. F refers to the Kleibergen-Paap Wald F-statistic for weak identification. Critical value refers to the Stock-Yogo 10% maximal IV size threshold. Cluster robust standard errors in parentheses * $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$