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Berlin Calling – Internal Migration in Germany

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Thomas K. Bauer, Christian Rulff, and Michael M. Tamminga[1]

Berlin Calling – Internal Migration in Germany

Abstract

This paper analyzes the determinants of internal migration in Germany. Using data on the NUTS-3 level for different age groups and Pseudo-Poisson Maximum Likelihood (PPML) gravity models, the empirical analysis focuses on the relevant push and pull factors of internal migration over the life cycle. Labor market variables appear to be most powerful in explaining interregional migration, especially for the younger cohorts. Furthermore, internal migrants show heterogeneous migration behavior across age groups. In particular the largest group, which is also the youngest, migrates predominantly into urban areas, whereas the oldest groups chose to move to rural regions. This kind of clustering reinforces preexisting regional heterogeneity of demographic change.

JEL-Code: R23, J11, O18

Keywords: Internal migration; gravity model; demographic polarization

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1 Thomas K. Bauer, RUB, RWI, and IZA Bonn; Christian Rulff, RUB and RWI; Michael M. Tamminga, RUB and RWI. *– The authors gratefully acknowledge the financial support of the German Science Foundation (DFG) within the Priority Program 1764: The German Labor Market in a Globalized World.-* *All correspondence to: Michael M. Tamminga, Universitätsstr. 150, 44801 Bochum, Germany, e-mail: michael.tamminga@rub.de*

1 Introduction

Demographic change is one of the main social, political, and economic challenges for many developed countries in the coming decades. Also in Germany, the population is both declining and aging rapidly. The challenges of this development for the social security systems, in particular the health and pension system, have been analyzed comprehensively.[1] One aspect that has largely been ignored in the ongoing discussion so far is the regional heterogeneity of this demographic process. As shown in Figure 1, regional age heterogeneity is prevalent in Germany with a clear tendency of younger people clustering in urban areas (panel (a)), middle-aged individuals in urban and suburban areas (panel (b)), and individuals older than 50 years in East Germany as well as in some rural parts of West Germany (panels (c) and (d)).

The age structure of a region has implications on economic factors like the human capital base (brain drain / brain gain) and the innovation potential of the affected regions, which in turn affect the economic performance of these regions (Gregory and Patuelli, 2015). Since fertility and mortality rates appear to be stable in the short-run (Dudel and Klüsener, 2016; Destatis, 2016), migration flows constitute one of the most important determinants of changes in the regional age structure. In this paper, we will focus exclusively on internal migration flows.[2] Because internal migration, if heterogeneous across age groups, influences both the source region's as well as the host region's age structure, we argue that it is important to gain insights into the different migration patterns of interregional migrants of different age groups. Our analysis builds conceptually on previous studies by Hunt (2006), Mitze and Reinkowski (2011), and Sander (2014), who conclude that economic factors provide the most explanatory power concerning internal migration flows in Germany.

We contribute to this literature by using smaller scale data compared to previous works, as well as by using age group-specific wages in order to measure earning perspectives for each group more precisely. Furthermore, for the first time, we add a price index based on housing prices to our model, which enables us to take regional differences in living costs into account. Based on various data sources on the county level[3], we estimate an extended gravity model in order to investigate the locational decisions of internal migrants of different age groups.

In a first step, we provide a detailed descriptive overview of the internal migration flows of different age groups in Germany. Our focus is to document heterogeneities across age groups concerning the frequency of migration and the location choice of the migrants. Compared to the previous literature, our analysis is based on the county level,

[1] See, e.g., Börsch-Supan *et al.* (2016).

[2] We will ignore international migration to Germany, since international migration flows and their age composition are already widely analyzed. See Greenwood (1997) for an overview of the literature.

[3] In this paper, the term 'county' refers to German *Landkreise*.

which enables us to analyze the determinants of migration more precisely. We show that migration behavior differs significantly between age groups, with the youngest group in our analysis (18 to 29 years old) being by far the largest (43% of all migrants), as well as the one with the highest urbanization tendencies. In a second step, we pinpoint the exact drivers of the heterogeneous migration behaviors of different age groups in order to shed light on possible heterogeneous magnitudes of push and pull factors across age groups.

In line with the majority of existing empirical studies, we find that labor market factors are the most powerful determinants of internal migration patterns. Our results further indicate that age group-specific wages are indeed a more precise measure for earnings perspectives explaining regional migration and affect predominantly younger age groups.

The paper proceeds as follows. The next section provides an overview of the framework of migration theory and the relevant empirical literature. The section further briefly presents historical internal migration patterns in Germany, since internal migration in Germany differs significantly from that in other countries. Section 3 outlines the empirical strategy and describes our data. The results of our descriptive and multivariate analysis are presented in sections 4 and 5, respectively. Section 6 concludes.

2 Theoretical Framework and Literature

The theoretical framework for the analysis of migration is based on the human capital theory developed by Sjaastad (1962) and Becker (1964). This model treats the migration decision as an investment decision, i.e., the returns to migration should exceed the cost of migration. Therefore, labor market conditions are at the core of the theoretical notion of migration theory. This idea has been further formalized by Todaro (1969) and Harris and Todaro (1970) who relax the assumption of complete information about wages and employment opportunities in all potential host destinations. Instead, they set up a model in which an individual compares the expected income from staying in the source region with the expected income from moving to another region less the cost of the move. In this model, income is a function of the wage rate and the probability of being employed in the respective region, which in turn is a function of the region's unemployment rate.

At the aggregate level the individual's migration decision can be modeled by a gravity model, which is based on the early work of Ravenstein (1885, 1889) and was first introduced by Zipf (1946). Zipf (1946) uses the physical concept of gravity and explains the volume of migration to be proportional to the product of the origin and destination population, and inversely proportional to the distance of the two regions. Combining the neoclassical idea of migration with the basic gravity model leads to an extended gravity model, which includes variables capturing the push and pull factors proposed by the neoclassical theory.

This extended model can be written as:

$$M_{ij} = f(C_{ij}, P_i, P_j, Y_i, Y_j, U_i, U_j), \tag{1}$$

where the number of migrants from region i to region j is a function of migration costs C_{ij}, the source (host) region's population P_i (P_j), a measure for the source (host) region's wage rate Y_i (Y_j), and the source (host) region's unemployment rate U_i (U_j). The model is usually extended by measures for local amenities and by variables reflecting regional living costs. In the simple model shown in Equation (1), the number of migrants between any two regions i and j is expected to decrease with increasing cost. The population of the origin, as well as the destination region is expected to positively contribute to the number of migrants. Ceteris paribus, the number of migrants is expected to be positively (negatively) associated with the wage rate and negatively (positively) with unemployment rate in the host (source) region.[4]

The implications of this model are empirically well documented, although mixed results concerning the influence of some particular push and pull factors are found. Furthermore, these factors appear to be of different importance for the migration decision of individuals at different stages of their life cycle, with individuals in their working age reacting more sensitive towards regional differences in labor market conditions. Empirical studies generally confirm these predictions of the neoclassical model: younger individuals react more sensitive towards regional differences of labor market characteristics compared to older groups (see, among others, Goss and Schoening (1984); Gregg *et al.* (2004); Plane *et al.* (2005); Bell and Muhidin (2009); De Groot *et al.* (2011); Etzo (2011); Piras (2017)).

In general, these insights are true for Germany as well. The German history of internal migration, however, is rather particular. In the first years after World War II, migration patterns in Germany were dominated by forced migrants from the former eastern territories of the German Reich.[5] In the 1950s and 1960s, when the economy was booming, West Germany, as most of Western Europe, was characterized by urbanization trends (Kontuly *et al.*, 1986; Fielding, 1989). This pattern changed during the 1970s and 1980s, where counterurbanization and suburbanization were the most prevalent trends. According to Kontuly (1991), these trends were especially strong in former industrial areas. The main destination for internal migrants further changed from the West to the South and the overall prevalence of internal migration in Germany declined from the 1960s until the 1990s (see, e.g., Bucher and Heins (2001)). The migration patterns of the following decade were largely shaped by the German reunification and the subsequent period of East-West labor migration, which partly balanced wage differentials in Germany (Decressin (1994), Hunt

[4]For a detailed description and a development of the migration theory, see, among others, Greenwood (1997) and Bodvarsson *et al.* (2015).

[5]See Bauer *et al.* (2013) for a detailed discussion of post-war forced migration into Germany.

(2000), Burda and Hunt (2001), Parikh *et al.* (2003), Heiland (2004), and, in part, Hunt (2006) and Alecke *et al.* (2010)). Especially forced migration after 1945 and East-West migration after the collapse of the iron curtain in 1989 are a particular German phenomena, making internal migration in Germany a relatively unique case and possibly distorting analyses on the influence of labor market factors on internal migration covering these periods.

Previous empirical analyses predominantly focus on German interstate migration, which limits the implications of the results concerning migration between smaller regional units. They further lack geographical information, such as the distance between regions, which prohibits estimating gravity models. Nonetheless, they find significant effects of labor market disparities on internal migration flows. One noticeable finding of Hunt (2000) and Burda and Hunt (2001) is that labor market factors have higher explanatory power as a pull factor, and variables like the unemployment rate are insignificant in the source regions. Hunt (2006) finds that wages have especially high explanatory power in the host region, while unemployment seems to be less important overall. This implies the effects of economic factors as push and pull factors to be asymmetric.

Different to Hunt (2000, 2006) and Burda and Hunt (2001), Mitze and Reinkowski (2011) and Sander (2014) do not explicitly deal with post-reunification movements and base their analysis on somewhat later time frames, 1996 to 2006 and 1995 to 2010, respectively. Furthermore, Mitze and Reinkowski (2011) use 97 Spatial Planning Regions and Sander (2014) 132 analytical regions calculated on the basis of county data for their analysis. In contrast to Mitze and Reinkowski (2011), who use extended gravity models to analyze the drivers of migration, Sander (2014) estimates a gravity model only including the distance and population as explanatory variables.

Sander (2014) underlines that migration patterns in Germany are heterogeneous across age groups. 18 to 24 year olds move predominantly out of non-urban areas. In comparison, driven by more heterogeneous reasons to migrate, the group of 25 to 29 year olds has, in addition to moving to urban centers, a higher tendency to move to areas in commuting distance to urban areas. The group of 30 to 49 year olds shows a pattern that contrasts the anecdotal notion of middle-aged families in suburban areas. It seems that over time, middle-aged families tend to contradict this stereotype to an extent by staying in urban centers instead of moving to suburban areas. Overall, Sander (2014) finds that migration to urban centers is increasing, while out-migration from urban centers is decreasing, especially for the younger age groups. These results seem to reinforce the hypothesis that internal migration intensifies existing demographic trends.

Mitze and Reinkowski (2011) document a high explanatory power for most of the economic factors. They find that income, measured as GDP per capita, is an important driver of locational choices. In particular the income in the destination region seems

to be a strong pull factor for migration. Additionally, employment prospects appear to affect internal migration substantially. The discrepancy to previous papers, in which only little effects of unemployment on migration are found, might stem from the different aggregation level of their data, since earlier studies predominantly used federal states as observation unit. Mitze and Reinkowski (2011) further investigate the age-specific heterogeneity of migration determinants. The results suggest that labor market factors affect only the migration decision of individuals below age 50, i.e., those with a strong labor market attachment. Younger age groups are also found to be more sensitive to income prospects by Burda and Hunt (2001) and Hunt (2006). These findings seem to underline the heterogeneous effects of economic factors across age groups, at least in magnitude, and in some cases even in direction.

3 Empirical Strategy and Data

3.1 Empirical Strategy

To analyze the determinants of internal migration in Germany, we estimate an extended gravity model (Greenwood, 1997) of the form:

$$M_{ijt} = \alpha d_{ij} + X_{it}^{'}\beta + X_{jt}^{'}\gamma + \phi_i + \kappa_j + \theta_t + \varepsilon_{ijt}. \tag{2}$$

The dependent variable M_{ijt} is the number of internal migrants between source county i and host county j in year t. The variable d_{ij} captures the distance in kilometers between the centroids of a county pair. Distance is included to proxy for migration costs, including the actual monetary cost of moving from county i to j, information and search costs, as well as the psychic costs of changing residency (Greenwood, 1997; Greenwood and Hunt, 2003). The vectors X_{it} and X_{jt} control for time-variant source and host county characteristics, respectively.[6] The vector X_{it} (X_{jt}) controls for the population of the source (host) county. For our baseline specification X_{it} (X_{jt}) further includes the source (host) county's unemployment rate, GDP per capita, (age group-specific) average wage, and a rental price index. The unemployment rate has been added to the model in order to reflect the employment prospects, whereas the GDP per capita proxies macroeconomic business cycle effects in the respective region (Bodvarsson *et al.*, 2015). The wage captures the income perspectives of each group in the respective region, and the rental price index reflects the living costs in a region. ϕ_i denotes fixed effects for the counties of origin and κ_j for the counties of destination, while θ_t refers to year fixed effects.

[6] All variables in the model, apart form the dependent variable, are included in logarithmic form. This enables us to interpret them as elasticities. For the sake of readability, we refer to them only by their variable names in the rest of this paper.

In a first step, we estimate this extended gravity model for our overall sample. Subsequently, we estimate Equation (2) separately for the four age groups (i) 18 to 29 years, (ii) 30 to 49 years, (iii) 50 to 64 years, and (iv) individuals aged 65 years and older. In these age group-specific estimations, except for the oldest group, we include the respective age group-specific wage instead of the average wage. By controlling for regional age-specific wages, we are able to proxy for group-specific regional income perspectives more precisely than most related empirical studies. Concerning the estimation of Equation (2) for the age group of people over 65 years, we exclude wage as the majority of this group has already left the labor market. By estimating these sub-sample regressions, we take into account that push and pull factors of migration might differ with respect to their signs as well as their magnitudes across age groups. For example, young individuals may particularly be attracted by urban areas with relatively promising job opportunities, e.g., a low unemployment rate, while individuals in the middle of their life cycle may put more emphasis on other factors, such as earnings and lower living costs. Individuals at the end of their working life might be affected by even different factors.

We estimate Equation (2) using the Poisson Pseudo-Maximum-Likelihood (PPML) estimator suggested by Santos Silva and Tenreyro (2006), which uses the absolute number of migrants between any pair of counties as dependent variable. This solves two fundamental problems of estimating gravity models using OLS. First, the log-linearization of the dependent variable truncates the sample due to the county pairs with zero observed migration, which are possibly not random, and thus may bias our estimates. Second, in a gravity model, heteroskedasticity does not only affect the efficiency, but also the consistency of a linear estimator. This problem is also solved by PPML (Santos Silva and Tenreyro, 2006).

3.2 Data

Our analysis makes use of various data sources in order to obtain a comprehensive set of explanatory factors. Specifically, we employ data on county to county migration including the migration status and the age group of the migrants. Since migration behavior of international migrants might be systematically different to the behavior of natives, e.g., due to network effects, we restrict our analysis to individuals with German nationality (Bodvarsson *et al.*, 2015). Information on the number of inter-regional migrants for each age group is drawn from changes in the place of residence as captured by the German population registers. These registers record every change of permanent residence across all counties (NUTS-3 level) within a year, including multiple and return moves. The data is disaggregated by age groups and by whether the person is a German citizen. The data needs to be corrected due to a peculiarity concerning the settlement of ethnic German migrants from Eastern European countries. All ethnic Germans are required to

enter the country through a single 'border transit center' (*Grenzdurchgangslager*) located in the county *Göttingen* in Lower-Saxony. After being registered and accepted as an ethnic German immigrant, they are allocated to the German federal states following the *Königssteiner Schlüssel*, a German allocation rule based on the regional tax base and population.[7] Because of this transit center, *Göttingen* appears to have extraordinary high migration flows. Additionally, after naturalization they appear as German migrants in our data.[8] Therefore we exclude *Göttingen* from our analysis entirely.

The information on the regional age-specific wages are provided by the IAB. They are calculated based on the full sample of the Establishment History Panel (BHP). Data on the unemployment rates, GDP per capita, and the population at the county-level is drawn from the *Regionaldatenbank*, a database of regional statistics published by the German Federal Statistical Office.[9] We differentiate between urban and rural areas based on population size and density. Urban areas are defined as either counties or district-free cities with a population density above 150 inhabitants per square kilometer. This calculation follows the definition of the Federal Institute for Research on Building, Urban Affairs and Spatial Development (BBSR).

The centroids for the calculation of distances are based on shape files provided by the German Federal Agency for Cartography and Geodesy (BKG), which uses the territorial boundaries of the counties by the end of each year.[10] Information on regional age-specific gross daily wages is provided by the Institute for Employment Research (IAB) and calculated exclusively for this project using the full sample of employees subject to social security contributions.[11]

Finally, we use a rental price index derived from the RWI-GEO-REDX data set, which is provided by the FDZ Ruhr at the RWI. Based on data from *Immobilenscout24*, the leading online platform for housing in Germany, the price index is created using hedonic price regressions, which control for the quality of the facility as well as regional characteristics and is provided as deviations of housing costs from the national mean.[12] Note that housing costs constitute the biggest single share of living costs in Germany, reaching a share of almost 20% in the consumer price index (Destatis, 2019).

[7]The allocation of these migrants varies between different federal states. For example, in the case of Baden-Wuerttemberg, they are transferred directly to particular counties and towns, whereas in Bavaria they are allowed to freely choose their region of settlement within the state. Further information on the distribution system for ethnic Germans can be found in Haug and Sauer (2007).

[8]The distribution of the naturalized Germans and the underlying legal process is discussed in more detail in Sander (2014).

[9]https://www.regionalstatistik.de/genesis/online

[10]http://www.geodatenzentrum.de/geodaten/gdz_rahmen.gdz_div?gdz_spr=deu&gdz_akt_zeile=5&gdz_anz_zeile=1&gdz_unt_zeile=0&gdz_user_id=0

[11]For detailed information on the data and the underlying calculations, see Schmucker *et al.* (2016).

[12]See Klick and Schaffner (2019) for a detailed explanation of the data set and the corresponding price index.

4 Descriptive Analysis

For the descriptive analysis, we use the full sample of internal migrants, restricted to German natives only, for the years 2008 to 2014. Depending on the year, we observe 401 to 412 counties with a total of 15,878,335 individuals changing residency across county borders in Germany in our observation period.

Concerning the intensity of internal migration, we find the same patterns as in other industrialized countries. Migration intensity in Germany differs according to the life cycle, which is illustrated by Figure 2, showing the skewed distribution of internal migrants across age groups. Compared to the group between 0 and 18 years, we observe a threefold increase in migration intensity for the group between 18 and 29 years, and a sharp decline for the older groups. The age group between 18 and 29 years constitutes 14% of the total population, but accounts for 43% (6.9 million) of all native internal migrants in Germany. This is the largest group of internal migrants, followed by the age group between 30 and 49 years being the largest population group (28%) but accounting only for 29% (4.6 million) of internal migrants. With shares of 8% and 6%, respectively, the other two age groups (50 to 64 years and older than 64 years), both representing around 21% of the total population, are of minor importance for the internal migration flows in Germany.[13] These numbers are relatively stable throughout the years of our observation period, which is illustrated in Figure A1 in the Appendix.

Additional to migration intensity, destination choices of internal migrants also differ across age groups. Table 1 shows the number of migrants by source and host counties differentiated by rural and urban areas. A large majority of internal migrants (12 million or 76%), originate from counties classified as urban and 24% from counties classified as rural. 3.6 million (23%) individuals migrate into rural counties, while 12.3 million (77%) migrate into urban counties, resulting in a migration gap of roughly 250,000 individuals less living in rural counties. If age groups are examined separately, the disparity of regional choices appears to be even more pronounced. From the 6.9 million migrants in the age group between 18 to 29 years, 1.7 million (25%) originate from rural counties and 5.1 million (75%) originate from urban counties. Only 1.3 million (19%) of them migrate into rural destinations, while the remaining majority of 5.6 million chooses to migrate into urban areas. This leads to a migration gap of almost 460,000 individuals in their age group for the rural counties. For the remaining age groups, this picture is reversed. Compared to younger groups, more individuals move to rural instead of urban destinations, resulting in a rural migration surplus of 83,561 individuals for the age group 30 to 49 years, around 46,000 for the age group 50 to 64, and around 20,000 for the age group older than 65.

[13] The remaining 2 million (13%) internal migrants are formed by the group of individuals under 18 year old. Since the largest part of this group can be assumed to move with their parents, they are not part of the analyses.

These results indicate that both, the intensity as well as the location choice of internal migrants differ largely across age groups with the youngest age group differing distinctively from the others. Their migration behavior leads to an increase in the share of the younger population in urban counties and to a decline of the same share in rural counties. Vice versa, the migration patterns of the other age groups leads to an increase in the population share of the older age groups in rural counties, and to a decrease in urban counties. Hence, these trends reinforce regional age heterogeneity. These migration patterns are displayed geographically in Figure 3. It highlights counties with positive net migration for all age groups (panel (a)), as well as differentiated for the four age groups (panel (b) to panel (d)). Again, this figure highlights the pronounced disparities between the youngest and the other age groups.

The individual effect of internal migration on the size of the population can be large for many counties. For one, the county of *Bautzen* has lost 12,292 people of the initial 328,990 inhabitants in 2008 due to internal migration. 10,924 or 89% of these migrants were in the age group 18 to 29, while the initial population of this age group was only 46,420 individuals. Hence, since 2008 almost a quarter of the 18 to 29 year old left *Bautzen*. Comparable figures can be observed for several other counties in East Germany and for some rural areas of West Germany. Figure 4 shows this development geographically. These maps display the total amount of net migration of the respective county between 2008 and 2014 as a share of the initial population of the respective age group in the year 2008, illustrating the effect of internal migration on age polarization. Panel (a), shows that the biggest relative loss of population occurred in eastern and some western rural counties, whereas the highest migration gains can be observed in metropolitan and suburban areas no matter whether in the East or the West. Panel (b) once more highlights the extreme clustering of younger individuals in urban areas and a loss of up to 33% in some rural counties. Panels (c) to (e) show that the migration behavior of the older groups is rather similar, reflecting the findings from Figure 3.

The impression that people in one age group migrate predominantly into regions with a high share of people in the same age group, is supported by a PPML regression of the number of migrants on the age group-specific age shares of the respective source and the host counties, and the distance. The results can be found in Table 2. As expected, the estimated coefficient for the distance is negative and significantly different from zero, indicating that migration predominantly takes place between close counties. The estimated coefficients for the source county's age-specific population share are positive and significant for all age groups. The estimated elasticities are close to one for all groups except for the 50 to 64 year olds. This effect, however, is not surprising. If the share of an age group in a certain region is large, the sending potential of this region is higher as well. Therefore, this can be interpreted as a mechanical effect. The estimated effects for the host county,

however, are more interesting. The effect is positive for all age groups except for the one aged 30 to 49 years, for which it is negative. This indicates, even though not being a causal effect, that the number of in-migrants is higher in regions in which already a large share of the respective age group resides. For the age group 30 to 49 years, however, the opposite is true. They predominantly migrate into regions in which the share of people in their age group is small. Overall, these results underline the results obtained before. The youngest and oldest age groups are attracted by regions in which the share of people belonging to the same age group is relatively high.

In general, we find strong urbanization tendencies regarding internal migration in Germany, which are driven to a large extent by the youngest age group in our analysis, which accounts for 43% of all internal migrants. The older age groups have an opposite migration pattern. Since the migration intensity of these older groups is substantially lower, (younger) migrants cluster in metropolitan areas and a large share of them does not seem to leave the cities at later points in the life cycle.

5 Multivariate Analysis

For the multivariate analysis, we exclude counties with non-constant boundaries during our sample period, and observations with missing values in our variables of interest. In doing so, we end up with 1,089,884 observations and 15,290,701 adult German internal migrants in the years from 2008 to 2014.[14] Since we use the borders of the counties from 2014, we observe, depending on the year, 377 to 401 counties.

The estimation results for our basic model (Equation (2)) are shown in Table 3.[15] Column (i) shows the results for the group containing all ages, column (ii) for the age group 18 to 29 years, column (iii) for the age group 30 to 49 years, column (iv) for the age group 50 to 64 years, and column (v) those for the age group 65 years and older. In columns (ii), (iii), and (iv) we use age group-specific rather than average wages as in the overall estimation.[16] In column (v), we exclude wages altogether, because the group of 65 years and older have a high propensity of already having left the labor market.

The estimation results for the overall sample shown in column (i) are mostly in line with economic theory. We find a negative effect for the distance variable, which means that a larger distance decreases the number of migrants with an estimated elasticity of around -1.78. In absolute terms, the coefficient of the distance variable is large compared to the

[14] Sample means are displayed in Table A1 in the Appendix.

[15] We have also estimated the model using OLS. The results are shown in Table A2 in the Appendix. The results obtained by OLS are comparable to those obtained by PPML.

[16] We estimated the sub-samples using the overall average wages without finding significant differences in the directions of the effects. The change in the wage variable mainly affects the coefficients concerning the age group 18 to 29 years. The results are shown in Table A3 in the Appendix.

other estimated coefficients. Concerning the influence of population size, we find that source counties with larger population experience higher numbers of out-migrants, while the host county's population size does not affect the number of in-migrants significantly. While the effect for the source county is as expected and likely to be a mechanical effect reflecting the higher migration potential of larger regions, the insignificant host county effect is counterintuitive.

Columns (ii)-(iv) of Table 3 highlight the heterogeneity of the population effect across age groups. Concerning the host counties, the effects of population size is positive for the age group 18 to 29 years, and negative for the other age groups. Compared to the host counties, the source county's population size effect appears to be positive for all age groups, even though only statistically significant for those younger than 50 years. The estimated effects concerning population size confirm the findings from the descriptive analysis: the majority of internal migrants originates from larger counties or district free cities. This is attributable to the fact that large counties have a larger migration potential as sending regions. The youngest age group predominantly migrates into more populated counties, while the older age groups seem to prefer more rural counties with smaller populations.

The source county's unemployment rate predominantly serves as a push factor. As for the population effect, the effect of the unemployment rate on migration appears to decrease with age, i.e., individuals in the age group 18 to 29 years react strongest to an increase in the unemployment rate of the source county, while the oldest age group appears not to be affected by the unemployment rate in a significant way, possibly because the latter choose to migrate not primarily due to labor market considerations. This pattern is in line with the findings of Mitze and Reinkowski (2011), who find unemployment effects exclusively for workforce relevant age groups as well. The unemployment rate in the host county is negatively associated with the number of in-migrants. Note, however, that this effect appears to be driven only by the age group 30 to 49 years.

Columns (ii)-(iv) of Table 3 further indicate that the GDP per capita is only negatively associated with the number of out-migrants for the two younger age-groups, while a higher GDP per capita fosters the out-migration of individuals older than 49. A higher GDP per capita in the host county increases in-migration for all age-groups but the youngest. Compared to GDP per capita, the effects of (age group-specific) wages appears to be more consistent, being negatively related to out-migration and positively related to in-migration. Again, younger age-groups tend to react most sensitive to wages. Housing costs in the source and host county have a significant but rather small effect on internal migration flows, indicating that the influence of regional prices is relatively small in magnitude. While higher rental prices reduce in-migration for all groups to a similar extent, rental prices in the source county only fosters the out-migration of those in the age group 30 to 49, whereas in the other age groups out-migrations is affected negatively. Overall, rental prices

appear to play only a minor role for the decision to migrate and – at least if compared to other factors – for the decision where to migrate.

Our results confirm the findings of the previous literature in several ways. First, the results indicate that economics factors have a strong influence on internal migration decisions in Germany. The effects of these factors are significant in the predicted ways for almost all age groups. We further observe heterogeneities across age groups, which possibly stem from life cycle effects. The effect of the wage as a pull factor seems to influence the youngest age group in particular. This is in line with the literature arguing that younger workers have on average higher returns to migration compared to other groups (Lehmer and Ludsteck, 2011). However, it is important to keep in mind that the reported results constitute correlations rather than causal effects, since the explanatory variables cannot be considered as exogenous in many cases. It is possible that migration itself can have an effect on the explanatory variables. Therefore the results are likely to suffer from reverse causality. This could especially be the case for wages and the rental price index, a connection that has been established, e.g., by Fendel (2016) for Germany.

6 Conclusion

In this paper, we have analyzed internal migration behavior in Germany. We identified differences in locational choices and the importance of push and pull factors of migration across age groups and revealed that urbanization tendencies are predominantly driven by younger migrants.

Our analysis is based on small scale administrative data, containing every migration movement across county borders between 2008 and 2014 disaggregated for different age groups. This data is further merged with regional information on unemployment, GDP, (age group-specific) wages, and housing costs. The empirical strategy we use is based on the gravity migration model and estimated using the PPML technique as suggested by Santos Silva and Tenreyro (2006). This strategy implies a positive connection between population and migration and a negative one between distance and migration. Furthermore, if migration is viewed as an investment decision, locational choices should be driven by interregional disparities in income perspectives. Previous studies tried to measure income perspectives using GDP and unemployment rates in the respective regions. We argue that wages, especially age group-specific wages, are more suitable for explaining income perspectives. Furthermore, we are able to use a hedonic price index for rents, based on *Immobilienscout24* data, to take disparities in living costs between regions into account, which have been largely neglected in previous studies. This enables us to provide a more precise picture of the role of living costs concerning migration decisions.

The descriptive analysis shows that the largest share of internal migrants is comprised

by the age group between 18 and 29 years, which accounts for more than 40% of the migrants. The major part of internal migration is directed to urban areas, which is especially true for the youngest group intensifying the age polarization between rural and urban areas. These findings are reinforced by regression results indicating that especially the youngest and oldest groups choose locations with higher population shares of their own age groups.

The general estimation results concerning the standard labor market indicators like the unemployment rate and GDP per capita generally confirm the implications of the neoclassical migration model. In addition, we find that wages have high explanatory power for internal migration in Germany and that these estimates are robust across several specifications. Higher wages in a region leads to lower migration outflows and higher migration inflows. Living costs do not seem to have a strong effect on out-migration, higher costs only reduces the amount of in-migrants. However, these effects are comparably small in magnitude.

To demonstrate the heterogeneous effects of labor market variables on migration behavior over the life course, we disaggregated our sample into four age groups. Indeed, the labor market indicators have different effects across age groups. Unemployment is a push factor for all groups in working age, but it is only connected to in-migration for the age group between 30 and 49. Housing prices in the source county influences the age group between 30 and 49 positively implying that rising living costs increase out-migration of this age group from the respective region, while higher housing prices in the host-county appear to decrease in-migration. Wages influence different age groups heterogeneously as well: higher wages in the source- (host-) county increase (decrease) in- (out-) migration for individuals younger than age 50, while the migration decision of older age groups does not seem to be affected by wages.

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Tables

Table 1: Number of Internal Migrants by Age Group and County Type

	All	18-29	30-49	50-64	65+
			Source		
Rural	3,800,017	1,736,074	975,527	315,205	266,278
	24.14%	25.50%	21.22%	24.48%	26.99%
Urban	11,941,342	5,073,034	3,622,410	972,376	720,398
	75.86%	74.50%	78.78%	75.52%	73.01%
			Host		
Rural	3,550,055	1,280,311	1,057,797	360,755	286,398
	22.55%	18.80%	23.01%	28.02%	29.03%
Urban	12,191,304	5,528,797	3,540,140	926,826	700,278
	77.45%	81.20%	76.99%	71.98%	70.97%
Total	15,741,359	6,809,108	4,597,937	1,287,581	986,676

Source: Destatis

Table 2: Gravity Model of Internal Migration including Regional Age Group-Shares

	(18–29) β/StdE	(30–49) β/StdE	(50–64) β/StdE	(65+) β/StdE
Distance	-1.6973^{***}	-1.8121^{***}	-1.9100^{***}	-1.8795^{***}
	(0.0074)	(0.0087)	(0.0074)	(0.0077)
Source county characteristics				
Age-specific population share	1.0221^{***}	1.1015^{***}	0.4157^{***}	1.0567^{***}
	(0.0236)	(0.0877)	(0.0657)	(0.1324)
Host county characteristics				
Age-specific population share	0.4977^{***}	-0.7125^{***}	0.8363^{***}	0.3554^{**}
	(0.0269)	(0.0793)	(0.0707)	(0.1301)
R^2	0.7904	0.8033	0.8114	0.7902
Observations	1,089,884	1,089,884	1,089,884	1,089,884

Source: Destatis, IAB, Immobilienscout24; authors' calculations.
*Notes: Results represent estimated coefficients and robust standard errors (clustered at the region-pair level) obtained from a Poisson pseudo-maximum likelihood estimator. The dependent variable for each column is the number of migrants between all county pairs. All explanatory variables are included in logarithmic form. The model further includes host and source county as well as year fixed effects. Asterisks denote statistical significance * at the .05 level; ** at the .01 level; *** at the .001 level.*

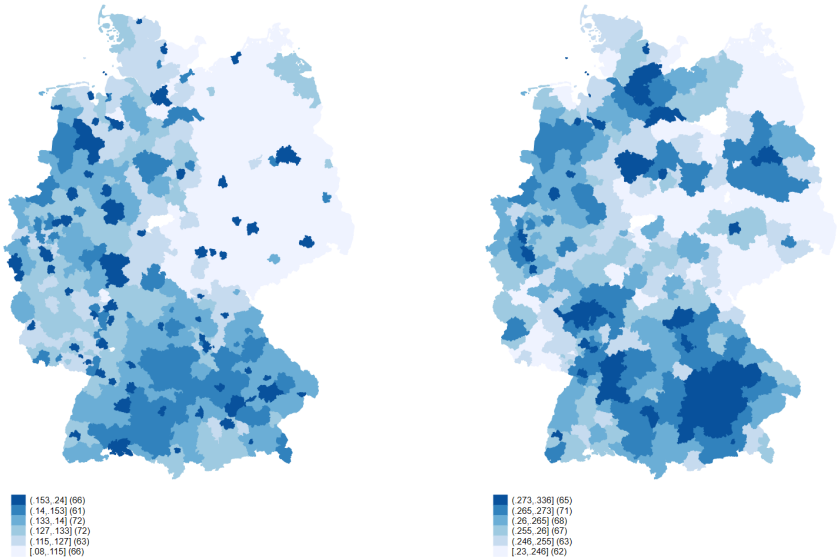
Table 3: Gravity Model of Internal Migration

	(All) β/StdE	(18–29) β/StdE	(30–49) β/StdE	(50–64) β/StdE	(65+) β/StdE
Distance	-1.7771^{***}	-1.6974^{***}	-1.8121^{***}	-1.9099^{***}	-1.8795^{***}
	(0.0075)	(0.0074)	(0.0087)	(0.0074)	(0.0077)
Source county characteristics					
Population	0.9025^{***}	1.5560^{***}	0.8581^{***}	0.1255	-0.1507
	(0.0698)	(0.0784)	(0.0810)	(0.1191)	(0.1486)
Unemployment rate	0.1362^{***}	0.2676^{***}	0.0559^{***}	0.0815^{***}	-0.0111
	(0.0115)	(0.0135)	(0.0162)	(0.0221)	(0.0280)
GDP per capita	-0.0652^{**}	-0.2184^{***}	-0.0802^{*}	0.1094^{**}	0.2677^{***}
	(0.0222)	(0.0247)	(0.0318)	(0.0385)	(0.0469)
Age-specific average wage	-0.6130^{***}	-0.2293^{***}	-0.2689^{***}	-0.1085	–
	(0.0598)	(0.0687)	(0.0727)	(0.0713)	–
Rental price index	0.0003	-0.0008^{*}	0.0016^{***}	-0.0016^{***}	-0.0002
	(0.0003)	(0.0003)	(0.0004)	(0.0005)	(0.0006)
Host county characteristics					
Population	-0.0487	0.5894^{***}	-0.5280^{***}	-0.6374^{***}	-0.1665
	(0.0702)	(0.0859)	(0.0823)	(0.1127)	(0.1365)
Unemployment rate	-0.0758^{***}	0.0119	-0.1527^{***}	-0.0166	0.0327
	(0.0111)	(0.0131)	(0.0149)	(0.0229)	(0.0273)
GDP per capita	0.0090	-0.1319^{***}	0.1490^{***}	0.1019^{**}	0.0150
	(0.0232)	(0.0275)	(0.0294)	(0.0394)	(0.0478)
Age-specific average wage	0.2459^{***}	0.4161^{***}	0.3696^{***}	0.0278	–
	(0.0662)	(0.0667)	(0.0789)	(0.0743)	–
Rental price index	-0.0030^{***}	-0.0024^{***}	-0.0031^{***}	-0.0049^{***}	-0.0023^{***}
	(0.0003)	(0.0004)	(0.0003)	(0.0005)	(0.0005)
R^2	0.7994	0.7890	0.8035	0.8110	0.7904
Observations	1,089,884	1,089,884	1,089,884	1,089,884	1,089,884

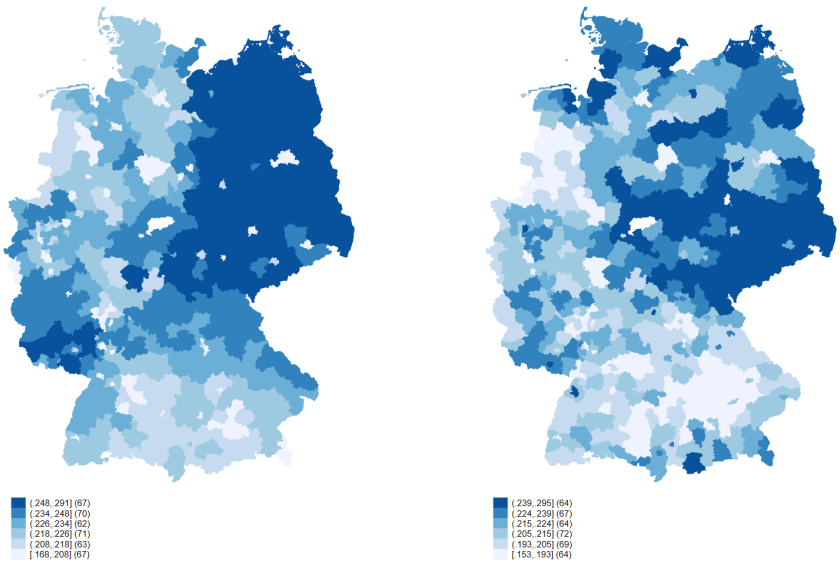
Source: Destatis, IAB, Immobilienscout24; authors' calculations.

*Notes: Results represent estimated coefficients and robust standard errors (clustered at the region-pair level) obtained from a Poisson pseudo-maximum likelihood estimator. The dependent variable for each column is the number of migrants between all county pairs. All explanatory variables are included in logarithmic form. The model further includes host and source county as well as year fixed effects. Asterisks denote statistical significance * at the .05 level; ** at the .01 level; *** at the .001 level.*

Figures



(a) 18 - 29 YEARS **(b)** 30 - 49 YEARS



(c) 50 - 64 YEARS **(d)** 65+ YEARS

Figure 1: REGIONAL AGE SHARES, QUANTILES (2014)
Source: Destatis, authors' illustrations.

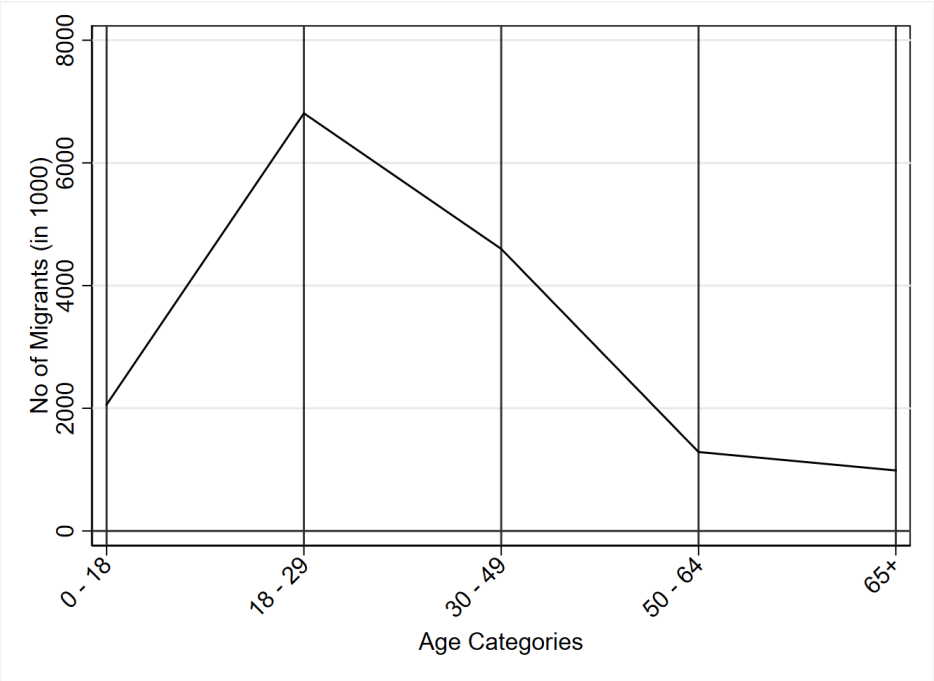
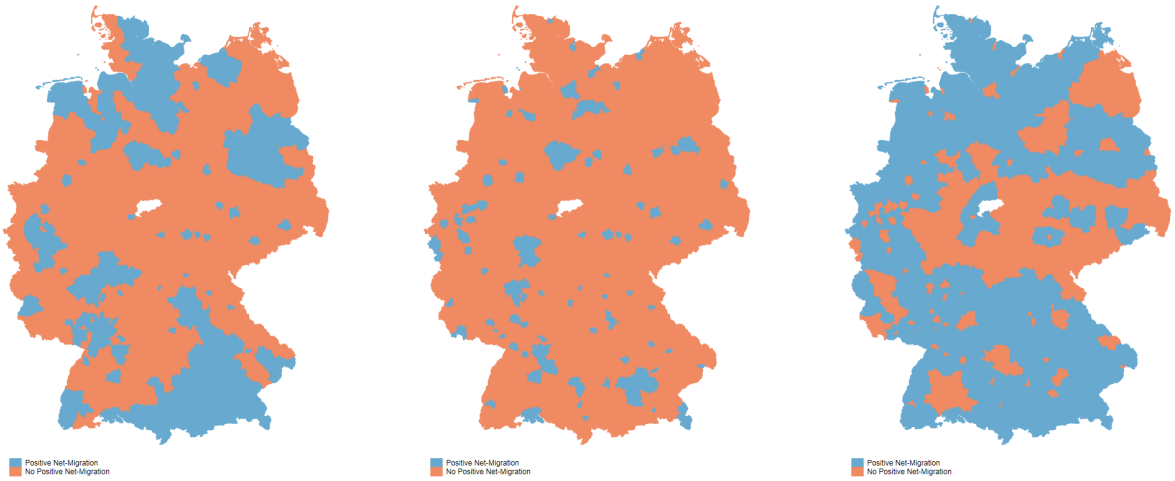
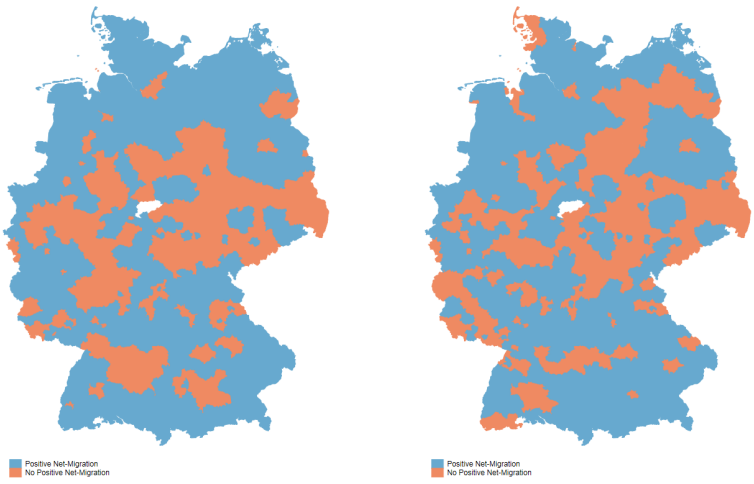


Figure 2: Relationship Between Age Group and Migration Intensity.
Source: Destatis; authors' calculations.
Note: The figure shows the average number of internal migrants for the five age groups.

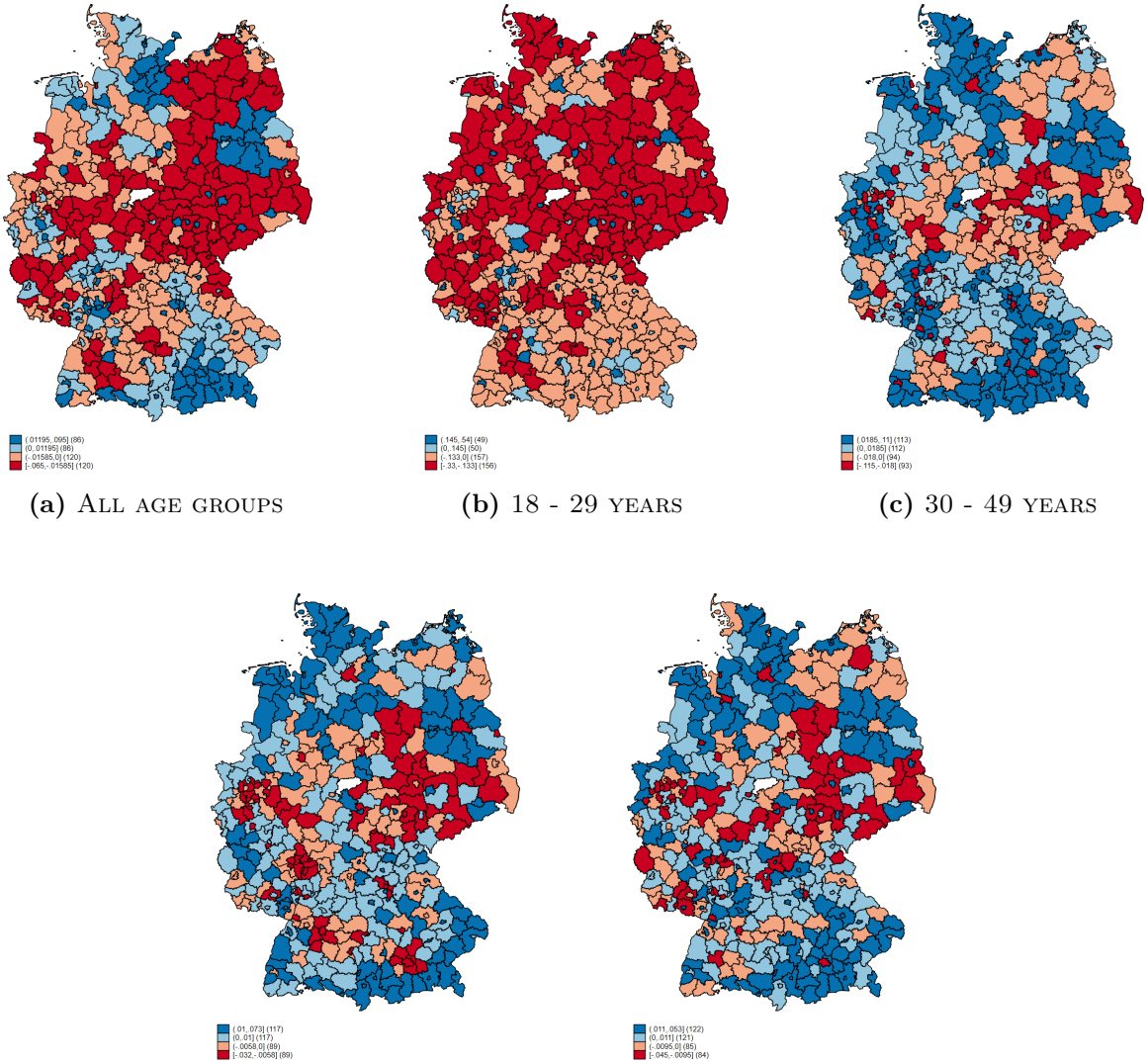


(a) All age groups **(b)** 18 - 29 years **(c)** 30 - 49 years



(d) 50 - 64 years **(e)** 65+ years

Figure 3: Positive net migration
Source: Destatis, authors' illustrations.



(a) All age groups **(b)** 18 - 29 years **(c)** 30 - 49 years

(d) 50 - 64 years **(e)** 65+ years

Figure 4: Cumulative net migration (2008 – 2014) relative to initial population of each age group (2008)
Source: Destatis, authors' illustrations.

Appendix

Table A1: Sample Means

	Mean	Std. Dev.	Min.	Max.
No. of migrants (total)	16.4378	108.3000	0.00	10028.00
No. of migrants (18–29)	6.9759	41.5993	0.00	2912.00
No. of migrants (30–49)	5.0828	38.1157	0.00	4439.00
No. of migrants (60–64)	1.3308	9.7237	0.00	847.00
No. of migrants (65+)	0.9291	6.8359	0.00	690.00
Distance	302.2312	150.8851	0.95	824.48
Population	201254.9419	231486.7010	33944.00	3469849.00
Unemployment	7.5752	3.5481	1.40	21.20
GDP per capita	31304.6157	13596.3733	12712.00	136224.00
Rent	13.6313	6.2809	3.95	45.23
Wage (total)	99.9901	14.7924	67.84	160.91
Wage (18–29)	77.3063	8.8136	55.91	111.90
Wage (30–49)	108.1422	16.9521	72.26	176.73
Wage (60–64)	114.5220	19.6997	72.61	204.23
Observations	1,089,884			

Source: Destatis, IAB, Immobilienscout24; authors' calculations.

Table A2: Gravity Model of Internal Migration – Estimated using OLS

	(All) β/StdE	(18–29) β/StdE	(30–49) β/StdE	(50–64) β/StdE	(65+) β/StdE
Distance	-1.4101^{***}	-1.2779^{***}	-1.1377^{***}	-0.8451^{***}	-0.7734^{***}
	(0.0036)	(0.0038)	(0.0044)	(0.0055)	(0.0058)
Source county characteristics					
Population	1.3854^{***}	1.7503^{***}	0.6957^{***}	0.5332^{***}	0.1775^{*}
	(0.0538)	(0.0543)	(0.0575)	(0.0794)	(0.0824)
Unemployment rate	0.1598^{***}	0.2193^{***}	0.0650^{***}	0.0572^{***}	0.0083
	(0.0117)	(0.0115)	(0.0127)	(0.0167)	(0.0182)
GDP per capita	-0.0274	-0.1697^{***}	0.0064	-0.0073	0.0776^{*}
	(0.0204)	(0.0202)	(0.0224)	(0.0299)	(0.0325)
Age-specific average wage	-0.7515^{***}	-0.3815^{***}	-0.2502^{***}	-0.1623^{**}	–
	(0.0537)	(0.0434)	(0.0557)	(0.0526)	–
Rental price index	0.0012^{***}	0.0006^{*}	0.0017^{***}	0.0006	0.0007
	(0.0003)	(0.0003)	(0.0003)	(0.0004)	(0.0004)
Host county characteristics					
Population	0.1066^{*}	0.6406^{***}	-0.2821^{***}	-0.1489	-0.0195
	(0.0535)	(0.0539)	(0.0581)	(0.0800)	(0.0843)
Unemployment rate	-0.1116^{***}	-0.0489^{***}	-0.1087^{***}	-0.0012	0.0144
	(0.0117)	(0.0116)	(0.0128)	(0.0167)	(0.0180)
GDP per capita	0.0134	-0.0464^{*}	0.0461^{*}	0.0083	-0.0323
	(0.0203)	(0.0201)	(0.0226)	(0.0295)	(0.0318)
Age-specific average wage	0.0076	0.1332^{**}	0.1905^{***}	-0.1182^{*}	–
	(0.0541)	(0.0438)	(0.0567)	(0.0529)	–
Rental price index	-0.0005	0.0004	-0.0008^{**}	-0.0013^{***}	-0.0010^{*}
	(0.0003)	(0.0003)	(0.0003)	(0.0004)	(0.0004)
R^2	0.7068	0.7138	0.6435	0.5312	0.5015
Observations	830,432	649,041	572,378	301,475	243,150

Source: Destatis, IAB, Immobilienscout24; authors' calculations.
*Notes: Results represent estimated coefficients and robust standard errors (clustered at the region-pair level) obtained from a Poisson pseudo-maximum likelihood estimator. The dependent variable for each column is the number of migrants between all county pairs. All explanatory variables are included in logarithmic form. The model further includes host and source county as well as year fixed effects. Asterisks denote statistical significance * at the .05 level; ** at the .01 level; *** at the .001 level.*

Table A3: Gravity Model of Internal Migration (Average Wage)

	(18–29) β/StdE	(30–49) β/StdE	(50–64) β/StdE
Distance	-1.6973^{***}	-1.8121^{***}	-1.9100^{***}
	(0.0074)	(0.0087)	(0.0074)
Source county characteristics			
Population	1.2271^{***}	0.8837^{***}	0.1635
	(0.0804)	(0.0821)	(0.1166)
Unemployment rate	0.2076^{***}	0.0580^{***}	0.0867^{***}
	(0.0134)	(0.0160)	(0.0225)
GDP per capita	-0.1241^{***}	-0.0838^{**}	0.1042^{**}
	(0.0252)	(0.0307)	(0.0395)
Average wage	-1.3046^{***}	-0.2449^{**}	-0.0528
	(0.0803)	(0.0747)	(0.1126)
Rental price index	-0.0006	0.0015^{***}	-0.0017^{***}
	(0.0003)	(0.0004)	(0.0005)
Host county characteristics			
Population	0.4436^{***}	-0.4718^{***}	-0.5800^{***}
	(0.0903)	(0.0815)	(0.1119)
Unemployment rate	-0.0351^{**}	-0.1406^{***}	-0.0043
	(0.0132)	(0.0148)	(0.0235)
GDP per capita	-0.0893^{**}	0.1343^{***}	0.0826^{*}
	(0.0284)	(0.0289)	(0.0398)
Average wage	-0.1345	0.5663^{***}	0.2474^{*}
	(0.0785)	(0.0778)	(0.1133)
Rental price index	-0.0020^{***}	-0.0032^{***}	-0.0049^{***}
	(0.0004)	(0.0003)	(0.0005)
R^2	0.7887	0.8035	0.8111
Observations	1,089,884	1,089,884	1,089,884

Source: Destatis, IAB, Immobilienscout24; authors' calculations.

*Notes: Results represent estimated coefficients and robust standard errors (clustered at the region-pair level) obtained from a Poisson pseudo-maximum likelihood estimator. The dependent variable for each column is the number of migrants between all county pairs. All explanatory variables are included in logarithmic form. The model further includes host and source county as well as year fixed effects. Asterisks denote statistical significance * at the .05 level; ** at the .01 level; *** at the .001 level.*

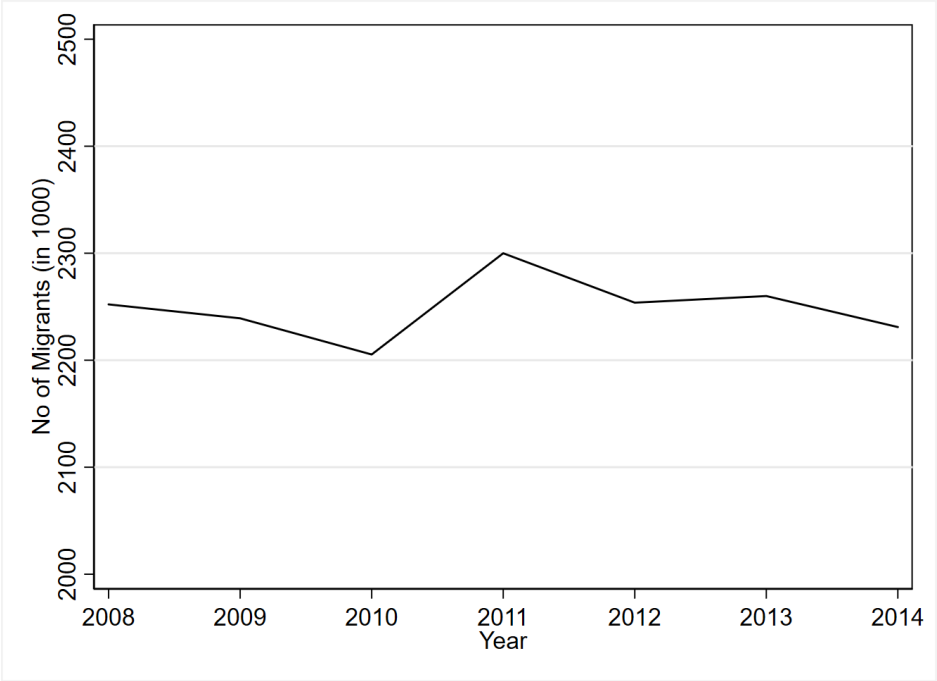


Figure A1: Number of Migrants per Year.
Source: Destatis; authors' calculations.
Note: The figure shows the average number of internal migrants for each year of observation.