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Move, Stay, or Pay: The Impact of Land Prices on Migration Balances in Germany

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This paper examines the effects of housing costs on net migration in Germany, a country with a polycentric structure. We apply a panel data estimation framework with a large array of unit, time, and regional fixed effects to close to 400 individual counties for the period of 2002 to 2018. Our findings suggest a strong and negative relation between residential land prices and net migration. We conclude that higher land prices can largely offset the additional amenities factored into housing costs and hence cause negative effects on migration. We show that our results are robust to various control specifications, including the addition of variables such as income, education, and age structure, and the use of time lags.

Keywords

Housing costs, Net migration, Amenities, Panel data, Germany

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1. Introduction

Migration is an important factor for regional development because it determines local population patterns aside from fertility and mortality. Since the decision to move or continue living in the same residence is influenced by numerous individual, sociocultural, and economic aspects, the subject of migration offers a broad range of research. Most studies address one or more of the following partially overlapping questions: who moves (e.g., international vs. domestic migrants), what is causing the move (e.g., economic, educational, political, or social reasons), when is a move likely (e.g., at what point in the life cycle), and in what direction is the move (e.g., to cities vs. rural areas)?

Our study focuses on one of the potential driving forces behind migration: the impact of land prices. We focus on Germany, a country with relatively low internal migration rates and a polycentric structure. Given the rise in property prices in Germany over the past decade, which has been very significant in some areas, our analysis is of particular relevance to policymakers and demographers who specialize in regional development. It applies all the more, considering that housing costs are the biggest expense for many households and that building a home tends to be closely linked to a lifetime decision on locational choice for most German households.

Apart from land prices, many other aspects influence the locational choice of migrants. These include employment opportunities, wages, and local amenities such as climate, neighborhood, and infrastructure. An early strand of the literature (e.g., Graves, 1983; Knapp and Graves, 1989; Wolff, 2009; Buch et al., 2014) argues that high housing prices are a signal of an amenity-rich environment and therefore, not necessarily a detractor, but potentially an attractor for migration. A different strand of the literature suggests that high housing costs have a negative influence on migration (e.g., Berger and Blomquist, 1992; Potepan, 1994; Muellbauer et al., 2006; Rabe and Taylor, 2012; Busch, 2016; Stawarz et al., 2020; Chavalleri et al., 2021). The results appear to vary, depending on the period of observation, region, and variables chosen to capture the price differences. Plantinga et al. (2013), for example, find a negative relation when they estimate the effect of housing prices on migration, but a positive effect when they use average apartment or land rents. Similarly, Buch et al. (2014) find no impact of land prices, but a positive effect of the price index on urban costs of living. We explicitly address the issue of causality between housing prices and migration for the case of Germany.

We apply a panel data estimation framework with a large array of unit and time fixed effects to close to 400 individual counties in Germany for the period of 2002 to 2018. Our study is most similar to Stawarz et al. (2020), who analyze internal migration for German counties and cities outside of counties between 2004 and 2017. However, in contrast to them, we use residential land prices instead of asking rents as a proxy for housing costs. In addition, we analyze net

migration effects, whereas they focus on internal migration rates, which are restricted to moves among German citizens only. Our estimation approach also follows a different strategy by controlling for a large number of regional fixed effects. Despite these differences, our results point to a similar direction as the findings of Stawarz et al. (2020).

We find that higher residential land prices have a significantly negative effect on net migration in Germany. In line with the economic theory, our baseline results further suggest a positive impact of income. We show that our estimates are robust to several alternative specifications.

The remainder of this paper is organized as follows. Section 2 provides a literature review on migration in Germany with a focus on housing costs and migration. The literature review also provides information on the institutional background of Germany. Our data and methodology are explained in Sections 3 and 4, respectively. Section 5 presents our results, and a conclusion is drawn in Section 6.

2. Literature Review

As early as 1889, Ernst G. Ravenstein published a study on the determinants of migration for European and North American countries. His findings suggest that economic conditions, population size (cities vs. rural places), and distance (from the point of departure) are the major factors that determine migration patterns. Today's literature on migration is vast and covers a broad range of different strands. One distinction can be made between the micro approach, which focuses on the behavior of individuals, and the macro approach, which is centered around places or locations (Ivan, 2008). In addition, studies often differ with respect to their spatial emphasis by analyzing either international or internal migration. The literature on internal migration further varies according to the regional level studied, such as municipalities, counties, or federal states.

Apart from these spatial aspects, studies differ in terms of the migration motives that are examined. The coverage ranges from historical, age-related, economic, and amenity- and housing-specific topics. The topics are often highly interrelated.

With respect to the historical motives of migration, a large body of literature covers the aftermath of the German reunification in 1990 (e.g., Kupiszewski et al., 1998; Wolff, 2009; Alecke et al., 2010; Goetzke and Rave, 2011; Sander, 2014).[1] Given the higher unemployment rates, lower wages, and less favorable

[1] From 1949 to 1990, the East German region was part of the Soviet Bloc, with a communist regime and a planned economy. The Western part, in contrast, had a democratic system with a free market economy. After the collapse of the Soviet Union and the

living conditions in East Germany compared to its Western counterpart, many East Germans migrated to the West after the fall of the Berlin Wall. This is consistent with the economic theory and the assumption that migration can mitigate economic differences and disparities in the labor market.[2] Decressin (1994), Kupiszewski et al. (1998), Wolff (2009), Alecke et al. (2010), Goetzke and Rave (2011), and Buch et al. (2014) find an inverse relation between unemployment and migration. However, as Decressin (1994) and Wolff (2009) suggest, mobility behavior is procyclical, which implies lower levels of gross migration after an aggregate shock that increases unemployment in all regions. International studies, such as Van der Gaag and Van Wissen (2008) and Chavalleri et al. (2021), confirm this dependency and a strong positive influence of the gross domestic product per capita. The impact of wages or income as measures of living standards on migration is less certain. It tends to be positive but is often nonsignificant. Alecke et al. (2010) suggest that the outcomes between studies with a micro- or macroeconomic orientation are likely to vary. According to the authors, macroeconomic studies assign a more prominent role to regional wage rate differentials in predicting German internal migration flows.[3]

Several studies show that cities and more densely populated areas in Germany grew in population during the past two decades (e.g., Buch et al., 2014; Sander, 2014; Stawarz and Sander, 2019). Apart from usually better economic conditions in urban regions, the literature suggests that age plays a major role in migration. People tend to move to agglomerations when they are young to find work (Sander, 2014; Just and Schäfer, 2017) or a partner (Sander, 2014) or to obtain higher education (Kupiszewski et al., 1998; Sander, 2014; Just and Schäfer, 2017; Weber, 2020). Individuals in their mid-life, families, and individuals around retirement tend to move to areas of lower density.[4] A related issue is the role played by amenities, which is usually greater in urban areas. The general consensus is that amenities make a region more attractive and hence tend to trigger in-migration (Buettner and Ebertz, 2007; Buch et al., 2014; Just and Schäfer, 2017). As Goetzke and Rave (2011) suggest, young adults value amenities the most, while middle-aged individuals prefer regions with low unemployment.

It is often difficult to determine an appropriate measure for amenities, because the amenities of one person can be the inconvenience of another (Storper and Manville, 2006). Moreover, the number of amenities that can be included in a representative preference function is virtually unlimited, and there likely exists

reunification of Germany, extensive financial aid and rescue and restructuring measures were necessary to improve the low competitiveness of the East German economy.

[2] However, since internal migration could not entirely balance the economic differences between East and West Germany, some authors explain this so-called migration puzzle by governmental transfer payments (e.g., Alecke et al., 2010).

[3] Napolitano and Bonasia (2010) find evidence in Italy that the results also depend on the period of observation.

[4] Ghio et al. (2023) confirm most of these aspects for European municipalities.

a high correlation among amenities (Graves, 1983). Therefore, Graves (1983) and Knapp and Graves (1989) propose the use of rents as a proxy for the regional supply of amenities, because they incorporate the qualitative endowments of a location. The results of Buettner and Ebertz (2007) support this assumption for Germany: amenities and disamenities do capitalize into land prices.[5] Given that housing and land prices factor in the value of amenities, two opposing effects can be considered to influence migration. The first effect, acting as a pull factor, is related to the benefits associated with amenities. The second effect is negative; higher prices are likely to be a push factor for normal goods. Which effect prevails is not always clear-cut, as the literature shows.

For the United States (US), Graves (1983) and Knapp and Graves (1989), for example, find higher rents to have a positive effect on migration. Therefore, they conclude that higher rent areas represent more desirable places. Using US Census micro data, Berger and Blomquist (1992) find that higher housing costs reduce the probability of people who have decided to relocate to move to more expensive places. However, regarding the decision to migrate or stay, the authors find no evidence that price differences play a significant role. Gabriel et al. (1992) arrive at similar results by using regional data at the level of US Census divisions. They conclude that high housing prices reduce in-migration but have no significant effect on out-migration. Potepan (1994) apply a two-stage least squares approach to the data of 52 US metropolitan areas and find that higher net migration raises housing prices, while, simultaneously, higher housing prices discourage further net migration. In a more recent study, Jeanty et al. (2010) use a generalized spatial two-stage procedure with data from Michigan, US. They also suggest that in-migration has a positive effect on housing values but rising prices favor out-migration as well. Plantinga et al. (2013) further indicate that higher housing prices reduce the probability of an area being selected by migrants. Their results become positive, however, when they estimate alternative specifications with the median house price, average apartment rents, and average urban land rents.

For the United Kingdom (UK), Muellbauer et al. (2006) suggest that the relation between housing prices and migration is negative, particularly when commuting is an alternative. Expected capital gains in housing and expected earnings growth, however, can offset high levels of house prices, as their 28-year panel results on net and gross migration show for the UK regions. Rabe and Taylor (2012), who also use UK panel data (1993–2008), find that high house prices in potential destinations deter migration, especially among homeowners, which the authors trace to credit constraints.[6] Rabe and Taylor (2012) find house prices to be less relevant for welfare recipients, since they tend to stay in rented accommodations after migration.

[5] Note that the availability of suitable land and the presence of regulation also drive building costs and rents (e.g., Saiz, 2010).

[6] Saka (2013) further finds that homeownership in West Germany is negatively associated with internal migration.

Chavalleri et al. (2021) estimate a gravity model with data from 14 Organization for Economic Co-operation and Development (OECD) countries. They conclude that house prices inhibit migration in countries that have experienced strong increases in the level and cross-regional dispersion of house prices (e.g., Sweden or the UK). Moreover, they suggest that high local housing costs tend to keep migrants away and promote out-migration.

This finding contrasts with that of Wolff (2009), who documents that higher rents are associated with less out-migration for Eastern Germany. Similar to Graves (1983), Wolff (2009) argues that rent levels reflect the attractiveness of a region, and mentions, for example, the cities of Dresden, Leipzig, and Erfurt, which grew in population despite high rents. Similar results are provided by Buch et al. (2014), who analyze the influence of labor market conditions and amenities on net migration for 71 German cities in both the eastern and western parts of Germany. They conclude that urban areas characterized by relatively high price levels tended to experience rather strong net in-migration between 2000 and 2007. Regarding land prices, the authors find neither an economic nor a statistical effect on migration in their baseline model. By using data from 3,000 German municipalities for the period of 2005 to 2009, Weber (2020) suggests that young people are increasingly forced to settle in suburban areas as a consequence of skyrocketing rent prices. In this context, Weber (2020) mentions the cities of Munich and Bremen, where the influx of young people has decreased to some extent. Busch (2016) also provides evidence that the domestic migration balance of big cities has declined markedly in recent years due to tense housing markets. The author concludes that it has become increasingly difficult for households that are thinking about buying a home or starting a family to meet their housing needs in many urban areas. Therefore, they are forced to move to regions with lower property prices. Furthermore, Busch (2016) assumes that the pressure on metropolitan real estate markets will diminish when foreign immigration declines. Stawarz and Sander (2019), who analyze the impact of internal migration on the spatial distribution of the population in Germany from 1991 to 2017, also refer to the high rents and limited housing availability in cities which counteract the trend of urbanization.

A recent study by Stawarz et al. (2020), which examines 401 German counties for the period of 2004 to 2017, applies a fixed effects panel approach to investigate the impact of housing costs on internal migration. In contrast to Graves (1983) and Wolff (2009), they find that rising housing costs in destination regions are strongly negatively related to migratory inflow (except in rural areas). Their results further show that the effect of increasing rents on internal migration is strongest for 18–24 year old and 30–49 year old migrants, who respond to increasing city rents by moving out to the hinterland.

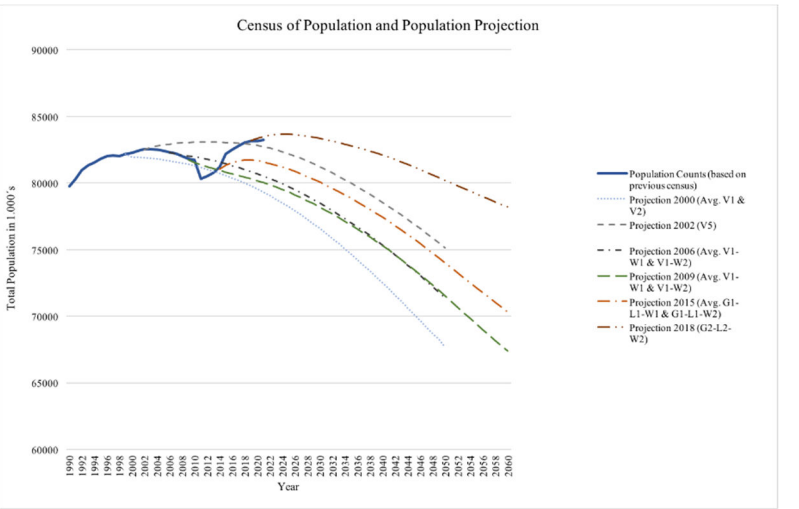
Our study contributes to the previous (especially the German related) literature by analyzing the same administrative units as Stawarz et al. (2020). Unlike them, however, we use an approach that controls for a large number of regional fixed effects. Moreover, we study the impact of land prices on net-migration, which

has several advantages, as discussed in Section 3. Finally, our study uses a longer time period.

2.1 Institutional Background of Germany

As shown in Figure 1, population development in Germany was almost always stronger than official forecasts over the past three decades.

Figure 1 Population Census and Population Projection



Notes: The baseline projections are mostly developed by averaging the high and low migration assumptions of the respective coordinated population projections of the German Federal Statistical Office.

Factors that have contributed to this positive deviation are longevity, immigration and potential measurement errors.[7] In 2014 and 2015 for example, there was a wave of immigration mainly caused by the war in Syria.[8] Even though Germany does not consider itself a country of immigration, such as Australia or the US, external migration must be taken into account when analyzing long-term price effects. This is one reason why we use net-migration data, as the values can serve as a general indicator of the attractiveness of a region. Another reason is the reluctance of the native population to relocate in Germany when compared for e.g., to the US, France, and Great Britain (see, for example, Arntz (2011)). Strong regional roots, traditions, and customs as well as a polycentric

[7] A recent study of the Deutsche Bank (Möbert, 2022) predicts that the German population will increase to around 86 million by 2030.
[8] Due to the Ukraine war, there was also a wave of immigration in 2022/2023. However, this event lies outside our period of investigation.

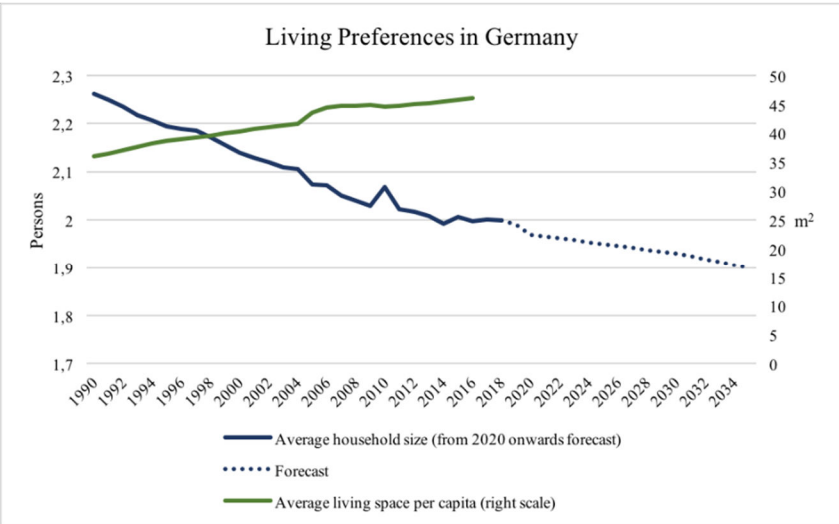
structure with many regional hubs are likely the main reasons why internal migration is limited in Germany in contrast to other major economies in Europe.[9] If people can find a job more easily near their current place of residence due to its polycentric structure, there are fewer reasons to move and hence less internal migration. In this context, a 2019 study by the Research Institute of the Federal Employment Agency confirms that, between 2014 and 2017, around half of all moves in Germany did not exceed a distance of 21 kilometers.[10] Given this structurally caused low level of internal migration, we consider net migration balances to be a better indicator to analyze price effects. In general, the economic theory suggests, declining housing demand and prices, given the aging society and shrinking population projections in Germany (in the past). However, as shown in Figure 2, two current trends are capable of counterbalancing the impact of the declining population on the residential market.

First, the average household size in Germany has declined from around 2.3 persons in 1990 to roughly 2.0 persons in 2018 and is projected to decrease further to 1.9 persons by 2035. Second, the living space per capita is increasing. The average living space per capita was 36 m2 in 1995, but surged to 46 m2 in 2021, which is an increase of nearly 30% within a period of 25 years. Higher incomes and changing living preferences are considered the main drivers of this development. The rise in real estate price indices over the past decade reflects these trends. However, when considering the indices on a regional scale (e.g. Klick and Schaffner, 2020), one can observe large differences in price trends by location. Therefore, we apply a methodology that accounts for a large array of regional peculiarities.

[9] The polycentric structure and regional fragmentation of Germany are deeply rooted in the history of feudal Germany and the Holy Roman Empire. Until the eve of the French Revolution (1789), Germany was a loose confederation of several hundred small principalities, mini-states, duchies, and free cities. There were about 1,800 tariff walls, and the ruling monarchs had idiosyncratic rights and laws in each region. A historical map from 1786 available online at http://www.bielski.de/karten/deu_1786x.jpg illustrates the patchwork of small political entities in Germany compared to other contemporary European kingdoms.

[10] Şaka (2013) analyzes the German Socio-Economic Panel which covers the years of 2000–2009 and also concludes that long-distance moves and internal migration are generally infrequent in Germany.

Figure 2 Living Preferences in Germany



Notes: Average household size and living space per capita are based on our own calculations by using data from the German Federal Statistical Office. Information about the forecast are derived from the online data at https://www.destatis.de/EN/Themes/Society-Environment/Population/Households-Families/Tables/projection-household.html.

3. Data

Our panel dataset comprises information on 399 German counties and cities outside of counties for the period of 2002 to 2018.[11] Our main dependent variable is net migration, which refers to the balance between in- and out-migration per 1,000 inhabitants for each region on an annual basis.[12] A detailed description of all the variables and their sources is provided in Table 1, while the summary statistics are given in Table 2.

[11] Henceforth, all counties and cities outside of counties will be referred to as counties.
[12] All population-related migration data prior to 2011 are harmonized by census-adjusted population values. This transformation results in small changes that only affect the decimal place. Please note that the census-adjusted population values are estimates and do not represent official data.

Table 1 Variable Definitions and Sources

Variable	Definition and Source
Dependent variable	
NetM	Total net migration per 1,000 inhabitants for each region on an annual basis. All population-related migration data prior to 2011 are harmonized by census-adjusted population values. The net migration data were derived from online data from the Federal Institute for Research on Building, Urban Affairs and Spatial Development (BBSR Institute) at https://www.inkar.de. The census-adjusted population data were obtained by request from the BBSR Institute as well. Note that the census-adjusted population values are estimates and do not represent official data.
InM	In-migration per 1,000 inhabitants for each region on an annual basis. For information on the census-adjusted population data, see notes on NetM variable.
OutM	Out-migration per 1,000 inhabitants for each region on an annual basis. For information on the census-adjusted population data, see notes on NetM variable.
Independent variable	
Prices	Building land prices in Euros per square meter. Since the data are derived as the average over two periods, starting with the reference year, the average of two contiguous values is taken to annualize the data. The data are provided by the Thünen Institute, available online at https://karten.landatlas.de/app/landatlas.
$GrossIncome_{(2002)}$	Mean gross income (median) in 2002 of all taxpayers in a region. The data are provided by the Thünen Institute, available online at https://karten.landatlas.de/app/landatlas.
$HigherEdu_{(2002)}$	Higher education variable constructed by the difference between the population in the age group 18–35 plus all students in a county, relative to the county population of the 18–35 year old age group (2002 values). The data on students enrolled at German higher education institutions for the winter semester of 2002 were derived from data of the German Federal Statistical Office at https://www-genesis.destatis.de/genesis/online?operation=sprach wechsel&language=en. Since many institutions maintain several facilities at different locations, we count all branches of universities in towns away from the main campus as an institution in the locality in which they are located.

(Continued…)

(Table 1 Continued)

Variable	Definition and Source
$Shop_{(2013)}$	Average county-wide proximity to the nearest supermarket in 2013, measured by the average travel time in minutes by car. Derived from data from the Thünen Institute (https://karten.landatlas.de/app/landatlas).
$OldAge_{(2002)}$	Old-age dependency ratio in 2002. The census-adjusted population data were obtained by request from the BBSR Institute.
$YoungAge_{(2002)}$	Young-age dependency ratio in 2002. The census-adjusted population data were obtained by request from the BBSR Institute.
Federal State	Indicator variable for each of the 16 federal states of Germany.
TI-Region	This indicator variable assigns each region according to its 2016 Thünen Institute (social-spatial) classification. For additional information, see Küppner (2016).
East-West	Indicator variable that equals 1 if the region belongs to the former German Democratic Republic (East Germany), and 0 otherwise.
City-County	Indicator variable that equals 1 if the region is a city, and 0 otherwise.
Border	Indicator variable that equals 1 if the region borders a foreign country, and 0 otherwise.
BorderCoastal	Indicator variable that equals 1 if the region borders a coast, and 0 otherwise.

Notes: Summary statistics are provided in Table 2.

To examine the effect of housing costs on migration, we use the prices of land that is zoned and approved for residential development. In Germany, these prices are a decisive factor for housing costs because of the fact that so little land is opened up for new developments. Given the high population density of Germany and its strong "Green movement", there is an overwhelming desire to maintain land for recreation and its natural state. Therefore, the plots that actually come on the markets have an extreme impact on housing costs. Moreover, similar to rents, the prices of residential land also depend on demand and its locational environment. Unlike rents, however, land prices are less dependent on qualitative factors such as building age, technical equipment, etc. which we consider as advantageous. In line with the findings of Graves (1983) and Buettner and Ebertz (2007), residential land approved for residential development should also capitalize into area and neighborhood amenities and disamenities, such as the climate, crime rate, infrastructure, and entertainment facilities. Therefore, we consider this variable as an appropriate proxy for housing costs.

Table 2 Sample Statistics

Variable	Mean	Median	Std. Dev.	Min	Max	Obs
Dependent variable						
NetM	2.85	2.56	6.12	-40.58	59.31	6,783
InM	46.9	42.3	20.23	14.01	346.51	6,783
OutM	43.31	38.91	17.25	19.17	309.77	6,783
Independent variable						
Prices	142.52	95.66	156.41	15.9	2,599.03	6,320
$GrossIncome_{(2002)}$	2,045.2	2,034.63	282.21	1,489.17	2,974.06	6,783
$HigherEdu_{(2002)}$	0.92	1.0	0.15	0.15	1	6,783
$Shop_{(2013)}$	4.16	4.21	1.27	1.87	8.88	6,766
$OldAge_{(2002)}$	0.28	0.28	0.03	0.18	0.39	6,783
$YoungAge_{(2002)}$	0.30	0.30	0.04	0.20	0.43	6,783
Federal State	7.95	8.0	3.79	1.0	16	6,783
TI-Region	2.96	3.0	1.54	1.0	5.0	6,783
East-West	0.19	0.0	0.39	0.0	1.0	6,783
City-County	0.27	0.0	0.44	0.0	1.0	6,783
Border	0.21	0.0	0.41	0.0	1.0	6,783
BorderCoastal	0.07	0.0	0.25	0.0	1.0	6,783

Notes: The statistics are based on the sample size for each variable as shown in the column labelled Obs (observations). The minimum and maximum values of net migration refer to the region of Trier, which experienced strong in-migration in 2015 and significant out-migration in 2016. We assume that the region was a drop-off centre for refugees in 2015.

As an indicator of regional infrastructure and amenities, we include the average county-wide proximity to the nearest supermarket, as indicated by the average travel time in minutes by car. To avoid issues of endogeneity, we use only the 2013 values of this control variable. We expect a negative relation between travel time and net migration, since nearby shopping facilities are associated with convenience.

To account for the effects of different conditions in the labor market on migration, including wage levels, we add the median gross income of all taxpayers. To avoid simultaneity and to isolate the channel of causation, we use the 2002 values of our income variable. This approach is consistent with other studies, such as that of Jeanty et al. (2010) and Buch et al. (2014), who also use initial-year values. As higher income levels indicate better living standards, we assume that they have a positive impact on migration.

To control for migration related to higher education, we construct a student variable (HigherEdu). As explained in Table 1, this control is the share of the

population in the age group 18–35 minus all students (2002 values).[13] Consequently, the student variable has a value of one if a county had no students in 2002 and a value less than one for counties with students enrolled in higher education institutions. If the share of students is high in relation to the cohort between 18 and 35, the value of this variable moves closer to zero.[14] The reason that we construct this variable and do not simply use absolute student numbers is to avoid large cities like Berlin or Munich being at the top just because of their size. Our variable, instead, controls for traditional university towns. Among the cities with the lowest values are Jena, Münster, Mainz, Heidelberg, Erlangen, and Würzburg. Since a lower value is associated with an established university, we expect a negative parameter sign for this variable (i.e., a positive impact on migration), given the increase in student numbers during the past decade.[15]

For the old-age and young-age dependency ratios, we include two variables to control for population patterns, which are measured as the populations below 18 and over 65 in relation to the population of working age (18–65 years old), respectively. Again, we use the 2002 values of these variables to avoid endogeneity issues.

To account for the historical East–West division of Germany, we include an East–West dummy variable. As discussed in the literature, the negative externalities of the long German division persist to this day, with lower living standards in the East compared to the West, although they are gradually narrowing.

We include several control variables to absorb regional differences. Given significant differences in price trends between rural and urban areas, two variables account for the agglomeration effects. The first is a zero/one indicator variable that distinguishes between counties and cities outside the jurisdiction of a county. The second variable assigns each region according to its 2016 Thünen Institute (social-spatial) classification into one of the five categories listed in Table 3. The regional distribution of the Thünen Institute county types is also shown in Figure 3.

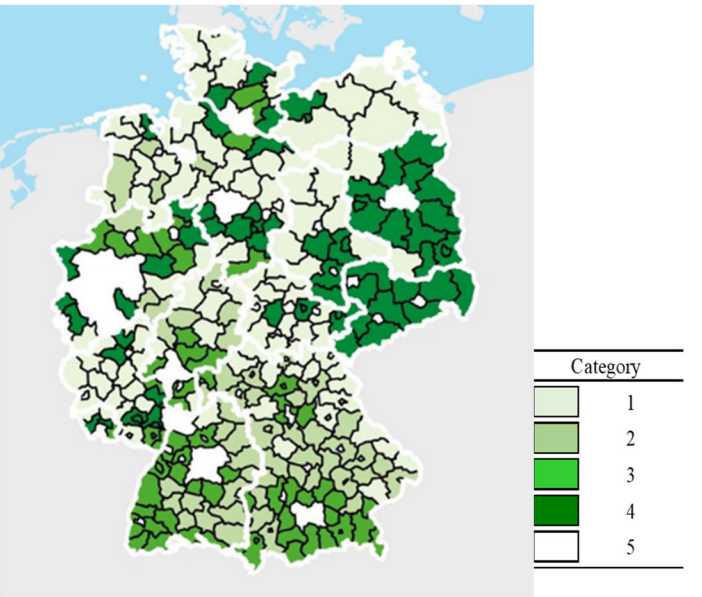
[13] Students of online universities are excluded, since they do not have to change their place of residence to participate in higher education.
[14] An extreme value of zero would indicate that the entire 18 to 35 year old population are all students.
[15] Since we use student numbers from 2002, one could be concerned that regions where a university only opened after 2002 are not sufficiently considered in our approach. However, since we are interested in a general trend and not in the effect a new university has on migration, we disregard this aspect.

Table 3 Social-Spatial Classification of 2016: Thünen Institute

Category	Index
1	Very rural with less than ideal socioeconomic conditions
2	Very rural with good socioeconomic conditions
3	Rather rural with good socioeconomic conditions
4	Rather rural with less than ideal socioeconomic conditions
5	Not rural

Notes: The regional distribution of the type of county based on the Thünen Institute is shown in Figure 3.

Figure 3 Regional Classification According to Typology of the Thünen Institute



Notes: map and respective categories are available online at https://karten.landatlas.de/app/landatlas.

In addition, we include a variable that assigns each base geographical unit (e.g., county) to its federal state. Germany is divided into 16 different federal states, all of which have their own constitution, which guarantees a high degree of local authority. Therefore, the local regulations of neighboring regions (e.g., in terms of education, shopping hours, building codes, real estate transfer taxes, and holidays) can vary significantly if they belong to different federal states. For example, the school-aged children of families who move to another federal state can face a different curriculum in the school system.

To capture the influence of neighboring countries (e.g., Switzerland, France, Poland, and the Czech Republic), we further include a zero/one indicator variable to control for border effects. Our concern that these regions are subject to different trade structures and demographic patterns is the main reason for this variable. Another control variable is whether a region borders a coast. Our panel dataset has a total of 6,783 observations and is not balanced due to missing values for residential land prices.

4. Methodology

The framework to examine the effects of building land prices on migration follows a panel regression approach with a large array of unit and time fixed effects. Our baseline regression in the following equation measures if regions with higher residential land prices experience differences in net migration:

$$NetM_{it} = \beta \times Prices_{it} + \alpha_i + \delta_t + \sum_{t=2002}^{2018} \sum_{h} \theta_{ht} \, \mathbf{1}\{year = t\} \times \boldsymbol{Z_{hi}} + \varepsilon_{it} \quad (1)$$

where the migration balance is our dependent variable; subscript i refers to our administrative units (counties and cities outside of counties) and t to time, measured in years; and subscript h identifies the various coefficients and variables that we use to capture geographic and other influences. The first term on the right side captures the price effect, as estimated by coefficient β. All time-invariant factors that determine annual migration at the regional level, such as local culture, history, and size, are absorbed by the unit fixed effects of our panel estimator indicated by the term α_i. The impact of year-specific events that affect all units, such as recessions, changes in federal laws, and base inflation at the national level, are captured by our time fixed effects δ_t.

The term $\mathbf{Z_{hi}}$ represents a set of dummy variables that are interacted with a time trend to control for differences among the German regions which include: i) a zero/one indicator variable that identifies whether a county belongs to the eastern or western part of Germany, ii) a zero/one dummy variable that separates cities outside of counties from counties, and iii) two additional zero/one indicator variables that capture whether a county borders a foreign country or a coast, respectively. The vector $\mathbf{Z_{hi}}$ also includes a variable that indicates the rurality of the location (as indicated by the typology of the Thünen Institute). Again, this variable assigns each region according to its socioeconomic and urban status into one of the five categories described in Section 3. To account for spatial dependencies at the state level, we also include in the vector $\mathbf{Z_{hi}}$ the corresponding variable that assigns each county to its federal state. Since each interaction (east–west, city–county, border, coastal,

Thünen Institute type, and federal state) allow for a separate time trend (as indicated by the coefficients of θ_{ht}), Equation (1) can capture many different trajectories. Therefore, the model can absorb a significant amount of heterogeneity in the dynamics of migration across counties. This differs from the vast majority of previous studies, where time fixed effects are often limited to country-wide trends, thereby ignoring local and regional differences. Standard errors are denoted as ε_{it}.

To check the robustness of our baseline estimates, we modify Equation (1) by including several economic and spatial control variables, which results in the following equation:

$$\begin{aligned} NetM_{it} = \beta \times Prices_{it} + \alpha_i + \delta_t \\ + \sum_{t=2003}^{2018} \sum_{j} \gamma_{jt} \, \mathbf{1}\{year = t\} \times \mathbf{X_{ji}} \\ + \sum_{t=2002}^{2018} \sum_{h} \theta_{ht} \, \mathbf{1}\{year = t\} \times \mathbf{Z_{hi}} + \varepsilon_{it} \end{aligned} \tag{2}$$

with the new vector $\mathbf{X_{ji}}$, where subscript j identifies the coefficients of the interactions of the year dummies with the additional control variables $Income_i$, $HigherEdu_i$ and $Shop_i$ included in vector $\mathbf{X_{ji}}$. To prevent issues of endogeneity via reverse causality, all of the control variables are measured by their base-year value.

The first control, $Income_i$, in $\mathbf{X_{ji}}$ stands for the median gross income of all taxpayers in region i in 2002. Given that higher income levels are associated with better living standards, we expect a positive relation with migration. The second term, $HigherEdu_i$, is related to our education variable, as explained in the data section. The term takes on a value smaller than one for regions with an institution of higher learning in 2002. For regions with a high share of students relative to the 18 to 35 year old population of the region, the value tends toward zero. Since tertiary education has become increasingly important with respect to career and job opportunities, we assume the coefficients to be negative. This would mean that regions with traditional universities (and hence higher education) have a positive impact on migration. The proximity to the next supermarket or discount store as a control for infrastructure and shopping possibilities is captured by the term $Shop_i$. Under the assumption that closer shopping opportunities are considered advantageous, we expect a negative relation between travel time and migration.

To account for differences in age patterns, we modify Equation (2) by replacing the education variable with the old-age and young-age dependency ratios of 2002, thus yielding an equation that is nearly identical to Equation (2). As this specification differs only in the subset of control variables included in $\mathbf{X_{ji}}$, we

omit the formal presentation here. In the following, we refer to Equation (3), when we modify Equation (2) with the old-age and young-age dependency ratios instead of using the education variable. We label the new control variables of the age ratios $OldAge_i$ and $YoungAge_i$, respectively. Since we use the 2002 values again to avoid endogeneity, we have no a priori expectations about the parameter signs. On the one hand, we consider areas with a younger population to be generally more lively and therefore more attractive for in-migration. On the other hand, areas with a high proportion of people under 18 in 2002 potentially experienced more out-migration in subsequent years. For regions with a high share of people older than 65 in 2002, the same arguments apply in the opposite direction.

5. Results

This section is divided into three parts. We first present the results of Equation (1). This is followed by our estimates with county-specific controls (Equations (2) and (3)). We conclude this section with a robustness check that adds time lags to our regression analysis.

5.1 Baseline Estimation

To examine the relation between land prices and migration, we first run Equation (1). Our baseline regression contains the annual migration balance for each region as the dependent variable and residential prices as the independent variable. Apart from unit-, time- and region-specific (e.g., east–west, rural–urban, federal state) fixed effects, no other controls are included in this baseline estimation. However, note again that this approach allows all sorts of overlapping entities to have their own trend and hence captures a significant amount of heterogeneity in the dynamics of migration across counties. The results are shown in Table 4.[16]

[16] To conserve space and given the large number of fixed effects coefficients, we present only our price and control coefficients. All the coefficient estimates and standard errors are available upon request from the authors.

Table 4 Estimation Results

Model:		**(1)**	**(2)**	**(3)**	**(4)**	**(5)**
Equation:		**(1)**	**(1)**	**(1)**	**(2)**	**(3)**
Dependent Variable:		**NetMit**	**InMit**	**OutMit**	**NetMit**	**NetMit**
Key Variable:						
Pricesit		-0.0067***	-0.0045	0.0025	-0.0073***	-0.0059***
		(0.0012)	(0.0033)	(0.0036)	(0.0013)	(0.0013)
Interaction (Estimated Parameters):						
GrossIncome(2002)	×Year	No (0)	No (0)	No (0)	Yes (16)	No (16)
HigherEdu(2002)	×Year	No (0)	No (0)	No (0)	Yes (16)	No (0)
Shop(2013)	×Year	No (0)	Yes (16)	Yes (16)	Yes (16)	No (16)
OldAge(2002)	×Year	No (0)	No (0)	No (0)	No (0)	No (16)
YoungAge(2002)	×Year	No (0)	No (0)	No (0)	No (0)	No (16)
Fixed Effect (Estimated Parameter):						
ID		Yes (399)	Yes (398)	Yes (398)	Yes (398)	Yes (398)
Year		Yes (17)	Yes (17)	Yes (17)	Yes (17)	Yes (17)
Federal State	×Year	Yes (265)	Yes (265)	Yes (265)	Yes (265)	Yes (265)
Dummy_City	×Year	Yes (34)	Yes (34)	Yes (34)	Yes (34)	Yes (34)
Dummy_East	×Year	Yes (34)	Yes (34)	Yes (34)	Yes (34)	Yes (34)
Dummy_Border	×Year	Yes (34)	Yes (34)	Yes (34)	Yes (34)	Yes (34)
Dummy_Coast	×Year	Yes (34)	Yes (34)	Yes (34)	Yes (34)	Yes (34)
TI Typ	×Year	Yes (85)	Yes (85)	Yes (85)	Yes (85)	Yes (85)

(Continued…)

(Table 4 Continued)

Model:	**(1)**	**(2)**	**(3)**	**(4)**	**(5)**
Equation:	**(1)**	**(1)**	**(1)**	**(2)**	**(3)**
Dependent Variable:	**NetMit**	**InMit**	**OutMit**	**NetMit**	**NetMit**
Sample Period	2002/2018	2002/2018	2002/2018	2002/2018	2002/2018
Adj. R^2	0.7595	0.8019	0.7394	0.7625	0.7641
Within R^2	0.0136	0.0286	0.0219	0.05864	0.0678
Observations	6,320	6,304	6,304	6,304	6,304

Notes: Standard errors are clustered at the county level, in parentheses, for our independent variable Prices. The numbers in parentheses behind indicate the number of parameters estimated. *** $p < 0.001$, ** $p < 0.01$, and * $p < 0.05$. Yes/No means whether the controls/variables in the same horizontal line are included in the model.

In contrast to Graves (1983), we find a strong negative relation between land prices and migration. Coefficient β is highly statistically significant and suggests that, ceteris paribus, a 100-Euro increase in land price (per sqm) is associated with a 0.6 lower net migration per 1,000 inhabitants. It follows that, even if amenities capitalize into housing costs, price differences impact the decision of households to move or stay. The negative impact is rather in line with the findings of, among others, Berger and Blomquist (1992), Potepan (1994), Rabe and Taylor (2012), Busch (2016), Stawarz et al. (2020), and Chavalleri et al. (2021).[17]

5.2 Sensitivity Analysis with Control Variables

To check the robustness of our baseline results, we next run Equation (2). This regression also includes the control variables for income, education, and shopping opportunities, as described in Section 4. Given the large number of coefficients, the results for our control variables are presented visually in Figure 4. With respect to the residential land price variable, the results are summarized in Model (4) of Table 4.

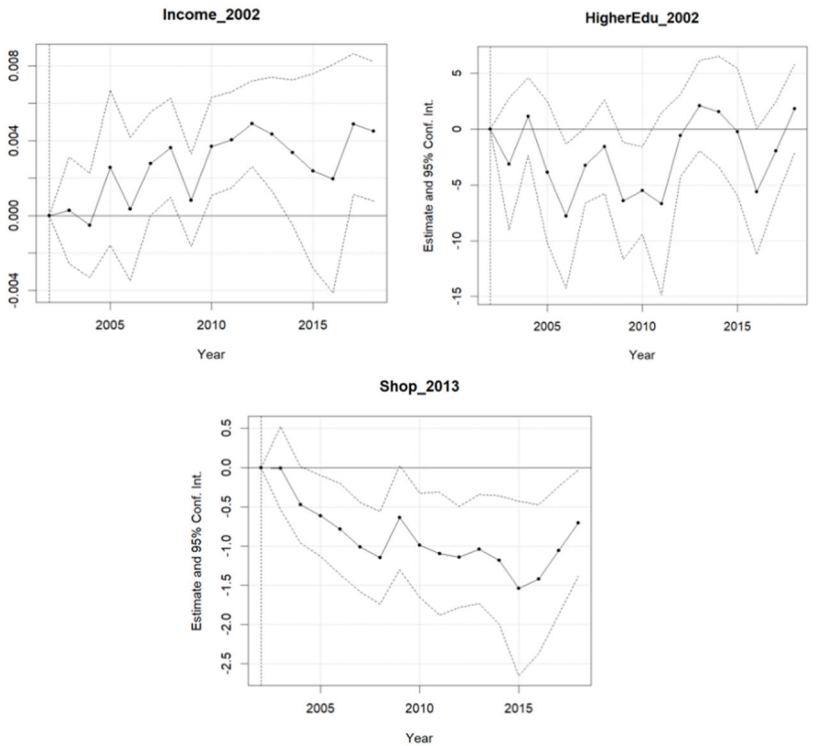
As our estimates of Equation (2) show, the land price coefficient is again highly significant, and the effect becomes even stronger when we control for economic, educational, and infrastructural factors. In this specification, a 100-Euro higher land price is, ceteris paribus, associated with a lower migration balance of around 0.7 persons per 1,000 inhabitants. Figure 4 shows that the coefficient signs of our control variables are consistent with the economic theory, but lag in statistical significance for some years.

Regarding the median gross income, our estimates suggest a positive impact on migration. This supports the findings of Wolff (2009), who proposes that income differences play an important role in explaining migration patterns. With respect to our education variable, most of the coefficients are negative but not statistically significant at the 95 percent level. Despite the negative sign of most parameters, which suggests that (traditional) university towns experience net positive migration balances, our results are too statistically weak to prove this relation. Since areas with an established university, such as Heidelberg, Freiburg, Göttingen, and Potsdam, often belong to the most expensive regions, which have also experienced a surge in housing costs over the past decade, we

[17] Since we use net migration for our dependent variable, we cannot be sure whether the effect is predominantly caused by immigration or emigration. Therefore, we re-estimate Equation (1) with our amenity control variable Shop2013 for the regional in-migration data (Model (2) of Table 4) and out-migration data (Model (3) of Table 4) separately. As shown in Table 4, both coefficients have the expected negative and positive signs, respectively. Our results suggest a price effect on in-migration that is almost twice as strong as that on out-migration. However, since both coefficients are non-significant, we continue to estimate the aggregate effect henceforth.

assume that the push effects of higher education and the pull effects of higher costs on migration largely cancel each other out. The last panel of Figure 4 indicates that closer shopping facilities, such as supermarkets and discount stores, are associated with higher migration balances. Since this variable can be seen as a proxy for infrastructure and shopping amenities, this result provides support for the argument that amenities play a role in-migration decisions.

Figure 4 Estimated Coefficients of $1\{year = t\} \times X_{ji}$ from Equation (2) (See Also Model (4) of Table 4)



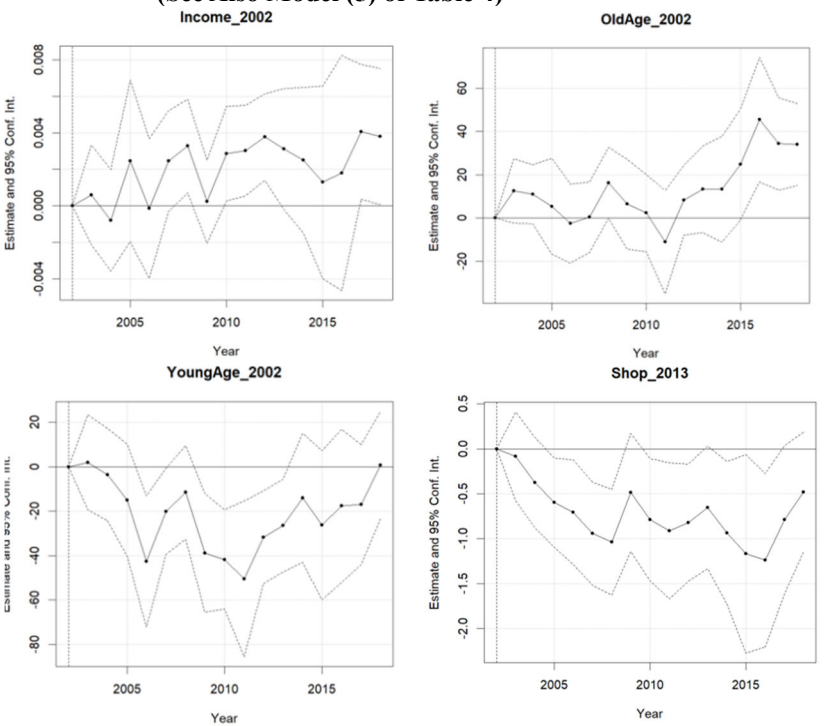
Note: We added dotted lines for 95% confidence intervals.

To control for different population structures, we run Equation (3) with the old- and young-age dependency ratios. We exclude the education variable in this specification, given the weak impact of this control in Equation (2). The regression results of Equation (3) are summarized in Model (5) of Table 4 and in Figure 5.

As shown by our estimates, the price effect is only mitigated to a small extent, when one replaces the education variable with the dependency ratios. Our land price coefficient is still negative and highly significant. The effect of income

and shopping facilities also remains rather similar to our previous estimates. With respect to the age variables, both controls provide only little evidence of a strong influence of the population younger than 18 or older than 65 in 2002 on migration patterns. However, due to the signs of the respective coefficients, we conclude that a large proportion of persons under 18 years of age promoted a relatively strong out-migration in the years following 2002. In regions with a large share of retirees, in contrast, migration balances remained rather constant and increased after around 2011. We assume that this result is related to the fact that older people are likely less mobile, while younger adults tend to move to find opportunities in higher education. The positive trajectory of the old-age dependency variable since 2011 is potentially caused by increasing vacancy rates in areas that had a high share of retirees in 2002.

Figure 5 **Estimated Coefficients of $1\{year = t\} \times X_{ji}$ from Equation (3) (See Also Model (5) of Table 4)**



Note: We added dotted lines for 95% confidence intervals.

5.3 Sensitivity Analysis with Time Lags

To test our results for reverse causality issues, we repeat Equations (1) to (3) with time lags. Table 5 summarizes the results of the respective estimates.

As our regression results show, all of the coefficients remain highly significant and negative when controlling for a period of up to five years. Overall, we still measure the strongest effect for Equation (2), followed by Equations (1) and (3). Given that housing costs are influenced by population changes (e.g., Potepan, 1994; Jeanty et al., 2010), our results suggest that the impact of migration on prices takes time to capitalize. We attribute this delay to lags in connection with the recognition, decision making, and implementation processes.

In summary, the results of our baseline estimates and control specifications suggest that migration is negatively related to land prices in Germany. This supports the findings of Stawarz et al. (2020), who use asking rents as a proxy for housing costs. Our results contradict those of Buch et al. (2014), who find no impact of land prices on migration for German cities. Our results are also at odds with those of Graves (1983). Contrary to the conclusion in Graves (1983), we find that higher prices have a negative impact on the migration balance, even though amenities are likely to be included in housing costs. Since our proxy, residential land prices, is mainly relevant for individuals and families who aim to build a (new) house, our results tend to emphasize the impact on these households rather than rental tenants.

6. Conclusion

Since migration is a main determinant in explaining for regional population patterns and changes, several strands of research address the causes and consequences of the decision of households to move. One of these strands analyzes the impact of amenities in this context. According to, for example, Graves (1983), land rents can be considered a proxy for a whole set of such amenities, given that favorable living conditions are capitalized into housing costs. Thus, more expensive regions are the result of an environment that provides a larger spectrum of amenities and a higher quality of life. Consequently, Graves (1983) suggests a positive relation between housing costs and migration, because the utility of people likely rises with more amenities.

Table 5 Estimation Results with Time Lags

Dependent Variable:			(1) $NetM_{it}$		(2) $NetM_{it}$		(3) $NetM_{it}$	
Key Variable:								
$Prices_{it}$	Lag(0)		-0.0066^{***}	(0.0012)	-0.0073^{***}	(0.0013)	-0.0059^{***}	(0.0013)
$Prices_{it}$	Lag(1)		-0.0073^{***}	(0.0013)	-0.0076^{***}	(0.0015)	-0.0062^{***}	(0.0015)
$Prices_{it}$	Lag(2)		-0.0096^{***}	(0.0019)	-0.0094^{***}	(0.0022)	-0.0076^{***}	(0.0022)
$Prices_{it}$	Lag(3)		-0.0119^{***}	(0.0025)	-0.0116^{***}	(0.0028)	-0.0093^{***}	(0.0028)
$Prices_{it}$	Lag(4)		-0.0126^{***}	(0.0023)	-0.0120^{***}	(0.0026)	-0.096^{***}	(0.0027)
$Prices_{it}$	Lag(5)		-0.0120^{***}	(0.0033)	-0.0108^{***}	(0.0037)	-0.0082^{***}	(0.0038)
Interactions:								
$GrossIncome_{(2002)}$		×Year	No		Yes		Yes	
$HigherEdu_{(2002)}$		×Year	No		Yes		No	
$Shop_{(2013)}$		×Year	No		Yes		Yes	
$OldAge_{(2002)}$		×Year	No		No		Yes	
$YoungAge_{(2002)}$		×Year	No		No		Yes	
Fixed Effects:								
ID			Yes		Yes		Yes	
Year			Yes		Yes		Yes	
Federal State		×Year	Yes		Yes		Yes	
Dummy_City		×Year	Yes		Yes		Yes	
Dummy_East		×Year	Yes		Yes		Yes	
Dummy_Border		×Year	Yes		Yes		Yes	

(Continued...)

(Table 5 Continued)

Dependent Variable:		(1) NetMit	(2) NetMit	(3) NetMit
Dummy_Coast	×Year	Yes	Yes	Yes
TI_Typ	×Year	Yes	Yes	Yes
Max. sample period		17 Years	17 Years	17 Years
Min. sample period		12 Years	12 Years	12 Years
Max. observations		6,320	6,304	6,304
Min. observations		4,459	4,448	4,448

Notes: Standard errors are clustered at the county level, in parentheses, for our independent variable Prices. *** $p < 0.001$, ** $p < 0.01$, and * $p < 0.05$. Yes/No denotes whether the controls/variables on the same horizontal line are included in the model.

To test this assumption for Germany, a country that has experienced a strong increase in housing costs during the past decade, we apply a panel framework with a large array of unit, time, and regional fixed effects to close to 400 individual counties for the period of 2002 to 2018. In contrast to the theory proposed, our estimations clearly show that higher residential land prices have a statistically significant and negative effect on migration in Germany. Despite the differences in our methodology and data base, this result is largely consistent with the findings of other studies, such as those of Busch (2016) and Stawarz et al. (2020). We conclude that higher prices can largely offset the additional amenities factored into housing costs and hence cause negative effects on migration. We show that our results are robust to several control specifications, including income, education, age structure, and time lag.

Given the polycentric structure of Germany, overall low internal migration rates, and rise in property prices in many regions during the past years, our analysis is of particular relevance to policymakers and demographers who specialize in regional development. It applies all the more, considering that housing costs are the largest expense for many households and building a home tends to be closely linked to a lifetime decision on locational choice for most German households.

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Disclosure Statement

The authors report that there are no competing interests to declare.

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