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# Housing Expenditures and Income Inequality

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**Abstract:** In this paper, we show that, in terms of real disposable income, changes in housing expenditures dramatically exacerbate the trend of income inequality that has risen sharply in Germany since the mid-1990s. More specifically, whereas the 50/10 ratio of net household income increases by 22 percentage points (pp) between 1993 and 2013, it increases by 62 pp for income net of housing expenditures. At the same time, the income share of housing expenditures rises disproportionately for the bottom income quintile and falls for the top quintile. Factors contributing to these trends include a decline in the relative costs of homeownership versus renting, changes in household structure, and residential mobility toward larger cities. Younger cohorts spend more on housing and save less than older cohorts did at the same age, with possibly negative consequences for wealth accumulation, particularly for those at the bottom of the income distribution.

**Keywords:** income inequality, housing expenditures

**JEL Codes:** D31, R21

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## 1. Introduction

Earnings inequality in Germany has sharply increased since the mid-1990s, with real wages rising at the top of the distribution, stagnating at the median, and falling dramatically at the bottom (Dustmann et al. 2009, 2014). A similar increase has occurred in inequality of household equivalized income, with top decile households enjoying substantial income growth, while income at the bottom decile has fallen in real terms (Fuchs-Schündeln et al. 2010, Biewen and Juhasz 2012). An important question that has received little attention so far is whether, and to what extent, shifts in housing costs counteract or further exacerbate inequality in disposable income net of housing expenditures.

This paper addresses this issue with a focus on Germany, which has a large rental market, with 55% of households renting in 2014, in contrast to 35% and 36% in the U.S. and UK, respectively.<sup>1</sup> While Germany until recently experienced unusually stable real house prices overall (Knoll et al. 2017), rental prices increased significantly during the 1990s, and then again after 2010 for newly rented properties. If owner-occupiers and renters are located at different parts of the income distribution, changes in the cost of renting versus ownership will affect inequality in income net of housing expenditures. In addition, because the income share of housing expenditures falls with rising income, the consumption possibilities of low-income households may be particularly hit by falling real incomes and/or rising housing expenditures (Albouy et al. 2016, Quigley and Raphael 2004).

To investigate these conjectures, we first document how inequality of equivalized net household income and differences in housing expenditures by income group translate into inequality of disposable income after housing expenditures. More specifically, we show that whereas the 50/10 ratio of net household income increases from 1.75 to 1.97 (by 22 percentage points, henceforth pp) between 1993 and 2013, the same ratio *net of* housing expenditures increases from 1.97 to 2.59 (by 62 pp). For low-income individuals, the increase

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<sup>1</sup> See the OECD Affordable Housing Database, available at: <http://oe.cd/ahd>.

in the share of income spent on housing occurs concurrently with a decrease in savings rates, which for those in the lowest quintile turn negative in the 2000s. In particular, among individuals in the bottom quintile of net household income, the share of income spent on housing increases from 27% in 1993 to 39% in 2013, while the mean share of non-housing expenditures decreases from 72% to 63% and the savings rate falls from 2% to -1%. Hence, for individuals at the bottom of the distribution, the increase in real housing expenditures exacerbates the loss in real disposable income. For high income groups, in contrast, these changes are reversed, with the share spent on housing decreasing from 16% to 14% in the top quintile of net household income.

Our analysis focuses first on the change in housing costs for renters versus owner-occupiers. Not only did the 1990s see privatization and decreased construction reduce the availability of social rental housing (whose subsidized rents are cheaper than those in private markets), but rental prices overall increased, driven partly by a general rise in residential mobility. This latter means new rental contracts at higher prices than existing agreements, prices that have increased dramatically since 2010. These trends mostly affect individuals in the lower part of the income distribution, who are disproportionately renters with higher rates of residential mobility, with far less impact on individuals further up the income distribution, who are more frequently homeowners. At the same time, homeowners also benefit from falling mortgage interest rates, especially since the late 2000s, which further exacerbates inequality after housing expenditures.

We also note that shrinking household sizes throughout the 1990s and 2000s (due primarily to a rising share of single households) increase housing expenditures per capita, a demographic trend that is strongest at the bottom of the household income distribution. In addition, movements from East to West Germany during the 1990s and the increasing migration of low-income individuals to more expensive urban areas during the 2000s change the regional allocation of households. Lastly, because housing is a necessity good, declining

real incomes at the lower end of the distribution increase the share of income spent on housing.

Taking a cohort perspective, we illustrate that successive birth cohorts start with higher inequality at any given age. Moreover, younger cohorts spend more of their income on housing, and save less, than older cohorts did at the same age. This holds in particular for young individuals at the bottom of the distribution, with potentially severe consequences for future wealth inequality.

Our paper contributes to the literature in several ways. First, it adds to the inequality literature by analyzing the link between income inequality, the cost of housing, and inequality in disposable income after housing expenditures. In particular, we show that in addition to the rise in income inequality, changes in the housing market are a second key driver of increased inequality in disposable income, leading to a divergence in consumption and savings patterns across income groups. Our work also relates to the literature on consumption inequality (e.g., Attanasio and Pistaferri 2016, Meyer and Sullivan 2013, and Heathcote et al. 2010 for the U.S., Blundell and Etheridge 2010 for the UK, and Fuchs-Schündeln et al. 2010 for Germany). While these studies concentrate mostly on overall consumption, we focus instead on housing as consumption's most important component, especially for low-income individuals.

Our research also extends the literature on housing markets by analyzing the development in Germany, where homeownership is not only less common than in the U.S. or the UK but also less equally distributed along the income distribution, driven by stricter mortgage regulations, and the virtual absence of a sub-prime lending market (SVR 2013, Voigtländer 2014). We further demonstrate that, although in international comparisons Germany is often seen as an outlier because of its far more moderate housing price development (Knoll et al. 2017), it in fact shows similar trends as the U.S. and UK in rising housing expenditure shares for renters and low-income individuals (Larrimore and Schuetz 2017, Albouy et al. 2016,

Quigley and Raphael 2004 for the U.S. and Belfield et al. 2015 for the UK). The literature for the Anglo-Saxon countries also has focused on housing affordability for younger cohorts (Goodman and Mayer 2018, Belfield et al. 2015) and in large cities (Metcalf 2018, Glaeser and Gyourko 2018, Gyourko et al. 2013). To our knowledge, we are the first to provide a comprehensive analysis of these issues for Germany.<sup>2</sup> Lastly, our paper contributes to the literature on the role of regional price differences for inequality (Moretti 2013, Diamond 2016) by showing that in Germany, once regional price differences are taken into account trends in regional mobility reinforce the rise in income inequality in *real* terms rather than mitigating it.

Our analysis is based on the Income and Expenditure Survey (Einkommens- und Verbrauchsstichprobe, EVS), a cross-sectional survey conducted every five years by the German Statistical Office. Households record different income sources and various consumption expenditures in a diary over a three-month period. The large sample size, as well as the precise recording of information over a long time period, make this dataset particularly useful for our research purposes. We also draw on household information from the yearly German Socio-Economic Panel (SOEP), as well as various other data sources that report house prices and rents.

The paper proceeds as follows. Section 2.1 provides background information and relevant stylized facts on the development of the German housing market over the last two decades. Moreover, Section 2.2 describes the datasets used. Section 3 discusses the core facts of the trends in household income inequality and housing expenditures across income groups. Section 4 then explores explanations for these trends, after which section 5 reports the results

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<sup>2</sup> Most existing papers for Germany focus on renters only (see e.g., Grabka and Verbist 2015, Backhaus et al. 2015, Fitzenberger and Fuchs 2017). Schier and Voigtländer (2015) use aggregate data and show that the costs of homeownership versus renting have decreased in recent years, driven by a fall in mortgage interest rates, but these authors do not consider distributional effects.

of a number of additional analyses. Section 6 concludes the paper with a discussion of the findings and their implications.

## **2. Background and Data**

### **2.1. Housing in Germany, the UK, and the U.S.**

#### *2.1.1. Patterns of Housing Tenure*

As Table 1 shows, homeownership rates in Germany are much lower than in the UK or the U.S., with about 45% of German households living in a property they owned in 2014 (19% as owner-occupiers with a mortgage and 26% as owners outright), as compared with around 64% in the UK and 65% in the U.S. In terms of the variation in homeownership across the income distribution, only about 22% of German households in the bottom income quintile are owners, while almost 50% of UK households and 36% of U.S. households in the bottom income quintile own their homes.<sup>3</sup>

The rental market in Germany, which accounts for around 55% of households, is primarily a private rental market (Kemp and Kofner 2010). The share of dwellings in the social rents sector amounts to only 4% in 2014, similar to the U.S. share (4%), but much smaller than those in the UK (18%) or France (19%).<sup>4</sup> Dwellings in Germany's social housing sector are provided partly by private investors who receive subsidies if they let the dwelling at below-market rent for 20 years, after which the social housing units become part of the private rental market. Over the past years, the number of social housing units has decreased sharply, from 2.6 million in 2002 to 1.4 million in 2014 (Gedaschko 2016), with only about 3.5% of households living in the social housing sector by 2014. Likewise, the municipal

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<sup>3</sup> Among the reasons for low homeownership rates in Germany, Voigtländer (2009) points to post-WWII subsidies for social rental housing, the moderate rent regulation that made rental property provision attractive to private landlords, and subsidies for private landlords such as accelerated depreciation or tax deductibility of mortgage interest payments.

<sup>4</sup> See the OECD Affordable Housing Database, available at: <http://oe.cd/ahd>.

housing sector, i.e. the stock of housing owned by municipalities, declined since the 1990s as several cities have privatized their housing stock that was provided for below-market rents (Held 2011).

### *2.1.2 Changes in Rental Prices*

Across our entire period of study (1993–2013), rents for new contracts can be freely set by landlords, subject only to weak constraints, while rents for existing contracts must not be higher than comparable average rents in the local market and can only be raised by 20% over a three-year period.<sup>5</sup> There are exceptions, however, since additional costs for modernization investment can be partly shifted to renters.<sup>6</sup> Figure 1a shows real rental price indices for Germany, comparing indices of all rents and of rents for new contracts, deflated by the general consumer price index. Average rents increase by a total of 20% between 1991 and 2000. This rise is due partly to large rent increases in East Germany, whose pre-reunification rental market had been strictly regulated and which afterwards sees large housing investments to modernize its housing stock. Rents also increase in West Germany due to an increase in the demand for housing following East-to-West migration during the 1990s and the arrival of ethnic German immigrants.<sup>7</sup> This increase in rental prices slows down in the late 1990s, however, and average rents decline slightly in real terms during the 2000s. Nevertheless, rents for new contracts (the dashed line in the figure) strongly diverge from existing rental rates from 2010 onward and then increase by about 15% in real terms (or as much as 19% for city dwellers) up to 2016. This divergence between average rents and new contract rents is consistent with the German regulatory environment, where existing contract rents are more

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<sup>5</sup> Before 2001, this threshold is 30% (see also Fitzenberger and Fuchs 2017 and the literature cited therein).

<sup>6</sup> Specifically, up to 11% of the modernization costs paid by the landlord can be shifted to renters, and this rent increase is not restricted by the local average rent or by the 20% cap, which would otherwise limit rent increases for existing contracts.

<sup>7</sup> Net migration from East to West Germany between 1991 and 2006 totals 1.45 million individuals (Fuchs-Schündeln et al. 2010), while ethnic Germans from the former Eastern block moving to Germany between 1987–2001 number 2.8 million (Glitz 2012).

strongly regulated while new contract rents can be more freely adjusted. Correspondingly, sitting tenants benefit from a length of residency discount, and the burden of adjustment is shifted to new renters.

In Figure 1b, we compare the rent indices in Germany to those in the U.S. and the UK, normalized to 100 in 1991. Whereas the UK shows the strongest rent increase over the period considered (by 37% in real terms between 1991 and 2016), the 12% increase in the U.S. is lower than that in Germany (15%), with even the late 1990's and early 2000's U.S. housing boom inducing only a small increase in rental prices.

### *2.1.3 Housing Prices and Mortgage Markets*

As regards the development of real house price indices for Germany, the UK and the U.S., house prices in Germany stay flat in the early 1990s, fall in real terms from the late 1990s onward for the next decade, and rebound modestly after 2010 (Figure 2). This pattern is in sharp contrast to the U.S. and UK, where house prices increase dramatically from the mid-1990s until the Great Recession, decrease afterward until 2011 (the U.S.) and 2013 (UK), respectively, and then start to increase again. Hence, housing prices in the Anglo-Saxon countries not only show a stronger long-term upward trend but also tend to be more volatile than in Germany.<sup>8</sup>

Because mortgage rates, like house prices, are also an important determinant of housing expenditures for owner-occupiers, Figure 3 graphs the decreases in real interest rates for new mortgages since the early 1990s in all three countries, which all see rates of about 5% in the early 1990s fall to below 1% in 2011. These decreases accelerate across the board in the immediate aftermath of the financial crisis before rebounding slightly. Nonetheless, although mortgage rates follow similar trends in all three countries, the level of mortgage debt develops quite differently in Germany (see Figure 3b). Whereas the mortgage debt-to-GDP ratio

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<sup>8</sup> See Knoll et al. (2017) for a comparative analysis of housing prices in various industrialized countries or Glaeser et al. (2008) for an analysis of housing price bubbles in the U.S.

decreases in Germany, it increases considerably in the Anglo-Saxon countries, with a 2015 mortgage debt to GDP ratio in Germany of about 42% compared to 63% in the U.S. and 68% in the UK. Hence, overall, the large reduction in interest rates does not lead to a large expansion of mortgage debt in Germany, resulting in a reduction in mortgage interest payments.

One obvious reason for these differences is the lower share of homeowners in Germany, resulting in lower demand for mortgage credit. This difference might also stem from the much stricter set of mortgage lending requirements in Germany. For example, German banks require higher down payments, such that the average share of equity financing in Germany in 2012 is 30% of the mortgage value, while it is just 15% in the UK (SVR 2013). Regulations also preclude a subprime lending market for households with low equity and unstable income, and mortgage equity withdrawal (borrowing against the mortgage value in expectation of rising house prices) is also uncommon.<sup>9</sup> Hence, mortgage holders in Germany are a select group whose wealth or income enable them to meet the required down payment, leading to individuals acquiring property relatively late in life.<sup>10</sup> These factors (as discussed in more detail below) affect the composition of homeowners and renters in terms of their position in the income distribution.

#### *2.1.4 Residential Construction*

Figure 4 compares the number of newly constructed housing units per 1,000 inhabitants across the three countries. Germany sees a construction boom after reunification, with about 4.2 million new flats built in West Germany between 1991 and 2000, and 1 million new flats in East Germany. This is driven by the modernization of the East German housing stock and

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<sup>9</sup> The expansion of the subprime mortgage market and the massive use of mortgage equity withdrawal played an important role in the housing price bubble and the increase in U.S. household debt after the 1990s (Mian and Sufi 2014).

<sup>10</sup> Whereas many people in the UK buy several houses over a lifetime and “climb up the housing ladder,” Germans typically buy only one house at a later age (Kemp and Kofner 2010).

the increased demand for housing space following East-West migration and the arrival of ethnic German immigrants. In the late 1990s and over much of the 2000s, however, construction slows down considerably, consistent with the flat rents and housing prices observed during this period (see Figures 1 and 2). Construction increases again after 2008. Meanwhile, in the U.S., construction increases strongly through the mid-2000s but declines sharply after the housing bubble burst. In the UK, construction remains relatively flat throughout much of the 1990s and 2000s.

### *2.1.5 Demographic Changes*

Several demographic changes in Germany are also likely to have had major effects on the housing market. First, as Figure 5 shows, average household size decreases from 2.27 in 1991 to 2.00 in 2015, which increases the demand for housing space per capita. Since households use fewer economies of scale in housing consumption, the housing expenditure burden increases over time for the individual. In the U.S. or UK, in contrast, households are larger on average and the decrease in household size occurs more slowly than in Germany.

## **2.2. Data**

Our main analysis is based on the 1993, 1998, 2003, 2008, and 2013 waves of the Income and Expenditure Survey (*Einkommens- und Verbrauchsstichprobe*, EVS), which is administered every five years by Germany's Federal Statistical Office to large repeated cross sections of households. The EVS serves as the basis for the consumption baskets used for official consumer price indices.<sup>11</sup> The data have three features that make them particularly well suited for our analysis: First, the sample size is large, with each wave of raw data covering between 96,000 and 128,000 individuals from 39,000 to 49,000 households. Second, the survey examines numerous categories of both income and expenditure in great detail,

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<sup>11</sup> For detailed data documentation, see *Federal Statistical Office* (2005a, 2005b, 2012, 2016).

allowing us to study various dimensions of inequality. Third, the EVS differs from other household surveys (e.g., the SOEP) in its reliance on a consumption diary kept for (at least) one quarter rather than on retrospective survey questions. This continuous measurement over a relatively long period results in higher data accuracy.<sup>12</sup> More details on the data used can be found in Appendix A.

Our main analysis focuses on working age individuals between 20 and 60. We consider all households with at least one individual in that age range and then form a sample of individuals in the age range based on the information of the corresponding household. We also verify certain of our key results using other age ranges (Appendix A). We exclude from the sample any individual who reports a negative or zero net household income or a share of housing expenditures, non-housing expenditures, or savings relative to net household income that is above two or below minus two. The final number of individuals (households) is 59,195 (32,268) in 1993, 70,522 (39,325) in 1998, 70,792 (39,895) in 2003, 69,355 (40,036) in 2008, and 60,743 (36,903) in 2013.

Throughout the paper, we consider income from various sources measured at the household level and *equivalized* to adjust for household size differences by dividing household income by the number of equivalent adults in the household and assigning the outcome equally to all household members.<sup>13</sup> We use the same method to make consumption expenditures – in particular housing expenditures – and savings comparable with income. We then calculate all inequality measures and other statistics at the individual level, converting all

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<sup>12</sup> The period of recordkeeping in the EVS of 3 months is far longer than that the diary in other consumption surveys. For instance, the Consumer Expenditure (CE) Survey in the US and the Living Costs and Food Survey (LCF) in the UK keep diaries for up to only two weeks. Bee et al. (2015) argue that infrequently purchased goods are not captured well by the two-week diary in the CE. The main housing expenditures we study (i.e., rent, energy, and mortgage payments) typically occur on a monthly basis and so should be well captured by the EVS.

<sup>13</sup> We use the new OECD equivalence scale, which assigns a weight of 1 for the first adult in the household, 0.5 for each additional household member aged 14 and above, and 0.3 for each additional household member under 14. The same scale is used e.g. in Biewen and Juhasz (2012) for Germany, as well as Attanasio and Pistaferri (2016) for the U.S. Alternative equivalence scales are investigated in Appendix A.

monetary values to 2010 euros using the Federal Statistical Office's consumer price index (CPI).<sup>14</sup>

Some of our analyses also rely on the yearly German Socio-Economic Panel (SOEP) because it provides a more detailed set of housing characteristics (e.g., whether the dwelling is in the social or public housing sector), as well as the longitudinal information used in the Section 5.1 analysis on permanent versus transitory inequality. We thus also compare EVS and SOEP outcomes to check whether both data sets give a consistent picture of the key trends in inequality and expenditures.

### **3. Income Inequality and Housing Expenditures**

#### **3.1. Income Inequality**

In line with the inequality literature (see e.g., Blundell and Etheridge 2010 for the UK, Attanasio and Pistaferri 2016 for the U.S., and Biewen and Juhasz 2012 for Germany), the key income concept considered in our analysis is *equivalized net household income*. This variable is defined as the sum of a household's labor income (from both dependent employment and self-employment of all household members), capital income, non-public transfer income, and public transfer income minus tax payments and social security contributions, equivalized and distributed to all household members (see Section 2.2).

In Figure 6, we show the growth of equivalized net household income at various percentiles of the distribution, indexing the percentiles to be zero in 1993 and giving all numbers in real terms. As the figure shows, the bottom of the income distribution is characterized by a sharp drop and the top by an increase, while the median remains largely unchanged. Over the 1993–2008 period, real income growth is -2% at the median, -11% at the

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<sup>14</sup> Because consumer prices rose much faster in East Germany than in West Germany following reunification, until 1999, the Federal Statistical Office published separate price indices for the two. We therefore use West and East Germany specific CPIs for the 1993 and 1998 waves.

10<sup>th</sup> percentile, and +3% at the 90<sup>th</sup> percentile. During the 2008–2013 period of high growth and declining unemployment, in contrast, real incomes increase at all percentiles. The cumulative real income change between 1993 and 2013 was thus -10% at the 10<sup>th</sup> percentile, +2% at the median, and +7% at the 90<sup>th</sup> percentile.

Figure 7 then illustrates the percent real growth of equivalized net household income along the income distribution. From 1993 to 2003, income declines below the 25<sup>th</sup> percentile then grows modestly between the 25<sup>th</sup> and 90<sup>th</sup> percentile but increases sharply above the 90<sup>th</sup> percentile. From 2003 to 2013, in contrast, interpercentile differences increase more sharply below the 80<sup>th</sup> percentile, with a drop in income below the 45<sup>th</sup> percentile, and a rise further up the distribution. Above the 80<sup>th</sup> percentile, there is no further increase in dispersion.

### **3.2. Housing Expenditures**

We next investigate the development of housing and other expenditures, and how it differs between income groups. Consistent with our income measure, we compute expenditures at the household level and then divide them by the number of equivalent adults in the household to construct equivalized individual expenditure measures. The unit of analysis is the individual, and the sample includes all individuals aged 20-60. Following Belfield et al. (2015), we define housing expenditures for *renters* as the basic rent (including utilities such as water and waste charges) and energy costs, and housing expenditures for *owner-occupiers* as mortgage interest payments, energy costs, and maintenance and operating costs.<sup>15</sup>

In Figure 8, which traces the 1993-2013 development of housing expenditures across income groups both in absolute terms and relative to income, the left-hand panel shows about a 32% increase in mean housing expenditures for individuals in the lowest income quintile,

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<sup>15</sup> Because repayment of mortgage capital constitutes an accumulation of net wealth and is thus part of savings rather than consumption, we include only mortgage interest payments in regular housing expenditures.

but a 9% decline for those in the highest. The middle panel, which displays the change in real income, clearly illustrates the sharp increase in income inequality and the decline of real incomes in the lowest quintile, thereby mirroring the results in Section 3.1. Thus, while the sharp increase in housing expenditures is accompanied by a large decrease in income for the lowest quintile of the income distribution, the highest quintile sees an increase in income and a fall in housing expenditures.

As the figure's right-hand panel illustrates, these trends lead in turn to a sharp increase in the share of household income spent on housing in the lowest income quintile, more modest increases in income quintiles further up the distribution, and a drop in the highest income quintile. For the lowest income quintile, this share increases from 27% in 1993 to 39% in 2013, with the steepest rise between 1993 and 2008, and a flattening out between 2008 and 2013. For the top income quintile, in contrast, the share of income spent on housing declines from about 16% in 1993 to 14% in 2013.

In Figure 9, we compare two inequality measures (the ratio of the 50<sup>th</sup> to the 10<sup>th</sup> percentile and the ratio of the 90<sup>th</sup> to the 50<sup>th</sup> percentile) for two concepts of net household income – before and after deduction of housing expenditures, respectively, with the former income concept as the focus of most inequality analyses (see Section 3.1). As the figure illustrates, the level of income inequality becomes much larger once housing expenditures are accounted for (in particular the 50/10 ratio). What is more remarkable is the divergence of these two income concepts over time. Between 1993 and 2013, the 50/10 ratio of income before housing expenditures increases from 1.75 to 1.97 (by 22 pp), while the 50/10 ratio of income net of housing expenditures increases from 1.97 to 2.59 (by 62 pp), meaning an almost triple change once housing expenditures are taken into account. The 90/50 ratio also shows a stronger increase over time after housing expenditures are accounted for, but the difference is smaller than its 50/10 counterpart.

We turn next to the share of household income spent on housing expenditures, non-housing expenditures, and on savings (Figure 10).<sup>16</sup> The changes over time are particularly salient for individuals in the bottom income quintile, whose share of housing expenditures increases from 27% in 1993 to 39% in 2013, while the share of non-housing expenditures increase from 72% to 63% and the share of savings decreases from 2% to -1%.<sup>17</sup> Further analyses (not shown here) reveal that the share of individuals in the bottom quintile with positive savings falls from 64% to 53%. In contrast, the other income groups see less dramatic changes in their consumption and savings patterns.

Finally, to examine the comparability of our two data sets, in Appendix Figures A2-A4 we use the SOEP data to replicate the previous findings from the EVS. The results for both data sets document the same key trends: rising inequality of equivalized net household incomes and a rising share of income spent on housing by low-income groups.

## **4. Explaining Inequality Trends**

Given the above evidence of a considerable divergence in housing expenditure shares between income groups, we now explore several factors that may contribute to this trend.

### **4.1. Housing Expenditures for Renters and Owner-occupiers**

Because homeownership rates vary across the income distribution, a divergence in housing expenditures for renters versus owner-occupiers leads to a corresponding divergence in after-housing income. We illustrate this divergence in Figure 11 using the different housing

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<sup>16</sup> We define the components as follows: *housing expenditures* (as discussed above) includes rent, mortgage interest, maintenance and operating costs, and energy costs; *other expenditures* include 10 categories of consumption expenditures (beverages, food, furniture, health, transport, information/communication, leisure/entertainment, education, eating out, and other goods and services), as well as non-consumption expenditures (insurance premiums, credit interest payments excluding mortgage interest, charitable contributions, private transfers made, and other items).

<sup>17</sup> Among the different non-housing expenditure items, the biggest drop for the lowest income quintile is in food expenditures (by about 5 pp), although most other consumption items (e.g., clothes, transport) also decrease.

expenditure components (in 2010 euros) for renters and owner-occupiers with and without outstanding mortgages. For renters, housing expenditures increase sharply between 1993 and 1998 before rising at a slower pace in subsequent years, resulting in about a 36% cumulative increase (from 3,600€ to 4,900€) between 1993 and 2013. For homeowners who own outright, expenditures also increase, but only by around 14% between 1993 and 2013. In contrast, for owner-occupiers with an outstanding mortgage, housing expenditures increase between 1993 and 2003 at a slower pace than for renters and decrease substantially from 2003 onward leading to an overall 1993-2013 decline by 4% (from 4,800 € to 4,600 €). This decrease in the latter period is the result of falling mortgage interest payments, and falling construction rates across the 2000s that lead to a maturing housing stock with fewer outstanding mortgages (Figure 4). In particular mortgage holders aged 45 and over benefit from falling interest rates and from a maturing housing stock (see Figure B1 in the Appendix).

To compare the relative costs of renting versus owning, holding constant housing characteristics, we estimate net imputed rents (NIR). These are defined as the counterfactual housing expenditures for owner-occupiers if the dwelling were rented instead of owned minus the actual housing expenditures (Frick and Grabka 2003).<sup>18</sup> For renters, NIR is zero by definition, while a positive (negative) NIR indicates that an owner-occupier pays less (more) than a renter for a comparable dwelling. We calculate the *relative* NIR by dividing the NIR by the owners' hypothetical rent expenditure. By tracing the evolution of the median relative NIR over time for owners with and without a mortgage (Figure 12), we show that the NIR is positive for both groups in all years, meaning that owners pay less than renters for a dwelling of comparable quality. For owners with mortgages, the median relative NIR was 12% in 1993 but increase to 24% in 2013, indicating that in the last year of the observation period they pay

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<sup>18</sup> To calculate the NIR, we estimate hedonic regressions of housing expenditures for renters on a set of housing and household characteristics and impute the rent for owner-occupiers based on their characteristics. We then deduct the owners' actual housing expenditures (mortgage interest payments, maintenance and operating costs). Finally, we predict the conditional distribution of housing expenditures by covariates using quantile regressions and aggregate up to the overall distribution (see Appendix C for details).

24% less than they would have paid to rent a similar dwelling. The sharp increase, especially between 2003 and 2013, reflects the fact that owners with mortgages could benefit from declining interest rates, as well as from the aging housing stock produced by declining housing construction over time. For owners without outstanding mortgage, the level of median NIR is naturally much higher, and also increases from 52% in 1993 to 58% in 2013. Hence, our figures overall show a falling cost of homeownership relative to renting over time.<sup>19</sup>

When we break down the shares of the three tenure types by income quintile (Figure 13), around 70% of the individuals in the lowest quintile are renters, leaving only a few owner-occupiers with a mortgage, while in the top income quintile, only about one third are renters and around half are owner-occupiers with a mortgage. On the other hand, the share of owner-occupiers who own their homes outright is similar in all income groups. From 1993 to 2003, however, the share of renters declines in almost all income quintiles, while the share of owner-occupiers rises, with the one exception of the lowest income quintile, in which the trends are reversed.<sup>20</sup> Possible explanations for why homeownership do not increase among the bottom quintile are the decline in real income making homeownership less affordable as well as other demographic trends among the low-income population (in particular, rising shares of single households and city dwellers, as discussed in the next section).

Nevertheless, overall, it is remarkable that the falling interest rates from the early to mid-2000s onward do not lead to higher homeownership rates. Rather, according to Figure 13, during the 2000s, the share of renters increases slightly across all income groups. One

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<sup>19</sup> Schier and Voigtländer (2015) also document a falling cost of homeownership versus renting in Germany, although their analysis does not begin until 2008. Moreover, Hiebert and Sydow (2011), in a comparison between Germany and other major euro-area countries (Belgium, Ireland, Spain, France, Italy, the Netherlands, and Finland), pinpoint Germany as the only country in which the ratio of rents to house prices has increased since the mid-1990s while decreasing in the other countries.

<sup>20</sup> This 1990's increase in homeownership is driven mostly by East Germans, who had very low homeownership rates during the GDR era. Hence, whereas the share of renters in West Germany only decreased from 47% to 46% between 1993 and 2003, in East Germany, it fell from 79% to 57%.

hypothesis is that the German banks' conservative lending policies restrict mortgage access to households with sufficiently high income and the savings to afford a sizeable down payment, suggesting that most individuals in the lowest income groups are unable to benefit from falling mortgage interest rates and rising net imputed rents.<sup>21</sup>

## **4.2. Changes in Housing and Household Characteristics**

### *4.2.1 Household Size and Demographics*

One important factor driving housing expenditures is household structure. In the German case (see Figure 14, Panel A), the share of individuals living in single households increases over the 1993-2013 period – in particular among the bottom income quintile, where it increases from 23% to 42%.<sup>22</sup> This trend toward smaller households means that individuals are less able to use economies of scale in housing consumption, which increases the share of their budget to be spent on housing.

### *4.2.2 Dwelling Size and Quality*

The living space per equivalent adult increases for all income groups (Figure 14, Panel B) but especially among the middle class. Therefore, the rise in housing space fails to explain the disproportionate increase in housing expenditures within the lowest quintile. Moreover, during the 1990s, the lower income groups enjoy the highest increase in the share of dwellings with central heating (Figure 14, Panel C), although the share of individuals living in relatively new dwellings (built in 1990 and after, Figure 14, Panel D) increases more for the top quintiles.<sup>23</sup>

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<sup>21</sup> The stricter lending requirements in Germany (SVR 2013, Voigtländer 2014), which are a distinguishing feature to the U.S. or the UK, result in lower homeownership rates, especially at the bottom of the income distribution.

<sup>22</sup> This increase includes single adults with and without children: In the bottom income quintile, the share of single adults without children increases from 16% to 33%, while the share of single adults with children increases from 6% to 9%.

<sup>23</sup> This variable is only available in the 2003 data onward.

These observations raise the question of to what extent quality improvements are demand driven (i.e., by the household choice to consume more or better living space) versus supply driven (i.e., by a changing housing stock induced partly by government regulations). If the quality improvement is caused by the latter, it is not welfare enhancing for low-income households but may rather reduce welfare through a loss in disposable income after housing (see Quigley and Raphael 2004 for this argument). In fact, supply-side factors are likely to have played a role in the 1990's housing construction boom, made possible in part by government subsidies for private investment in modernization and new construction.<sup>24</sup> Moreover, the prevailing rent regulation incentivizes modernization, since costs of housing modernization investment can partly be shifted to renters, and landlords can thus circumvent the stricter regulation of existing rent contracts. Not only may this new construction and modernization have made it harder for low-income households to find smaller and cheaper flats even when they wanted to, but patterns of new housing stock construction may have adapted only slowly to changing household structures such as the rise in single households.

#### *4.2.3 Regional Migration Patterns*

In Figure 15, we show the income spent on housing by those in the lowest income quintile in West and East Germany across different community sizes, defining the quintile at the Germany-wide level. As the figure shows, individuals in the lowest income quintile living in large cities spend a much larger share of their income on housing than those living in smaller municipalities (about 10 pp more). However, the increase in the income share spent on housing over time is evident across all size categories and not limited to large cities.

We then consider how different income groups are located across regions and how regional mobility has changed over time. As Figure 16 shows, individuals in the lowest

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<sup>24</sup> See also Frick and Grimm (2009). For the U.S., Quigley and Raphael (2004), Glaeser and Gyourko (2018), and Metcalf (2018) all discuss the role of governmental regulations and local housing policies in the availability of cheap housing for low-income households.

income quintile disproportionately relocate to West Germany and larger cities, both of which have higher housing costs. During the 1990s (a time of considerable migration flows from East to West Germany), the share of individuals in the bottom income quintile who live in West Germany increases from 65% to 73%, while the share of those living in cities with over 100,000 inhabitants increases from 32% in 1993 to 42% in 2013. For other income groups, the share living in large cities falls from 1993 to 2003 but then rises again from 2003 onward.<sup>25</sup> Evidence also exists for increasing residency polarization over time; that is, in 2013 individuals in both the bottom and the top quintiles are more likely to live in large cities than those in the middle of the distribution.

These findings on rural-urban mobility suggest that those at the bottom of the income distribution are at least as likely to move to cities as those who are better off, and that changes in the regional allocation of the population do not compensate for the increase in nominal income inequality. These conclusions seemingly contrast with Moretti's (2013) finding for the U.S. that during 1980–2000, college-educated workers increasingly move to more expensive cities where they face larger increases in housing costs. Although Moretti argues that this finding explains about one quarter of the increase in the nominal wage difference between college and non-college workers, he also admits that these stark effects are limited to the college/non-college gap, while the 90/50 and 50/10 wage gaps are little affected by changes in the regional costs of living. These latter measures are more closely related to our analysis. Still, we undertake a detailed comparison with Moretti (2013) by repeating our analysis using skill groups (see Appendix C for detailed results). As Figure C1 shows, both high-skilled and low-skilled individuals are more likely to live in large cities than medium-skilled individuals, and the increase over time is higher for both high- and low-skilled.

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<sup>25</sup> These findings relate to the analysis by Kemper (2009) who characterizes the late 1990s as a period of “suburbanization” followed by a period of “reurbanization” during the 2000s. However, he doesn't distinguish between different income groups.

We then use information on regional price differences to assess how they affect both general inequality and inequality between skill groups (see Appendix C for details of the regional CPI). According to Table C2, the levels of the 50/10 ratio and 90/50 ratio in equivalized net household incomes are barely affected when regional price differences are accounted for. In line with the regional migration patterns described above, the increase in the 50/10 ratio over time becomes stronger (+23 pp instead of +22 pp between 1993-13), but the magnitude of the change is small. Furthermore, following Moretti (2013), we also analyze whether trends in wage inequality and skill premia (based on German administrative Social Security data) are reduced when accounting for regional price differences (see Tables C3 and C4).<sup>26</sup> Although controlling for regional price differences reduces the level of inequality slightly (particularly the high-skill vs. medium-skill gap given that college-educated workers are more likely to live in cities), the *increase* in inequality in real wages for both overall wages and skill wage premia is virtually the same irrespective of whether wages are deflated by different regional price indices.

Moretti (2013) argues that the welfare consequences of regional mobility depend on whether it is driven by labor market conditions or by movers' preferences for amenities in cities.<sup>27</sup> Here, we use SOEP data which have the advantage of including direct information on the main motives for the respondents' last residential move. As Table 2 shows, among those in the lowest quintile who recently moved from a rural area to a city, 35% cite job related reasons for the move. Among those that had made other moves (not from rural areas to cities), only 11% cite job related reasons. Results are similar for movers in other quintiles. Table C1

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<sup>26</sup> The data used are from the Sample of Integrated Employment Biographies (SIAB), with wage findings based on full-time workers aged 20-60, and estimated skill wage premia based on regressions of log wages on education (low/medium/high), experience, experience squared, age, age-squared, and dummies for gender and German citizenship.

<sup>27</sup> In a replication of Moretti (2013), Diamond (2016) argues that changes in amenities compensate high-skilled individuals for higher city housing costs.

also shows that rural-to-city moves in all skill groups are more strongly driven by job-related reasons. Overall, therefore, job-related reasons are key drivers for rural-to-city moves.

#### *4.2.4 Costs of Residential Mobility*

In addition to housing expenditures being higher in more urban areas, residential mobility *per se* involves costs for those who rent their home.<sup>28</sup> This is because during the period considered, rents for new contracts are freely negotiable, while rents for existing contracts are tied to the average local rent and can only be raised by up to 20% within any three-year period (see Fitzenberger and Fuchs 2017 and the literature cited therein). In fact, rent increases are far higher for movers than for stayers in all years, with the difference being particularly large during the 1990s (Figure 17, Panel A).<sup>29</sup>

Individuals in the lowest income quintile by far show the highest level of residential mobility (Figure 17, Panel B), which increase even further during the 1990s, making this group most vulnerable with regard to rent increases associated with a new lease. In contrast, homeownership rates are higher, and residential mobility is lower among high-income individuals, who are therefore affected much less by the strong rent increases for new leases. We conclude that residential mobility is a likely contributor to rising inequality in income net of housing expenditures.

#### *4.2.5 Provision of Social and Municipal Housing*

Many dwellings in the social housing sector are provided by private investors who receive public subsidies if they let the dwelling at a below-market rent. These requirements to

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<sup>28</sup> Although the U.S. literature typically focuses on mobility costs for homeowners only (see e.g., Bricker and Bucks 2016, Andersson and Mayock 2014, Ferreira et al. 2010), in the German context, in which a large part of the population and most low-income individuals rent, an analysis of mobility costs for renters is very important.

<sup>29</sup> In further analyses (available upon request), we also estimate the discount in rent for an additional year of residency length, both unconditionally and after regression adjustment for rental unit characteristics. The adjusted discount is slightly smaller in magnitude since dwellings with higher residency length also tend to be older and of lower quality. The conditional discount is larger in the 1990s (up to -0.8% per additional year of residency) with a particularly strong increase in new contract rents during that period. By the 2000s, however, the discount leveled off to around -0.4% per additional year of residency.

keep rents low typically expire after 20 years, after which social housing units lose their status and become part of the general private rental market. For many existing social housing units, this status expires during our observation period with few new units added (Gedaschko 2016). Likewise, municipal housing, owned or co-owned by city governments to provide housing for below-market rent, shrinks as municipalities increasingly privatize their housing stock to consolidate their budgets (Held 2011).

This strong decline in social and municipal housing between 1993 and 2003 is clearly illustrated by Figure 18, which shows the share of individuals in the lowest quintile living in social or municipal housing declining from about 29% in 1993 to 15% in 2013. The share of individuals living in social and municipal housing is highest for the lowest income quintile, although there is a strong decline until the mid-2000s for all income quintiles. Nonetheless, the share is much lower for higher income quintiles and by 2013 lies much below 10% for the second lowest to the highest quintile.<sup>30</sup>

In further analyses, we calculate the discount in housing expenditures of rental flats in the social or municipal sector compared to rental flats in the private sector, both raw and adjusted for housing characteristics.<sup>31</sup> Although the raw differential is substantial at around -20%, this difference is driven mainly by the lower quality of flats. Conditional on quality, the discount is between 5% and 8% in most years, with a slight decrease in recent years. Hence, in recent years, the social rent sector overall does not contribute much to lower housing expenditures for low-income individuals.

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<sup>30</sup> This trend speaks against Schier and Voigtländer's (2016) finding of a growing share of individuals in social and municipal housing whose income position has improved greatly since they moved in.

<sup>31</sup> The adjusted differential comes from a regression of log housing expenditures for renters, which additionally controls for a quadratic in dwelling size, dummies for dwelling equipment (with central heating, a garden, a balcony), a quadratic in years of housing tenure, dummies for federal state and city size, dummies for the number of adults in a household, and dummies for the number of children in the household.

### 4.3. Decomposition Analysis

To quantify how strongly the various factors documented above contribute to the trends in housing expenditure shares across income groups, we now perform a decomposition analysis in which we separate the 1993–2013 change in housing expenditure shares for each income quintile into a composition effect and a coefficients effect.<sup>32</sup>

Table 3 (Panel A) reports the 1993 and 2013 shares of housing expenditures by income quintile and the aggregate decomposition of the change over time. As discussed above, the share of housing expenditures increases the most for the lowest quintile (by 11.9 pp) while decreasing slightly for the highest quintile (by 2 pp). Changes in the coefficients explain part of this divergence as they have opposite impacts at the bottom and top of the distribution, inducing a 5 pp (42% of the total 11.9 pp) increase in the housing expenditure share for the bottom quintile but a 1.5 pp (75% of the total 2 pp) reduction for the top quintile. This differential development of the coefficients effect across the income distribution mirrors our finding in Section 4.1 that the relative cost of renting vs. homeownership increases over the 1993–2013 period. The bottom income quintile consists mainly of renters, who are more affected by rent increases, while the top income quintile consists mainly of homeowners with outstanding mortgages who can benefit from falling mortgage interest rates.

Composition changes also explain an important part of the divergence of housing expenditure shares. For the bottom income quintile, 6.9 pp (or 58%) of the increase in expenditure shares is due to the composition effect, while for the top quintile 0.6 pp (or 25%) of the decrease is explained by composition changes. Table 3 (Panel B) provides a further breakdown of the composition effect into the contributions of various factors. Changes in

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<sup>32</sup> More specifically, we compute  $\bar{y}_{13} - \bar{y}_{93} = \bar{X}_{13}\beta_{13} - \bar{X}_{93}\beta_{93} = \bar{X}_{13}(\beta_{13} - \beta_{93}) + \beta_{93}(\bar{X}_{13} - \bar{X}_{93})$ , where  $\bar{X}$  are average covariate levels and  $\beta$  are estimated parameters. We do not show the detailed decomposition of the coefficients effect because the relative size of individual variables is dependent on the base category for the categorical variables (see the corresponding discussion in Firpo et al. 2011).

household demographics (in particular, the rising share of single households) are a key factor for the bottom income quintile, explaining 3.3 pp (or 28%) of the increase in housing expenditure shares for this group. A second important factor is change in real income, which contributes 1.9 pp (16%). As demonstrated in Section 3.1, real income declines at the bottom of the distribution both during the 1990s and especially in the 2000s, which leads to an increase in the share of income spent by the bottom quintile on the necessity good of housing. Change in the regional allocation of individuals (*Region*) – that is, the movement of households to more expensive regions – is a third smaller contributor to the rise in housing expenditures at the lower end of the distribution. For individuals in the top income quintile, however, the same factors either decrease housing expenditure shares (e.g., *Income* or *Region*) or have far smaller effects (*Household Demographics*).

Improvements in housing quality clearly push up housing expenditure shares for all quintiles, but these effects are strongest for the 3<sup>rd</sup> quintile (+1 pp), and weaker for both the bottom (+0.6 pp) and the top (+0.4 pp) quintile. This observation is consistent with our finding in Section 4.2.2 that the 1990's construction boom increases housing space for the middle class to a greater extent than for the bottom or top of the income distribution. Changes in quality thus do not explain why the shares of low income individuals diverge so much from those of the rest. Changes in tenure type – that is, the rising homeownership rates seen primarily in the 1990s – work to decrease housing expenditures if owners pay less than renters conditional on quality (which, as demonstrated in Section 4.1, is indeed the case). Hence, as Table 3 shows, the effect of tenure type is negative for the higher quintiles who see an increase in homeownership rates over time (see Section 4.1) but positive for the bottom quintile whose homeownership rate decreases.

The findings for the EVS are confirmed in Table D1 by the results of the analogous decomposition using the SOEP data, highlighting again the strong roles of the coefficient effect, household demographics, and income. The SOEP data allow us to additionally

consider the role of changes in social housing and residential mobility. We find that neither contributes much to the increase in the share of income spent on housing by those in the bottom quintile.

## 5. Lifecycle Inequality and Intergenerational Trends

### 5.1. Permanent versus Transitory Inequality

Because part of cross-sectional income inequality in a given year may reflect transitory income shocks, it may overstate inequality over the lifecycle (Gottschalk and Moffit 1994). For example, if individuals in the bottom quintile in a given year were to move more quickly to a higher quintile in the next year, this rising income mobility could compensate the trend toward rising inequality. Moreover, households at the bottom might respond to higher housing expenditures by moving to cheaper accommodations. To address these possibilities, we use the panel dimension of the SOEP, calculate the within-person average of household income and housing expenditure over a five-year moving window, and compare these “long-term” measures to the respective yearly measures.<sup>33</sup>

Panels A-B in Figure 19 show evidence for income smoothing, as the levels of the 50/10 and 90/50 ratios are lower for five-year-average incomes than for yearly incomes. However, the *increase* in inequality, especially at the bottom, is also visible for the five-year-average. Likewise, the share of long-term housing expenditure over long-term income for the bottom quintile (shown in Figure 19, Panel C) is about 3 pp lower in levels than when yearly measures are considered, although the strong upward trend is similar. Overall, therefore, changes in year-to-year income mobility do not offset the rising inequality of yearly

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<sup>33</sup> The five-year average income in year  $t$  is calculated as  $\frac{1}{5} * (y_{t-2} + y_{t-1} + y_t + y_{t+1} + y_{t+2})$ . If an individual is not observable for the full five-year period, we only average over the years in which that person is observed. About 4% of individuals are not observable for at least three years and so are dropped.

incomes.<sup>34</sup> Moreover, as the results also suggest, households do not proportionately reduce real housing expenditures when real incomes fall. A possible reason is that rents for new contracts are often higher than rents for existing contracts, so that reducing housing expenditures would mean substantially reducing housing quality (see Section 4.2.4).

## 5.2. Cohort Effects and Intergenerational Trends

Two other important questions implied by the research are how these inequality trends affect subsequent cohorts and what implications they have for intergenerational inequality. Table 4a, which reports the 50/10 and 90/50 ratios of net equivalized household income within different birth cohorts and age groups, illustrates a typical age profile of inequality. That is, the 50/10 ratio is high among individuals aged 20–29 (when some are still in education and have low income, while others are already working) and then decreases in the 30–39 age range before increasing again up until the 50–59 range (reflecting the steeper earnings growth of individuals with high income). Successive cohorts, however, begin with higher inequality at any given age, with a 50/10 ratio of 1.63 for 30–39 year olds in the 1954–63 cohort, 1.70 for those in the 1964–73 cohort, and 1.83 for those in the 1974–83 cohort. The increase in the 90/50 ratio is similar across cohorts, albeit more muted.

Also, the share of income spent on housing has changed across cohorts, both overall and for the bottom and the top income quintile (Table 4b, Panels A-C).<sup>35</sup> When pooling all income groups, we find a moderate increase in the share of income spent on housing across cohorts by age. For instance, the average share of income spent on housing by those aged 20–29 increases from 19.4% for the 1964–73 cohort to 24.2% for the 1984–93 cohort (Panel A). Moreover, there are strong differences across income quintiles, with the share of income spent

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<sup>34</sup> Our results confirm previous analyses that show falling wage and income mobility in Germany since the 1990s (see Riphahn and Schnitzlein 2016, Grabka and Goebel 2013). Bönke et al. (2015) also document higher *lifetime* earnings inequality for German cohorts born in the 1960s than for previous cohorts.

<sup>35</sup> The quintiles are defined within each cohort-age group cell.

on housing increasing strongly across cohorts for all age groups in the bottom income quintile (e.g., by 11.4 pp and 14 pp for those aged 20–29 and 50–59, respectively) but remaining constant or even falling for those in the top income quintile (e.g., no change for the 20–29 age range and a decline of 2 pp for those aged 50–59). Finally, homeownership rates change both within and across cohorts (Table 4b, Panels D-F).<sup>36</sup> For a given cohort, the share of homeowners increases with age. Within age groups, this share increases until the 1964-73 cohort, but then declines for younger cohorts. To illustrate, the share of homeowners at age 30–39 is 36.7% for the 1954–63 cohorts, increases to 44.4% for the 1964–73 cohorts, and then declines to 40.8% for the 1974–83 cohorts (Panel D). The drop in homeownership rates for younger cohorts seems to affect both the bottom and top income quintiles (Panels E-F), and may reflect changing patterns of household and family formation.

Taken together, we find that more recent cohorts show higher income inequality at any age. Moreover, low-income individuals in more recent cohorts spent considerably more on housing than low-income individuals of previous generations, and experience falling homeownership rates. This implies that low-income individuals among the young in particular will have lower savings and wealth to accumulate over their lifetime.

## **6. Discussion and Conclusions**

By analyzing the trends in inequality of household income and housing expenditures – the largest component of household consumption – over the last two decades in Germany, we demonstrate that inequality in income after housing expenditures increases more than that before housing expenditures, with the 50/10 ratio increasing threefold once housing expenditures are considered. For the bottom income quintile, the share of income spent on

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<sup>36</sup> Individuals who live with homeowning parents are not counted as homeowners, an exclusion that is mainly relevant for the 20-29 age group.

housing rises considerably, while for other income quintiles it increases much less or even slightly declines.

These trends can be attributed to several factors. First, an increase in rental prices during the 1990s makes renting more expensive, while for owner-occupiers, housing expenditures rise far less and even fall after the mid-2000s because of falling mortgage interest rates and lower outstanding mortgages. Altogether, this has distributional consequences given that owners are more likely to be from the upper part of the income distribution. In calculating net imputed rents for homeowners, we find a sharp decrease in the relative costs of homeownership versus renting. Additional factors that contribute to rising housing expenditures at the lower end of the income distribution include compositional changes, mainly in household structure (a rising share of single households) and regional migration patterns (a rising share of those living in large cities and in West Germany). The decline in the provision of social housing plays only a minor role. Finally, the share of income spent on housing as a necessity good is further increased by declining real income among individuals at the lower end of the income distribution.

Many of the above findings mirror those for Anglo-Saxon countries. For example, rising housing expenditure shares, especially for renters and low-income individuals, are documented for both the U.S. (Quigley and Raphael 2004, Albouy et al. 2016, Larrimore and Schuetz 2017) and the UK (Belfield et al. 2015). However, the *magnitude* of both levels and changes is more moderate in Germany.<sup>37</sup> At the same time, in contrast to the UK, where per capita household living space falls (Belfield et al. 2015), housing quality for low-income individuals in Germany improves over time. In fact, homeownership rates in Germany

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<sup>37</sup> For example, 2014 data from the OECD Affordable Housing Database show that for renters in the bottom income quintile, the median share of income spent on rents (excluding heating costs and utilities) was 27% in Germany, 42% in the UK, and 50% in the U.S. The OECD data, however, concern the household level and exclude heating costs and utilities, so the expenditure shares for Germany are lower than the shares reported in our paper (see <http://oe.cd/ahd> for further information). Using the OECD definition for the EVS data used in our paper, we obtain an income share spent on rents of 28% in the lowest income quintile, which is quite similar to the number reported by the OECD.

slightly decrease for the most recent cohorts, although the changes across generations are far smaller than in the U.S. or UK (Goodman and Mayer 2018, Belfield et al. 2015).<sup>38</sup> Interestingly, in contrast to Moretti's (2013) reported findings for the U.S., trends in regional mobility toward more expensive areas do not mitigate trends in inequality in Germany.

Although the recent developments in housing expenditures in Germany are relatively modest when considered in an international context, the strong rise in inequality of after-housing disposable income is nonetheless important. For the bottom income quintile, the sizeable increase in the share of income spent on housing is associated with an overall decrease in savings, which fall from 2% to -1%, and with a decrease in the share with positive savings from 64% to 53%. For all other income quintiles, savings rates are higher and decrease by less.

This development is worrying not only because of its immediate impact on savings but for its long-term effect on wealth accumulation at a time of significantly reduced public pension benefits and government efforts to stimulate private savings as complementary retirement funding, moving the German model closer to that of Anglo-Saxon countries. In this context, our findings that a large and growing share of low-income individuals do not save is especially concerning,<sup>39</sup> especially given that lower access to mortgages in Germany (relative to the U.S. and UK) reduces the possibility of wealth accumulation through housing property, particularly for the less well-off. Rising inequality in savings is thus even more likely to contribute to higher wealth inequality in the future.<sup>40</sup>

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<sup>38</sup> For example, Belfield et al. (2015) report that homeownership at age 25 in the UK more than halves between cohorts born in the mid-1960s (45%) and those born in the mid-1980s (20%). For the U.S., Goodman and Mayer (2018) report a sharp decline in homeownership among young individuals aged 25–34, down from 49% in 2005 to 35% in 2015.

<sup>39</sup> See also Corneo et al. (2009) who conclude that attempts to boost the savings rate of low-income households via government subsidies have so far not been successful.

<sup>40</sup> For the US, Kuhn et al. (2017) show that housing wealth is the most important component of the wealth portfolio for the middle class, and that changes in the housing market are key drivers for wealth inequality. Saez and Zucman (2016) show that rising inequality of savings rates in the US over the last decades are a driver for rising wealth inequality.

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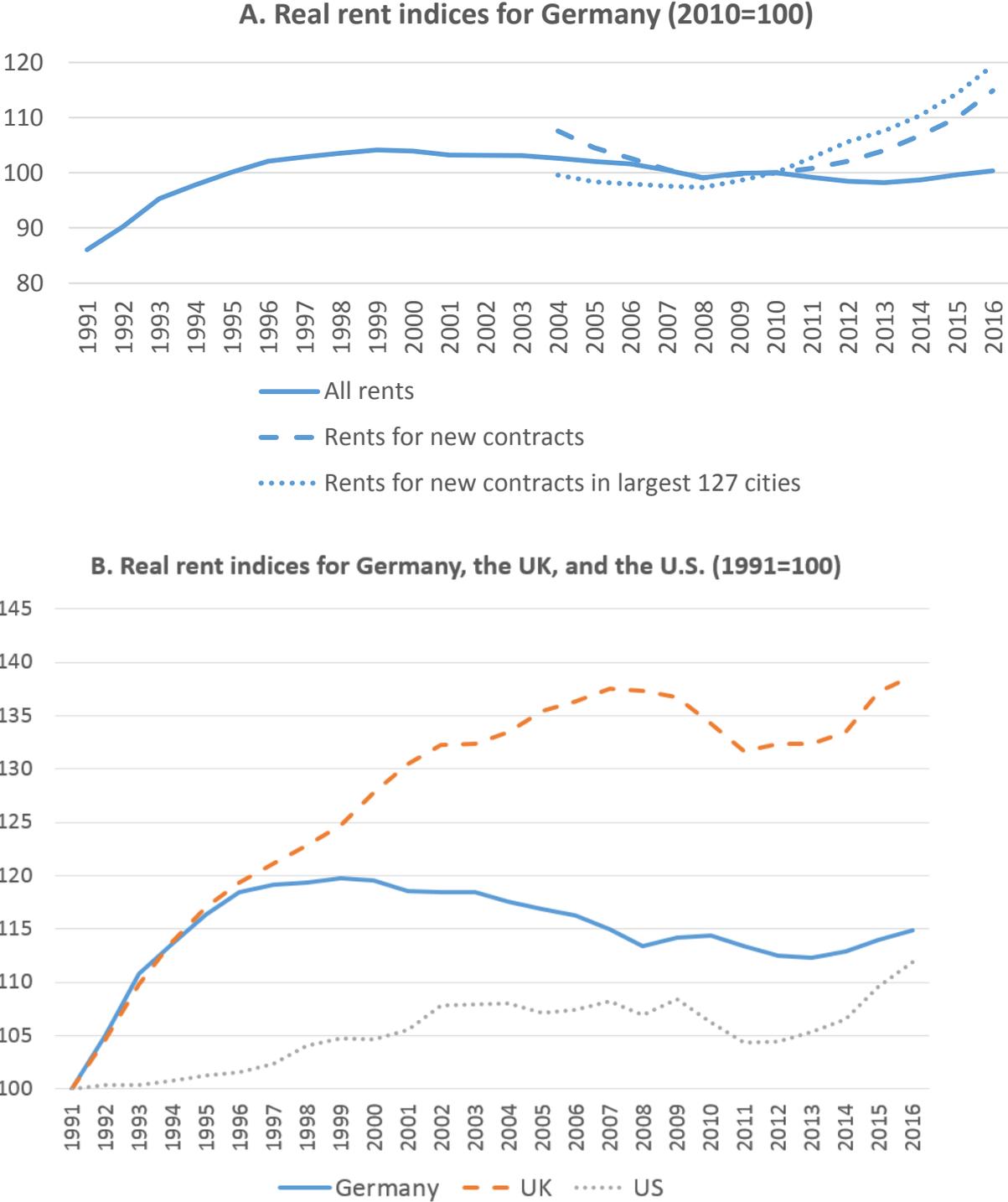
## Tables and Figures

**Table 1: Percent of households living in various tenure types (2014)**

	All households	Income quintile				
		Lowest	2nd	3rd	4th	Highest
<i>Germany:</i>						
Renters	54.7	77.2	60.2	51.1	44.6	35.0
Owner with mortgage	19.0	5.4	13.6	20.0	25.8	33.9
Owner outright	26.0	16.9	25.9	28.4	29.5	30.9
<i>US:</i>						
Renters	34.9	59.0	41.4	32.1	24.1	16.8
Owner with mortgage	40.3	15.6	29.3	42.2	53.7	61.4
Owner outright	22.9	21.4	26.8	24.1	21.1	21.2
<i>UK:</i>						
Renters	35.6	48.4	49.7	36.7	24.6	14.0
Owner with mortgage	30.7	14.4	18.4	29.8	42.2	54.1
Owner outright	32.6	35.4	31.1	32.6	32.4	31.2

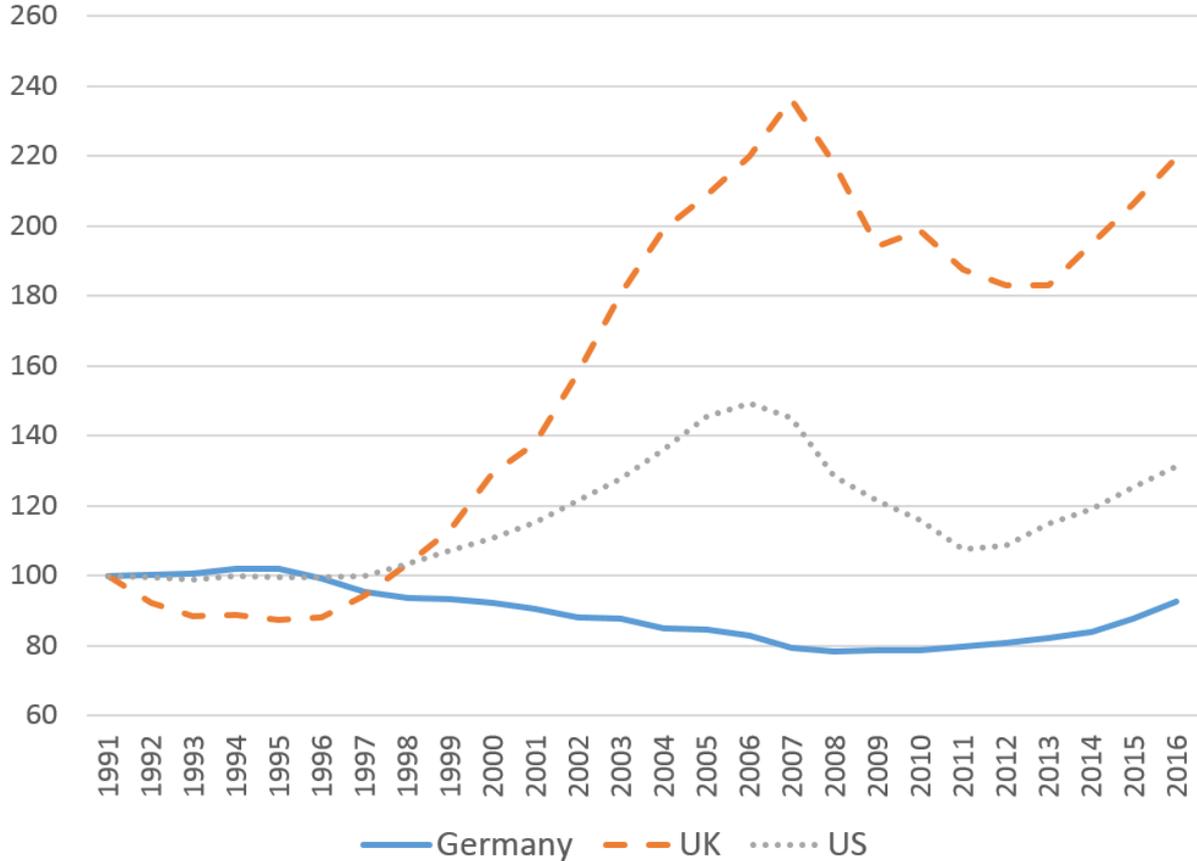
Source: OECD Affordable Housing Database, available at: <http://oe.cd/ahd>

**Figure 1: Real rent indices**



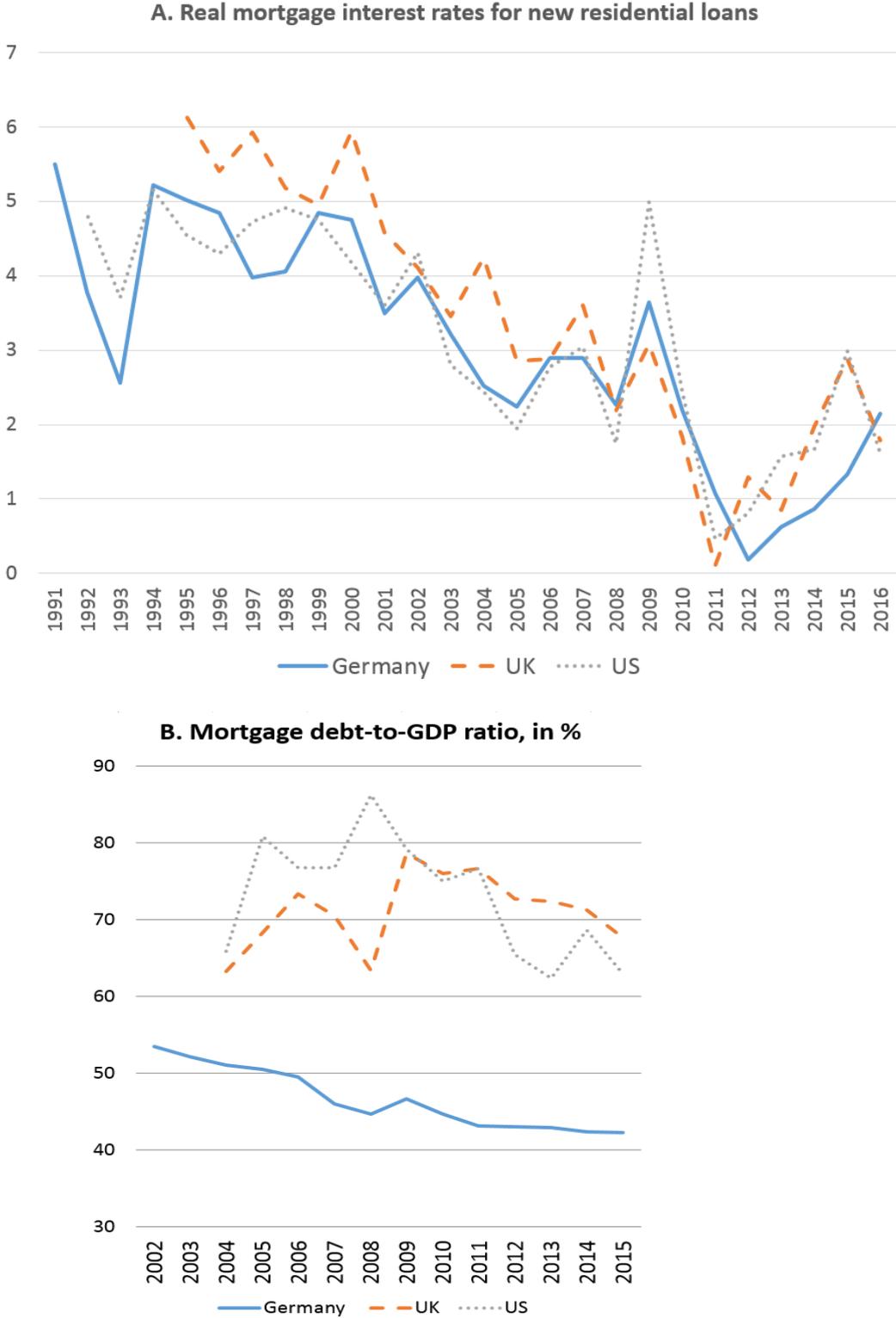
Sources: Index for all rents: German Statistical Office (2016). Index for rents for new contracts: BBSR (only available from 2004 onward). Index for rents in top 127 cities: Bundesbank. U.S. and UK indices come from the OECD Analytical house price indicators, available at: [https://stats.oecd.org/Index.aspx?DataSetCode=HOUSE\\_PRICES](https://stats.oecd.org/Index.aspx?DataSetCode=HOUSE_PRICES). All indices are deflated using the CPI for each country.

**Figure 2: Real house price indices (1991=100)**



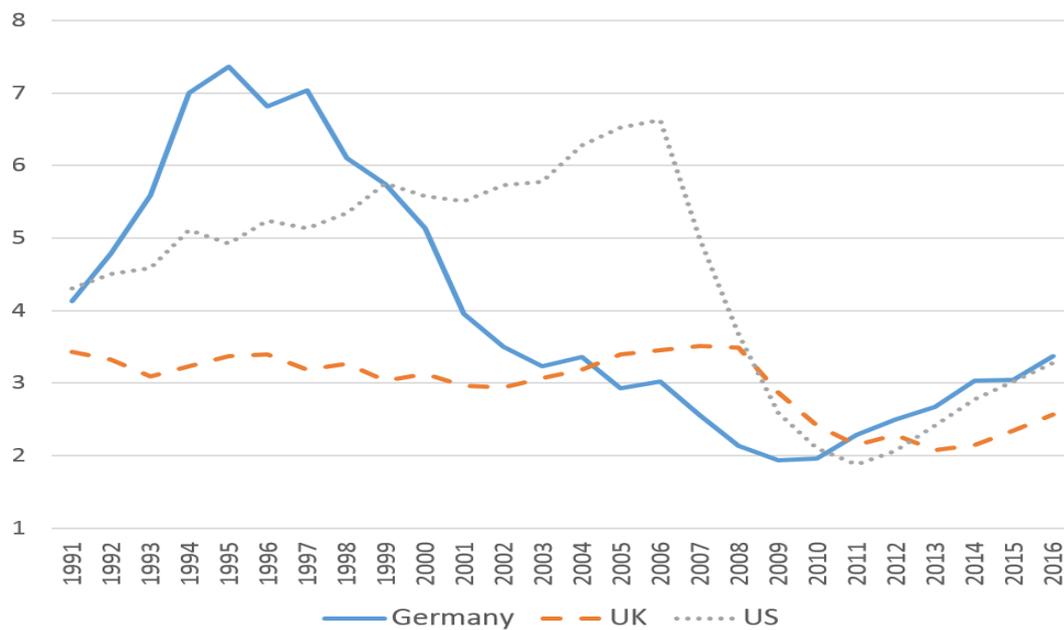
Sources: OECD Analytical house price indicators, available at: [https://stats.oecd.org/Index.aspx?DataSetCode=HOUSE\\_PRICES](https://stats.oecd.org/Index.aspx?DataSetCode=HOUSE_PRICES) House prices include prices for the sale of newly-built and existing dwellings. All indices are deflated using the CPI for each country.

**Figure 3: Changes in mortgage interest rates and mortgage debt**



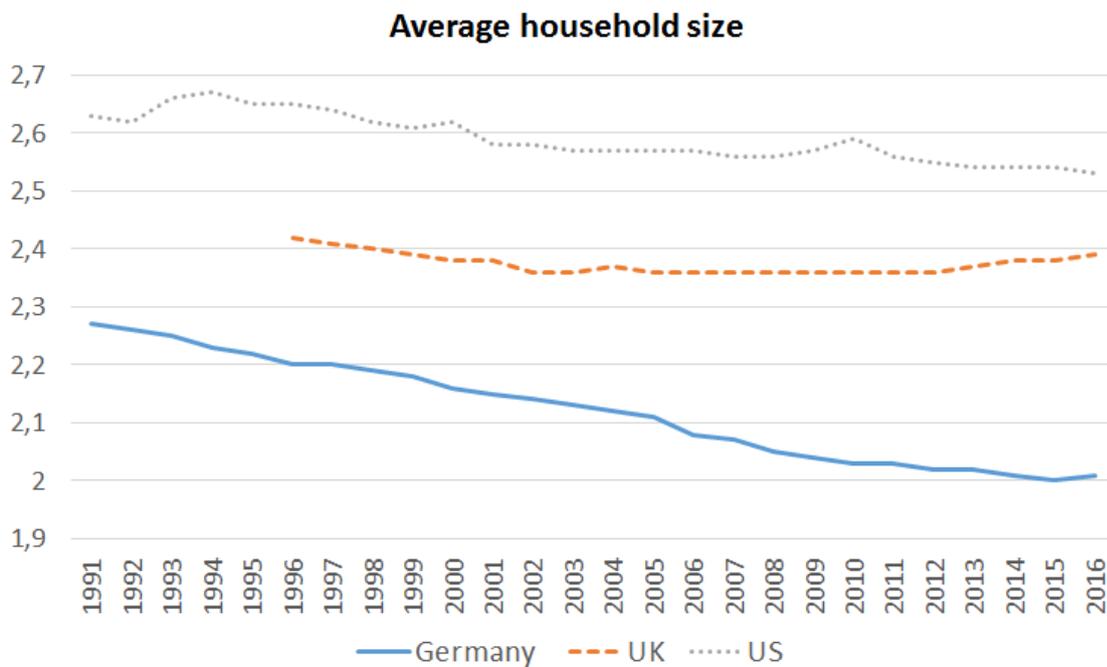
Sources: German and UK interest rates are for five-year fixed rate mortgages, U.S. interest rates are for 15-year fixed rate mortgages. Data on interest rates come from the Association of German Pfandbrief Banks (Germany), Bank of England (UK), and the St. Louis Fed/Fannie Mae/Freddie Mac (US). All interest rates are converted to real rates using the CPI for each country. Data on mortgage debt and GDP come from the Hypostat (2015) report by the European Mortgage Federation.

**Figure 4: Number of newly completed housing units relative to population (per 1,000 inhabitants)**



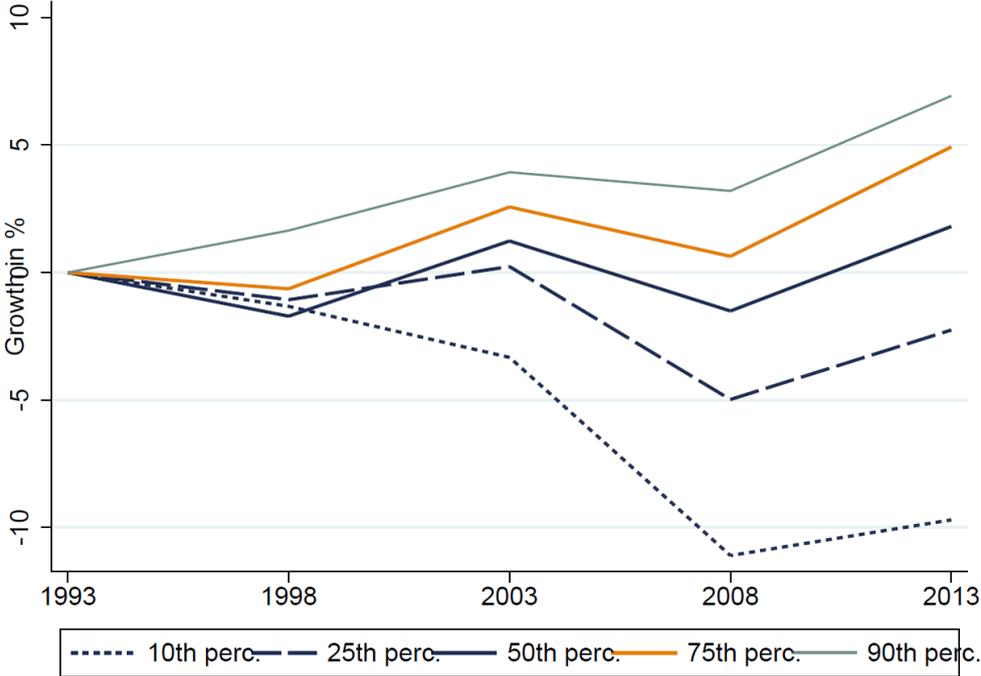
Sources: Germany: German Statistical Office; UK: Office for National Statistics (population), Department for Communities and Local Government (new construction); U.S.: Census Bureau.

**Figure 5: Demographic Trends**



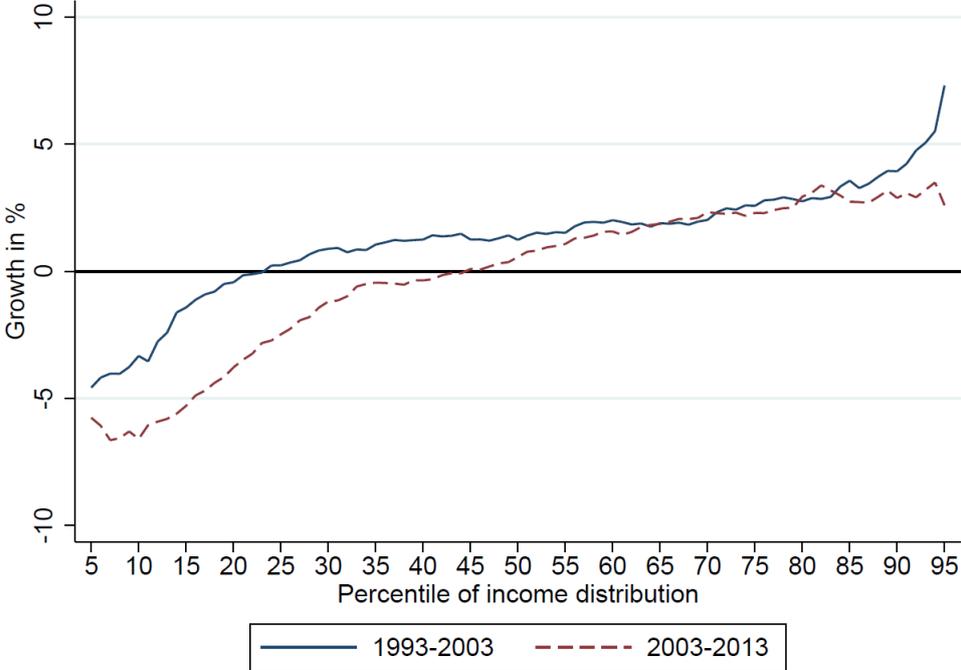
Source: Germany: German Statistical Office, UK: Office for National Statistics, U.S.: Census Bureau.

**Figure 6: Cumulative real growth of equivalized net household income, relative to 1993**



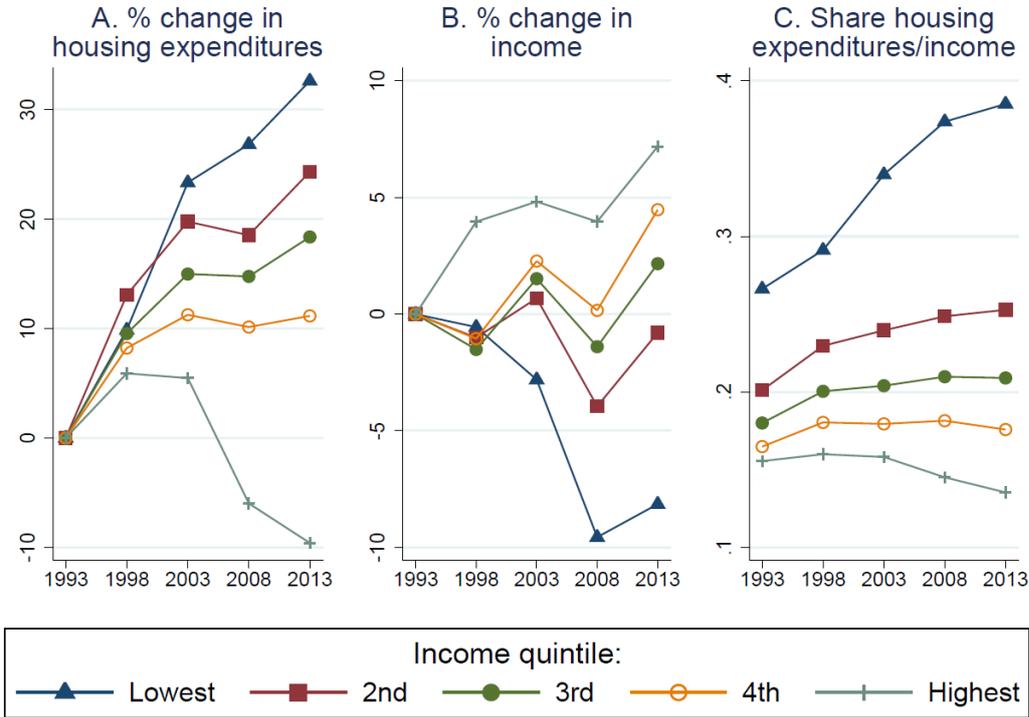
Source: EVS, author calculations.

**Figure 7: Percent real growth in equivalized net household income, by percentile**



Source: EVS, author calculations.

**Figure 8: Housing expenditures and income, by income quintile**



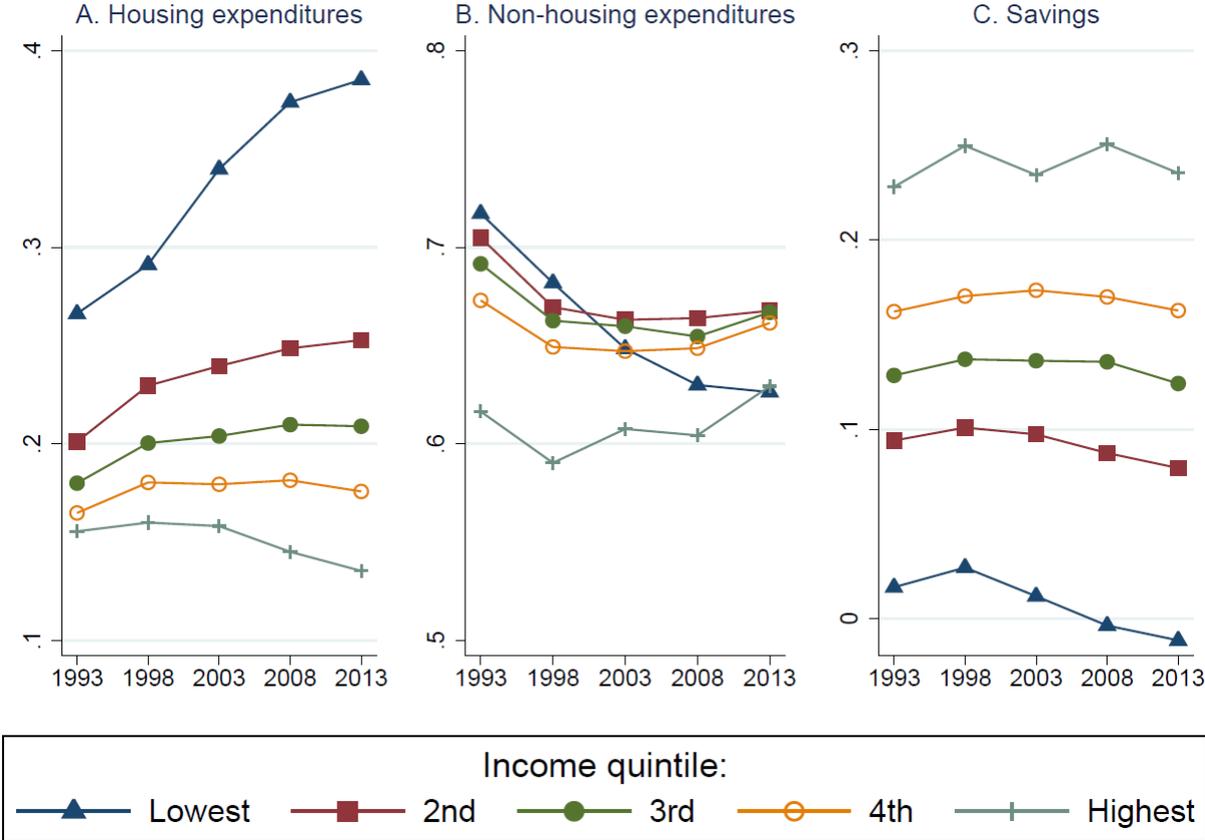
Source: EVS, author calculations.

**Figure 9: Inequality of equivalized net household income – before and after housing expenditures**



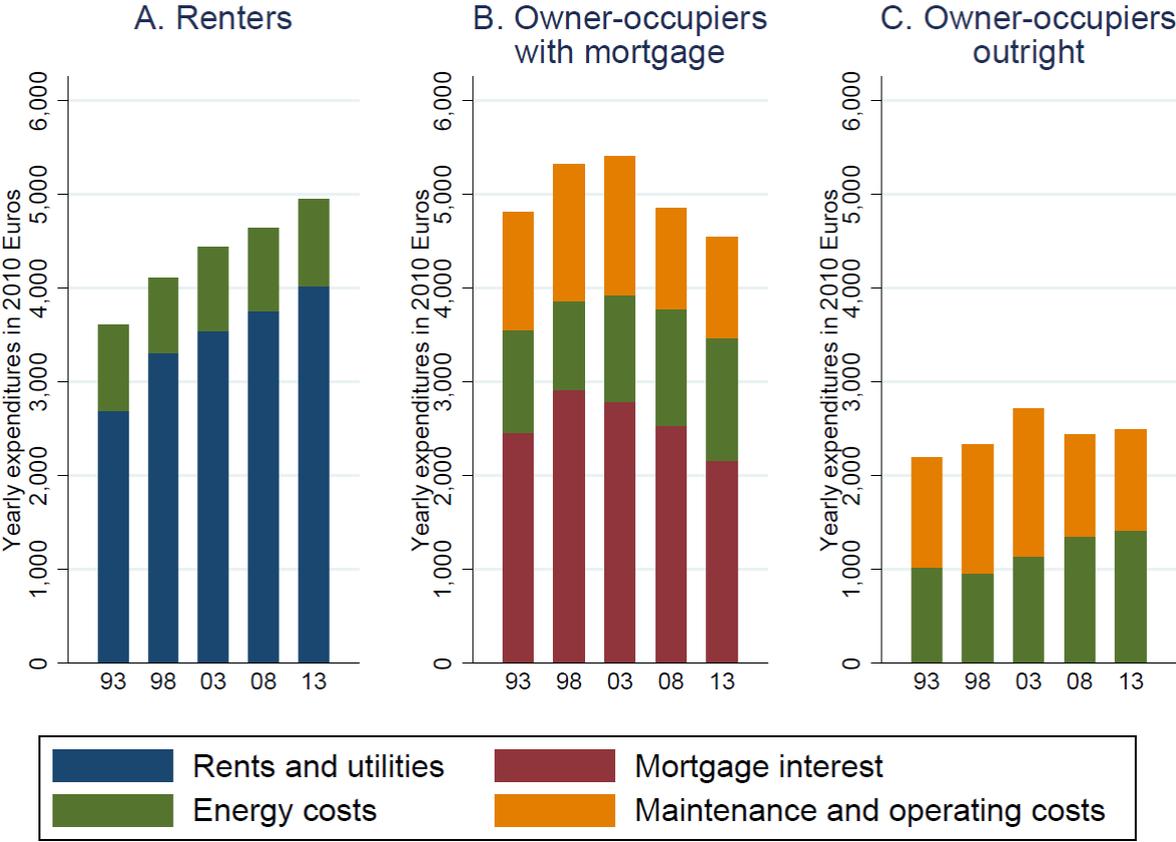
Source: EVS, author calculations.

**Figure 10: Expenditure shares by quintile of equivalized net household income**



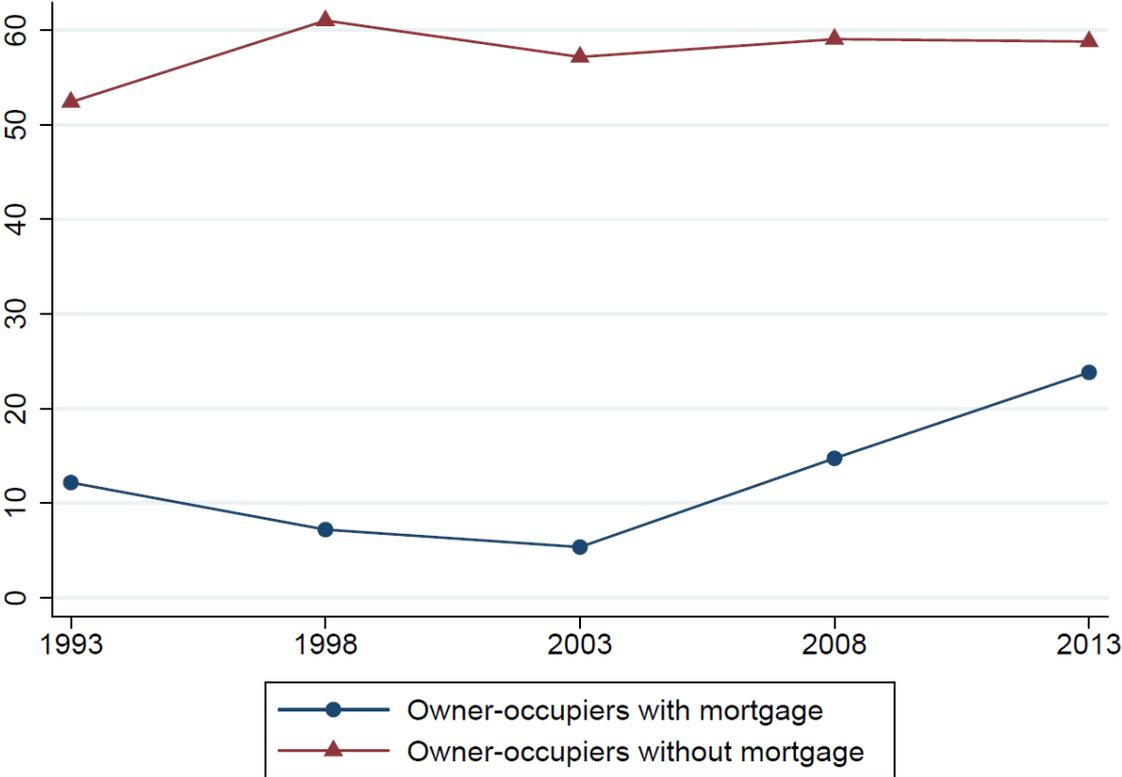
Source: EVS, author calculations.

**Figure 11: Components of equivalized housing expenditures, by type of house tenure**



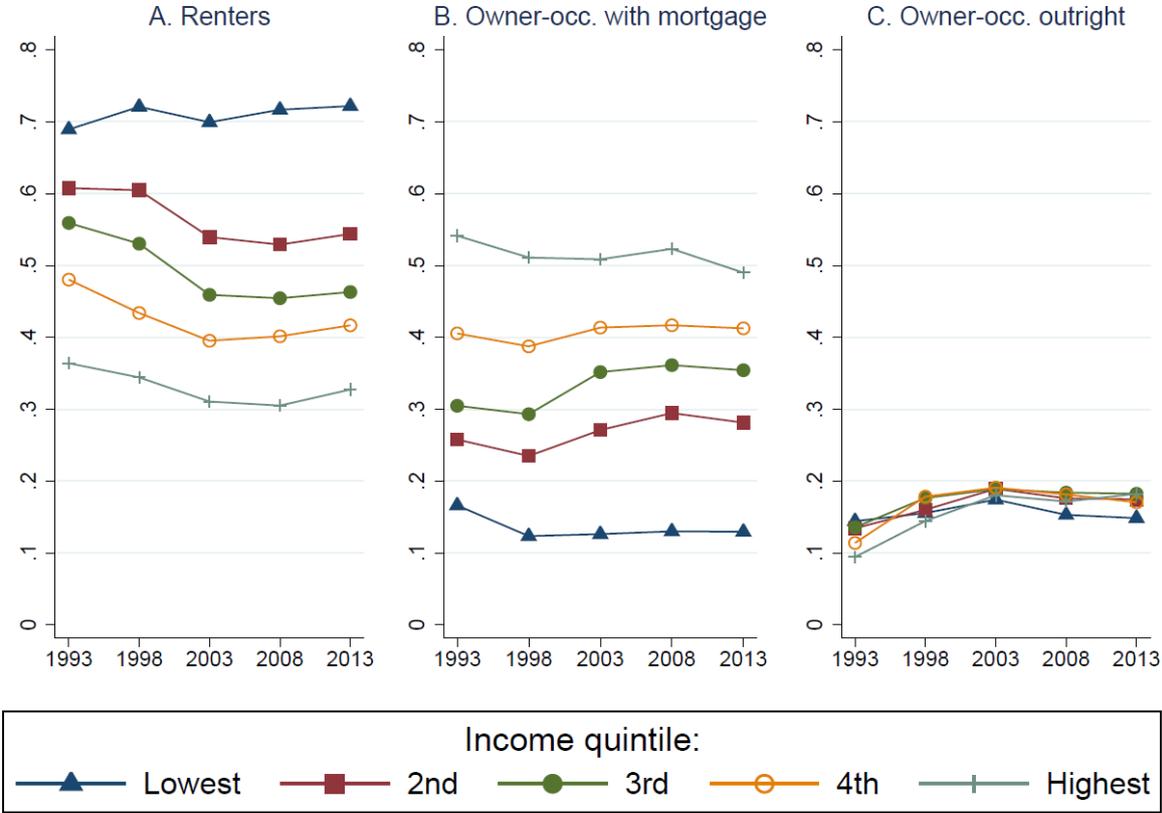
Source: EVS, author calculations.

**Figure 12: Median relative net imputed rents (NIR) for owner-occupiers in percentages**



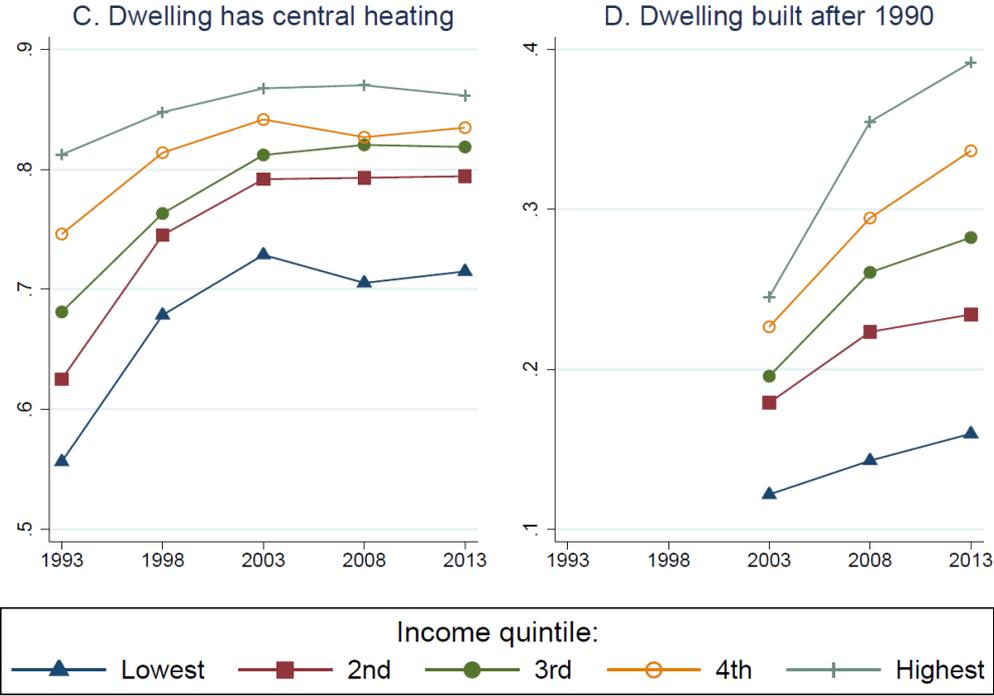
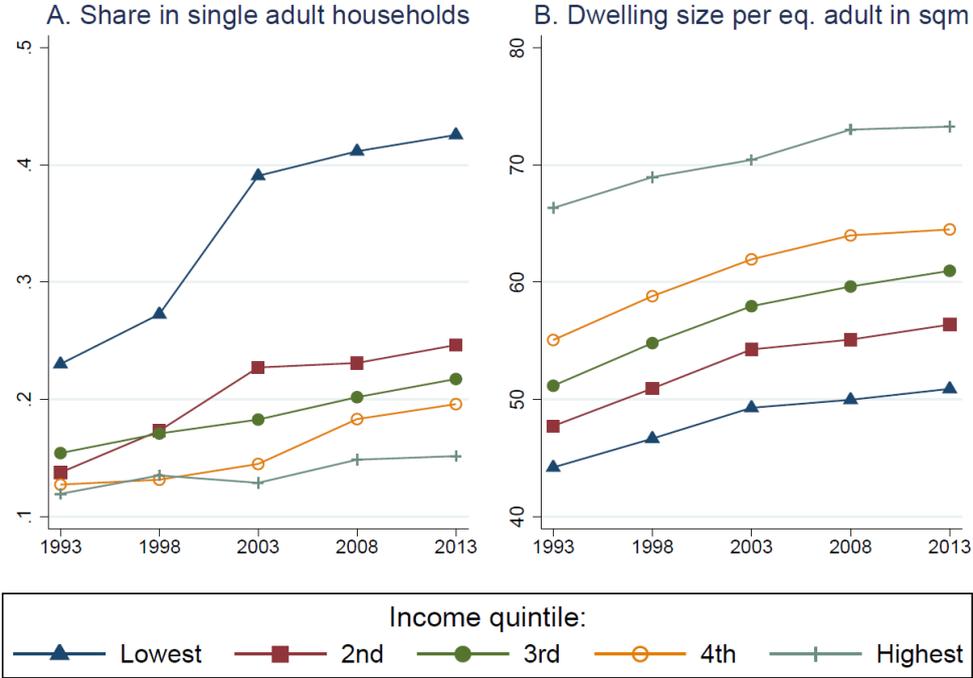
Source: EVS, author calculations.

**Figure 13: Share of tenure types, by quintile of equivalized net household income**



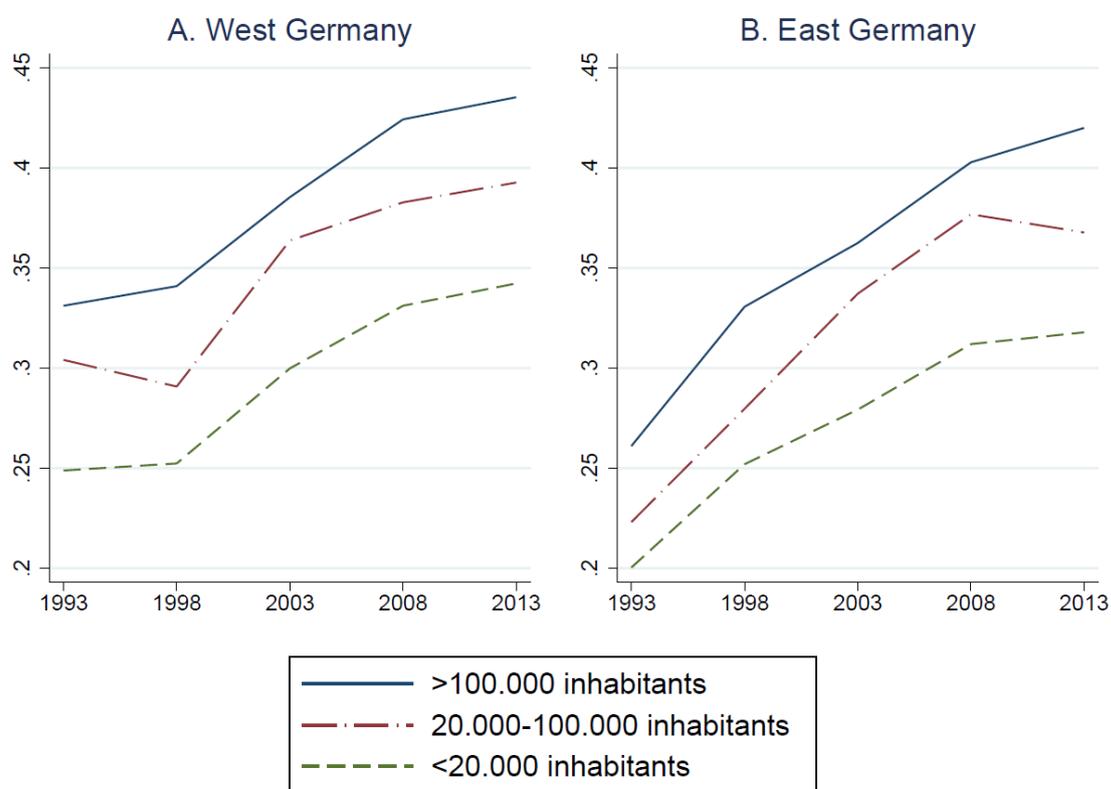
Source: EVS, author calculations.

**Figure 14: Housing conditions, by quintile of equivalized net household income**



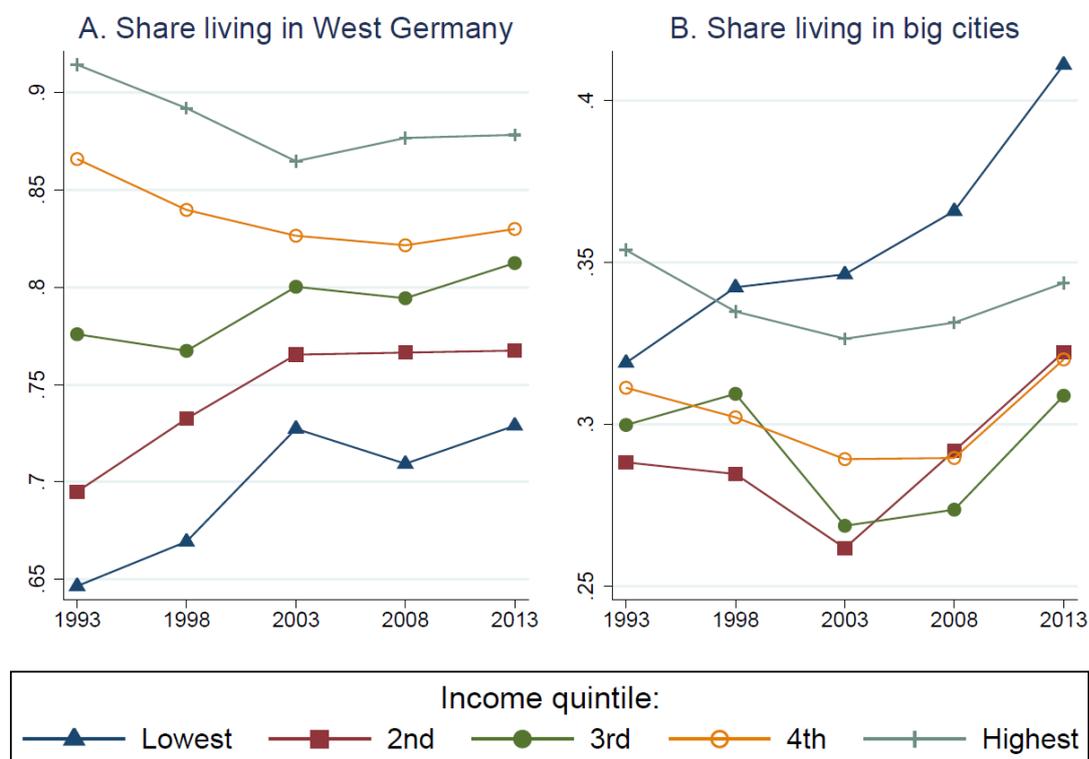
Source: EVS, author calculations.

**Figure 15: Regional differences in the share of income spent on housing, for lowest income quintile**



Source: EVS, author calculations.

**Figure 16: Regional distribution, by quintile of equivalized net household income**



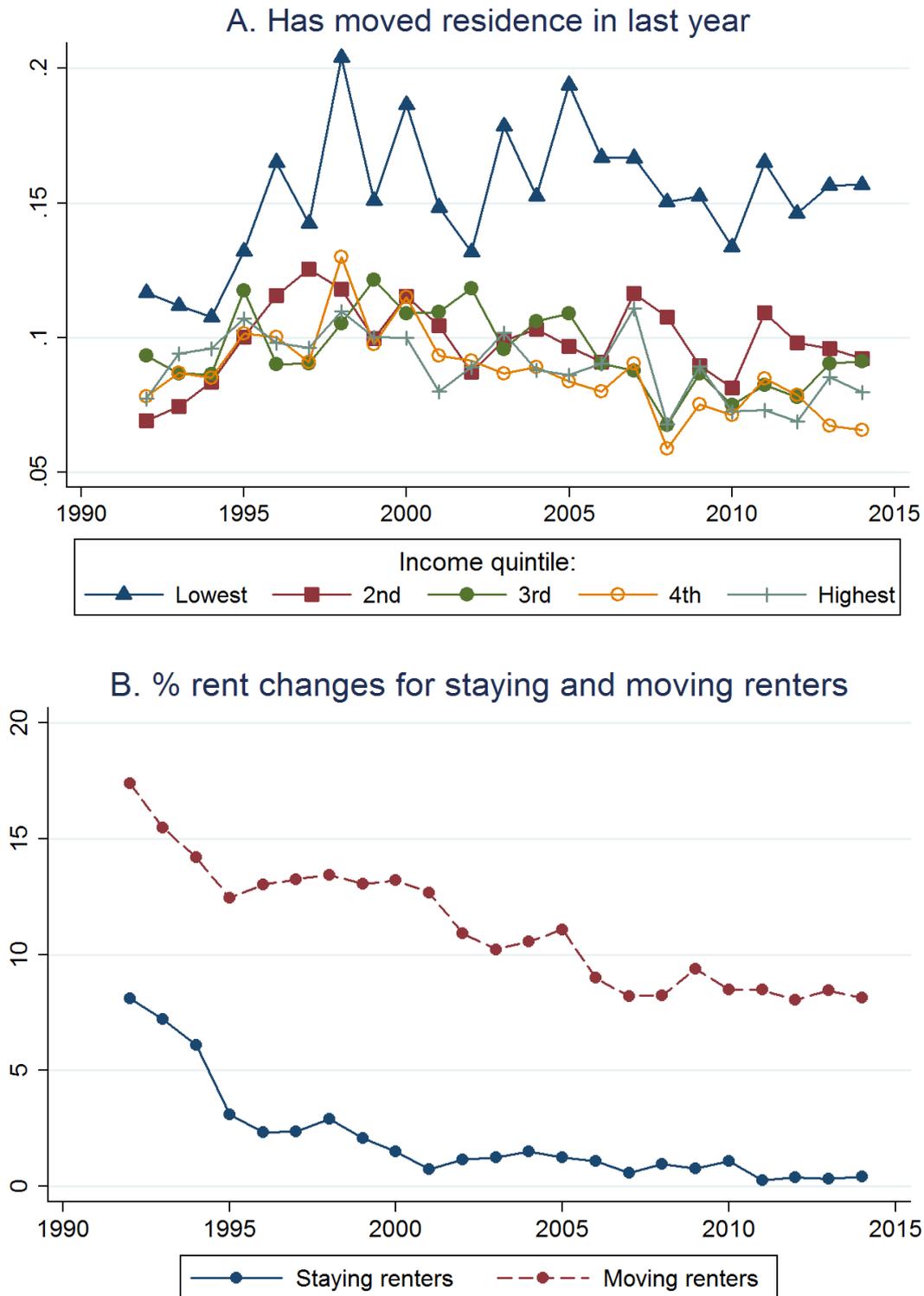
Source: EVS, author calculations.

**Table 2: Reasons for residential moves, in percentages**

	Lowest income quintile		2nd-4th income quintile		Highest income quintile	
	Rural-to-city moves	Other moves	Rural-to-city moves	Other moves	Rural-to-city moves	Other moves
Job reasons	35.0	10.7	37.8	9.6	36.7	13.1
Family reasons	40.2	40.3	40.7	35.1	36.2	30.8
Old dwelling too small/too big	11.8	32.9	13.9	31.4	16.9	23.4
Bought own home	1.3	3.9	2.5	15.4	5.3	25.5
Other reasons	11.7	12.1	5.2	8.6	4.6	7.2

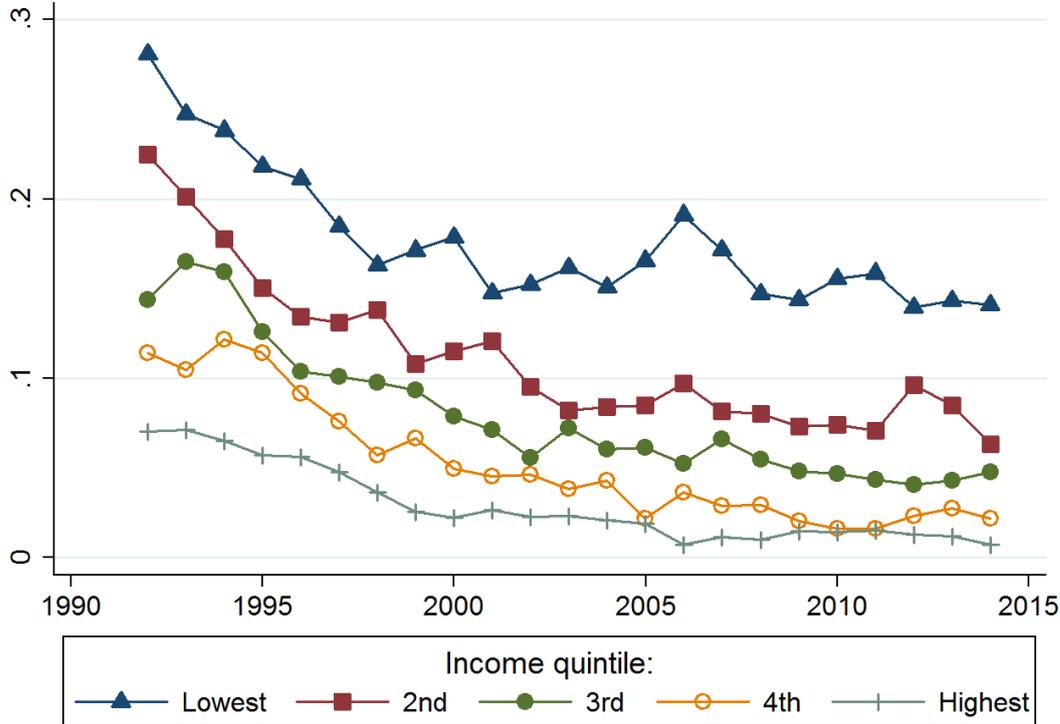
Source: SOEP, author calculations. Survey question: “What was the main reason for your last residential move?”

**Figure 17: Changes in residential mobility**



Source: German Socio-Economic Panel (SOEP), author calculations.

**Figure 18: Share of individuals in social/municipal rental housing**



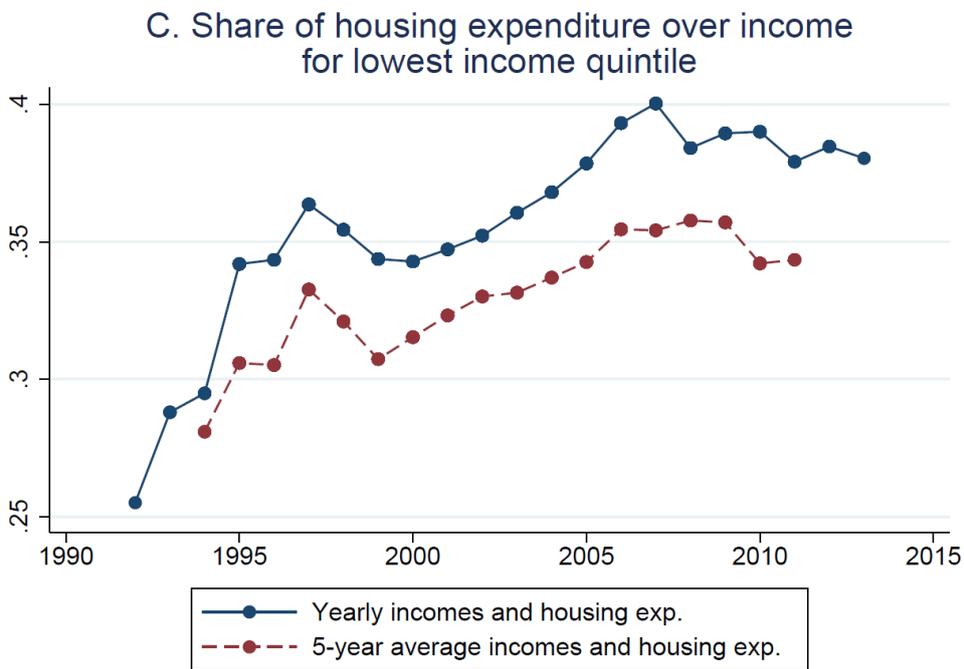
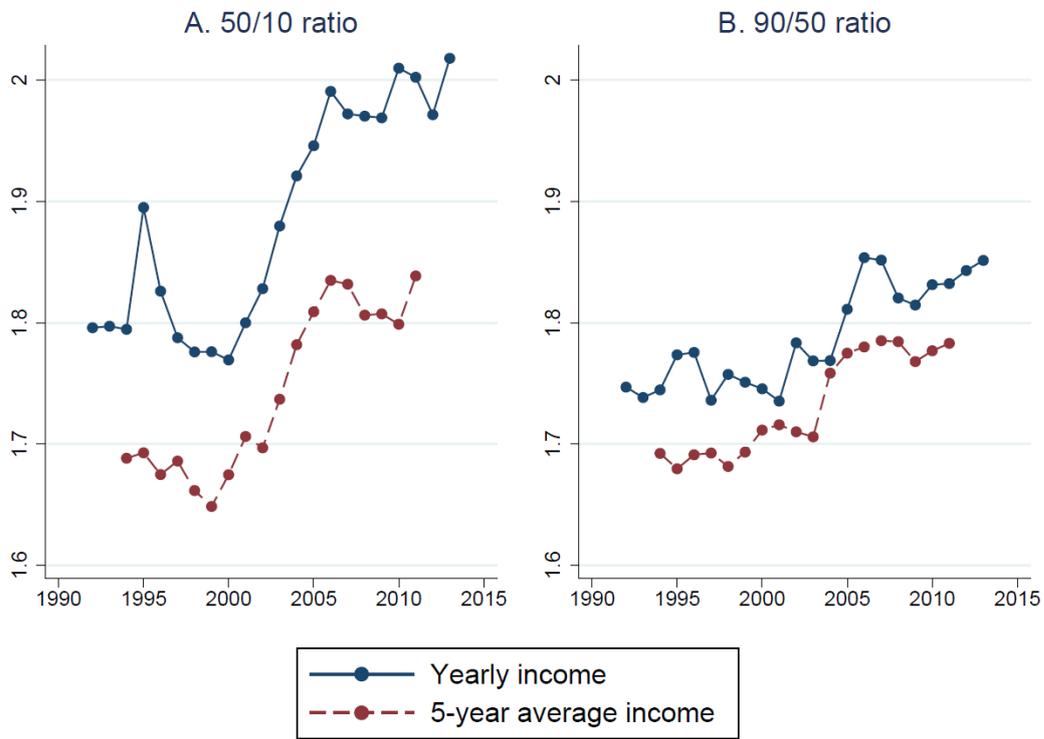
Source: German Socio-Economic Panel (SOEP), author calculations.

**Table 3: Decomposition of changes in housing expenditure shares, 1993 to 2013 (EVS)**

	Quintile of equivalized net household income				
	Q1	Q2	Q3	Q4	Q5
<i>A. Aggregate decomposition</i>					
1993	0.266*** (0.002)	0.201*** (0.001)	0.180*** (0.001)	0.165*** (0.001)	0.155*** (0.001)
2013	0.385*** (0.002)	0.253*** (0.001)	0.209*** (0.001)	0.176*** (0.001)	0.135*** (0.001)
Change	0.119*** (0.002)	0.052*** (0.002)	0.029*** (0.001)	0.011*** (0.001)	-0.020*** (0.001)
Coefficients	0.050*** (0.003)	0.032*** (0.002)	0.019*** (0.002)	0.005** (0.002)	-0.015*** (0.001)
Composition	0.069*** (0.002)	0.020*** (0.001)	0.010*** (0.001)	0.006*** (0.001)	-0.006*** (0.001)
<i>B. Detailed decomposition of the composition effect</i>					
Household Demographics	0.033*** (0.002)	0.010*** (0.001)	0.004*** (0.001)	0.005*** (0.001)	0.002*** (0.000)
Region	0.010*** (0.001)	0.005*** (0.001)	0.002*** (0.000)	0.001 (0.001)	-0.001* (0.001)
Tenure Type	0.001 (0.001)	-0.004*** (0.001)	-0.004*** (0.001)	-0.003*** (0.000)	-0.008*** (0.000)
Dwelling Quality	0.006*** (0.001)	0.008*** (0.001)	0.010*** (0.001)	0.007*** (0.000)	0.004*** (0.000)
Income	0.019*** (0.001)	0.001* (0.000)	-0.002*** (0.000)	-0.003*** (0.001)	-0.003*** (0.000)

Note: The table shows a Blinder-Oaxaca decomposition of changes in housing expenditure shares separately for each quintile of equivalized net household income. *Household Demographics* includes dummies for the number of adults in the household, dummies for the number of children, dummies for 4 age groups (20–29, 30–39, 40–49, 50–59), and a dummy for German nationality. *Region* includes dummies for 16 federal states and 4 categories of city size. *Tenure Type* includes dummies for being a renter, owner with mortgage, or owner without mortgage. *Dwelling Quality* includes a cubic in household size and dummies for whether the dwelling is equipped with central heating or a garage. *Income* includes a cubic in eq. net household income. Standard errors are in parentheses. The counterfactual used for the decomposition is based on the composition in 2013 and the coefficients in 1993. Source: EVS, author calculations.

**Figure 19: Yearly income vs. income averaged over five years**



Source: German Socio-Economic Panel (SOEP), author calculations. For year  $t$ , the five-year average of income and housing expenditure is calculated as a moving average:  $\frac{1}{5} * (y_{t-2} + y_{t-1} + y_t + y_{t+1} + y_{t+2})$ .

**Table 4a: Cohort changes in income inequality**

	Birth cohort					
	1934-43	1944-53	1954-63	1964-73	1974-83	1984-93
<i>50/10 ratio of eq. net hh. income</i>						
Age 20-29				1.828	1.898	1.912
Age 30-39			1.629	1.698	1.832	
Age 40-49		1.787	1.804	1.885		
Age 50-59	1.815	2.048	2.152			
<i>90/50 ratio of eq. net hh. income</i>						
Age 20-29				1.701	1.753	1.780
Age 30-39			1.820	1.836	1.888	
Age 40-49		1.865	1.897	1.943		
Age 50-59	1.895	1.966	2.015			

Source: EVS, own calculation.

**Table 4b: Cohort changes in homeownership and housing expenditure shares**

	Birth cohort					
	1934-43	1944-53	1954-63	1964-73	1974-83	1984-93
<i>A. Share of income spent on housing: All</i>						
Age 20-29				0.194	0.229	0.242
Age 30-39			0.212	0.231	0.231	
Age 40-49		0.190	0.218	0.221		
Age 50-59	0.189	0.221	0.233			
<i>B. Share of income spent on housing: Lowest income quintile</i>						
Age 20-29				0.274	0.355	0.388
Age 30-39			0.269	0.326	0.350	
Age 40-49		0.257	0.328	0.361		
Age 50-59	0.277	0.360	0.417			
<i>C. Share of income spent on housing: Top income quintile</i>						
Age 20-29				0.143	0.148	0.143
Age 30-39			0.180	0.167	0.149	
Age 40-49		0.161	0.156	0.138		
Age 50-59	0.144	0.146	0.124			
<i>D. Share of homeowners</i>						
Age 20-29				0.132	0.140	0.113
Age 30-39			0.367	0.444	0.408	
Age 40-49		0.549	0.577	0.587		
Age 50-59	0.563	0.600	0.608			
<i>E. Share of homeowners: Lowest income quintile</i>						
Age 20-29				0.061	0.049	0.038
Age 30-39			0.258	0.279	0.237	
Age 40-49		0.399	0.365	0.358		
Age 50-59	0.422	0.371	0.335			
<i>F. Share of homeowners: Top income quintile</i>						
Age 20-29				0.252	0.290	0.197
Age 30-39			0.471	0.542	0.490	
Age 40-49		0.721	0.731	0.722		
Age 50-59	0.744	0.788	0.803			

Source: EVS, author calculations.

## **Appendix A: Data Appendix**

### The “Einkommens- und Verbrauchsstichprobe” (EVS):

*Threshold for Top Incomes.* Representativeness of the EVS at the very top end of the distribution is limited by the fact that households above a certain income threshold are not included in the data, since participation rates of this group are very low. This threshold amounted to a monthly net household income of 35,000 Deutschmark (17.895 €) in the 1993 and 1998 waves, and 18,000 € in the 2003, 2008 and 2013 waves. Becker (2014) finds that this restriction affects less than 1% of all German households in each year. Excluding these households certainly leads to underestimation of inequality in the upper part of the distribution. However, percentile ratios (such as the ratio of the 90th to the 50th percentile of the income distribution) should be less sensitive to outliers in the tails than, for example, measures like the variance or top income shares. Moreover, most of our attention is focused on the lower part of the distribution.

*Self-employment and Capital Income.* A well-known problem of household surveys is that they tend to underestimate income from self-employment or capital income. For example, Becker (2014), by comparing EVS and SOEP data to aggregate data from German national accounts, shows that although both household surveys capture income from dependent employment and public transfers very well, they capture only half the income from self-employment or capital income that is shown in national accounts. This, again, should contribute to underestimation of inequality in particular at the top of the distribution.

*Age Ranges.* We also compare the key analyses for the whole sample without age restriction, for the age range 20–60 and the age range 25–55. As shown in Figure A1, the trends are similar, although the patterns are most pronounced for the 20–60 age range.

*Survey Weights.* From the 2003 wave onwards, the surveys use both household weights and person weights. Household weights adjust for the characteristics household type, social status of the main earner, and net household income; person weights additionally adjust for individual income, gender, age and social status (see Statistisches Bundesamt 2005a, 2005b, 2012, and 2016 for a further description). Because our analysis is on the individual level, we

use the person weights, which we impute for the 1993 and 1998 waves by taking the individuals in the 2003 wave and regressing the log ratio of household and person weight on household characteristics (federal state, household size, decile of net household income) and individual characteristics (position in household, gender, age, nationality, labor force status, and decile of individual labor income). We then predict the person weight for each individual in the 1993 and 1998 wave based on his or her household weight.

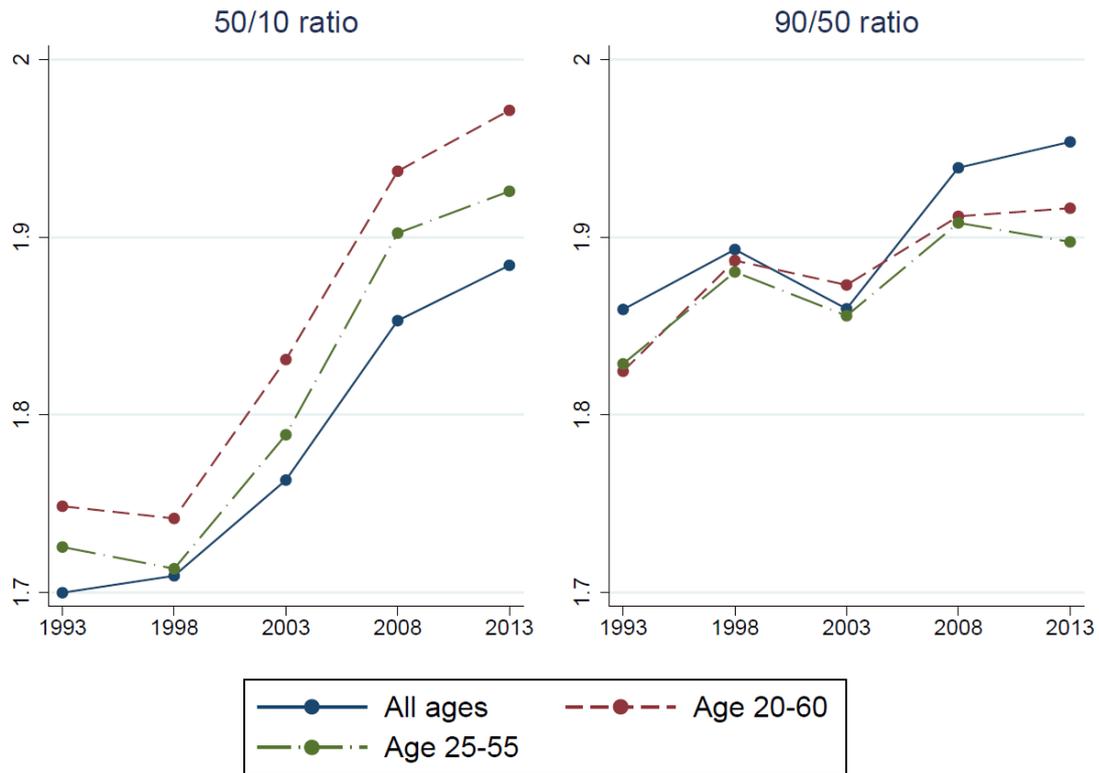
*Mortgage Interest Payments.* In the 1998 wave, there is a low share of mortgage interest payments relative to total mortgage payments (interest payments plus repayment of mortgage capital) of 34%, while it is higher in the other surveys (47% in 1993, 54% in 2003, 50% in 2008, and 45% in 2013). To smooth the series, we take the 1993 and 2003 samples and regress the ratio of mortgage interest relative to repayment of mortgage capital on dwelling and household characteristics. We then take the 1998 sample and predict the ratio for each observation based on the characteristics and the average of the estimated coefficients from 1993 and 2003. Based on this predicted ratio, we impute mortgage interest payments for 1998.

*EVS vs. SOEP Data.* We employ the 1992 to 2013 waves of the yearly SOEP household panel, using sample selection criteria and variable definitions that are comparable to the EVS and restricting the sample to individuals aged 20–60. Household incomes and expenditures are measured on the household level, equivalized by the number of persons in the household, and then distributed among all household members. In the SOEP, net household income also includes the sum of labor income from dependent employment and self-employment, capital income, private transfers, and public transfers minus taxes. It excludes imputed rent from owner-occupied housing. Housing expenditures include rent and energy costs for renters, as well as mortgage interest, energy costs, and maintenance costs for owner-occupiers. In the SOEP, mortgage payments include both interest payments and repayment of mortgage capital. We exclude the latter as it is not part of housing consumption but increases net wealth. From each wave of the EVS, we calculate the share of mortgage interest relative to total mortgage payments (separately for owners in each income quintile) and apply this correction factor to the mortgage payments in the SOEP, interpolating between years in which the EVS was not conducted.

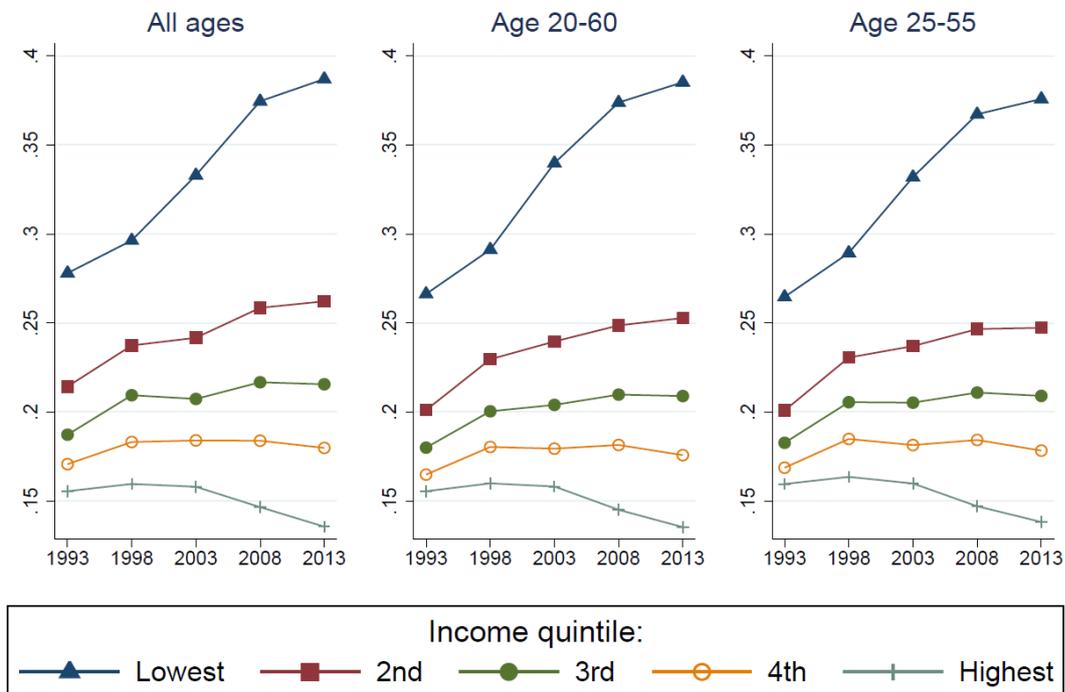
Figure A3 shows the 50/10 and 90/50 ratios of equivalized net household income in both data sets. The SOEP numbers fluctuate considerably between some years, probably due to the low

sample size. Nevertheless, the SOEP and EVS show very similar trends. The 50/10 ratio increases between the late 1990s and the mid-2000s, followed by a more modest increase in recent years. The 90/50 ratio shows a similar upward trend in both data sets, but the levels of upper-end inequality are higher in the EVS than in the SOEP. This is because the levels of net household income are higher in the EVS, particularly at the 90th percentile (not shown here). These differences at the top of the net income distribution between the two data sets might be driven by the different ways taxes are measured: tax payments are self-reported by households in the EVS, while the SOEP simulates taxes based on income and official legal rules. Becker et al. (2003) and Becker (2014) argue that this simulation does not consider potential loopholes or special tax exemptions, which might lead to an overestimation of taxes for richer households. This argument is supported by our finding in Figure A4 that the levels of the 90/50 ratio are very similar in the SOEP and EVS. Figure A5 shows that both data sets agree on the increasing divergence in housing expenditures between income groups, in particular the strong increase for the bottom income quintile.

**Figure A1: Alternative age ranges**

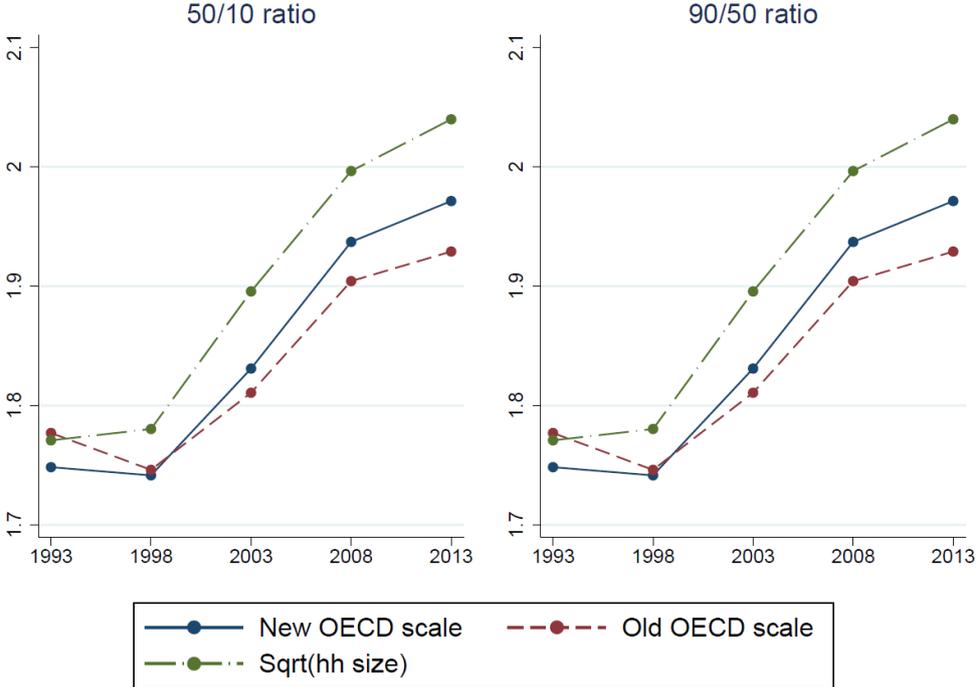


**Share of income spent on housing**

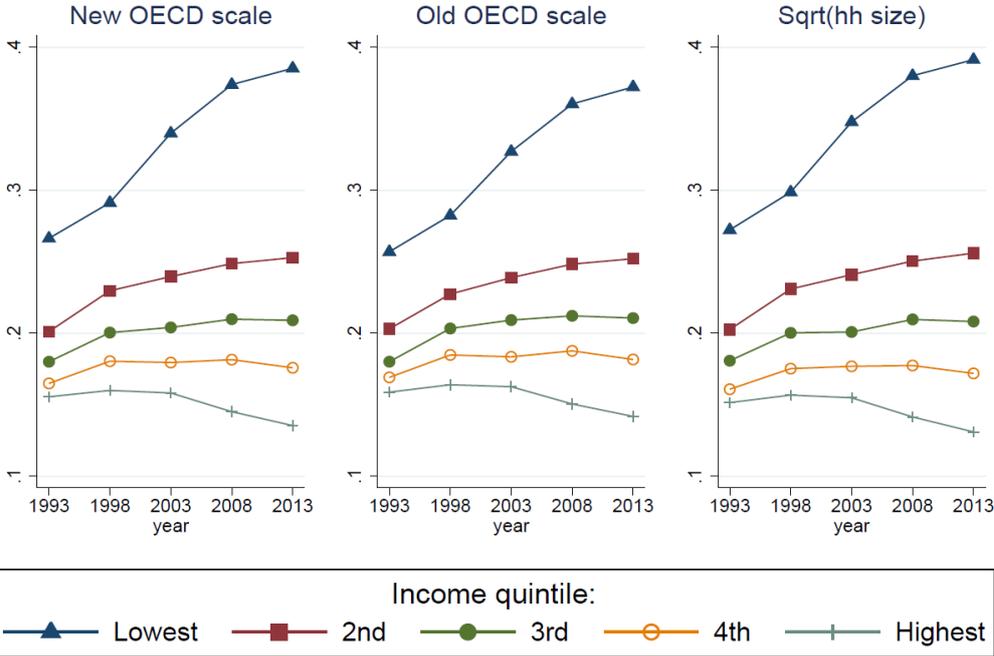


Source: EVS, author calculations.

**Figure A2: Alternative equivalence scales**

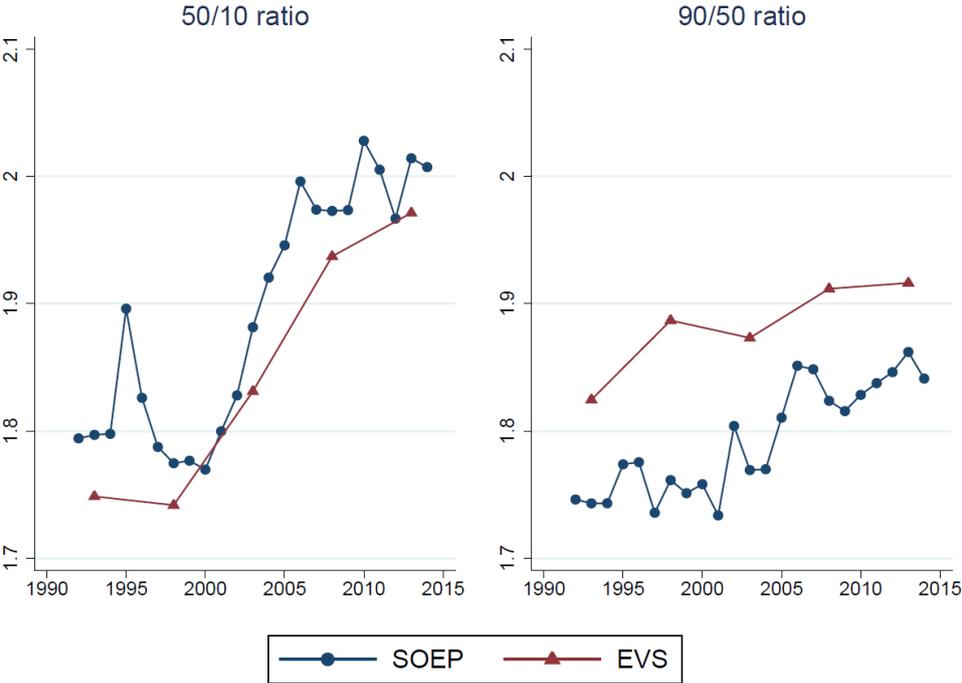


**Share of income spent on housing**



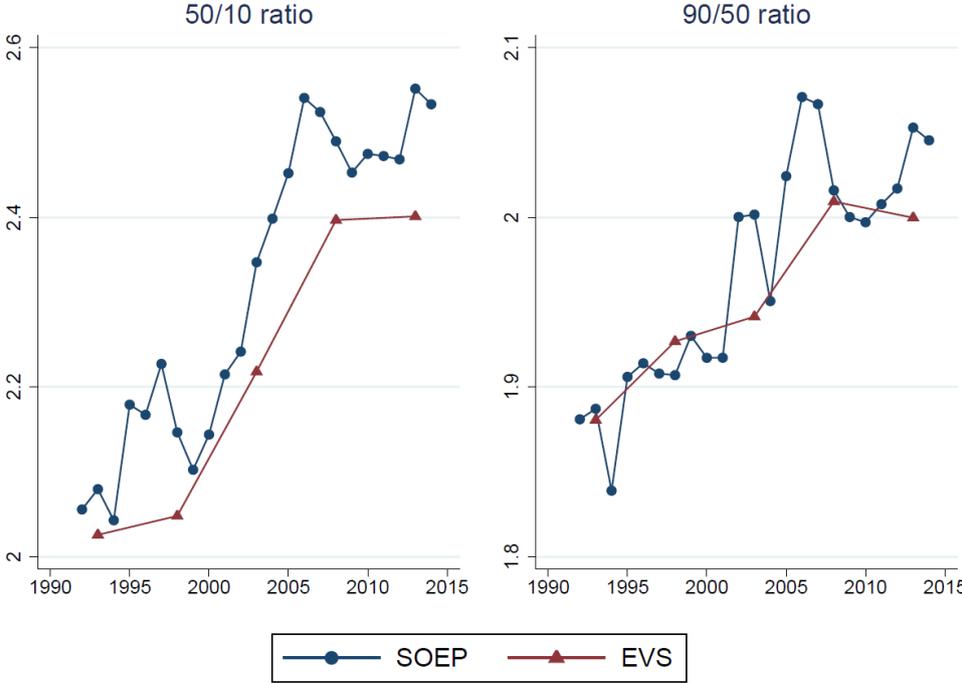
Source: EVS, author calculations. The “new OECD scale” is the default used in the paper, and assigns a weight of 1 for the first adult in the household, 0.5 for every household member of age 14 and above, and 0.3 for every household member below 14. The “old OECD scale” uses weights 1, 0.7 and 0.5, respectively. “Sqrt.(hh size)” divides household income by the square root of household size.

**Figure A3: Inequality of equivalized net household income: EVS vs. SOEP**



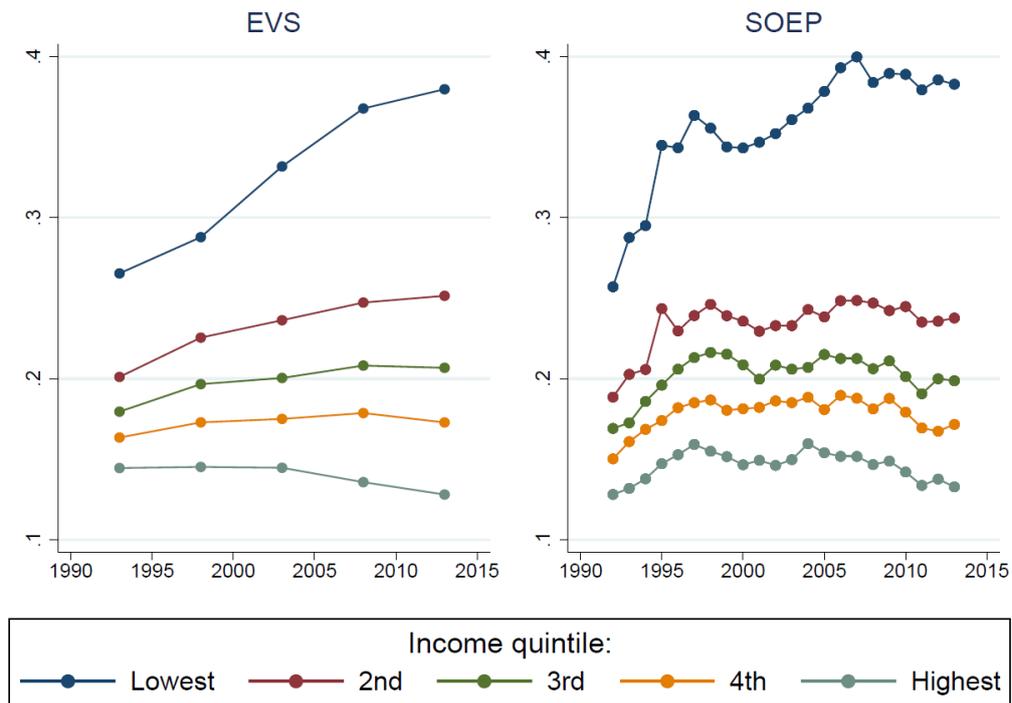
Source: SOEP and EVS, author calculations.

**Figure A4: Inequality of equivalized gross household income: EVS vs. SOEP**



Source: SOEP and EVS, author calculations.

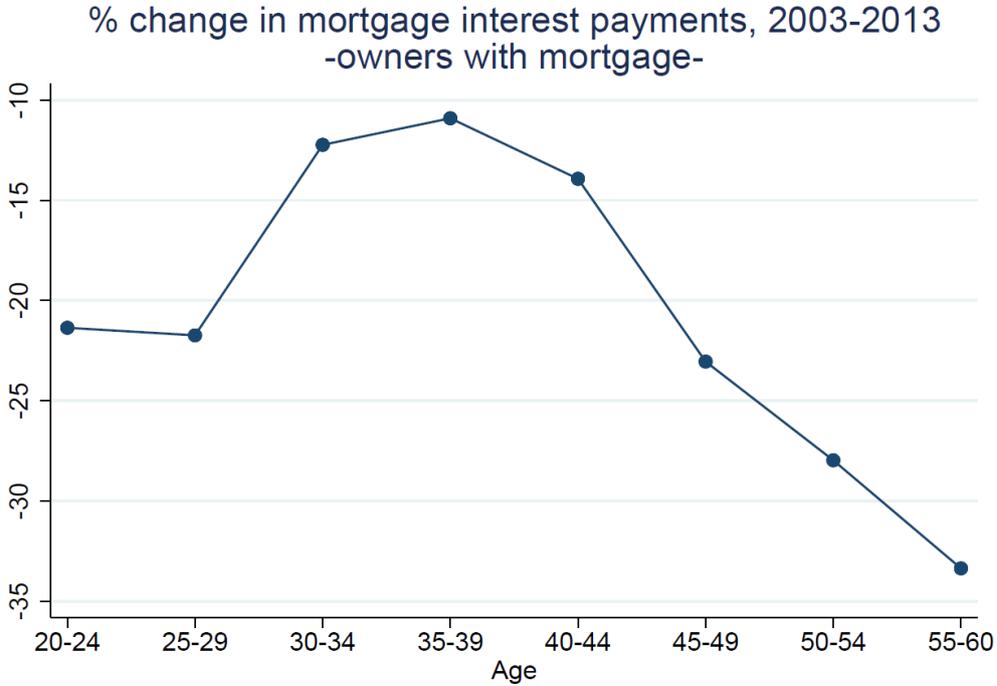
**Figure A5: Share of housing expenditures over income: EVS vs. SOEP**



Source: SOEP and EVS, author calculations.

**Appendix B: Additional Material for Section 4.1. (Relative Costs for Homeowners vs. Renters)**

**Figure B1: Percent change in mortgage interest payments, 2003–13, for owners with mortgages**



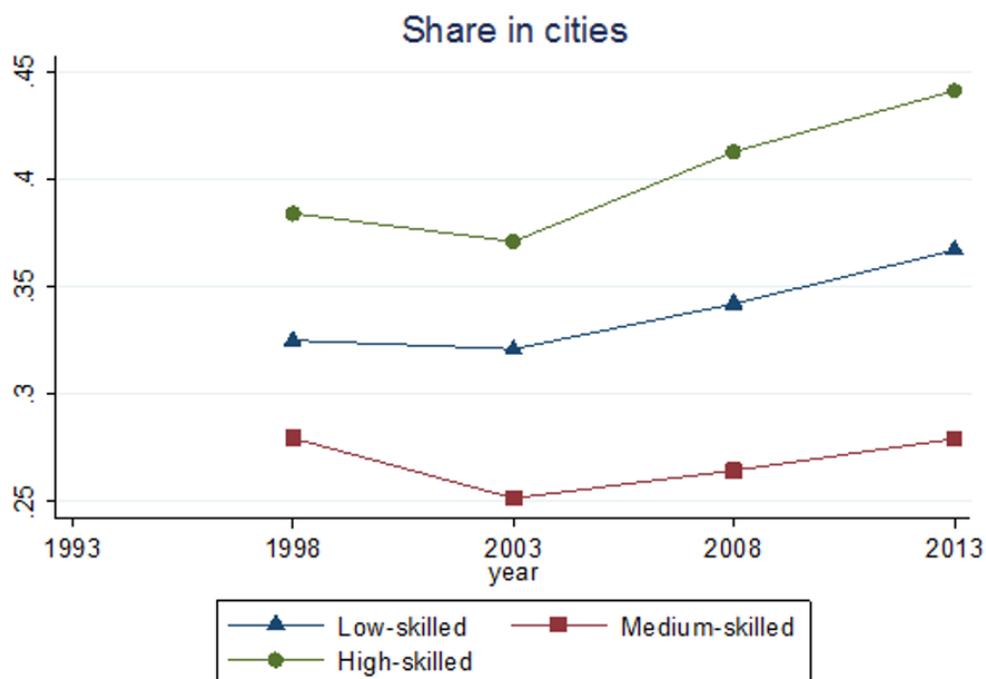
Source: EVS, author calculations.

**Method for Imputing Net Imputed Rents (NIR) among Homeowners:**

Building on Machado and Mata (2005) and Melly (2006), we apply the following procedure. First, we take the sample of renters and estimate a series of quantile regressions of housing expenditures on dwelling and household characteristics at 99 equispaced quantiles from  $\theta=0.01, \dots, 0.99$ . We then take the sample of owner-occupiers and predict for each observation the 99 conditional quantiles of the counterfactual housing expenditures. Finally, we inflate the data set by 99; that is, we use each predicted quantile as an owner observation with weight  $1/99$ . For each observation in the inflated data set, we subtract the actual housing expenditures to obtain the net imputed rent (NIR). The relative NIR is obtained by dividing the absolute NIR by the owner household’s counterfactual housing expenditures, which we calculate separately for owner occupiers with and without mortgage debt.

**Appendix C: Additional Material for Section 4.2.3 (Regional Mobility and the Effect of Regional CPIs)**

**Figure C1: Share living in cities, by skill group**



Source: EVS, author calculations. Education is not available in the 1993 wave. Low-skilled = no postsecondary degree, medium-skilled = vocational training degree or higher secondary school degree, and high-skilled = tertiary education degree. Students are excluded.

**Table C1: Reasons for residential moves by skill group, in percentages**

	Low-skilled		Medium-skilled		High-skilled	
	Rural-to-city moves	Other moves	Rural-to-city moves	Other moves	Rural-to-city moves	Other moves
Job reasons	32.9	6.0	30.5	8.9	51.8	20.8
Family reasons	32.2	35.3	46.2	37.5	28.2	29.8
Old dwelling too small/too big	26.2	38.3	12.7	29.9	11.5	25.4
Bought own home	1.0	8.6	2.9	14.4	2.8	17.3
Other reasons	7.6	11.8	7.8	9.3	5.7	6.7

Source: SOEP, author calculations. Survey question: “What was the main reason for your last residential move?”

A regional CPI for Germany is available only for 2009 (see BBSR 2009 for a detailed data description). The regional CPI data and regional rent data are limited to the district (Kreis) level, while the EVS data contain more aggregate regional information based on federal states and three classes of community sizes. To merge both data sets, we thus had to aggregate the district-level price data accordingly.

Based on these data, we construct two types of regional price indices over time. First, we simply impute the 2009 level for all years, ignoring region-specific price changes and considering only the effect of mobility between more or less expensive regions. Second, we use the region-specific information on new rental contracts that is available from 2004 onward (see BBSR). We combine this information on region-specific rental indices to extrapolate regional price differences (for 2003, we simply impute the 2004 value of the rent index). We then deflate incomes by either one of these indices.

**Table C2: Inequality of equalized net household income (EVS)**

	50/10 ratio			90/50 ratio		
	1993	2003	2013	1993	2003	2013
Nationwide CPI	1.75	1.83	1.97	1.82	1.87	1.92
Regional CPI	1.74	1.83	1.97	1.80	1.86	1.90
Regional CPI + regional rent index	-	1.83	1.98	-	1.86	1.91

Source: EVS, author calculations.

**Table C3: Inequality of daily wages (SIAB)**

	50/20 ratio			80/50 ratio		
	1993	2003	2010	1993	2003	2010
Nationwide CPI	1.42	1.47	1.57	1.37	1.40	1.47
Regional CPI	1.39	1.45	1.54	1.33	1.38	1.45
Regional CPI + regional rent index	-	1.44	1.53	-	1.38	1.45

Source: SIAB7510, author calculations. Data are for social security-covered full-time workers age 20-60

**Table C4: Skill premia (SIAB)**

	Medium-skilled vs. Low-skilled			High-skilled vs. Medium-skilled		
	1993	2003	2010	1993	2003	2010
Nationwide CPI	0.16	0.18	0.20	0.48	0.55	0.60
Regional CPI	0.15	0.17	0.20	0.45	0.52	0.57
Regional CPI + regional rent index	-	0.17	0.19	-	0.52	0.57

Source: SIAB 7510, author calculations. Premia are based on a regression of log daily wages for social security-covered full-time workers aged 20-60, controlling for education (low/medium/high), exp, exp<sup>2</sup>, age, age<sup>2</sup>, gender and a German nationality dummy. *Low-skilled* = no postsecondary degree, *Medium-skilled* = vocational training degree or higher secondary school degree, and *High-skilled* = tertiary education degree.

## **Appendix D: Additional Material for Section 4.3. (Decomposition Analysis)**

**Table D1: Decomposition of changes in housing expenditure shares, 1992/93 to 2012/13 (SOEP)**

	Quintile of equivalized net household income				
	Q1	Q2	Q3	Q4	Q5
<i>A. Aggregate decomposition</i>					
1992/93	0.286*** (0.003)	0.206*** (0.003)	0.183*** (0.005)	0.171*** (0.003)	0.145*** (0.002)
2012/13	0.392*** (0.003)	0.239*** (0.002)	0.201*** (0.002)	0.173*** (0.002)	0.140*** (0.001)
Change	0.106*** (0.004)	0.033*** (0.003)	0.018*** (0.006)	0.002 (0.004)	-0.005** (0.002)
Coefficients	0.033*** (0.006)	-0.003 (0.005)	-0.001 (0.006)	-0.021*** (0.008)	-0.008*** (0.003)
Composition	0.072*** (0.004)	0.036*** (0.003)	0.019*** (0.003)	0.024*** (0.006)	0.002 (0.002)
<i>B. Detailed decomposition of the composition effect</i>					
Household Demographics	0.026*** (0.003)	0.016*** (0.002)	0.011*** (0.001)	0.006*** (0.001)	0.005*** (0.001)
Region	0.002 (0.001)	-0.001 (0.001)	-0.001 (0.000)	-0.002** (0.001)	0.001** (0.001)
Tenure Type	0.003** (0.001)	-0.001 (0.001)	0.001* (0.001)	0.002*** (0.001)	-0.002*** (0.001)
Dwelling Quality	0.006*** (0.002)	0.013*** (0.002)	0.011*** (0.001)	0.011*** (0.002)	0.006*** (0.001)
Social/Municipal Housing	0.003*** (0.001)	0.002*** (0.000)	0.001 (0.001)	0.001** (0.000)	-0.000 (0.000)
Length of Residency	0.002** (0.001)	0.001*** (0.000)	0.001** (0.000)	-0.000 (0.000)	0.002*** (0.001)
Income	0.030*** (0.002)	0.006** (0.003)	-0.005*** (0.002)	0.005 (0.006)	-0.009*** (0.001)

Note: The table shows a Blinder-Oaxaca decomposition of changes in housing expenditure shares separately for each quintile of equivalized net household income. *Household Demographics* includes dummies for the number of adults in the household, dummies for the number of children, dummies for 4 age groups (20–29, 30–39, 40–49, 50–59), and a dummy for German nationality. *Region* includes dummies for 16 federal states and 4 categories of city size. *Tenure Type* includes dummies for being a renter, owner with mortgage, or owner without mortgage. *Dwelling Quality* includes a cubic in household size, dummies for 5 building types, and dummies for whether the dwelling is equipped with central heating, balcony, basement, or garden. *Length of Residency* includes dummies for 4 categories of residency length (<5 years, 5–9 years, 10–19 years, and 20+ years). *Income* includes a cubic in eq. net household income. Standard errors are in parentheses. The counterfactual used for the decomposition is based on the composition in 2012/2013 and the coefficients in 1992/1993. Source: SOEP, author calculations.