DOES OWNING YOUR HOME MAKE YOU RETIRE EARLY?
A COMPARATIVE ANALYSIS OF GERMANY AND THE UK

Abstract

Despite its key role in generating and consolidating social inequalities, little is known about the role of housing at critical life course transitions, particularly in later life. This article studies the effects of home ownership on the risk of entering retirement between age 51 and 65 in two distinct country contexts. After delineating the causal estimand and identification conditions, the analysis uses the doubly-robust, non-parametric Targeted Maximum Likelihood Estimation method with panel data from the German SOEP (n = 12,234) and the UK BHPS/UKHLS (n = 11,544). In line with theoretical expectations, home ownership is found to raise individuals' retirement risks compared to renting by up to 21.3pp. in the UK and up to 7.4pp. in Germany. However, these effects are largest or only present for outright owners and close to statutory age thresholds. These findings highlight housing as a dimension of social stratification in work-to-retirement transitions and show how the institutional context moderates this relationship.

Introduction

Compared to other sources of inequality in retirement transitions, housing has received limited scholarly attention. For instance, housing is absent from two systematic reviews of the determinants of retirement timing (Fisher et al., 2016; Scharn et al., 2018) and retirement does not feature in two reviews about the individual-level effects of housing (Dietz and Haurin, 2003; Zavisca and Gerber, 2016). This is surprising given that housing is known to be closely linked to major life course outcomes, ranging from wealth accumulation (e.g., Sodini et al., 2023; Fuller et al., 2020) to health and well-being (e.g., Diaz-Serrano, 2009) to demographic (e.g., Mulder and Billari, 2010) and political behaviour (e.g., Ansell, 2014). Housing is also a core pillar of the welfare state alongside education, social security and health care, all of which have been studied more extensively (Torgersen, 1987). Moreover, the relevance of housing has likely been exacerbated in recent years as a result of rents and house prices (e.g., Ansell, 2019), declining public investments in social housing (e.g., Adkins et al., 2021), weaker rent and financial regulations (e.g., Kholodilin and Kohl, 2021), and the emergence of housing as a financial asset class (e.g., Bohle and Seabrooke, 2020), all adding to housing insecurity, mainly among low-income groups (Dewilde and De Decker, 2016).

A potential link between housing and retirement behaviour has been suggested by early work on 'property-based welfare,' which argues that home ownership can act as a form of self-insurance against social risks in old-age (Conley and Gifford, 2006; Doling and Ronald, 2010; Kemeny, 2001, 2005; Castles, 1998). Accordingly, individuals purchase their home in early life to benefit from lower housing costs later in life, often encouraged by subsidies and tax exemptions for homeowners (Kholodilin et al., 2023). By complementing or substituting a regular pension, owning one's home may thereby lead to earlier retirement than renting. This effect may be even more relevant if governments limit other sources of retirement income to

promote longer working lives (Hinrichs, 2021). Yet, causal and comparative studies on the link between housing and retirement behaviour are scarce. This article aims to address this gap.

Empirically, the article contributes evidence on the causal effects of home ownership on the risk of retirement in Germany and the UK, two countries that differ distinctly with regard to central housing and welfare regime features. Following a review of prior research, the article hypothesises that home ownership raises individuals' retirement risk compared to renting by providing a permanent income, reducing their geographical mobility, and presenting a source of perceived security, especially for outright owners. It also discusses the institutional context factors in both countries that are hypothesised to moderate this effect by structuring the access to certain tenure types and determining to what extent ownership provides social and economic advantages over renting. To test the hypotheses, the causal differences in the risks of retirement between continuous renting and homeowning are estimated for each age from 51 to 65 based on panel data from the German SOEP and the UK BHPS/UKHLS.

Methodologically, the article contributes by using Targeted Maximum Likelihood Estimation (TMLE), a novel statistical framework for causal inference with major advantages over conventional regression modelling. Due to its double robustness and by using machine learning for the estimation, TMLE reduces the risks of bias and misspecification and improves statistical efficiency, even in the presence of complex time-varying confounding. TMLE is also precise and flexible in how treatments are assigned and the target quantity is estimated, making it advantageous for applied research. To ensure the validity of the analysis, the article presents robustness checks for each of the assumptions required for causal identification.

Overall, the results indicate that continuous home ownership has a substantial positive effect on the risk of retirement that is even larger for outright owners and varies both by age and by country. Close to statutory retirement ages and in the UK, in particular, home ownership appears to be a major driver of earlier retirement entries, suggesting that institutional context

conditions moderate the role of housing across later life. More generally, the results highlight housing as a relevant dimension of social stratification in major life course transitions and show that the institutional context can mitigate or exacerbate this relationship. Moreover, the article illustrates the advantages of TMLE together with transparent statements of the casual estimand and identification conditions for social stratification and life course research.

Literature review and hypotheses

Prior empirical studies

The relationship between housing and retirement has been studied in several disciplines and for different countries and time periods. A first line of evidence is descriptive. The early study by Doling and Horsewood (2003) draws on aggregate data for European countries during the 1990s and finds that home ownership rates are negatively associated with the employment participation of older men, while accounting for labour market conditions, social spending and house price levels. A more recent analysis by Leinonen et al. (2018) based on Finnish micro-level register data finds that homeowners retire earlier than renters even if socio-economic and family characteristics as well as total household income, wealth and debt levels are taken into account. Similarly, Kuhn et al. (2021) use cross-sectional data to show that home ownership in Germany, but not in Switzerland, is associated with earlier retirement, which is consistent with previous correlational analyses by Drobnič (2002) and Berkel and Börsch-Supan (2003).

Another body of work has investigated the role of housing wealth instead of tenure and has applied more sophisticated causal inference approaches, often relying on changes in local house prices to induce exogenous variation in housing wealth. The majority of studies focuses on the United States and largely concurs that housing wealth has negative effects on later life

labour market participation, employment and working hours (Farnham and Sevak, 2016; Zhao, 2018; Sevak, 2002; Begley and Chan, 2018; Zhao and Burge, 2017, 2021). The only two studies for Europe focus on the UK and come to mixed conclusions. While Disney et al. (2015) do not find effects of changing property prices on the retirement timing of homeowners, a later analysis by Disney and Gathergood (2018) shows that higher property prices reduce the labour market participation of older homeowning men.

A third strand of work has examined the role of household wealth, of which housing is usually the largest part, but which also includes non-housing components like private pension plans, cash savings and other financial assets. While studies for the United States consistently find that higher wealth exerts negative effects on older individuals' employment participation (e.g., Butrica and Karamcheva, 2013, 2020; Karamcheva and Butrica, 2018), the evidence for Europe is less extensive and clear. For instance, Bloemen (2011) and Kuhn et al. (2021) find that wealth is associated with earlier retirement in the Netherlands, Germany and Switzerland, whereas Larsen and Pederson (2008) report a negative association between wealth and earlier labour market withdrawals in Denmark.

Altogether, the review of prior studies hints at an empirical association between home ownership and earlier retirement, but also reveals a number of limitations. Firstly, studies focus on different age ranges and periods and either on single or large groups of countries so that it is difficult to compare the results and it remains unclear whether and under what conditions they would hold in different contexts. A second limitation concerns measurements. Housing tenure is usually measured at one point in time, which is problematic if a person's tenure status has varying effects at different ages or changes across later life, for example due to changes in household composition (e.g., Angelini et al., 2014). Also, a wide range of hardly comparable outcome measures is used, including retirement status or timing, employment or labour market participation, or working hours. Thirdly, the few studies that explicitly examine housing tenure

rely on aggregate or cross-sectional data or employ statistical techniques that do not allow to establish whether the observed associations are causal. Lastly, it is doubtful whether the effects of housing wealth rather than housing tenure, which represent treatment effects on the treated population of homeowners, would extend to the entire population and may not fully reflect the role of housing as a source of inequality in retirement transitions.

Mechanisms linking housing tenure and retirement behaviour

Theoretically, at least three mechanisms can be cited that may causally link individuals' housing tenure and their retirement behaviour.

First, home ownership provides individuals with a 'permanent income' that may allow them to withdraw from employment relatively earlier than renters. This income depends on the dwelling's size, quality and location net of taxes, mortgage and maintenance costs, and can be realised by living rent-free ('income in kind') or by converting the dwelling's market value into cash through sale or by borrowing against it as collateral ('income in cash') (Doling and Ronald, 2010). Unlike earnings from employment, income from home ownership is permanent because it is foreseeable and can be relied upon in the future. Assuming full information and rationality, economic life cycle models predict that individuals will use this permanent income to stabilise their consumption in the long term, which allows them to reduce their labour supply in the present and thus leads to earlier retirement (Modigliani and Brumberg, 1954; Friedman, 1957). However, a common critique of life cycle models is that the consumption smoothing implicated by the standard model is not reconcilable with the decline in consumption typically observed among retirees, known as the "retirement consumption puzzle" (Hurst, 2008). More recent formulations of life cycle models have therefore integrated 'behavioural' factors such as home production, uncertainties about future health and income, as well as heterogenous

preferences for risk and leisure to rationalise why retirement decisions may not always be consistent with optimal consumption smoothing (e.g., Melvin and Toohey, 2018; Hurd and Rohwedder, 2006). Despite of these qualifications, life cycle models generally predict that the permanent income from home ownership will in any case raise homeowners' risk of retirement.

Second, home ownership limits individuals' geographical mobility and may thereby reduce their employment chances. This argument builds on the premise that the costs involved in moving are higher for homeowners than for renters due to the sales process, taxes, and legal fees it involves. These transaction costs reduce homeowners' propensity to move, as reflected by considerably lower mobility rates (Haurin and Gill, 2002; Tatsiramos, 2006; Angelini and Laferrère, 2012). In case of unemployment or desired job changes, this mobility constraint may hinder homeowners' access to distant labour markets, which in turn impairs their job search and matching behaviour and thus leads to worse employment outcomes. Originally formulated by Oswald (1996), this hypothesis has not remained undisputed. Empirical support for adverse employment effects of home ownership is mixed (Havet and Penot, 2010; Battu et al., 2008; Caliendo et al., 2015). In fact, it has been argued that homeowners' limited mobility may even encourage employment by lowering their reservation wage and increasing job search efforts in local labour markets (e.g., Munch et al., 2006). However, available studies concentrate on few labour market outcomes (mainly the occurrence and duration of unemployment and job-to-job changes) in the total population rather than the retirement decision of older individuals, who likely differ in their mobility preferences, search and matching behaviour. For health reasons and due to lower work attachment and a preference for leisure, for example, older individuals may prefer to retire rather than to leave their home or to accept any available local job (Robison and Moen, 2000). They may also be less inclined to adjust their reservation wage because the option of drawing on an old-age pension is available to them (e.g., Axelrad et al., 2017). It is

therefore more plausible to expect that the limited mobility of older homeowners' increases the risk of retirement compared to renters.

Third, home ownership may raise individuals' perceived security during the transition to retirement. In addition to the economic considerations central to the first two mechanisms, sociological and psychological perspectives highlight the complexity of individual retirement decision-making processes (Feldman and Beehr, 2011; Adams and Rau, 2011; Jex and Grosch, 2013). Accordingly, the planning for and decision to retire unfold over longer time periods, are influenced by a variety of psycho-social factors, and involve imagining one's life in retirement in view of considerable uncertainties. These subjective processes are highly variable in the population as they depend on social, economic, and health-related resources that jointly reduce or heighten individuals' certainty about their future life in retirement (e.g., Moffatt and Heaven, 2017). Advantaged social groups are better able to exercise control over their lives, to adjust to unforeseen circumstances and to maintain routines, roles, and their living standard in retirement (Bardasi et al., 2002). Worse-off individuals can instead be less certain about their future living conditions and may be more hesitant to withdraw from working life and to enter a new stage in life. In this context, home ownership may present a source of certainty because it ensures a stable living situation in a known environment and is linked to positive subjective outcomes (Zavisca and Gerber, 2016), such as financial (Tharp et al., 2020) and housing satisfaction (Elsinga and Hoekstra, 2005) as well as positive perceptions of opportunity (Rohe et al., 2002), poverty (Watson and Webb, 2009), material security (Garten et al., 2022), and well-being (Herbers and Mulder, 2017). These positive aspects likely contribute to individuals' perceived security about their future in retirement, and may thereby give rise to a third mechanism by which home ownership raises the risk of retirement compared to renting.

Taken together, all three mechanisms imply that homeowners are generally at a higher risk of entering retirement than their renting counterparts. A first hypothesis thus reads:

H1: Compared to renting, home ownership increases the risk of retirement throughout later life.

While the overall effect of home ownership is expected to be positive, it is important to consider differences between different tenure categories. In particular, the effects brought about by all three mechanisms can be expected to be less pronounced for homeowners with mortgage debts compared to outright owners. First, similar to a rent, mortgage payments directly reduce the permanent income derived from home ownership. Second, regular mortgage payments may necessitate income from continued employment and lower owners' reservation wage, and thus attenuate the effect of owners' limited geographical mobility. Finally, mortgage debt that will need to be paid off in the future may reduce the perceived security that can be derived from home ownership. Consequently, a second hypothesis reads:

H2: The positive effect of home ownership on the risk of retirement is larger for outright ownership than for ownership with outstanding mortgage debts.

Housing and welfare state context in Germany and the UK

The expected causal effects are likely moderated by context conditions that determine to what extent home ownership generates social and economic advantages over renting. In the European context, Germany and the UK represent two housing and welfare regimes that differ distinctly in how different housing tenures are accessed, valued and privileged, and may affect individuals' retirement risk via the mechanisms discussed above.

The accessibility of different tenure categories is primarily determined by features of countries' housing regime, including the availability of social housing and mortgage finance as well as the regulation of rents and tenant protections (Hoekstra, 2010; Kemeny, 2001, 2013; Bayrakdar et al., 2018). The UK is typically described as a dualist system that is characterised by a large, deregulated private housing sector and a more strictly regulated cost-rental sector reserved for vulnerable groups. Tenancies in the private rental market tend to be short and rents can be high and increased at short notice (Kemp, 2015). Also, the stock of social housing has declined significantly since the 1980s as a result of fewer new builds and policies that allowed social tenants to buy property at discounted prices on competitive mortgage markets (Murie, 2016; Toussaint and Elsinga, 2009). High levels of inflation further contributed to the attractiveness of buying into property, which was seen as an opportunity for building wealth and a protection against rising rents (Soaita and Searle, 2016). Altogether, this led to a decline in competitive rental options and a broad tendency towards home ownership, at high levels of mortgage debt, even among lower socio-economic groups.

Germany, in contrast, is characterised by a unitary rental system in which a more widely accessible social housing sector competes directly with the private market. Private and public investment in rental housing have long exerted downward pressure on rents, along with more comprehensive rent and tenant protection regulations such as indefinite contracts and rent caps. Access to mortgage finance is more restricted and deposit requirements are higher than in the UK. Also, house price inflation has been relatively low, which contained rent increases and the relative wealth gains of owners (Voigtlander, 2009), although house prices have risen sharply in recent years (Kholodilin and Michelsen, 2017). Altogether, renting remains a competitive and acceptable alternative to ownership, even among higher socio-economic groups.

In addition to institutional features of the housing regime, the social norms attached to different tenure categories vary between countries (Kemeny, 2001; Ronald, 2008). Like other

English-speaking countries, the UK is often portrayed as a 'homeowner society' (Ronald 2008; Kohl, 2020; Ronald and Kadi, 2018), where home ownership is regarded as part of a fulfilled, middle-class life and a mark of personal success, while renting, particularly in the social sector, carries a social stigma (Rowlands and Gurney, 2000). In Germany, by contrast, long-term renting is seen as an acceptable tenure status for broad cross-sections of society and is less stigmatised than in the UK (Scanlon et al., 2014).

The UK's and Germany's different institutional and cultural orientations towards home ownership are reflected in markedly different housing tenure structures. In 2021/22, 40,7% of the German population were homeowners (25,2% outright owners) and 54,6% lived in rental arrangements (3,0% on a subsidised rent), whereas 67,7% of the UK population owned (39,3% outright) and 31,2% rented their home (20,0% on a subsidised rent) (OECD, 2024).

Complementary to these differences in the sphere of housing, welfare provision more generally is more or less centred on home ownership. Housing-welfare regime (Kemeny, 1981, 1992, 1995) and varieties of residential capitalism (Schwartz and Seabrook, 2009) theories contend that high levels of home ownership are directly related to low levels of public welfare expenditure, especially on pensions (also see van Gunten and Kohl, 2020; Blackwell and Kohl, 2019). Consistent with this prediction, public spending in the UK's liberal welfare state is low and oriented towards means-tested minimum benefits. In the Beveridge-style pension system, private pensions play a central role and income risks in old-age are largely individualised. Also, few options for early retirement through early exit or disability pension schemes are available (Hofäcker and Unt, 2013). As a result, the permanent income from home ownership likely presents a central supplement to old-age welfare provision for large parts of the population, in line with the notion of 'property-based welfare' (Doling and Ronald, 2010; Searle and McCollum, 2014; Soaita and Searle, 2018). The strong norm towards home ownership may

further add to the importance of housing tenure for individuals' perceived security during the transition to retirement (Herbers and Mulder, 2017).

In Germany's conservative welfare state, by contrast, public welfare spending is higher and benefits are closely linked to previous contributions to the social security system. In the Bismarckian pension system, the public pillar provides the largest share of old-age income for most of the working population, so that income risks are less privatised. Also, despite rising retirement ages and tighter eligibility criteria, routes for early retirement have long been and remain available, for example for severly disabled persons or individuals with long contribution histories. As a result, home ownership is likely less central to welfare provision in old-age and other source of income are available to individuals approaching retirement. The higher share of and more egalitarian norm towards renting likely contribute to the less central role of housing as a source of welfare in retirement.

Taken together, in a context where public support for earlier retirement is limited and home ownership is institutionally and culturally privileged over renting, home ownership can be expected to present a central advantage that allows individuals to withdraw from the labour market relatively earlier. Accordingly, the third hypothesis reads:

H3: The positive effect of home ownership on the risk of retirement is larger in the UK than in Germany.

Analytical strategy

Target population, data, and samples

The target population for the analysis consists of the homeowners and renters aged 51 to 65 in Germany and the UK between 1991 and 2021. To represent these groups, micro-level panel data are drawn from the British Household Panel Survey (BHPS) and the UK Household Longitudinal Study (UKHLS) for the UK (England, Wales, Scotland, and Northern Ireland) (University of Essex, Institute for Social and Economic Research, 2023) as well as the Socio-economic Panel (SOEP) for Germany (Goebel et al., 2023). The Comparative Panel File by Turek et al. (2021) is used to harmonise the three datasets.

The samples for both countries include all respondents who are continuously observed in yearly intervals from age 50 until they retire, reach age 65 or are right-censored. The final samples include 12.549 respondents for the UK and 12.601 respondents for Germany, and a total of 78.706 and 78.794 person-years, respectively. 2.061 (16,4%) respondents in the UK and 2.437 (19,3%) in Germany enter retirement during the observation period. The full sample statistics are presented in Appendix A.1 in the Supplementary Materials.

The overall share of missingness in the final samples is 6,0% for the UK and 1,3% for Germany. Missing values are imputed using multiple imputation via chained equations. For the final results, estimates from ten imputed datasets are combined following Rubin's rule.

The presented estimates are not weighted because all models condition on variables that strongly determine sampling and attrition and unweighted estimates are more precise (Winship and Radbill, 1994).

Measures

A binary indicator for respondents' retirement status measured at each age serves as the outcome variable throughout the analysis. A person is considered to be retired if they are not employed and describe themselves as being retired or receive an old-age pension.

Two variants of the treatment variable are used to test the different hypotheses. First, a binary indicator for whether a respondent owns (either outright or through a mortgage) or rents the dwelling they live in at a given age. Second, a categorical variable that further distinguishes between renters, outright homeowners and homeowners with outstanding mortgage debt.

An extensive set of control variables is included through which the treatment and the outcome may be non-causally associated. These are either time-invariant (year of birth, gender, level of education, and whether the person was born abroad) or may vary at each age (region, marital status, household size, whether the respondent has any children, whether their current partner lives in the same household, poor self-rated health, occupation group, self-employment, public sector employment, employment status of respondents and their current partner, logged equivalised household income, and the unemployment and inflation rates).

All time-varying variables including the treatment are measured with a lag of one year to reduce the risk of reverse causality.

Estimand

In order to test the hypotheses, the estimand of interest is defined as the difference between the risks of being retired for a person had they – counterfactually and continuously – owned or rented their own home from age 50. This difference between these potential outcomes represents an individual treatment effect, and averaged over the target population it represents

the average treatment effect (ATE) (Morgan and Winship, 2015). Defining the estimand in terms of a difference in risks makes the results both easier to interpret and less statistically arbitrary compared to other quantities more commonly estimated in survival analyses, such as hazard ratios (Hérnan, 2010; Syriopoulou et al., 2022).

The estimand can be formally expressed as:

$$ATE_t = E[Y_t(D_{50}, \dots, D_{t-1} = d')] - E[Y_t(D_{50}, \dots, D_{t-1} = d)]$$

whereby Y denotes the expected retirement risk at age t under the continuous housing tenure status D from age 50 through $t - 1$. Again, the treatment is lagged by one year to reduce the risk of reverse causality. According to the hypothesis to be tested, d takes different levels of the treatment variable whereby renting serves as the reference category in all analyses. Due to the fundamental problem of causal inference, the ATE cannot be observed directly, since a person either rents or owns their home at a given age and their counterfactual retirement status is therefore unknown.

Identification

For the estimand to be identified from the observed data, three assumptions must hold. First, the treatment and the outcome must be sequentially ignorable so that only individuals' housing tenure causes variation in their retirement status at each age. This is important because individuals likely select into a housing tenure status based on characteristics that also determine their retirement risk including both individual- and household-level factors that may vary over time. Considering the large set of control variables in the analysis reduces the risk of violating this assumption. Moreover, a check for the robustness of the results to unobserved confounding is presented below.

Second, the assumption of positivity must hold, which states that all individuals in the target population must have a non-zero probability of receiving the treatment. In the present case, individuals within all levels and combinations of covariates should be able to own and to rent their home at each age in later life. While it is plausible that each person may in principle be both a homeowner or renter, the robustness of the results to potential positivity violations is discussed below.

Lastly, the stable unit treatment value assumption (SUTVA) holds that the treatment of an individual does not influence the potential outcome of others and that individuals' potential outcome for all treatment levels is unambiguously defined and equal to their observed outcome. In the present case, the SUTVA might be violated if some housing tenure categories affect a person's retirement risk in vastly different ways. Hence, the robustness of the estimation results to an alternative construction of the treatment variable is discussed below.

Estimation

The estimation uses Targeted Maximum Likelihood Estimation (TMLE), a statistical framework that originated in epidemiology (van der Laan and Rubin, 2006; van der Laan and Rose, 2011, 2018; Schuler and Rose, 2017 for an introduction). In the survival setting, TMLE combines the estimation of the outcome event (i.e., retirement) with the estimation of both the treatment assignment (i.e., housing tenure) and the censoring mechanism. By combining these steps, the initial outcome model is adjusted ("targeted") to produce an unbiased effect estimate.

TMLE has major advantages over conventional regression analyses. Firstly, it is doubly robust so that if either the outcome model or the treatment and censoring models are correctly estimated, the final estimate will be consistent (i.e., converge to the true target quantity as the sample size grows), and if all models are correctly estimated, the final estimate will be efficient

(i.e., produce a consistent estimate with the lowest possible variance). This double robustness can substantially reduce bias and raise efficiency compared to methods that rely on modelling either the outcome (e.g., G-estimation) or the treatment assignment (e.g., inverse probability of treatment weighting) (Rose and van der Lann, 2011; Porter et al., 2011). It is therefore particularly useful when theory is not sufficiently clear as to how an outcome or the treatment and censoring mechanisms are to be modelled. Secondly, TMLE allows for the use of machine learning for the estimation while still producing valid standard errors. This reduces the risk of misspecification, and is again useful when theory does not imply a certain model specification while more flexible machine learning algorithms can detect potential interactions and non-linear relationships between variables. Thirdly, unlike standard regression models, TMLE can handle time-varying confounders that are themselves affected by the prior treatment without "controlling-away" the effect they mediate between the treatment and the outcome, an issue that is highly common in longitudinal analyses (Wodtke, 2013; Clare et al., 2019).

In addition to its favourable statistical properties, TMLE has advantages for applied research. In particular, it is flexible and precise with regard to how and to whom a treatment is assigned and how the target quantity is estimated. This is because, instead of a coefficient in a regression model, TMLE is based on predicting potential outcomes for each unit under clearly stated treatment rules which are then aggregated into substantively meaningful effect measures over the population of interest (Lundberg et al., 2021). This opens up avenues for a large range of theoretically meaningful and policy-relevant treatment rules and target estimands (Hoffman et al., 2024). In the present case, for example, the treatment rule holds that all individuals are assigned to continuously renting and owning their home from age 50. This "static" treatment is informative because housing trajectories are often more complex and may involve switches between different tenure statuses. Other than in conventional regression modelling, contrasting

"always-renting" and "always-homeowning" makes it easier to understand how an estimate of the average treatment effect at each age comes about and how it can and cannot be interpreted.

The estimation with TMLE proceeds in four steps. In a first step, an outcome model is estimated to predict individuals' retirement risk at each age based on all previous values of the treatment and the control variables. In a second step, the censoring and treatment mechanisms are modelled based on the previous values of the covariates. These models are used to predict each individual's probabilities of censoring and of receiving the treatment. In the third step, individuals' observed outcome is regressed on the product of the inverse censoring probability and the (negative) inverse probability of (not) receiving treatment for (un-)treated individuals as well as the initial outcome predictions for individuals' observed treatment status as a fixed offset. In a last step, the resulting "fluctuation parameter" can be used to de-bias ("target") the initial predictions of individuals' retirement risks as continuous homeowners and renter. If the identifying assumptions hold, the mean difference between these predictions is consistent with the ATE. Standard errors are calculated based on the variance of the efficient influence curve (Díaz et al., 2023). This procedure is repeated for each age from 51 to 65. For more details on the estimation procedure, see Schuler and Rose (2017) and Rose and van der Laan (2011).

All estimation steps use the SuperLearner ensemble learner (van der Laan, Polley, and Hubbard, 2007) which combines three common machine learning algorithms (random forests, extreme gradient boosting, and the LASSO) based on 5-fold cross-validation, in line with the recommendations in Phillips et al. (2023). In addition, the TMLE procedure is implemented with 5-fold cross-fitting to avoid overfitting. The analysis was conducted in R using the lmtp (Williams and Díaz, 2024) and SuperLearner (Polley et al., 2024) packages.

Results

Descriptive results

Figure 1 presents the cumulative risks of retirement for homeowners and renters as they are observed in the sample, unadjusted for confounding and informative censoring. The same graphs for homeowners with and without mortgage debt are presented in Appendix B.1.

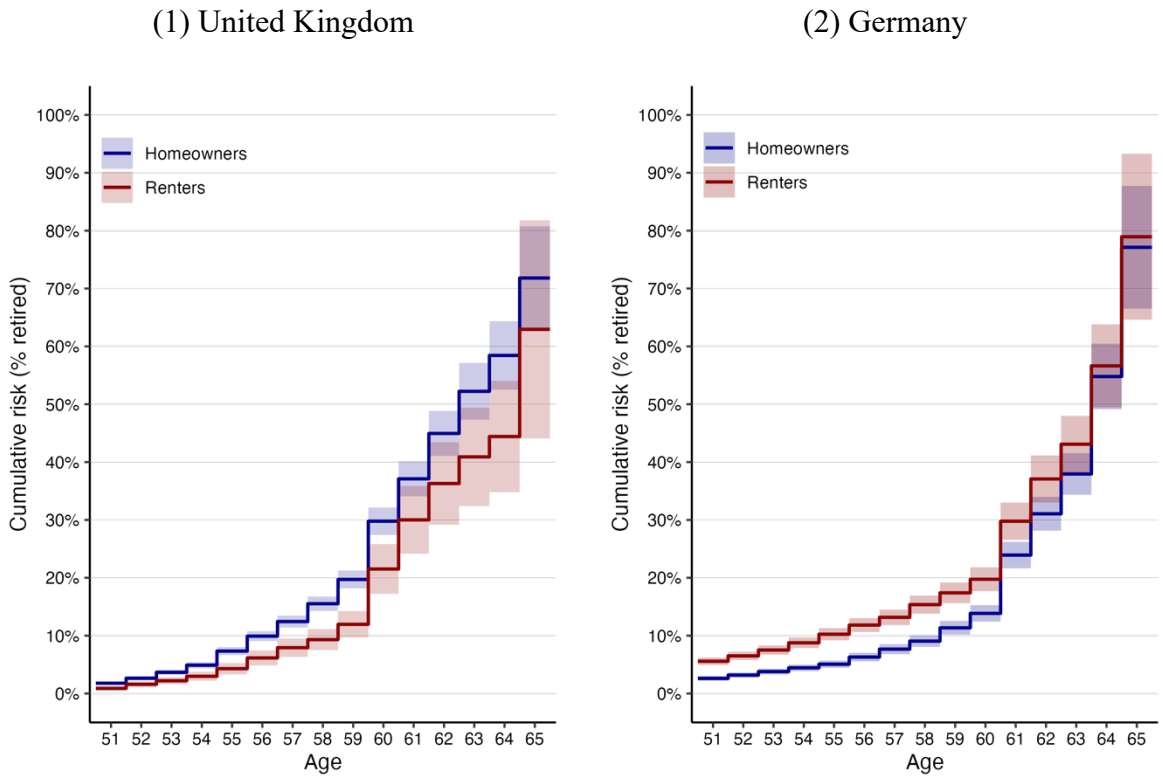

Figure 1: Kaplan-Meier estimates of the retirement risks of homeowners and renters.

Notes: Shaded areas represent 95% CIs.

ALT text: Graphs showing Kaplan-Meier estimates of the cumulative risks of retirement for homeowners and renters in the United Kingdom and Germany.

In the UK, homeowners are at a higher risk of entering retirement at all ages from 50 to 65. For example, at age 60, which has been the statutory normal retirement age for women until 2010 and remains a salient age threshold, homeowners are at an 8.27pp. (95%-CI: 3.36pp., 13.17pp.) higher risk of retirement than renters at the same age. At age 64, owners are 14.02pp. (95%-CI: 2.73pp, 25.31pp.) more likely to be retired. Only at the statutory normal retirement age of 65, this gap narrows to 8.87pp. (95%-CI: -12.00pp., 29.74pp.) and becomes statistically insignificant. Further distinguishing between ownership types indicates that the differences in retirement risks compared to renters are even larger for outright homeowners but small and statistically insignificant for owners with outstanding mortgage debts. At age 60, for example, outright owners are 17.68pp. (95%-CI: 12.52pp., 22.84pp.) more likely to be retired whereas owners with mortgage debts do not differ from renters (0.03pp.; 95%-CI: -4.77pp., 4.71pp.). The largest difference in retirement risks can be observed between renters and outright owners at age 64 (risk difference (RD): 23.70pp.; 95%-CI: 11.90pp., 35.50pp.).

By contrast, renters in Germany are at a persistently higher risk of being retired than homeowners throughout later life. For example, at age 60, the former statutory early retirement age for women, the difference between the retirement risks of renters and homeowners lies at 5.9pp. (95%-CI: 3.38pp.; 8.41pp.). This gap narrows at subsequent ages and turns statistically insignificant from age 63 to 1.82pp. (95%-CI: -16.01pp.; 19.67pp.) at the statutory retirement age of 65. Other than in the UK, distinguishing between ownership types does not indicate substantial differences between owners with and without mortgage debt, and both groups show similar differences in retirement risks compared to renters at all ages in later life.

Causal differences in retirement risk

Figure 2 presents the first set of results from the TMLE analysis. The two upper graphs show the cumulative risks of retirement for continuous renting and homeowning that are fully adjusted for confounding and informative censoring. The lower graphs show the differences in retirement risks between continuous renting and owning. If the identifying assumptions hold, this quantity represents the ATE defined above.

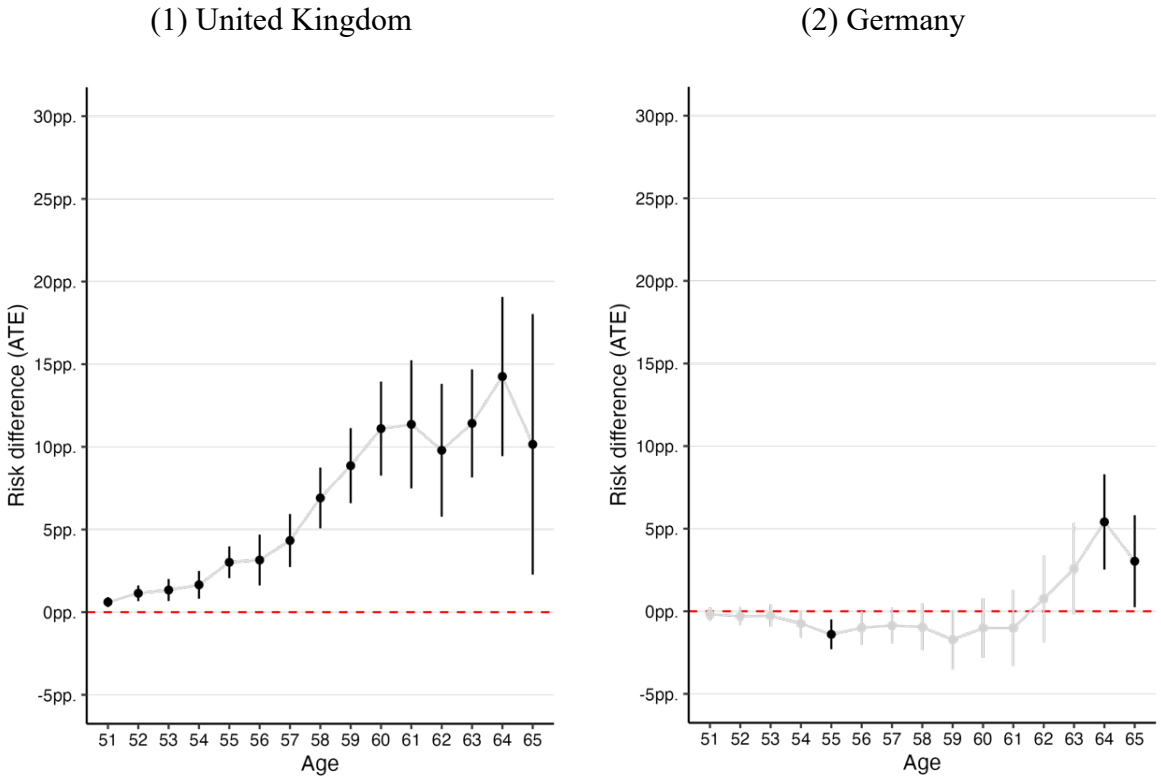

Figure 2: Causal differences in retirement risks between continuous renting and homeowning.

Notes: Whiskers represent point-wise 95% CIs. Insignificant effects are greyed out.

ALT text: Graphs showing targeted maximum likelihood estimates of the causal differences in retirement risks between continuous renting and homeowning in the United Kingdom and Germany.

In the UK, continuous home ownership appears to exert a substantial causal effect on the risk of retirement throughout later life. In line with hypothesis H1, the retirement risk linked to continuous homeowning is consistently higher than for renting, as indicated by large positive and statistically significant risk difference estimates. The estimates reveal that the effect of ownership is strongly age-dependent and that the gap in retirement risks that can be attributed to continuous ownership increases with age. Notably, the causal difference increases at each age until 61 (RD: 11.4pp.; 95%-CI: 7.49pp., 15.23pp.) and reaches 14.26pp. (95%-CI: 9.44pp.; 19.07pp.) at age 64, one year ahead of the statutory normal retirement age. As this trajectory illustrates, the effects of housing tenure are largest close to major retirement thresholds. Finally, at age 65, the effect of home ownership decreases to a 10.15pp. (95%-CI: -2.27pp.; 18.03pp.) higher retirement risk, indicating that renters are able to "catch-up" with their homeowning counterparts at the statutory normal retirement age.

In Germany, by contrast, home ownership does not appear to causally raise the risk of retirement at most ages in later life, as indicated by small and statistically insignificant risk difference estimates. Contrary to expectations, continuous ownership does not lead to a higher retirement risk between ages 51 and 63, with the exception of a small negative effect at age 55 (RD: 1.4pp.; 95%-CI: -0.23pp., -2.30pp.). This suggests that the large differences in observed retirement risks at these ages are likely explained by individuals with different retirement risks selecting into different housing tenures based on the observed covariates. Only at the last two observed ages, the effects are positive and significant at 5.36pp. (95%-CI: 2.49pp., 8.22pp.) at age 64 and 3.03pp. (95%-CI: 0.26pp., 5.80pp.) at age 65, suggesting that German owners make use of their home to retire early only shortly before or at the statutory normal retirement age.

Taken together and in line with hypothesis H3, the results show that the positive effects of home ownership between age 51 and 65 are considerably larger in the UK than in Germany, especially towards the end of working life.

Causal differences in retirement risk by ownership type

Figure 3 presents the second set of results from TMLE. The graphs illustrate the causal differences in the retirement risks between continuous renting and outright homeowning as well as homeowning with outstanding mortgage debts.

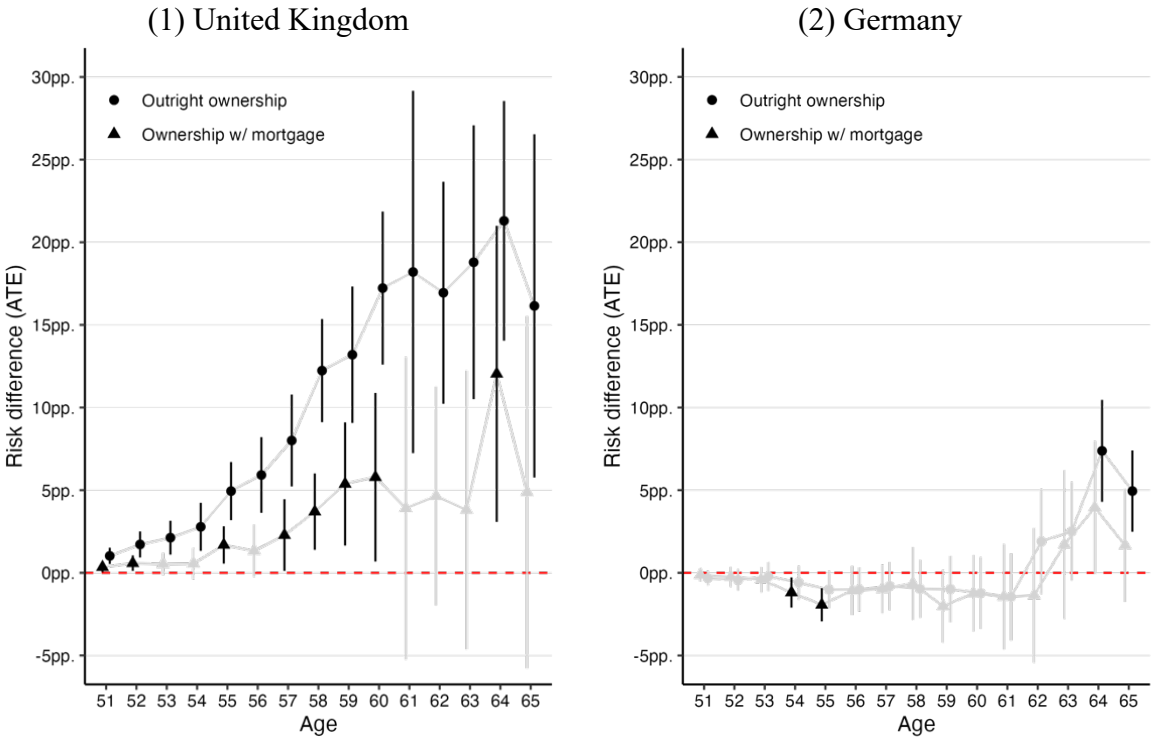

Figure 3: Causal differences in retirement risks between continuous renting and homeowning by ownership type.

Notes: Whiskers represent point-wise 95% CIs. Insignificant effects are greyed out.

ALT text: Graphs showing targeted maximum likelihood estimates of the causal differences in retirement risks between continuous renting, outright homeowning and homeowning without mortgage debts in the United Kingdom and Germany.

In the UK, distinguishing between the two types of ownership reveals that the positive effects of continuous ownership are much larger for individuals that own their home outright,

in line with hypothesis H2. The effects of outright ownership are large and significant at each age from 51 to 65. For continuous ownership with outstanding mortgage debt, by contrast, the effects are smaller and statistically significant only close to major age thresholds, up to age 60 and at age 64. One year ahead of the statutory normal retirement age, for example, continuous outright homeowners are 21.30pp. (95%-CI: 14.04pp.; 28.55pp.) and those with outstanding mortgage debts are only 12.04pp. (95%-CI: 3.08pp.; 21.00pp.) more likely to be retired than their renting counterparts.

In Germany, by contrast, continuous homeownership, both with and without mortgage debts, does not appear to have substantial effects on individuals' retirement risk, except for the last two years before the statutory normal retirement age. Outright ownership exerts a positive effect on the risk of being retired of 7.38pp. (95%-CI: 4.30pp.; 10.46pp.) at age 64 and 4.95pp. (95%-CI: 2.49pp., 7.41pp.) at age 65. This shows that the effects for home ownership found in the previous analysis are fully explained by the large effects of outright ownership.

Again, in line with hypothesis H3, the estimates show that the positive effects of home ownership, both with and without mortgage debts, are larger in the UK than in Germany.

Robustness checks

In addition to the analyses presented above, several robustness checks were conducted that correspond to each of the three identifying assumptions.

Robustness to unobserved confounding. Unobserved confounding would violate the sequential ignorability assumption by inducing a spurious correlation between the treatment and the outcome. The main concern in the present analysis relates to unobserved components of wealth such as financial assets (private pensions, stocks, etc.), cash savings or debts that may confound the link between a person's housing tenure and retirement behaviour. For example,

a person may be more likely to own their home and to retire early, but only as a result of holding high levels of non-housing wealth. Generally, the included covariates, particularly the measure of household income, which includes incomes from financial assets, likely accounts for much of this variation in wealth. Unobserved wealth (or any other confounder) would need to be associated with both the treatment and the outcome above and beyond all of these measured confounders in order to bias the causal estimates. The minimum strength of these associations can be quantified by calculating so-called E-values (van der Weele and Ding, 2017; van der Weele, 2022). Appendix C.1 contains E-values for all point estimates and confidence intervals from the analysis of continuous renting and homeowning. The E-values for the largest effects at age 64, for example, indicate that an unobserved confounder would need to raise the risks of both continuous home-ownership and of entering retirement by at least 1.94-fold in the UK and 1.51-fold in Germany, above and beyond the measured confounders, to shift the effect to zero. Given the high E-values and wide range of controls included in the analyis, it appears unlikely that an unobserved confounder would fully invalidate the findings.

Robustness to positivity violations. Positivity would not be given if some individuals were very unlikely to be renters or homeowners given their (combination of) covariate values. This would be reflected by extreme treatment probabilities estimated in the second step of the TMLE procedure. To examine whether this is the case, Appendix C.2 plots the distribution of the ratios between the probabilities of receiving the observed and the assigned treatment values ('density ratios') for the analysis of renting and homeowning. Values close to 1 indicate that individuals are equally likely to rent and own their home, whereas higher values indicate that individuals are less likely to receive the assigned treatment than their observed treatment status. Overall, the figure shows that density ratios appear to be modestly higher at age 51, particularly in the UK, where some homeowners are unlikely to rent their home given their covariate values.

Nevertheless, the figures shows that density ratios are close to 1 in both Germany and the UK for all ages after 51, reducing the concern for a positivity violation.

To avoid that large density ratios lead to unstable estimates, the density ratios at each age are truncated at the 97.5th percentile. This level was chosen to achieve a balance between the bias and the variance of the estimates (Léger et al., 2020; Cole and Hernán, 2008). To assess the robustness of the results to this level of truncation, Appendix C.2 shows additional analyses where the density ratios are truncated at the 95th and the 99th percentiles. Overall, the direction, significance and patterns of the estimates appear to be highly stable for both Germany and the UK, regardless of the level of truncation. Less truncation leads to marginally larger estimates (but higher variances) than in the results reported above, while more truncation slightly reduces the point estimates but increases their precision.

Robustness to treatment inconsistency. The SUTVA may be violated by an inconsistent definition of the treatment. In particular, the population of renters in social housing may benefit from reduced rents and higher housing security in similar ways as homeowners, and may thus be advantaged relative to their counterparts in private renting. As a robustness check, analyses were performed where individuals in social or state-subsidised rent arrangements are separated from the group of private renters. The figures in Appendix C.3 show that for both Germany and the UK, the direction, significance, and pattern of the effects remain substantively similar even if only private renting is considered as the reference category.

Discussion

Motivated by the growing role of housing for the distribution of wealth and life chances as well as the scarcity of causal and comparative evidence, this article set out to ask the simple question: *Does owning your home make you retire early?*

The analyses presented above provide strong evidence that the answer is predominantly yes. Using rich longitudinal survey data and a novel statistical method for causal inference, the results indicate i) that home ownership exerts a positive effect on individuals' retirement risk, ii) that this effect is larger for outright homeowners, and iii) that it is considerably larger in the UK than in Germany. Additionally, the results show that the effect of home ownership is highly age-dependent and is largest or only present close to statutory retirement thresholds.

These results have implications for social stratification and social policy research. With regard to the former, they indicate that housing should be considered as a relevant dimension of social stratification in work-to-retirement transitions. Specifically, the type of housing tenure appears to be crucial in determining the risk of retirement across later life. Outright ownership, in particular, is found to be the most advantaged tenure category, likely because it is associated with a higher permanent income, reduced geographical mobility, and higher perceived security that allow homeowners to withdraw from employment earlier than renters. These findings are consistent with research showing that housing tenures are closely linked to inequalities in other life course transitions, which has primarily focused on outcomes in early- and mid-life (Mulder and Billari, 2010). The results further suggest that transitions in later life, including from work to retirement, are equally if not more strongly shaped by housing conditions, which reflect (dis-)advantages accumulated over the previous life course (Angelini et al., 2013).

Furthermore, the results show that the effects of housing are highly age-dependent, and at least in the UK, increase with age. This points towards a cumulative (dis-)advantage process (Dannefer, 2003; DiPrete and Eirich, 2006), whereby the effects of continuous home ownership or renting compound over time. To detect the social inequalities generated through this process, research should use longitudinal data, avoid the measurement and estimation of the effects of housing at single points in time, and apply appropriate methods such as TMLE, in line with the life course approach (Fasang and Mayer, 2020).

With regard to social policy research, the results suggest that the institutional context factors related to countries' welfare and housing regime act as moderators of the causal effects of housing tenure. The country comparison indicates that the greater orientation of the British welfare state towards "property-based welfare" (Ronald and Doling, 2008) likely exacerbates the stratifying effect of housing, whereas the more equal position of homeowners and renters in Germany mitigates this effect. These results also support the argument that home ownership acts as a self-insurance that provides a permanent income in old-age and thereby allows older individuals to retire relatively earlier (Conley and Gifford, 2006; see also Rodem and Pfeffer, 2021 on the "buffer function of wealth"). This is likely particularly relevant in the UK context, where few other options for earlier retirement exist. However, next to acting as a self-insurance, the article proposed geographical mobility and perceived security as additional mechanisms through which housing may affect individuals' retirement behaviour. These mechanisms, too, depend on the institutional context which determines the transactions costs of moving and the level of housing security in the population, for example through tenant protections and rent regulations.

Moreover, the results suggest that housing tenures interact with institutionalised age threshold in determining retirement risks throughout later life. Particularly in the UK, the gaps in retirement risks attributable to continuous home ownership are largest shortly before key age thresholds but decline at the normal retirement age of 65. When approaching retirement age, outright owners thus appear to make use of their home to retire earlier, but renters "catch-up" with their owning counterparts when reaching normal retirement age, indicating that retirement age thresholds serve as strong behavioural reference points (Seibold, 2021).

Next to these substantive findings, the article demonstrates how TMLE can be used as a novel approach for estimating causal effects in longitudinal data. In addition to being doubly robust and allowing for the integration of machine learning algorithms, TMLE can handle time-

varying confounders that are themselves affected by past treatment, which is common but often ignored in longitudinal research (Clare et al., 2019). Moreover, the article clearly states the target estimand and identification conditions, and how they may be violated (Lundberg et al., 2021). The positivity assumption, for example, is central to claims of causality but rarely made explicit or tested in applied research, even though positivity may not always be given if some groups are unlikely to be exposed to a treatment or to receive an intervention. In such cases, TMLE and related estimators allow to implement more complex (but potentially more realistic) treatment regimes, where the treatment is not statically assigned but depends on the observed status or treatment history and thereby ensures positivity (Hoffman et al., 2024).

Nevertheless, several limitations of the analysis and related avenues for future research should be considered. Firstly, while the results are consistent with expectations based on rough country characteristics, the small-N comparison cannot possibly identify specific institutional features or policies that explain the observed country differences. In addition, the data used for the analysis cover three decades from the 1990s to the early 2020s, a period during which major housing and welfare reforms were implemented and economic conditions varied considerably. Future research may benefit from following specific birth cohorts that were exposed to similar institutional and economic conditions, and from examining how specific policy changes alter the effects of housing tenures. Secondly, the analysis could not discriminate between the three mechanisms that are hypothesised to bring about the causal effects of different housing tenures. Future work could exploit changes in rent prices or geographical variations or use survey items that measure subjective housing security to assess their relative importance. Thirdly, the results depend on assumptions that have been made transparent throughout the analysis but that are ultimately untestable. In particular, the ignorability assumption is central to disentangle causal from selection processes that may contribute to the large effects of home ownership (Zavisca and Gerber, 2016). Future research could use other data (that include information on wealth, in

particular) or quasi-experimental designs to validate the results. Lastly, the average treatment effects reported above likely mask considerable heterogeneities that could not be investigated due to data limitations. It would be worthwhile to study whether the effects of housing tenures differ by gender, period and cohort, income and wealth levels, area of residence (rural vs. urban and East vs. West Germany), and type of mortgage (fixed or variable), among others.

In conclusion, this article again highlights housing as a source of social stratification in work-to-retirement transitions that has barely received attention in research and policy. This may change as current cohorts of homeowners and renters close to retirement age are exposed to growing housing insecurity, rising rents, and price volatilities (Dewilde and de Decker, 2016; Arundel and Doling, 2017). Moreover, young cohorts in many European countries show steadily declining home ownership rates, with increasing difficulties for young families to enter home ownership, compounded by growing employment insecurities (Dewilde, 2020; Lennartz et al., 2016; Lersch and Dewilde, 2015). If left unaddressed, these developments will contribute to unequal life course outcomes, extending into retirement.

Data availability statement

Access to the German dataset (SOEP, v38, doi: 10.5684/soep.core.v38.1eu) can be requested through the website of the SOEP Research Data Center: https://www.diw.de/en/diw_01.c.678568.en/research_data_center_soep.html

Access to the UK datasets (BHPS and UKHLS; doi: 10.5255/UKDA-SN-6614-19) can be requested through the website of the UK Data Service: https://www.understandingsociety.ac.uk/documentation/access-data/

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