DOES OWNING YOUR HOME MAKE YOU RETIRE EARLY? [1]

Jan Einhoff[2]

Draft version: 14/06/2023

Abstract

[Highlighted text is in progress]

Keywords: Retirement timing; Home ownership; Parametric g-formula

[1] This document was prepared for the DYNAMICS research seminar on 19/06/2023. The latest version is available here. Replication materials are stored here. Comments and suggestions are very welcome.

[2] DYNAMICS RTG and Humboldt University; E-Mail: jan.einhoff@hu-berlin.de; DYNAMICS is funded by the German Research Foundation (DFG) - 390285477/GRK 2458.

Introduction

An interdisciplinary body of work in comparative political economy, housing studies and social policy research highlights the role of home ownership as “property-based welfare” (Doling and Ronald, 2008; Ronald et al., 2017). In times of welfare retrenchment, housing has emerged as part of a “hidden welfare state” (Howard, 1999; Kholodilin et al., 2023) that provides “social policies by other means” (Seelkopf and Starke, 2019), including various fiscal exemptions for homeowners. These benefits compound the role of housing in shaping the distribution of wealth and power that has led some scholars to argue that home ownership, especially in urban areas, has become a crucial factor in contemporary class formation (e.g., Findeisen, 2022).

To shed light on the potential micro-level impacts of property-based welfare, this study investigates how home ownership affects a key life course outcome: the timing of the transition to retirement. Retirement is particularly interesting in the context of various policies that have been introduced since the mid-1990s to counter the rising costs of population ageing by delaying the withdrawal from paid work (Hofäcker et al., 2016). Should the benefits of home ownership instead lead to earlier exits, they could be a major constraint on these policy efforts, while at the same time being an important source of (not only financial) security for large parts of the elderly population (Elsinga and Hoekstra, 2005; OECD, 2020).

To date, most scholarly work has focused on the role of home ownership for other life course outcomes, including family formation and transitions into and out of joblessness (for a review, see Zavisca and Gerber, 2016). Research on the relationship between home ownership and retirement timing is scarce and mostly focused on the United States (e.g., Zhao and Burge, 2017; Farnham and Sevak, 2016) or on household wealth including non-housing assets (e.g., Butrica and Karamcheva, 2020). The main study for Europe by Doling and Horsewood (2003) is limited to a correlational analysis of aggregate employment and housing data, making it difficult to draw causal conclusions. Altogether, while these studies find negative associations of home ownership with the age at retirement, they do often not employ causal identification strategies, focus on single countries or do not cover more recent years. An additional drawback is that most studies measure home ownership only at one point in peoples’ lives, e.g., at age 50. This is problematic because critical events such as job loss or separation can lead to changes in home ownership even at later life course stages (Dewilde and Stier, 2014).

Against this background, this study contributes evidence on the causal effect of home ownership on retirement timing in Germany and the UK, two countries that represent distinct welfare state and housing regimes in the European context. Based on a review of economic and sociological mechanisms, I contend that persons owning their home retire earlier than their renting counterparts, and that this effect is driven by homeowners' permanent income, their reduced mobility and perceived security, and thus only holds for outright owners. Furthermore, based on a discussion of key institutional differences, I argue that the effect is larger in the UK where home ownership is more widespread and normatively charged and pension incomes are more dependent on housing and financial markets than in Germany.

For the empirical analysis, I draw on micro-level data on individuals aged 50 and older during the years 1991 to 2020 from three representative household surveys: the German Socio-economic Panel (SOEP) as well as the British Household Panel Study (BHPS) and its successor, the UK Household Longitudinal Study (UKHLS). The longitudinal data allow me to overcome several identification issues, most crucially the dynamic selection into (and out of) home ownership, which is in part based on time-varying characteristics that are themselves influenced by previous housing conditions, such as individuals' work and family situation. I use the parametric g-formula, a model-based approach for causal inference from epidemiology (Robins, 1986; Hernán and Robins, 2023), to address the issue of dynamic selection as well as to report and visualise causal estimands that are more meaningful than the widely used hazard ratios: differences in retirement risk from age 50 to 70 between standardised populations that own their home or rent throughout later life (Hernán, 2010; Syriopoulou et al., 2022).

Theory

Historical background and prior studies

Why should home ownership and the timing of retirement be causally related? From a historical perspective, housing and retirement have long been central domains of welfare state intervention. To explain the emergence and impacts of such interventions, research commonly applies the theoretical concept of 'de-commodification' (Esping-Andersen, 1990). From this view, social policies primarily shelter "deserving" groups, often explicitly the working classes, from (labour) market forces by ensuring minimum living standards, (re-)distributing resources, and providing insurance functions. Retirement is a typical domain for such de-commodification where policies regulate the access to different income sources in old-age and thereby encourage or reduce the need for labour market participation in later life.

Housing policy, on the other hand, is less well understood from the perspective of de-commodification (Torgersen, 1987). In 1999, Howard's seminal book on the "hidden welfare state" in US social policy argued that tax regimes beneath the surface of comprehensive welfare state programmes play a central role in (re-)distributing life chances and in incentivising private welfare provision. Housing is a primary field for such "social policy by other means" (Seelkopf and Starke, 2019) in the form of neo-classical demand-side instruments such as tax exemptions for house purchases, mortgage payments, and capital gains[3]. These measures tend to be highly technical, difficult to quantify, and have therefore, other than pensions, received little attention from welfare state scholars (Kholodilin et al., 2023; see also Titmuss, 1958). The main idea in the existing literature is that of "property-based welfare" (Doling and Ronald, 2008), meaning that states have shifted from active provision of social policy benefits to more passive efforts to promote home ownership as a means of sustaining old-age livelihoods.

This lack of attention is problematic for at least two reasons. First, because property-based welfare might drastically alter the distributional impact of welfare state interventions as home-owning middle classes become their primary beneficiary. Second, extensive government support for home ownership might crowd out public expenditure in other welfare state domains including for public pensions and active labour market and ageing policies. In fact, despite their

[3] Tax arrangements for homeowners, which are usually weakly progressive, account for large shares of governments' revenues (in 2019, property-related taxes made up between 0.5% (Czech Republic) and 14.2% (South Korea) of total tax revenues in the OECD; UK: 11,8% and Germany: 3.3%; OECD, 2022).

different logics, a scattered literature points towards a strong macro-level relationship between the domains of housing and retirement, which can be broadly divided into two historical periods (see Kohl, 2018 and Van Gunten and Kohl, 2020; Aalbers, 2008).

From the post-war era until the 1990s, contributions by Kemeny (e.g., 1980, 1981, 2001 2005), Castles (1998) and others described the relationship between housing and the welfare state as a "really big trade-off" (Castles, 1998). They argued that, firstly, homeowners who take on mortgage debt oppose taxation levels that would be required for comprehensive social policy programmes, and secondly, that households use home ownership as a form of life-cycle insurance and substitute for public welfare provision. Consequently, as countries experience rising levels of home ownership, support for redistributive public welfare should diminish, a development which is politically capitalised by centre-right parties that cut social spending and oppose taxation in the interest of homeowners (e.g., Ansell, 2014; Conley and Gifford, 2006; Prasad, 2012). In countries with high levels of home ownership and limited public spending, housing thus becomes a major determinant for individuals' access to welfare. In their study of European countries, Doling and Horsewood (2003) present cautious evidence that higher home ownership is indeed associated with lower labour market participation of older (male) workers. More recently, however, studies suggest that the inverse relationship between home ownership and welfare spending, especially on pensions, has weakened or might even have reversed (e.g., Van Gunten and Kohl, 2020), potentially as a result of deficit financing (Castles and Ferrera, 1996) or political resistance against welfare state retrenchment (Huber and Stephens, 2001; Pierson, 2011). Also, the transition of countries into "property-owning democracies" (Rawls, 1971) has created political support for home ownership from both centre-right and centre-left parties that compete for property-owning constituencies (Schelkle, 2012; Kohl, 2018).

Another perspective on the relationship between housing and the welfare state emerged during the phase of economic volatility from the early 2000s throughout the Great Recession and its aftermath. Here, not a systematic trade-off, but the financialisation of both housing (e.g., Kohl, 2018) and pension systems (e.g., Ebbinghaus, 2015) created a tight link between the two domains (see also van der Zwan, 2014). In highly financialised market economies, housing not only functions as a consumption good but as an asset class that enables households to diversify their portfolio in order to prepare for social risks in old-age (Ansell, 2014). At the same time, political reforms extended the role of funded occupational and private pensions and thereby increased the dependence of welfare provision on financial market returns (Ebbinghaus, 2015). In particular, the growth of ("subprime") asset-backed securities (esp., mortgage debt) during the 2000s provided institutional investors such as life insurances and mutual and pension funds with ample investment opportunities that came to a sudden halt with the 2007/08 financial crisis, most drastically in Southern Europe (Spain, Portugal) and the Anglosphere (US, Ireland) (IMF, 2009; Casey, 2012). This entanglement of housing and pension provision via financial markets along with losses in private savings and rising private and public debt has motivated several studies on the consequences for retirement behaviour (e.g., Butrica and Karamcheva, 2013; 2016, 2018, 2020; Farnham and Sevak, 2007, 2016). In sum, these studies suggest that wealth including through home ownership is strongly associated with earlier retirement, while mortgage debt and negative wealth shocks significantly prologue individuals' working lives.

Institutional context in Germany and the UK

Germany and the UK, the two countries this study focuses on, represent cases where the described historical trajectories played out in distinctly different ways as a result of marked institutional differences. These factors are important because they determine which parts of society can attain home ownership and to what extent home ownership provides advantages over renting in terms access to welfare and thereby opportunities for earlier withdrawals from the labour market (DiPrete, 2002).

The UK, on the one hand, can generally be described as a liberal market economy in which markets are the main mechanism for allocating resources (Hall and Soskice, 2001). This is also true of housing, which is structured in a dualistic system with a large private housing sector and strictly regulated social housing reserved for the most vulnerable groups (Kemeny, 1995). Private home ownership is encouraged by the state through various tax schemes and there are large financial markets for mortgages and home equity. Moreover, despite falling homeownership rates in recent years, owning a home continues to be seen as part of a fulfilled life (Ronald 2008; Arundel and Ronald, 2021; Kohl, 2020). This is reflected in one of the highest proportion of homeowners in the OECD (OECD, 2023). At the same time, and in line with the notion of a trade-off, public welfare provision in the UK is marginal and the role of the state is confined to ensuring basic living standards and means-tested social assistance. The pension system is characterised by "Beveridge"-type features, including large occupational and private pension pillars, and means-tested state pensions that are primarily targeted at poverty reduction (Ebbinghaus, 2020). Combined with liberal labour market regulations and few early exit options, this reduces opportunities for early retirement and encourages longer working lives typical of a “late exit” regime (Ebbinghaus and Hofäcker, 2013). This institutional focus on extending working lives has been further reinforced in recent years by adjustments in the replacement ratio and increases in the statutory retirement age.

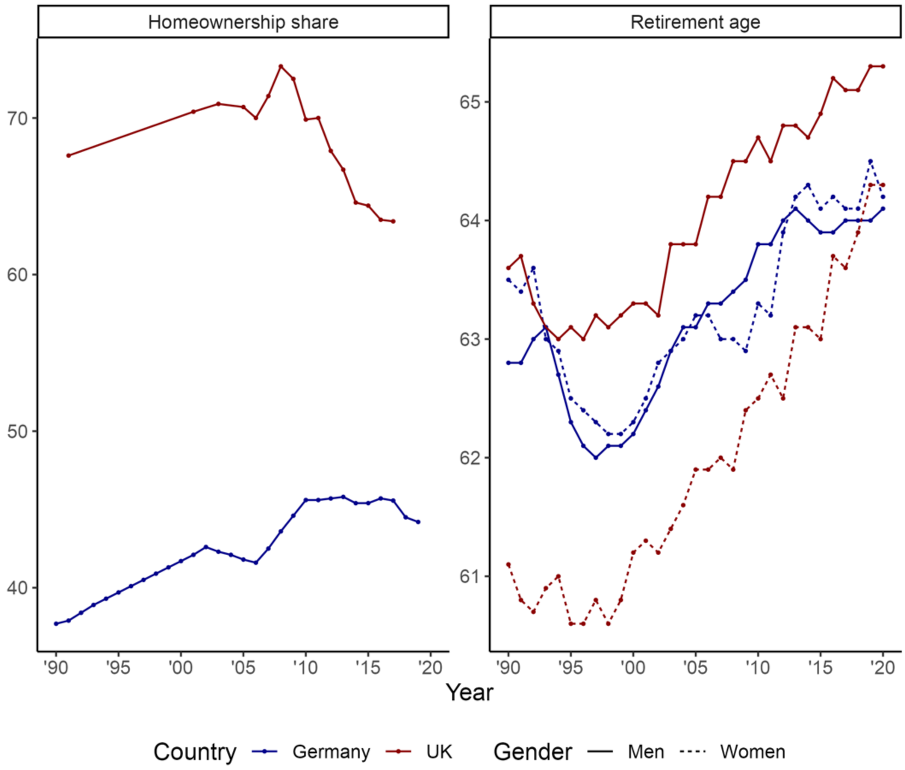


Figure 1: Home ownership shares and average effective retirement ages of men and women in Germany and the UK, 1990 to 2020 or latest year available

Data: Home ownership shares from Kohl (2017) and Eurostat (2023); Average effective retirement ages from the UK Office for National Statistics (2021) and the Bundesinstitut für Bevölkerungsforschung (2023).

Germany, on the other hand, is commonly described as a coordinated market economy, with the state playing a more interventionist role in regulating labour and housing markets. The rental market is structured as a unitary system with protective tenancy rules, a small social housing sector and relatively low levels of home ownership. Mortgage debt levels are lower than in the UK, largely as a result of a smaller and more regulated private credit market (Schelkle, 2012). This has led to renting being seen as more equivalent to home ownership, with Germany resembling a 'tenant society' (Helbrecht and Geilenkeuser, 2010; Kemeny, 1981). Also, in 2006, the conservative-led coalition government abolished the largest tax subsidy and housing programme ("Eigenheimzulage") (Muellbauer, 2018). In the aftermath of the financial crisis, the level of total mortgage debt remained stable (Bundesbank, 20/21) and the level of home ownership did not fall as sharply as in the UK. Germany's conservative-corporatist welfare state is at the same time more extensive and focused on status and income maintenance based on past contributions, with an active regulatory role of the state to ensure a relatively high degree of decommodification, with strong labour market regulation and a marginal and at most complementary private pension (Ebbinghaus, 2006). Due to these factors, Germany can be classified as an "early exit" regime, at least for much of the period under consideration, although the last two decades have seen a strong increase in the exit age due to liberalising labour market and pension reforms and efforts to close early retirement schemes at the public and firm level and to retain older workers in the labour market (Hofäcker and Unt, 2013; Ebbinghaus and Hofäcker, 2014). Strong occupational stratification of benefits.

Table 1: Institutional context in Germany and the UK

	Germany	**UK**
VoC type	CME	LME
Housing regime	Unitary	Dualist
Welfare state regime	Conservative-Corporatist	Liberal
Pension system type	Bismarckian	Beveridge
Retirement regime	Early exit	Late exit
Dependency on home ownership in welfare provision	Low	High

These rough characterisations suggest that home ownership takes a more central role in individuals' welfare provision in the UK than in Germany. In line with Doling and Ronald's (2008) conception of "property-based welfare", housing makes up a significant share in older persons' income in the market-based welfare system of the UK, while public sources of welfare are means-tested and provide only for basic financial security. In contrast, the dependency of welfare provision on the ownership of a home is lower in Germany, where tenure types are more equally distributed and publicly supported and pension incomes and thus retirement timing are to a larger extent tied to occupational status and earlier contributions.

To sum up, housing and retirement are inherently linked domains of the welfare state that create distinct ways in which homeowners are advantaged over renters in terms of access to welfare. On the level of institutions, Germany and the UK differ markedly in the extent to individual welfare provision depends on home ownership. Next, I will discuss how individual-level differences in retirement timing can be expected to emerge in these contexts.

Individual-level mechanisms

At least four mechanisms have been discussed in economics and sociology to explain the causal link between home ownership and retirement timing: (1) home ownership provides a *permanent income*; (2) home ownership reduces *geographical mobility*; (3) home ownership promotes *perceived security*; and (4) *Social norms* compound these mechanisms by prescribing certain attitudes and behaviours.

From economists' view, home ownership is above all a source of income that comprises both 'income in kind' (or 'imputed rent') and 'income in cash' (Doling and Ronald, 2010). The former refers to the value that is embedded in the size and quality of a dwelling and its location which provide shelter, comfort, and private space. Income in kind is proportional to the market rent a dwelling would attract. The latter refers to a dwelling's value that can be converted into cash through sale (directly or as annuity) or by borrowing against it as collateral (e.g., through equity release). Income in cash is proportional to the market or capital value of a dwelling. The total income (in kind and in cash) an owner can ultimately derive from their dwelling further depends on maintenance costs, outstanding loans taken out for the purchase, and taxes levied on the dwelling's notational or imputed value. In sum, this implies that the income from home ownership increases with a dwelling's total value and is higher for outright owners than for mortgage-paying owners and where the tax burden on ownership and purchase is low.

How this income affects labour supply, including the decision to enter retirement, is mainly studied in the framework of life cycle models dating back to Modigliani and Brumberg (1954) and Friedman (1957). In its basic formulation, the model predicts that any 'permanent income' (i.e., income that can be anticipated and planned), such as from owning a home, will have a lasting impact on individuals' consumption behaviour. Assuming rational and fully informed decision-making and leisure being a normal good, higher permanent income from home ownership should increase the consumption of leisure and thus reduce individuals' labour supply, leading to earlier withdrawals from paid work. While there is ample empirical support for this negative effect of permanent income on labour supply, studies of retirement timing show mixed results (for Germany, see Kuhn et al., 2021; for the UK, see Disney et al., 2013). Most studies examine total household wealth and include home ownership only as a control or additional independent variable among others (e.g., Butrica and Karamcheva, 2018, 2020), and the associations they estimate should therefore be interpreted cautiously (Keele et al., 2020).

Also, while life cycle models establish a link between home ownership and retirement timing via changes in leisure consumption, a common criticism concerns the assumption that individuals smooth their consumption by optimally adapting to current and future economic circumstances. In fact, this premise is inconsistent with the typically observed sharp decline in consumption levels among recent retirees, known as the “retirement-consumption puzzle” (Banks et al., 1998). Accounting for this unexpected pattern requires auxiliary (‘behavioural’) assumptions about irrationality and uncertainties, varying preferences for risk and leisure, as well as social and institutional context factors (Hurd and Rohwedder, 2006).

Next to the permanent income derived from home ownership, economists have pointed to the reduced geographical mobility of homeowners. Oswald (1996) was the first to argue that homeowners’ limited access to distant labour markets impairs their job search and matching behaviour (Havet and Penot, 2010). Subsequent works, in contrast, contend that homeowners’ reduced mobility might promote employment by lowering reservation wages and increasing search efforts in local labour markets (Munch et al., 2006; Coulson and Fisher, 2002). These opposing claims might explain why the empirical evidence is mixed and it is not clear whether home ownership has positive, negative or no effects on employment outcomes (e.g., Caliendo et al., 2015 for Germany; Battu et al., 2008 for the UK). Also, as for tests of life cycle models, most studies examine labour market participation in general rather than retirement and do not differentiate between age groups which differ in their willingness and ability to search for work and adjust wage expectations (Axelrad et al., 2017). For older homeowners, especially those who own their home outright, entering retirement and living on a pension may present a more attractive option than moving out or taking up any available job close to home.

Retirement is not an entirely individual choice but depends on social influences and the evaluation of one’s life vis-à-vis others. Building on this insight, sociologists have considered further factors, namely the role of non-pecuniary resources and of social norms.

A first line of argument is that owning, rather than renting, one’s own home promotes ‘perceived security’, which comprises different subjective measures such as well-being, control over one’s life, and perceptions of one’s social position (see Zavisca and Gerber, 2016, for a review). For example, in most European countries, homeowners are generally more satisfied with their housing situation than renters (Elsinga and Hoekstra, 2005). Homeowners are also less likely than renters to perceive themselves as being poor, especially among older age groups

(Watson and Webb, 2009). Although it is not clear to what extent these relationships are causal, these non-pecuniary resources associated with home ownership can in turn be related to the decision to retire: Individuals who perceive their living situation as relatively more secure may be to be more inclined to take the risk of leaving paid work and rely on non-labour incomes to maintain their living standard in retirement. This effect is likely to be stronger in contexts where renters are less protected and renting and social housing are largely reserved for disadvantaged groups. Moreover, similar to paying a rent, outstanding mortgage debt is likely to reduce the perceived security that individuals can derive from their home.

In addition, sociologists have underscored that housing and retirement are governed by norms that prescribe certain behaviours. These norms can be expected to strengthen the causal mechanisms described above. On the one hand, in societies that strongly value home ownership over renting, the permanent income and perceived security it provides should be relatively higher than in countries where renting is seen as equally valuable. On the other hand, life course scholars have argued that individuals orient themselves to age-related norms that structure the order and timing of life course events and transitions (Bernardi et al., 2019). For older workers, research has shown that the perceived normative exigency of pursuing paid work usually ceases at the (gendered) 'normal retirement age' (e.g., Radl, 2012; Han and Moen, 1999). This widely accepted age boundary typically lies below countries' statutory retirement age and individuals would prefer to enter retirement even before reaching full pensionable age (Esser, 2005). Taken together, this implies that…

Hypotheses

Three hypotheses can be derived from the discussion. Firstly, the four mechanisms – permanent income, geographical mobility, perceived security, and social norms – concur in their prediction that, all else equal, home ownership leads to earlier retirement. Thus, a first hypothesis reads:

H1: Homeowners retire earlier than their renting counterparts.

Secondly, however, because the permanent income and perceived security homeowners can derive from their home should be reduced by the amount of outstanding mortgage debt, a second hypothesis is that:

H2: The effect is larger for outright owners than for those with outstanding mortgage debt.

Lastly, because home ownership is more common, normatively charged and explicitly supported by government and because public welfare provision is more residual and individual welfare in retirement in the UK thus more dependent on the permanent income and perceived security derived from home ownership, a last hypothesis is the following:

H3: The effect is larger in the UK than in Germany.

Data and methods

Data and working sample

The analyses use combined micro-level data 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, 2018) as well as the Socio-economic Panel (SOEP) for Germany (Goebel et al., 2018). All three surveys sample households and interview their individual members in yearly intervals using CAPIs. Moreover, all three surveys employ complex sampling designs to ensure representativeness of changing national populations, e.g., by oversampling certain regions or minority groups. For the analysis, I use the main surveys only and I use the Comparative Panel File provided by Turek, et al. (2021) to harmonise the different data files.

Taking this data, I impose several restrictions to construct the working sample[4]. First, I only include individuals aged between 49 and 70 who retire at age 51 or later. This is a common threshold in the literature to exclude persons who retire unusually early, e.g., due to disabilities. Second, because I use time-varying covariates that must be observed in the year before a person retires, I only include individuals who are at risk of retirement or retiring during the sampling period from 1991 to 2020. Third, in line with previous studies, I exclude respondents who are inactive at age 50, which removes mostly women from earlier cohorts (see Appendix X).

Both censoring and truncation are present in the data, primarily as a result of sample restrictions and survey attrition. Appendix X provides a detailed discussion of the incidence of censoring and truncation, potential biases, and how I deal with them. In essence, I use statistical models that can deal with non-informative right censoring as well as a combination of listwise deletion and hot-deck imputation to handle interval censoring where at most one interview between successive survey years was missed by a respondent.

The final working sample includes X individuals from X households in the UK and X individuals from X households in Germany, amounting to a total of X person-year observations in the UK and X in Germany. X (X%) individuals in the UK and X (X%) in Germany transition

[4] Note that the target populations are the sample, not the populations of Germany and the UK, since I use samples restricted to the sub-set of complete observations to ensure the internal validity of the analysis.

into retirement during the observed period. X (X%) and X (X%) respondents identify as female in the UK and Germany, respectively. Appendix X provides further descriptive statistics.

Variables

The outcome variable used throughout the analysis is a binary indicator for individuals' 'retirement status' at each age. As different conceptualisations exist in the literature (Denton and Spencer, 2009), I use the most common sociological definition of retirement as having left the last job for individuals who describe themselves as being "retired" or "disabled" (Radl, 2013). I also present a robustness check in Appendix X using a definition of retirement as receiving old-age pension benefits, which is more common in the economics literature.

I use two variations of the treatment variable. First, 'home ownership status' is a time-varying binary indicator for whether an individual owns (either outright or with a mortgage) or rents (either through private or social renting arrangements) their home at a given age. Second, 'tenure status' is a time-varying categorical variable that separates outright homeowners from those with outstanding mortgage debt as well as those who rent. This second variant allows me to examine the effect of having a permanent income and perceived security derived from home ownership which should be markedly higher for outright owners (as in H2).

I include several control variables that are likely to confound the relationship between home ownership and retirement timing. These are time-invariant (gender, education, migration background, and socio-economic class of respondents' father) or vary over time: year, region, employment status, employment status of respondents' current partner, economic sector, job tenure, socio-economic class, marital status, household size, and self-assessed health (see Table X in Appendix X for the justification and measurement of each variable).

Estimands and identification

Before making statistical modelling choices, the key question to ask is: Which estimand is most appropriate for testing the theoretical arguments made above (Lundberg, 2021)? Since I am interested in the total causal effect of home ownership on the retirement risk at each age, a meaningful theoretical estimand can be defined as the difference in whether a person is retired at a certain age had they owned versus had they rented their home (as in H1). The difference between these two potential outcomes (for being a homeowner vs. being a renter) represents an individual treatment effect, and averaged over the study population, it represents the average treatment effect (ATE) (see, e.g., Imbens and Rubin, 2015; Morgan and Winship, 2015). By estimating the ATE at all ages from 50 to 70, I obtain a differentiated picture of the expected effect of home ownership throughout peoples' later life course.

Because both potential outcomes are not observable for one individual, the theoretical estimand must be related to an empirical estimand. In the analyis, this quantity will be inferred from the observed data for individuals who actually own or rent their home. To do so, several threats to the identification of the treatment effect must be considered.

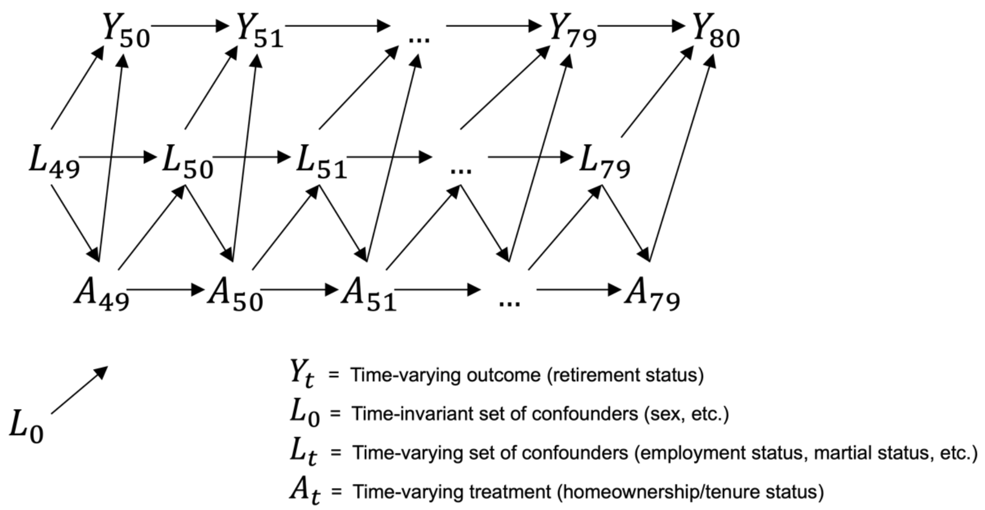
Firstly, identification is complicated by confounding and selection into treatment, since persons who own their home likely differ from those who rent across several dimensions that also affect their retirement timing. For example, home ownership is more widespread among a selected group of healthy, married, and better educated individuals in professional occupations who are, at the same time, known to retire relatively late (e.g., Garcia and Figueira, 2021; Fisher et al., 2016). Among potential confounders, wealth stands out as the most difficult to measure variable. However, home ownership itself is often the most important storage of households' wealth (Fuller et al., 2019). To further account for the selection of wealthy individuals into early retirement, the analyses also control both for individuals' socio-economic class, which is a key predictor of life-time wealth accumulation (including through private pensions, life insurances, or other financial assets) as well as for their fathers' socio-economic class, which is a key predictor for inheritance of wealth (see, e.g., Hansen and Wiborg, 2019). Together with the control variables listed above, this should significantly reduce the risks of confounding and selection into treatment.

Secondly, a key identification threat is treatment-confounder feedback[5]. In this case, a time-varying confounder (L_t in Figure 2) that affects both individuals' retirement (Y_t) and their home ownership status (A_t) is itself affected by earlier home ownership (A_{t-1}). Three variables stand out among the confounders as being particularly prone to such treatment-confounder feedback: individuals' employment and family status as well as their partners' employment status. All three factors have been shown to determine individuals' likelihood to transition into

[5] Interestingly and although rarely considered in quantitative life course research, treatment-confounder feedback can be thought of as a form of cumulative (dis-)advantage where a "favorable relative position becomes a resource that produces further relative gains" (DiPrete and Eirich, 2006: 271). In the present case, homeowners might be incentivised to take-up relatively more stable jobs which, in turn, allow them to pay off their mortgage debt more quickly which might, in turn, further strengthen their relative position in the labour market.

retirement as well as their housing status, but they are themselves dependent on individuals' earlier home ownership status. This is crucial because these factors then not only confound the effect of home ownership but might also mediate part of this effect from an earlier period on individuals' retirement status in the next period ($A_{t-1} \rightarrow L_t \rightarrow Y_{t+1}$; see Bulbulia, 2022 for an illustration of treatment-confounder feedbacks using DAGs). For example, homeowners live in more stable relationships, and stable relationships are in turn linked to higher likelihood of being a homeowner as well as earlier retirement. Numerous studies find evidence for such links between housing and family status as well as individuals' and their partners' employment status (for reviews, see Havet and Penot, 2010 and Zavisca and Gerber, 2016). Simply conditioning on these confounder-mediators, as is often done in time-to-event studies, would "control-away" parts of the total causal effect of home ownership and downward-bias the final estimate (Kohler, 2023; Hernán and Robins, 2023). I address this issue by using the parametric g-formula which I explain in more detail below.

Figure 2: Assumed structure of the causal effect of home ownership on retirement timing with treatment-confounder feedback between A_t and L_t.



Notes: Own depiction. Time-invariant confounders that affect all nodes such as sex are not displayed.

Thirdly, several studies indicate that home ownership status and retirement timing might be endogenous (e.g., Butrica and Karamcheva, 2020). Specifically, individuals are likely to anticipate their retirement at a certain age and manage their savings and housing situation including their mortgage debt accordingly. Similarly, individuals who retire unexpectedly, e.g., due to a health shock, might not be able to repay their outstanding mortgage debt as a result of foregone income from continued work. Both cases would induce reverse causality and lead to upward-biased estimates of the home ownership effect.

Lastly, selection bias would be a problem for causal identification if a certain group selectively dies or otherwise leaves or not enters the survey. As for confounding and selection into treatment, conditioning on covariates that determine sample selection and attrition reduces this risk (Winship and Mare, 1992; Hernán et al., 2004).

Estimation

I employ the parametric g-formula to estimate the empirical estimand. The parametric g-formula approach belongs to the family of g-methods and is basically a generalisation (hence 'g') of standardisation (Robins, 1986). It is used to estimate outcome distributions for a study population under hypothetical treatments, and is thereby firmly rooted in the counterfactual causal inference paradigm (Hernán and Robins, 2023; Pearl, 2009). In the present case, this allows me to estimate retirement timing outcomes as if everyone in the study population was a renter versus as if everyone was a homeowner throughout their later life (a sustained treatment strategy as opposed to dynamic regimes with time-varying treatments, which are also possible). The contrast between these two distributions can be interpreted as treatment effect.

This approach has important advantages over conventional regression modelling. It produces straightforward interpretations of causal effects (independent of the statistical tests with which they are estimated), it clearly separates individual-level and population-averaged effects, and it allows for flexible statistical modelling. This makes it straightforward to model any type of outcome, distribution or functional form and to adjust for various sources of bias, especially in the presence of treatment-confounder feedback (Imai et al., 2010; Keil et al., 2014; Daniel et al., 2013).

In order to identify causal effects, the parametric g-formula makes the assumptions of counterfactual consistency (i.e., treatment is defined unambiguously and all treated individuals receive the same treatment), exchangeability (i.e., no unmeasured confounding and informative censoring), and positivity (i.e., probability of receiving every value of the treatment conditional on confounders is greater than zero). For thorough introductions to g-methods, see Naimi et al. (2017) and Keil et al. (2014), and for a more technical discussion, see the book by Hernán and Robins (2023). In the remainder of this section, I provide a brief overview of the estimation procedure, which closely follows Keil et al. (2014) and Keil and Richardson (2017). I discuss technical aspects and each step in more detail in Appendix X.

The estimation proceeds in four steps. In the first step, I estimate the so-called outcome model using the complete data set and a pooled logistic regression (i.e., a discrete-time hazards model) for individuals' retirement status in each year. The model includes the treatment variable (i.e., home ownership or tenure status) as well as an interaction between the treatment variable and categorical age to capture the full variation in retirement risk. The model further adjusts for the covariates listed above, including the potential confounder-mediators. All time-varying covariates are lagged by one year to minimise the risk of reverse causality.

In the second step, I run a separate model for each confounder-mediator. Specifically, I estimate multinomial logistic regressions that adjust for treatment status in the previous year, age, age squared, age cubed as well as several control variables. The model specifications from this and the previous step can be found in Appendix X.

In the third step, I simulate new datasets under different intervention strategies that set the treatment status according to the hypothesis to be tested. To do so, I randomly draw 2,000[6] individuals from the original dataset, delete the outcome values, specify the same treatment status at all time points for all individuals (e.g., always being a homeowner), and keep only the first observed values in all covariates for all individuals. Using the models estimated in the previous two steps, I then successively predict values for the confounder-mediator and outcome variables for each individual at each age until they enter retirement, are censored or reach age 70 by drawing from Bernoulli or multinomial distributions with the conditional mean given by the predicted probabilities of the respective model.

In the fourth step, the simulated datasets are concatenated and the outcome values from under each intervention strategy are summarised using different effect measures. While hazard ratios are the most common effect quantities in survival analysis settings, several contributions on the "hazards of hazard ratios" (Hernán, 2010) have criticised them for being uninformative and prone to misinterpretation (see Sutradhar and Austin, 2018; De Neve and Gerds, 2020). This is because hazard ratios cannot express changes in the magnitude of effects over time and have a built-in selection bias in that they represent the risk of experiencing an event conditional upon previous survival. Both are major limitations for studies of retirement timing.

[6] Following previous studies (e.g., Keil et al., 2014), I sample a number of individuals below the full sample size to balance computation time with a sufficiently large sample size to reduce uncertainty in the estimation.

I therefore opt for differences in risk as main effect measure, a practice recommended by Syriopoulou et al. (2022) and others. Risk hereby refers to the cumulative probabilities of having entered retirement until a given age. Differences in these risks have a straightforward interpretation and directly map on the empirical estimand: They represent the difference in the share of retirees at a certain age between the treatment and the control group, e.g., homeowners and renters. Following Keil and Richardson (2017) and to handle censoring, I use the Kaplan-Meier estimator to produce risk curves from the simulated data for the treatment and control group, and I obtain the risk difference by comparing these curves at each age.

In the fifth step, I repeat the previous four steps via non-parametric bootstrapping with 200 iterations with replacement to generate point estimates and 95% confidence intervals using the mean and standard deviation of the estimated distributions[7].

I adapt this procedure to test the different hypotheses. First, to test H1, I estimate risk curves and differences in risk for the contrast over home ownership status (everyone always homeowner vs. everyone always renter). Next, to test H2, I re-run the analysis for the contrast over tenure status (everyone always outright homeowner vs. everyone always renter). Finally, H3 will be examined by comparing the risk differences for homeowners and renters between Germany and the UK. I stratify all analyses by gender to explore effect heterogeneity and due to differences in labour market conditions and statutory pension regulations.

The R code for replicating the analysis is available here.

Robustness checks

To validate the results, I conduct a number of robustness checks. The details and results can be found in Appendices X to X. First, I graphically compare the parametric g-formula and the non-parametric Kaplan-Meier estimates of retirement risks under the natural course (i.e., under no intervention). Second, I consider different specifications for the confounder/mediator and outcome model to rule out misspecification. Third, I compare the results with conventional survival analysis methods, including Cox proportional hazard models and piecewise constant hazard models with the same specifications as the outcome-model described above. Fourth, I re-run the analysis on samples that exclude renters in social or subsidised housing programmes

[7] The number of iterations is currently set to 30 because even with parallelisation, each iteration takes about one hour. The number 200 is what has been used in comparable studies.

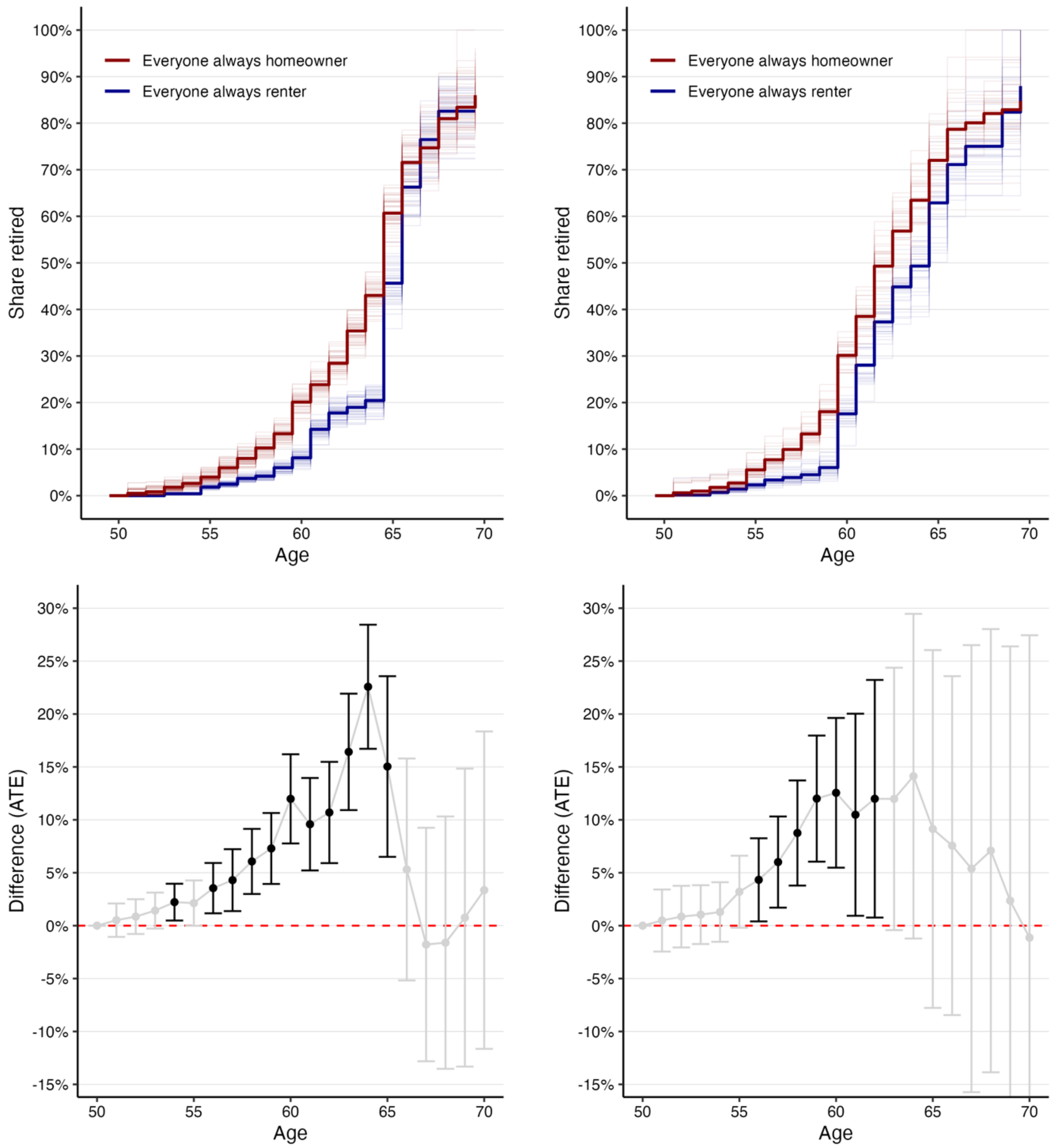
(20% in the UK and 7% in Germany in 2020; OECD, 2023). Lastly, to check for endogeneity resulting from anticipation, I run regression discontinuity analyses using statutory retirement ages as exogenous source of variation in retirement risk. If individuals who adhere to the statutory retirement age are found to change their home ownership or tenure status, anticipation is likely to explain parts of the effect on retirement timing.

Preliminary results

For the UK, I find that home ownership leads to up to 22% and 13% higher risk of being retired for men and women, respectively. The effect ceases at the statutory retirement age, suggesting that renters are able to "catch up" at the institutionalised thresholds of 65 and 60 years.

Figure 3: Standardised risk curves and differences in risk of retirement from age 50 to 70 based on parametric g-formula estimates: Homeowners vs. Renters in the UK

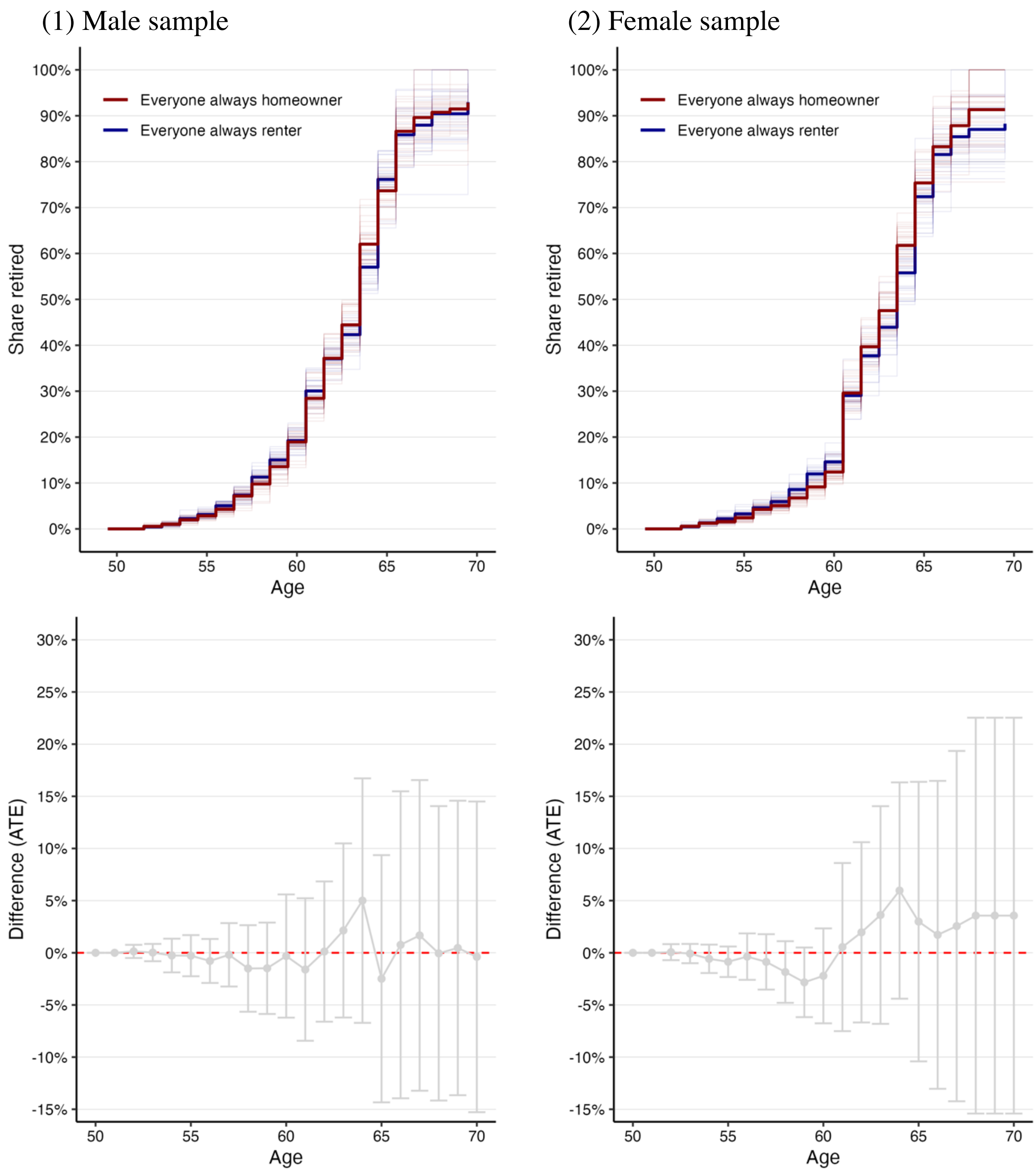
(1) Male sample (2) Female sample



Notes: Thick lines show the mean bootstrap estimate. Thin lines show the estimates from 30 bootstrap iterations. Whiskers are bootstrap 95% confidence intervals. Grey whiskers overlap with 0.

For Germany, I find that home ownership does not significantly increase the risk of retirement throughout later life.

Figure 3: Standardised risk curves and differences in risk of retirement from age 50 to 70 based on parametric g-formula estimates: Homeowners vs. Renters in Germany



Notes: Thick lines show the mean bootstrap estimate. Thin lines show the estimates from 30 bootstrap iterations. Whiskers are bootstrap 95% confidence intervals. Grey whiskers overlap with 0.

Conclusion

Potential implications:

- Housing is a major factor for inequality in retirement outcomes
- But only in the UK where public support beyond basic welfare is limited
- Declining home ownership among younger cohorts will cause problems where public welfare support is marginal
- Policymakers must consider long-term life course impacts of hidden welfare policies
- More comparative work is needed as well as analyses by cohort, level of wealth, etc.
- More empirical rigour, question first approaches needed, carefully define meaningful estimands based on theory instead of statistical model
- G-methods provide for statistical flexibility to deal with various issues that are usually insufficiently addressed in quantitative life course research

Foreseeable limitations:

- I do only consider tenure type but not quality nor value of housing
- Not ownership of a dwelling itself but its volatile relative price matters (Ansell, 2014)
- I do not test relative importance of and interrelations between mechanisms
- g-formula still based on parametric modelling; could be extended to non-parametric and machine learning approaches as well as doubly robust implementation with IPTW

Open questions:

- How to test mechanisms, and are mediator/confounders not themselves "mechanisms"?
- Are other forms of wealth adequately captured by controls?
- Framing of the paper: should the main focus lie on "property-based welfare"?
- Can I model anticipation in parametric g-formula instead of RDiT?

How does the paper fit into my dissertation project?

- Explore housing as a rarely considered aspect of (class-)inequality in late working lives
- Test mechanism of 'Access to income sources' as laid out in framework chapter using a solid causal inference approach
- Examine the influence of "unconventional" welfare policies that might counteract policy goal of extending working lives in a comparative design

Appendices

This appendix includes the following sections:

1. Appendix A: Variable selection, harmonisation and operationalisation
2. Appendix B: Missingness and imputation procedure
3. Appendix C: Descriptive statistics
4. Appendix D: Crude Kaplan-Meier curves
5. Appendix E: Technical details of the parametric g-formula approach
    a. Estimation procedure
    b. Comparison of observed data and natural course
6. Appendix F: Sensitivity checks with conventional survival models
    a. Methods
    b. Results from Cox proportional hazard models
    c. Results from proportional hazards tests
    d. Results from piecewise constant hazard models
7. Appendix G: Testing for anticipation of retirement
    a. Data and method
    b. Results from RDiT models

Appendix A: Variable selection, harmonisation and operationalisation

In this section, I briefly discuss how I harmonised the various variables from the three surveys using the Comparative Panel File (CPF) created by Turek and colleagues (2021) as well as the operationalisation of each variable. Table X provides an overview on the variables I included in the analysis.

Table X: Variables used in the analysis

	Variable	**Label in BHPS**	**Label in UKHLS**	**Label in SOEP**
1				
2				
3				
4				
5				
6				
7				
8				
9				
10				
11				
12				
13				
14				
15				
16				
17				
18				
19				

Appendix B: Missingness and imputation procedure

As in the vast majority of similar studies, missing data is a concern for the analysis and poses a threat to its internal and external validity. This section presents an overview on which data are missing and how I deal with them.

Missingness

Specifically, four types of missingness are present in the data:

- Right truncation: At age 80
- Right censoring: x
- Interval censoring: x

Table X provides an overview on the incidence of missingness across the four different types and for all variables used in the analysis.

Table X: Share of missing observations

Variable	Germany	United Kingdom

The first two types of missingness can easily be handled by the methods I apply. The models are estimated on the continuously observed years a respondent is present in the data starting from the year they enter the survey to the year they either retire, leave the survey, or reach age 70.

Imputation

To deal with the last type of missingness and following similar studies, I use a combination of listwise deletion and hot-deck imputation in cases where at most one of successive survey years was missed by a respondent.

X

Appendix C: Descriptive statistics

Table X provides the descriptive statistics for all variables in the working sample.

Table X: Descriptive statistics

Variable	**Categories**	**Germany**	**United Kingdom**
		mean (sd) / column %	mean (sd) / column %

Appendix D: Crude Kaplan-Meier curves

This section presents crude Kaplan-Meier curves for retirement transitions, stratified by gender and county for the entire population and by home ownership and tenure status. Home ownership and tenure status are measured one year before the transition to retirement.

Figure X: Crude Kaplan-Meier risk curves, UK

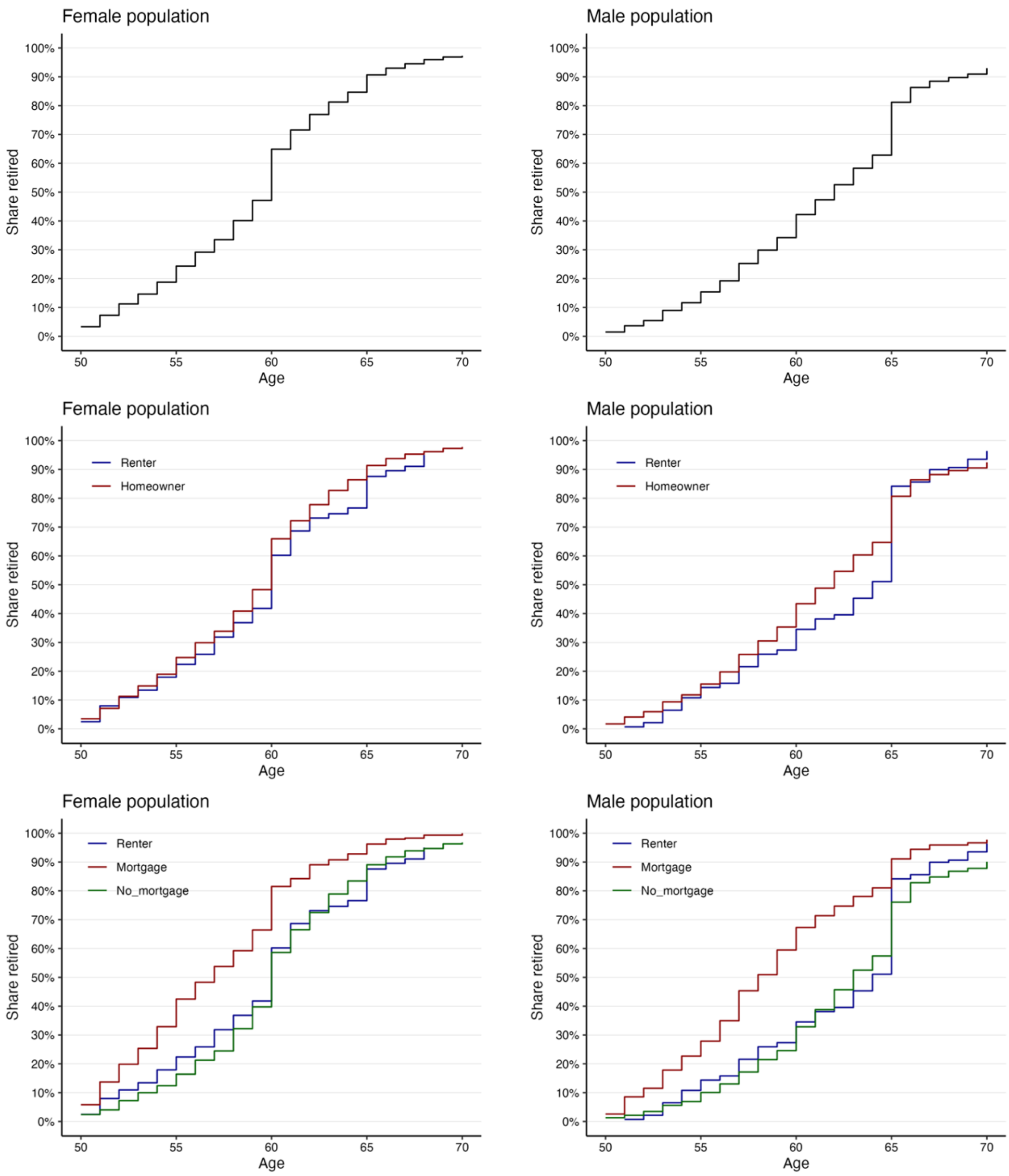
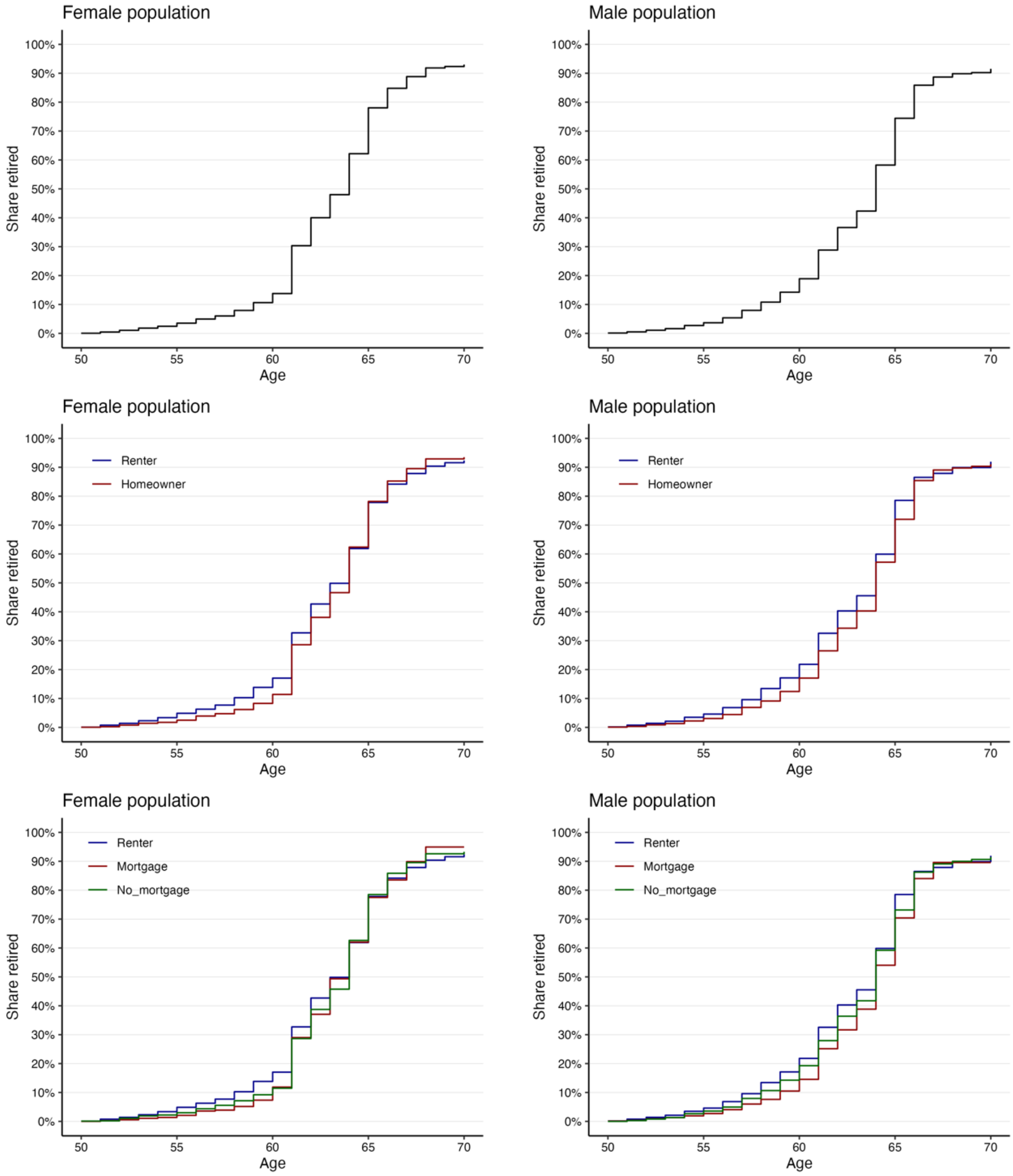


Figure X: Crude Kaplan-Meier risk curves, Germany



Appendix E: Technical details of the parametric g-formula approach

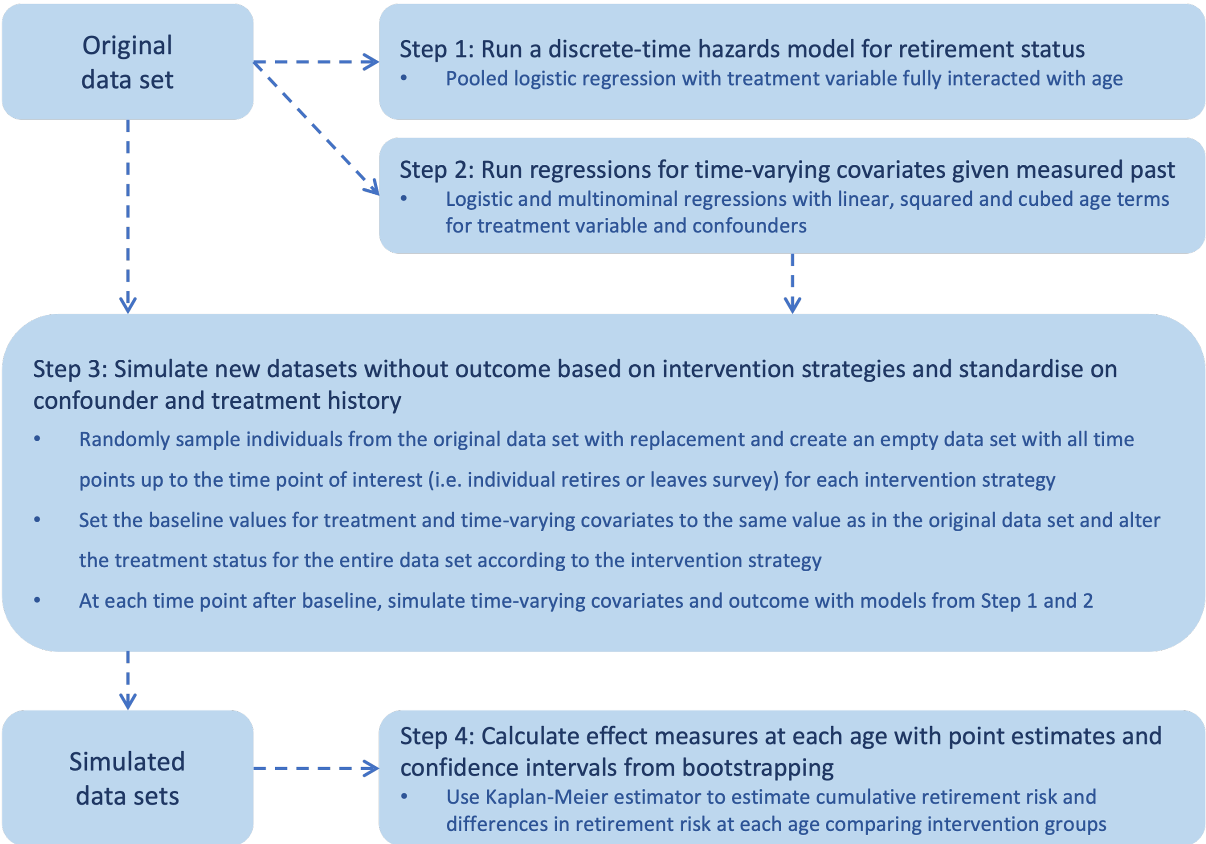
This section provides a more detailed discussion of the parametric g-formula approach, which has so far been seldomly applied in life course research and in sociology more generally. I start with a general discussion of g-methods and the estimation procedure I applied, and I close with a comparison of the observed data with the natural course simulated using the g-formula.

G-methods, g-formula, and the g-null paradox

X

Estimation procedure

Figure X: Estimation procedure implemented for the parametric g-formula



Source: Own illustration based on Keil et al. (2014)

Table X contains a description of the models used in the parametric g-formula procedure.

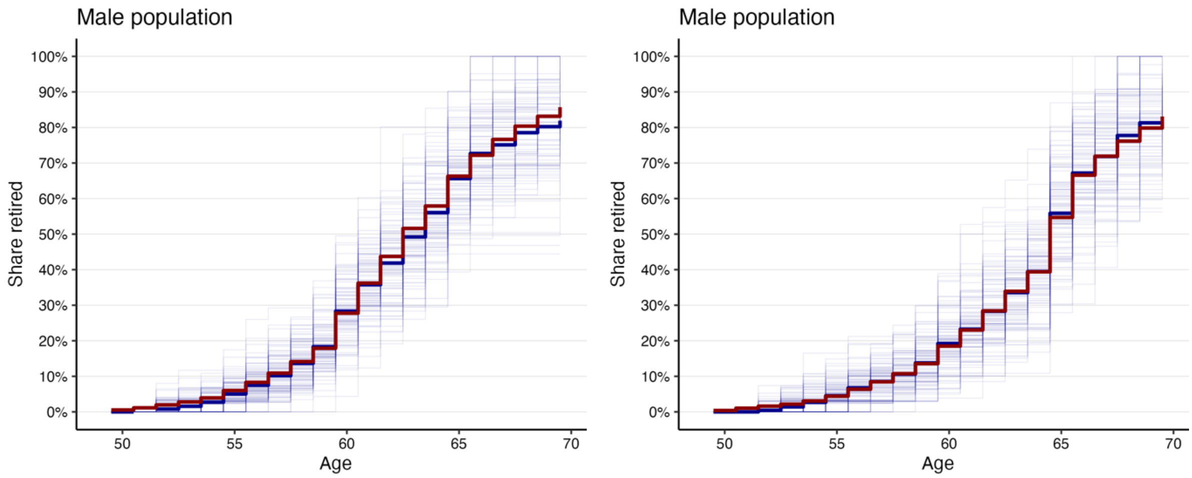
Table X: Models used for the parametric g-formula analysis

Model	**Type**	**Specification**
Outcome	Logit	$retired_{it} = \beta_0 + \beta_1 homeowner_{t-1} + \beta_2 job\_status_{t-1} + \beta_3 industry_{t-1} + \beta_4 marital\_status_{t-1} + \beta_5 nchildren_{t-1} + \beta_6 household\_size_{t-1} + \beta_7 health\_status_{t-1} + \beta_8 care\_duties_{t-1} + \beta_9 education + \beta_{10} migrant + \beta_{11} region + \beta_{12} year$
Employment status	Multinomial	$emp\_status_{it} = \beta_0 + \beta_1 homeowner_{t-1} + \beta_2 job\_status_{t-1} + \beta_3 industry_{t-1} + \beta_4 marital\_status_{t-1} + \beta_5 nchildren_{t-1} + \beta_6 household\_size_{t-1} + \beta_7 health\_status_{t-1} + \beta_8 care\_duties_{t-1} + \beta_9 education + \beta_{10} migrant + \beta_{11} region + \beta_{12} year$
Partner's employment status	Multinomial	$emp\_status\_p_{it} = \beta_0 + \beta_1 homeowner_{t-1} + \beta_2 job\_status_{t-1} + \beta_3 industry_{t-1} + \beta_4 marital\_status_{t-1} + \beta_5 nchildren_{t-1} + \beta_6 household\_size_{t-1} + \beta_7 health\_status_{t-1} + \beta_8 care\_duties_{t-1} + \beta_9 education + \beta_{10} migrant + \beta_{11} region + \beta_{12} year$
Marital status	Multinomial	$marital\_status_{it} = \beta_0 + \beta_1 homeowner_{t-1} + \beta_2 job\_status_{t-1} + \beta_3 industry_{t-1} + \beta_4 marital\_status_{t-1} + \beta_5 nchildren_{t-1} + \beta_6 household\_size_{t-1} + \beta_7 health\_status_{t-1} + \beta_8 care\_duties_{t-1} + \beta_9 education + \beta_{10} migrant + \beta_{11} region + \beta_{12} year$

Comparison of observed data and natural course

Figures X and X show risk curves based on the observed data and the parametric g-formula estimates under no intervention ("natural course"). Closely aligned curves indicate good model fit in that the parametric models underlying the estimation predict the risk of retirement well.

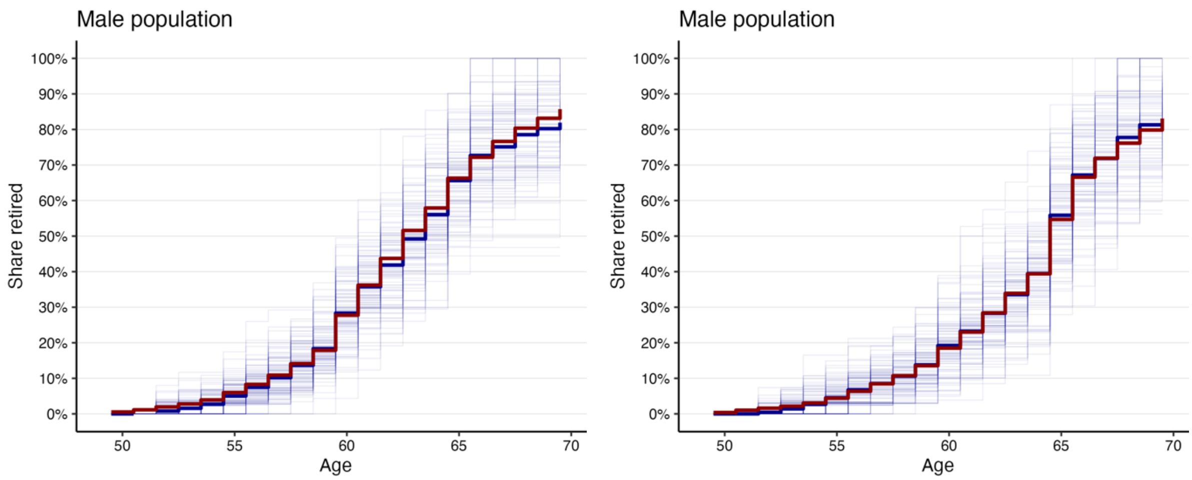
Figure X: Risk curves from observed data and under natural course, UK



Notes: Thick lines show observed course and mean estimate of the natural course. Thin lines show natural course from 200 bootstrap iterations.

Data: BHPS waves 1 to 18 and UKHLS waves 1 to 12

Figure X: Risk curves from observed data and under natural course, Germany



Notes: Thick lines show observed course and mean estimate of the natural course. Thin lines show natural course from 200 bootstrap iterations.

Data: SOEP v35

Appendix E: Sensitivity checks with conventional survival models

This section presents results from conventional survival analyses. I first introduce the methods before I present the results graphically. The substantive findings are discussed in the main text.

Methods

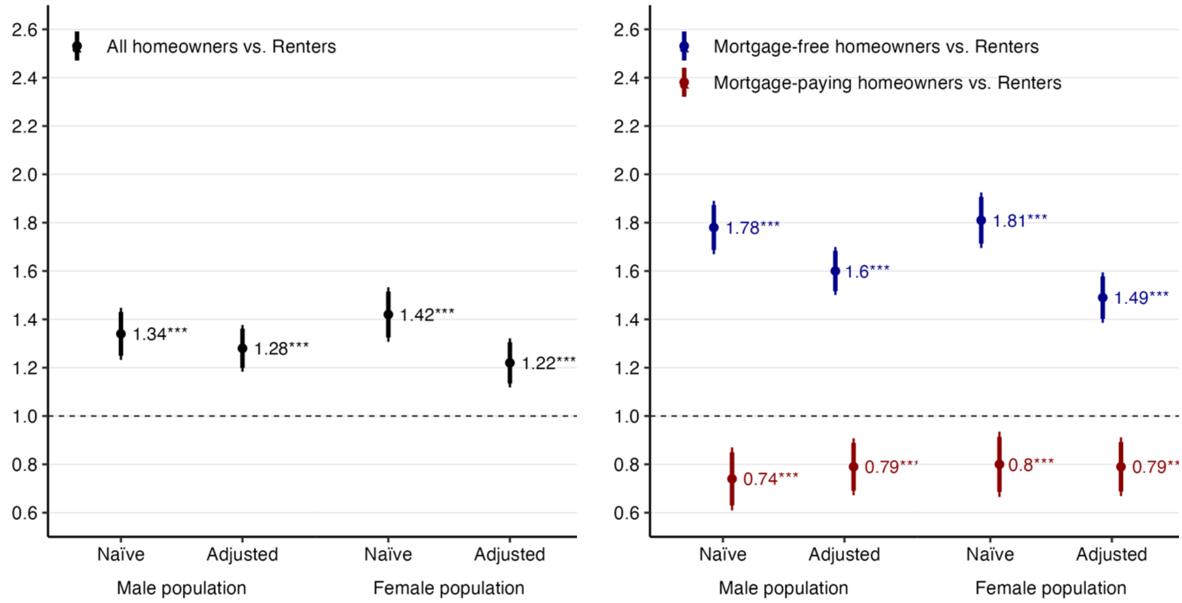
In a first step, I apply Cox proportional hazards models, the most common method in survival analysis that is also used in most comparable studies of retirement timing. Cox models assume that the hazards associated with all covariates are proportional over time, i.e., that their effect does not change in magnitude over time. Put simply, home ownership should have the same effect on the risk of retirement at all ages. Furthermore, as discussed in the main text, Cox models (as all conventional regression models) cannot handle feedback effects between time-varying treatment and confounding variables, because conditioning on such variables would block parts of the effect that is mediated by the confounder (see Section X). If this issue is absent, however, Cox models should yield results similar to the main analyses. I run the Cox models with different specifications: a naïve model which only includes home ownership status and a fully adjusted model which adds the other time-invariant and time-varying variables, both separately by country and gender. I estimate the models using the *coxph* function of the *survival* package in R. The results are displayed in Figure X.

In a second step, I calculate scaled Schoenfeld residuals, which is a common statistical test of the proportional hazard assumption of Cox models. In essence, Schoenfeld residuals compare the weighted average value with the observed value of each covariate at each time point, and are scaled to downweigh residuals at time-points where the variance is high. I can then be tested whether these scaled residuals are associated with time, and if that is the case, the proportional hazards assumption is judged to be violated (Grambsch and Therneau, 1994). I use the *cox.zph* function of the *survival* package in R, and provide results of Schoenfeld tests for all Cox models estimated in the previous step.

In a last step, I estimate piecewise constant hazard models, a less common but arguably more appropriate type of survival method for studying retirement transitions. The main advantage of piecewise constant hazard models is that they allow the baseline hazard rate to vary within prespecified time intervals. As in Cox models, the baseline hazard rate within these intervals is assumed to be proportional. Piecewise constant models are better suited for studying retirement timing, which is strongly determined by institutionalised and normative age boundaries, for example, at age 60 and 65 (Although even piecewise hazard ratios suffer from distinct problems as several recent publications have shown; Bartlett et al., 2020). I run the models with the same (time-varying) covariates as in the main analyses, and specify the following age intervals for the baseline hazard: 50 to 55, 55 to 59, 60, 61 to 64, 65, 66 to 70. For the estimation, I use the *pchreg* function of the *pch* package in R. The results are displayed in Figure X.

Results from Cox proportional hazard models

Figure X: Estimates from Cox proportional hazard models, UK

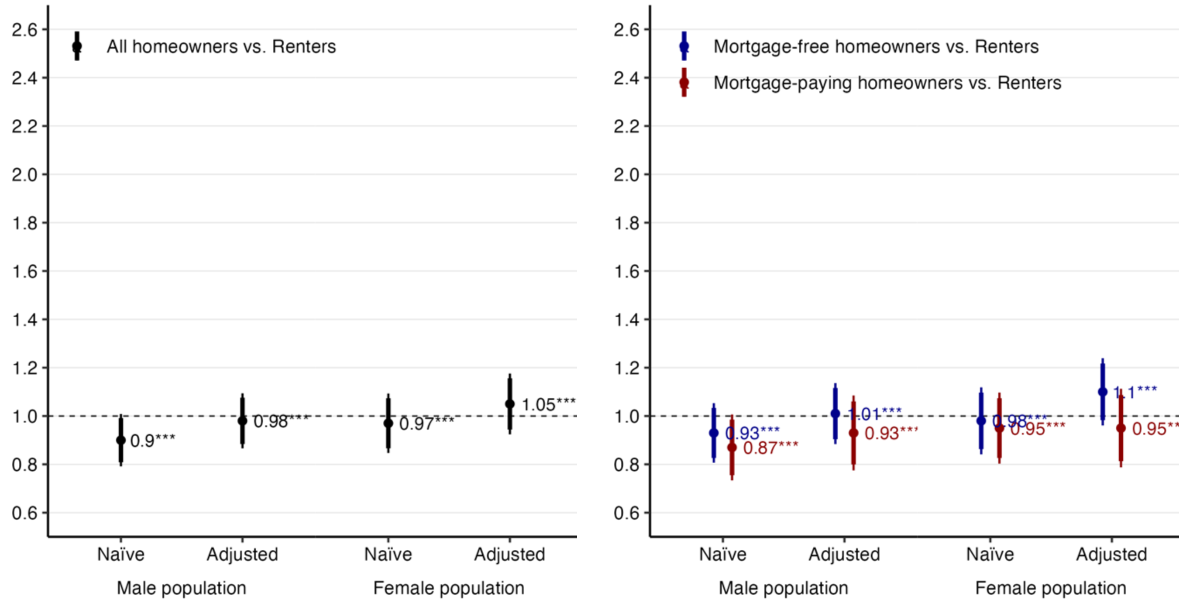


Notes: Whiskers around point estimates indicate 90% and 95% confidence intervals. All models include year and region dummies. Adjusted models add controls for education level, migration background, occupation, industry, workplace size, marital status, number of children, household size, health status, care duties, prior job status, and partner job status. All time-varying variables are lagged by one year.

Data: BHPS waves 1 to 18 and UKHLS waves 1 to 12

Significance levels: *p<0.1; **p<0.05; ***p<0.01

Figure X: Estimates from Cox proportional hazard models, Germany



Notes: Whiskers around point estimates indicate 90% and 95% confidence intervals. All models include year and region dummies. Adjusted models add controls for education level, migration background, occupation, industry, workplace size, marital status, number of children, household size, health status, care duties, prior job status, and partner job status. All time-varying variables are lagged by one year.

Data: SOEP v35

Significance levels: *p<0.1; **p<0.05; ***p<0.01

Results from proportional hazards tests

Table X: Results from scaled Schoenfeld residuals tests, UK

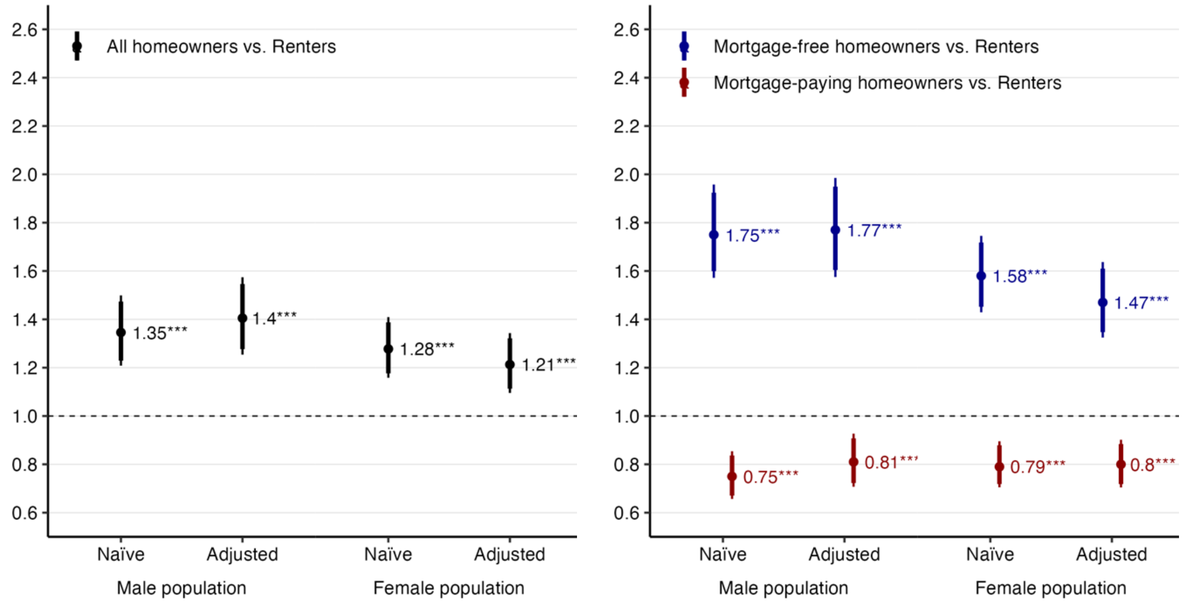
Sample	Treatment variable	Model	Significant association with process time?
Male population	Home ownership status	Naïve	No (p = 0.08)
Male population	Home ownership status	Adjusted	No (p = 0.31)
Female population	Home ownership status	Naïve	No (p = 0.15)
Female population	Home ownership status	Adjusted	No (p = 0.66)
Male population	Tenure status	Naïve	Yes (p = 0.002)
Male population	Tenure status	Adjusted	Yes (p = 0.007)
Female population	Tenure status	Naïve	Yes (p = 0.006)
Female population	Tenure status	Adjusted	Yes (p = 0.014)

Table X: Results from scaled Schoenfeld residuals tests, Germany

Sample	Treatment variable	Model	Significant association with process time?
Male population	Home ownership status	Naïve	No (p = 0.08)
Male population	Home ownership status	Adjusted	No (p = 0.31)
Female population	Home ownership status	Naïve	No (p = 0.15)
Female population	Home ownership status	Adjusted	No (p = 0.66)
Male population	Tenure status	Naïve	Yes (p = 0.002)
Male population	Tenure status	Adjusted	Yes (p = 0.007)
Female population	Tenure status	Naïve	Yes (p = 0.006)
Female population	Tenure status	Adjusted	Yes (p = 0.014)

Results from piecewise constant hazard models

Figure X: Estimates from piecewise constant hazard models, UK

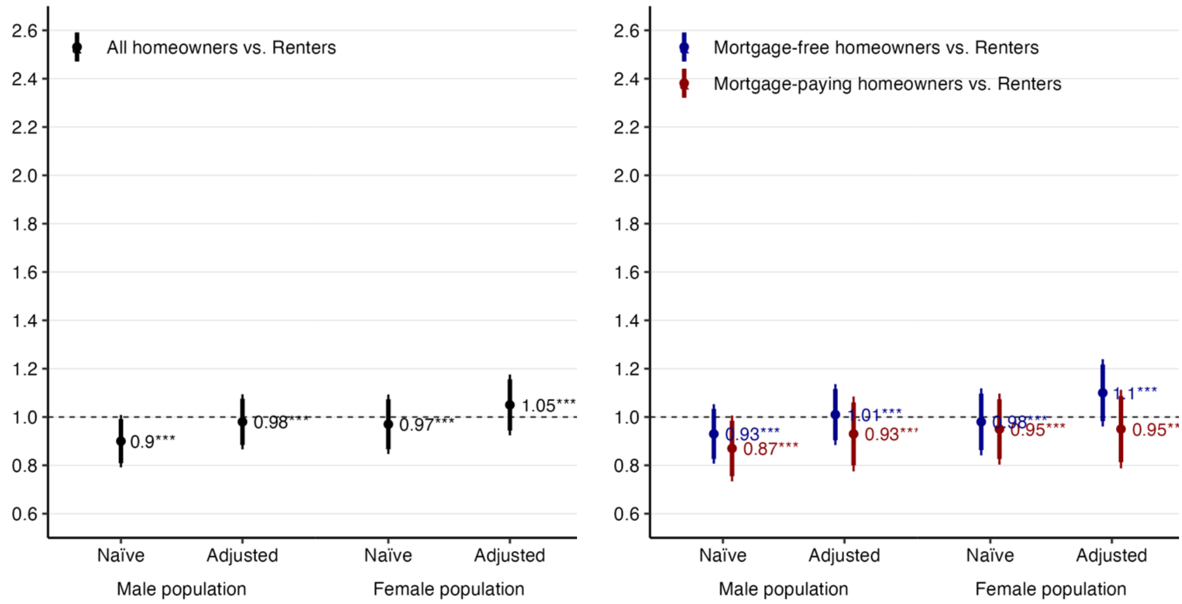


Notes: Whiskers around point estimates indicate 90% and 95% confidence intervals. The baseline hazard is allowed to vary within the following age intervals: 50 to 55, 55 to 59, 60, 61 to 64, 65, 66 to 70. All models include year and region dummies. Adjusted models further include education level, migration background, occupation, industry, workplace size, marital status, number of children, household size, health status, care duties, prior job status, and partner job status. All time-varying variables are lagged by one year.

Data: BHPS waves 1 to 18 and UKHLS waves 1 to 12

Significance levels: *p<0.1; **p<0.05; ***p<0.01

Figure X: Estimates from piecewise constant hazard models, Germany



Notes: Whiskers around point estimates indicate 90% and 95% confidence intervals. The baseline hazard is allowed to vary within the following age intervals: 50 to 55, 55 to 59, 60, 61 to 64, 65, 66 to 70. All models include year and region dummies. Adjusted models further include education level, migration background, occupation, industry, workplace size, marital status, number of children, household size, health status, care duties, prior job status, and partner job status. All time-varying variables are lagged by one year.

Data: SOEP v35

Significance levels: *p<0.1; **p<0.05; ***p<0.01

Appendix F: Testing for endogeneity

As discussed in Section X, a main threat to the identification of the effect of home ownership on retirement timing is endogeneity. In particular, individuals are likely to anticipate their retirement at a certain age, which might make them adapt their housing status or manage their mortgage debt accordingly, leading to reverse causality. Previous studies have dealt with this issue by using fixed effects models or instrumental variable designs, e.g., in which mortgage debt is instrumented with housing prices indices, effective interest rates and average purchasing prices (e.g., Butrica and Karamcheva, 2013, 2018, 2020). Although these analyses usually find that such instruments are sufficiently strong to predict the treatment status, they cannot fully rule out endogeneity concerns. In the following, I will discuss how a regression discontinuity design (RDD) provides an alternative strategy to test whether retirement exerts a (reverse) causal effect on home ownership or tenure status. I will present the data and method along with limitations of the RDD approach as well as the quantitative results.

Data and method

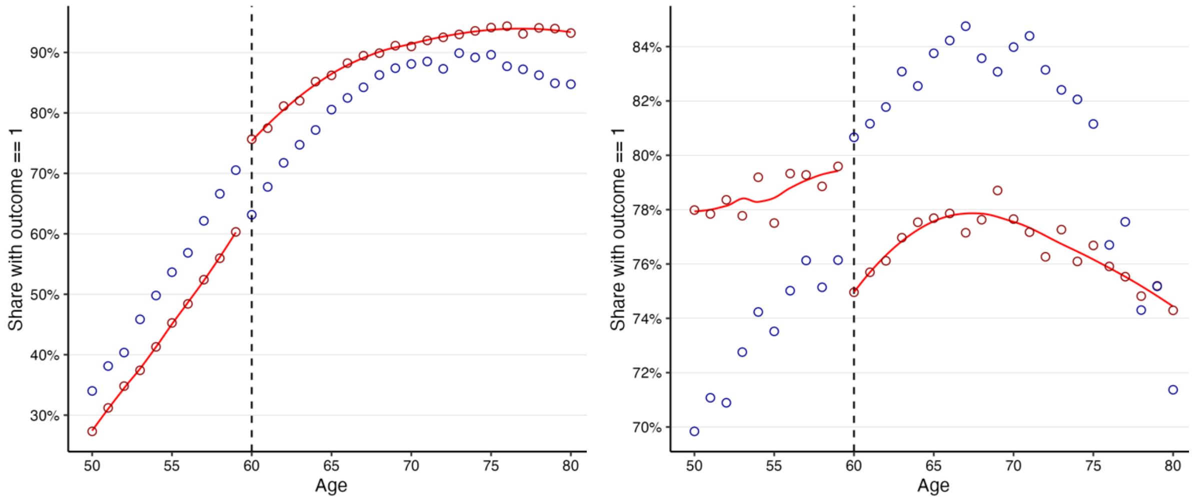
The panel structure of the data lends itself to a RDD in time (RDDiT; see Hausmann, 2017 for a technical discussion). Statutory retirement ages, and indeed the Kaplan Meier curves show a sharp jump in retirement at the age thresholds of 60 and 65 years.

At least two limitations of the RDD approach should be considered. The first concerns external validity. A second limitation results from differences in the age at which certain groups are eligible for retirement.

Below I present the quantitative results of which the substantive takeaways are discussed in the main text (see Section X).

Results from RDiT models

Figure X: Shares of homeowners in all persons (left panel) and of mortgage-free homeowner among homeowning persons (right panel) in 1-year bins, Female population, UK



Notes: Red points are compliers. Blue points are non-compliers. Red line is a local polynomial fit.

Table X: Estimates from fuzzy RDDs, Female population, UK

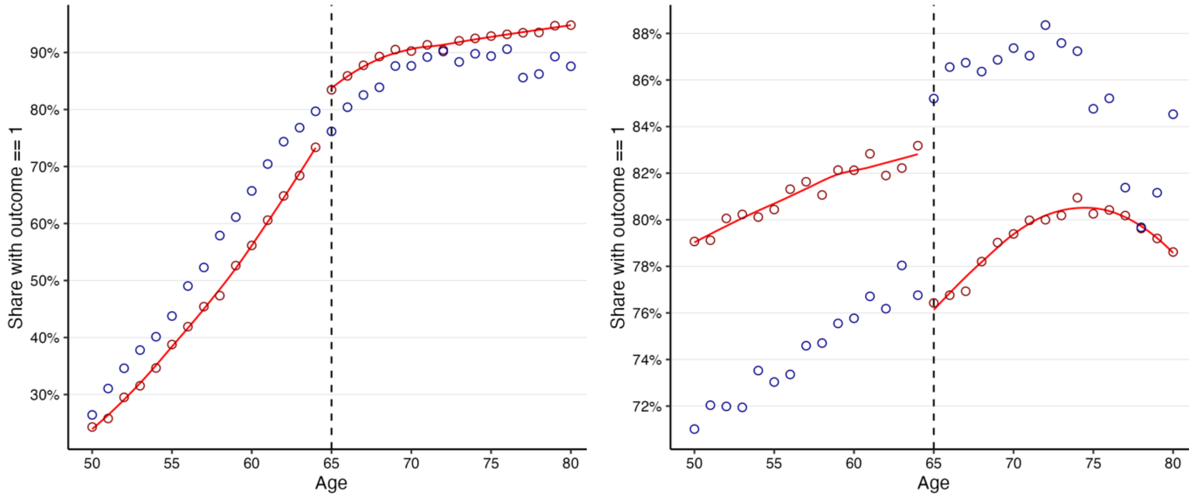
Outcome	Home ownership		Mortgage-free homeowner	
Polynomial: Linear				
Model	(1)	(2)	(3)	(4)
Estimate	0.06	–0.10	0.80***	0.62**
	(0.06)	(0.11)	(0.12)	(0.21)
Polynomial: Quadratic				
Model	(5)	(6)	(7)	(8)
Estimate	0.06	–0.10	0.80***	0.62**
	(0.06)	(0.11)	(0.12)	(0.21)
Polynomial: Cubic				
Model	(9)	(10)	(11)	(12)
Estimate	0.06	–0.10	0.80***	0.62**
	(0.06)	(0.11)	(0.12)	(0.21)
Bandwidth	+/-10 years	+/-5 years	+/-10 years	+/-5 years
Person-years	129,624	67,618	101,641	53,179
Individuals	19,679	12,985	15,264	10,179

Notes: Models include year and region dummies. Cluster-robust standard errors in parentheses.

Data: BHPS waves 1 to 18 and UKHLS waves 1 to 12

Significance levels: *p<0.1; **p<0.05; ***p<0.01

Figure X: Shares of homeowners in all persons (left panel) and of mortgage-free homeowner among homeowning persons (right panel) in 1-year bins, Male population, UK



Notes: Red points are compliers. Blue points are non-compliers. Red line is a local polynomial fit.

Table X: Estimates from fuzzy RDDs, Male population, UK

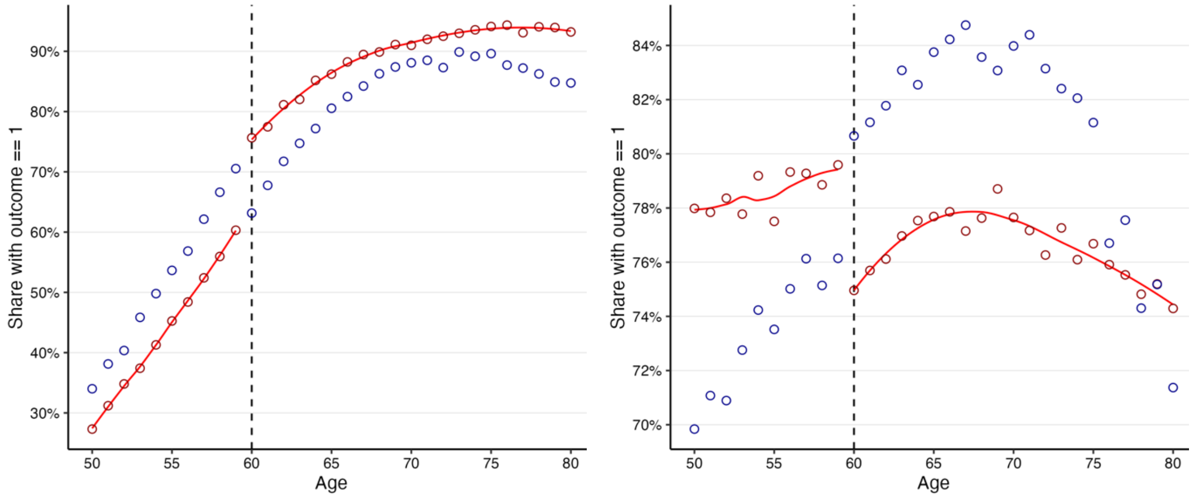
Outcome	Home ownership		Mortgage-free homeowner	
Polynomial: Linear				
Model	(1)	(2)	(3)	(4)
Estimate	0.06	–0.10	0.80***	0.62**
	(0.06)	(0.11)	(0.12)	(0.21)
Polynomial: Quadratic				
Model	(5)	(6)	(7)	(8)
Estimate	0.06	–0.10	0.80***	0.62**
	(0.06)	(0.11)	(0.12)	(0.21)
Polynomial: Cubic				
Model	(9)	(10)	(11)	(12)
Estimate	0.06	–0.10	0.80***	0.62**
	(0.06)	(0.11)	(0.12)	(0.21)
Bandwidth	+/-10 years	+/-5 years	+/-10 years	+/-5 years
Person-years	129,624	67,618	101,641	53,179
Individuals	19,679	12,985	15,264	10,179

Notes: Models include year and region dummies. Cluster-robust standard errors in parentheses.

Data: BHPS waves 1 to 18 and UKHLS waves 1 to 12

Significance levels: *p<0.1; **p<0.05; ***p<0.01

Figure X: Shares of homeowners in all persons (left panel) and of mortgage-free homeowner among homeowning persons (right panel) in 1-year bins, Female population, Germany



Notes: Red points are compliers. Blue points are non-compliers. Red line is a local polynomial fit.

Table X: Estimates from fuzzy RDDs, Female population, Germany

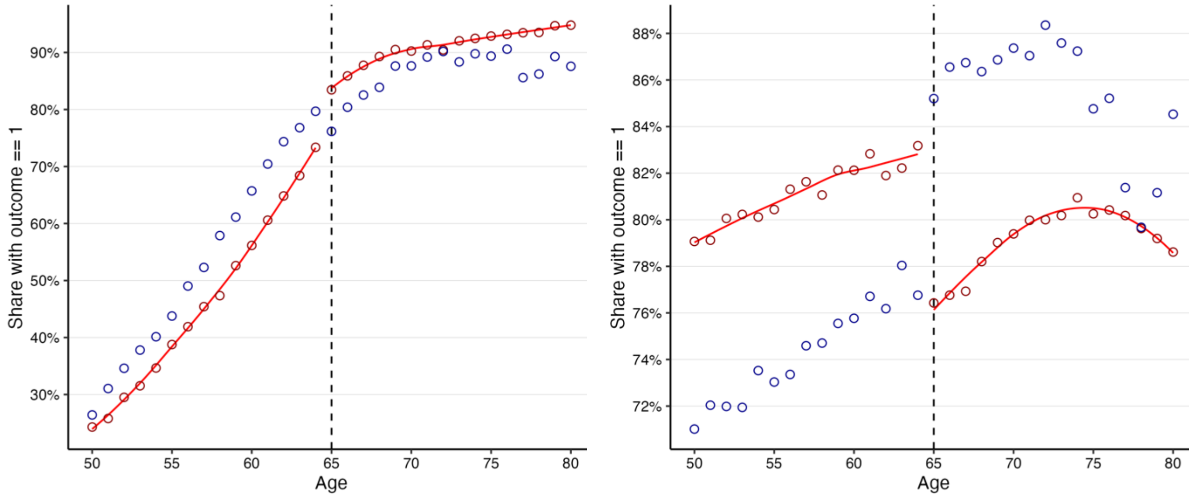
Outcome	Home ownership		Mortgage-free homeowner	
Polynomial: Linear				
Model	(1)	(2)	(3)	(4)
Estimate	0.06	–0.10	0.80***	0.62**
	(0.06)	(0.11)	(0.12)	(0.21)
Polynomial: Quadratic				
Model	(5)	(6)	(7)	(8)
Estimate	0.06	–0.10	0.80***	0.62**
	(0.06)	(0.11)	(0.12)	(0.21)
Polynomial: Cubic				
Model	(9)	(10)	(11)	(12)
Estimate	0.06	–0.10	0.80***	0.62**
	(0.06)	(0.11)	(0.12)	(0.21)
Bandwidth	+/-10 years	+/-5 years	+/-10 years	+/-5 years
Person-years	129,624	67,618	101,641	53,179
Individuals	19,679	12,985	15,264	10,179

Notes: Models include year and region dummies. Cluster-robust standard errors in parentheses.

Data: SOEP v35

Significance levels: *p<0.1; **p<0.05; ***p<0.01

Figure X: Shares of homeowners in all persons (left panel) and of mortgage-free homeowner among homeowning persons (right panel) in 1-year bins, Male population, Germany



Notes: Red points are compliers. Blue points are non-compliers. Red line is a local polynomial fit.

Table X: Estimates from fuzzy RDDs, Male population, Germany

Outcome	Home ownership		Mortgage-free homeowner	
Polynomial: Linear				
Model	(1)	(2)	(3)	(4)
Estimate	0.06	–0.10	0.80***	0.62**
	(0.06)	(0.11)	(0.12)	(0.21)
Polynomial: Quadratic				
Model	(5)	(6)	(7)	(8)
Estimate	0.06	–0.10	0.80***	0.62**
	(0.06)	(0.11)	(0.12)	(0.21)
Polynomial: Cubic				
Model	(9)	(10)	(11)	(12)
Estimate	0.06	–0.10	0.80***	0.62**
	(0.06)	(0.11)	(0.12)	(0.21)
Bandwidth	+/-10 years	+/-5 years	+/-10 years	+/-5 years
Person-years	129,624	67,618	101,641	53,179
Individuals	19,679	12,985	15,264	10,179

Notes: Models include year and region dummies. Cluster-robust standard errors in parentheses.

Data: SOEP v35

Significance levels: *p<0.1; **p<0.05; ***p<0.01