Loaded but Lonely: Housing and Saving Responses to Spousal Death in Old Age[*]

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Abstract

Most retirees live on low income but hold, and eventually die with, substantial wealth. This is puzzling in relation to standard economic theory of life-cycle savings and consumption. One leading explanation is that lack of dissaving in old age is due to precautionary motives. Another explanation is that it relates to housing consumption preferences or costs of adjusting housing. One way to test these motives is to look at household responses to income changes in old age. However, despite the large literature on old age saving behavior, there is little clear evidence on such responses. In this paper, I use administrative data from Denmark and a DD design to present novel evidence on the causal effects of spousal death, and the following income drop, on financial and housing outcomes among elderly homeowners. I find that most widow(er)s do not move and do not tap into their home equity. This provides little support for precautionary motives, but strong support for the importance of motives related to housing consumption. I show results suggesting that low housing mobility is both driven by transaction costs of moving and preferences for staying in the same house.

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1 Introduction

It is a fact in developed countries that most households dissave slowly during retirement and, as a result, die with substantial net wealth holdings. At the same time, households live their last few decades of life on low income compared to the lifetime average. This is puzzling to economists and contradicts standard theory of life-cycle consumption and saving behavior.

The "retirement saving puzzle" is not just interesting from the perspective of economic theory; it has implications for policy making too. Most of the wealth accumulated is in housing, and home equity of elderly households represents a substantial share of total net wealth in the population.[1] In order to design social insurance systems and mortgage products to help households smooth consumption over the life-cycle, it is important to understand the underlying motives for the lack of dissaving in old age, especially with respect to home equity. Is home equity accumulation a response to imperfections in insurance markets? Or is it just not attractive for elderly households to extract home equity in their existing homes, but also not desirable for them to move?

One possible explanation for the lack of dissaving in old age is that home equity is accumulated as precautionary savings to smooth consumption around shocks to income and expenses. Another possible explanation is that the lack of dissaving is driven by housing consumption preferences or transaction costs of adjusting housing consumption, combined with an inability or unwillingness of households to extract home equity from the current house (see De Nardi, French and Jones 2016 for a review of motives behind savings after retirement). One way to empirically investigate precautionary motives and housing consumption behavior of elderly homeowners, is to look at responses to family events such as death or health shocks (used in for instance Poterba, Venti and Wise 2011). However, there exists little clear evidence on these responses - with a causal interpretation and precise measures of the outcomes of interest - and saving behavior in old age to a great extent remains a puzzle.

In this paper, I provide novel evidence on the causal effects of changes in income on financial and housing outcomes among elderly homeowners. In particular, I ask the question of whether retirees tap into their home equity when their spouse dies, and whether they do that by mortgaging their existing house, by moving to another owned house in which they downsize or mortgage, or

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[1]In 2015, home equity of retirees accounted for 21 % of total home equity in the Danish population and 9 % of population total net wealth (Statistics Denmark, Statistikbanken: www.statistikbanken.dk, table FORMUE4).

by moving to rental housing. If homeowners are not able or willing to take out home equity loans, the easiest way to liquidate home equity is to move and downsize or to move and exit homeownership. Hence, as financial responses are potentially closely linked to housing responses, I also ask the question of whether retirees adjust housing when a spouse dies by looking at moving, homeownership, home size and housing consumption to income.

If home equity is accumulated as precautionary savings to facilitate consumption smoothing in old age when a spouse dies, I would expect retirees to tap into the equity around spousal death. I would expect this especially among the household who stay in the same house, or move to a similar house, and therefore largely choose to maintain the pre-death level of housing consumption. If households do not draw down home equity when the spouse dies, or if drawdown happens only among widowed households who move and downsize, it is difficult to reconcile with precautionary motives. In that case, the lack of dissaving in old age seem to rather be driven by motives related to housing consumption preferences and housing mobility. The separate motives have different implications for the optimal design of social insurance systems, mortgage products, and housing policies.

Existing work, to be described in detail below, has documented aggregate age profiles of wealth, indebtedness, and homeowner rates. This shows that net wealth levels on average stay high in retirement, and that most of this is held in home equity. Homeowner rates remain high even in the very old ages, and as mortgage debt is gradually paid back over the lifetime, housing wealth accumulates (see for instance Nakajima and Telyukova 2016). Several studies have focused on family disruption (death or divorce) or health shocks and shown that these events are correlated with wealth reductions (Poterba, Venti and Wise 2011 among others). This supports the precautionary motive. Most household wealth is held in housing, and shocks and wealth reductions are also correlated with drops in homeowner rates. This highlights the complicated issue of the house being both an asset and a consumption good - and the potential importance of housing consumption preferences for saving patterns. However, to the best of my knowledge, there is no clear evidence on the causal effects of shocks to income in old age on savings and debt, homeownership, housing mobility, and housing consumption. This is most likely due to data shortcomings.

A compelling research design to estimate these effects requires a panel data set which follows the same elderly households over several years. The design should allow for causal interpretation of the effects, for instance by observing groups of "treated" and "control" (counterfactual) households, respectively. As death events, or other events inducing a substantial income change, are

infrequent, even in retirement, the sample has to be large in order to have a sufficient number of events. The outcomes of interest - household income, balance sheets, moving, and home characteristics - are often not observed in survey data, or are misreported. For the study to be informative about the precautionary motive, it should be possible with the data and setting to make the case that savings of the widow are not kept for other insurance purposes later in life.

In the current paper, I use a data set, identification strategy, and setting by which I am able to overcome the empirical challenges of previous studies on the effects of spousal death on financial and housing outcomes in retirement. I use administrative data from Denmark covering the full population over the period 1995-2013. This allows me to set up a difference-in-difference (DD) design exploring the variation in timing of spousal death across households. Here I observe several pre- and post-death years to check for parallel trends and to detect dynamic responses over time. I also follow the widow up until her own death.[2] The data contains administrative records of all my outcomes of interest, and I hence observe responses of income, balance sheets, moving, and housing based on high-quality, third-party reported data. The context of Denmark ensures that the drop in income from spousal death is a relevant event to investigate. Due to the high level of social security in Denmark, out-of-pocket medical and long-term-care expenses are low and the uncertainty around these is highly limited, compared to for instance the U.S. This makes spousal death the major event in retirement for which households would keep precautionary savings, and a major event for which they would adjust housing.

I find that household income drop by around one-fourth of the pre-death level as a consequence of spousal death. I find that households on average reduce net wealth by around 20 % and home equity by 28 % of the levels observed in the control group. However, looking at mortgaging, I find a decrease in mortgage debt on average, and no effect on mortgaging among the households who stay in the same house after spousal death. Hence, all reductions in home equity are driven by housing wealth reductions (downsizing and moving into rental homes). This suggests that the precautionary motive is not a dominant driver of the lack of wealth decumulation in old age. Home equity does not seem to be used to smooth consumption around the drop in income from spousal death.

Looking at moving, homeownership, and housing consumption, I show that the majority of households have not moved from the house four years after spousal death. Most of those who

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[2]As described in section 3.2, I refer to the surviving part of the household as the widow, for simplicity, though my analysis includes both males and females (widowers and widows).

move also exit homeownership. Looking at housing consumption, the home size (in square meter) of widowed households is reduced by only 9 square meter or 7 % of pre-death levels. This implies that a calculated housing consumption share of income increases by 10 %-points from an already high share of 35 %. The results on financial and housing responses in combination suggest that households would dissave to a greater extent if mobility was higher or if they were able or willing to take out more mortgage debt while staying in the same house.

With respect to determinants of moving, I find suggestive evidence that low mobility and low responsiveness of housing consumption to income changes can be explained by both transaction costs of adjusting housing and attachment to the specific house and local area. This suggests that policies to facilitate consumption smoothing in old age should focus on both aspects, i.e. should aim to lower transaction costs of adjusting housing for the elderly and aim to find ways for them to stay in the same house or local area and still be able to tap into the home equity. My results do not support the idea that home equity is accumulated in old age as an insurance in response to late-life uncertainty about income and expenses, and hence do not suggest that government provision of more generous medical and social insurance in old age would stimulate household wealth drawdown.

The paper proceeds as follows. Part 2 reviews the existing literature on saving behavior in old age and responses to spousal death. Part 3 presents the empirical context of Denmark, describes the unique data, and shows descriptive life-cycle profiles of savings. In Part 4, I present the results on responses to spousal death. Part 5 concludes.

2   Literature Review

Saving behavior over the life-cycle, and in retirement specifically, is widely studied but still not well understood. Two often proposed explanations for the accumulation of wealth late in life are the precautionary savings motive and the bequest motive. De Nardi, French and Jones (2016) provide a thorough review of the literature on reasons for observed saving patterns of retirees. They point out that more work is needed to distinguish the precautionary motive from other motives. I will not examine the bequest motive in the current paper, but instead focus on disentangling the precautionary motive from motives related to housing consumption.

The idea behind the precautionary motive is that households keep large holdings of wealth to insure themselves against shocks to income and expenditures, especially medical outlays, in re-

tirement. This motive arises when households are not able to perfectly smooth consumption via credit and insurance markets (see e.g. Deaton 1991; Carroll, Hall and Zeldes 1992). This explanation for wealth accumulation in old age is supported by the finding that household savings tend to decline around the time of family disruption (death or divorce) or health shocks in old age, which is shown in a series of papers based on American survey data for the elderly population (the HRS and the AHEAD data), including Venti and Wise (2002), Venti and Wise (2004), Sevak, Weir and Willis (2004), Lee and Kim (2008), Coile and Milligan (2009) and Poterba, Venti and Wise (2011).

With respect to housing, the studies on "household events" conclude that home equity does not seem to be used to support general non-housing consumption, but is liquidated at the time of spousal death or sickness. They also find that homeowner rates tend to decline when households experience a shock. Venti and Wise (2004) is the only paper to look at housing mobility. They find it to be low unless there is a change to household structure, and they find that reductions in home equity are correlated with moving and discontinued homeownership.

Uncertainty about out-of-pocket (OOP) medical expenses and the length of life have been identified as a major reason for savings in retirement in the context of the U.S. (De Nardi, French and Jones 2010), consistent with the precautionary motive. Davidoff (2009) and Davidoff (2010) also find that home equity might substitute for long term care insurance and annuity pensions, and hence potentially is accumulated as an insurance against late-life risk. Relatedly, Huang, Li and Ross (2016) finds that claiming of Social Security Retirement Income is delayed during house price booms, suggesting that home equity substitutes for social insurance. However, in a comparison between the U.S. and Sweden, with high and low, respectively, OOP expenses late in life, Nakajima and Telyukova (2015) find that medical expenses motivate saving in financial assets in retirement, but does not affect homeownership and housing wealth.

A few studies have suggested that bequests and precautionary motives are not sufficient to account for all of the observed savings in old age, and they point to motives related to housing. Nakajima and Telyukova (2012) use an estimated structural model to show that much of the savings in old age can be explained by a preference of retirees for staying in their house as long as possible.

The housing-related motives often become evident in descriptive analyses of housing wealth and homeowner rates across ages. Nakajima and Telyukova (2016) document this across countries using survey data from the U.S., the U.K. and Europe, and they find that net worth decumulation seems to be correlated with decumulation of housing wealth, and in particular the speed of the

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decline in the homeowner rate with ages. Hence, they conclude that understanding homeownership decisions and saving in housing among the elderly, is important for understanding the overall saving behavior. Angelini, Brugiavini and Weber (2014) focus on mobility among the elderly in a cross-country study and find that moves are rare in general, especially in countries with high transaction costs. Moves are more likely in case of a family event, such as widowhood, and more likely among house-rich and cash-poor households.

In summary, the current studies highlight home equity in old age as a potential source of insurance against late-life uncertainty about income and expenditures, and also point to homeownership and moving decisions as key for understanding overall saving behavior in old age. However, there is little causal evidence on household financial and housing responses to changes in income or expenditures in old age, and few studies are able to test the different motives behind the lack of dissaving empirically, presumably due to data limitations.

The current paper builds on both the insights from the studies of survey round-to-round changes in family composition and wealth, and the studies of wealth holdings and homeownership over ages. The major advantage of this paper is the access to administrative data. The empirical approach that I am using is similar to the one applied in some of the existing studies, but the data enables me to improve the method and to set up a research design that allows for causal interpretation. The studies of savings over ages suggest that homeownership decisions and mobility are important. The administrative data has precise and valid records of moving, homeownership, and home size, all of which are often associated with noise and misreporting in survey data, and are therefore not studied in detail in the existing studies of responses to spousal death or health events in old age.

3   Empirical Context, Data, and Descriptives

3.1   Old Age and Homeownership in Denmark

There are two main reasons for why Denmark is an ideal setting for studying saving behavior in old age and motives related to precautionary savings and housing. First, Denmark provides a low-uncertainty environment with respect to out-of-pocket medical expenses and long-term care costs. Spousal death is one of few, if not the only, major event that Danish households would need to keep savings for in order to maintain the same living and consumption standards throughout retirement. Hence, if households accumulate home equity as an insurance, this is the event where

it should be cashed out.[3] Second, Denmark is a "homeowner" society, just as the U.S., the U.K. and many other developed countries with high homeowner rates. This implies that the portfolio composition and saving behavior over ages for Danish households is similar to these other countries, and it is reasonable to believe that we can learn something general about saving behavior in old age from the Danish case.

Like many other European countries, Denmark has government-provided medical care insurance. The system is compulsory and tax-based with universal coverage. As a result of this, household out-of-pocket spending on health care is very low for all ages. Doctor visits, hospitalizations, and medical treatment are not associated with any out-of-pocket costs, and there is a cap on annual out-of-pocket outlays to medicine of around USD 600. Denmark also has tax-based universal long-term care coverage, which contains both home and institutional care (see e.g. Colombo et al. 2011). Hence, household uncertainty with respect to late-life expenses is highly limited.

There is also low uncertainty about income streams in retirement. The Danish government provides a universal means-tested tax-based social pension, which is paid out to all Danish retirees as long as they live. The transfer consists of a monthly basic transfer of USD 950, which everyone is entitled to, and a potential monthly supplement of USD 500 which depends on other income.[4] Private pension contributions and employer contributions have become more common over time, but among the current generation of retirees, and those included in this study, less than half of the individuals have income from other pensions than the social pension.[5] Since the social pension transfer stops when the beneficiary dies, the death of a spouse induces a substantial drop in household income. The official retirement age, at which one is entitled to social pension, is 65 for the current generation of people retiring but up to 68 for younger birth cohorts. Most people retire at the official age: in 2015, 70 % of people at the age of 65-66 had retired.[6]

In summary, Danish retirees face low uncertainty with respect to late-life expenses and income. If elderly homeowners accumulate home equity as an insurance, in order to be able to maintain the same living standard throughout retirement, spousal death (for couple-households) is therefore the main event for which they would need coverage. This motivates why responses to spousal death,

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[3]This is similar to the logic used in Nakajima and Telyukova (2015), where they exploit the differences in healthcare and long-term care coverage between Sweden (similar to Denmark) and the U.S. to investigate retirement saving behavior, as described in the literature review.

[4]The potential supplement is USD 1,000 for single households.

[5]This is even lower for women: 46 % of all retirees, but only 42 % of the women, had some income from private pensions or employer administered pensions in 2015 (Statistics Denmark, Statistikbanken: www.statistikbanken.dk, table INDKP104). This is probably due to the lower labor market participation of women, when these cohorts were in their working ages.

[6]Statistics Denmark, Statistikbanken: www.statistikbanken.dk, table RAS209.

in the context of Denmark, are informative about the precautionary motive as an explanation for the lack of wealth drawdown in old age.

While most Danish retirees live on low income, they are well-off financially. Table 1 shows the balance sheets and portfolio composition of Danish households in 2015 for three different groups: all households, couples, and elderly couples, respectively. The average household has around DKK 1.8m in net wealth (approx. USD 270,000). Excluding pension wealth, this drops to nearly DKK 1m, of which more than two-thirds is net wealth in home equity (property wealth minus secured debt). Couples have more net wealth than the average household, as well as higher gross wealth and debt levels, while the elderly couples have more housing and financial wealth, but lower mortgage debt and liabilities to banks, compared to the average couple of all ages. This illustrates the build-up of wealth during retirement which will be documented in detail below and which is also a fact in most other developed countries.

Denmark has a strong culture of homeownership as do the U.S, the U.K., France, Italy, and many other developed countries. This to a great extent drives portfolio compositions and life-cycle saving and debt profiles of households as shown in the cross-national study of Nakajima and Telyukova (2016). Consequently, the overall financial situation of Danish retirees is similar to the one of retirees in many other countries.[7]

Most net wealth of retirees is locked up in housing. If households stay in owner-occupied housing throughout life, mortgage regulation and access to home equity loans is important for the possibility of home equity drawdown. The Danish mortgage market is considered to have a low degree of regulation, at the same level as mortgage markets in The U.S. and the U.K., according to the cross-country ratings in Chiuri and Jappelli (2010). The measure of mortgage market regulation is based on, among other things, maximum household leverage allowed and options for home equity withdrawal.

Denmark has a legal maximum loan-to-value of 80 % in mortgage banks. Homeowners can easily refinance to change the mortgage loan terms or, with sufficient home equity and a good credit status, to extract home equity (see Andersen et al. (2015) for a detailed description of refinancing in the Danish mortgage system). It has been possible to extract home equity for non-housing purposes since a mortgage reform in 1992, and this new credit source was quickly utilized by homeowners (Leth-Petersen 2010). A 30-year fixed rate mortgage with repayments has traditionally been the standard way of financing house purchases, but new products have been introduced in

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[7]See for instance Poterba, Venti and Wise (2011) for a description of balance sheets of elderly American households.

the mortgage market (adjustable rate mortgages introduced in 1996, interest-only mortgages introduced in 2003).

All mortgages are issued under the Danish so-called "pass through" system through the covered bond market. In this system, mortgage institutions are not allowed to take any interest rate risk or to price discriminate between borrowers. The borrower pays the coupon on a covered bond in interest payments, and the outstanding mortgage debt is the market value of the bond at any time. This implies that the mortgage loan terms are very transparent to the borrower. Danish covered bonds are considered low-risk and have proven to be as liquid as Danish government bonds during times of financial stress (2009; 2011, the Danish Central Bank). This implies that homeowners get comparably low interest rates on their mortgages. Hence, over all, the Danish mortgage market is flexible, homeowners can easily take out new mortgages and thereby extract home equity, and due to the "pass through" system this is even a relatively cheap source of credit. Though the maximum loan-to-value of 80 % is not necessarily allowed for every borrower in all housing markets, homeowners with no existing mortgage debt will usually be allowed to take out a loan which is the case for a majority of homeowners on retirement. However, there are no hard rules on this, and current income is often taken into consideration which might limit the access to credit for elderly on social pensions. Denmark does not have reverse mortgages for elderly homeowners.

3.2 Data

The analysis is based on administrative data for the full Danish population over the period 1995-2013. The main data set is constructed by combining several administrative registers with information about income, taxes, assets and liabilities, labor market status, demographics, and date of death linked through personal identification numbers. I am able to link individuals to their spouses/cohabitants and children. This is important in order to follow households over time and construct household outcomes. It also enables me to keep track of wealth of children and to observe whether children are living nearby. Each individual has a home address which can be linked to a housing register with information about characteristics of the house that they reside in. I also have access to a register with information about all property transactions by with, in combination with the home address, I can construct measures of local housing market characteristics.

I look at the death of one partner from a couple using the definition of couples from Statistics Denmark's family definition which includes both married couples and cohabiting couples.[8] Ho-

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[8]According to Statistics Denmark's family definition, a couple is two people who are living together and who form

wever, throughout the paper, I refer to the death of a partner as "spousal death" for simplicity. In my analysis sample, 97 % of the couples are also married, and my results are robust to using only married couples. Also for simplicity, I refer to the surviving part of the couple as the "widow", though this can be a woman as well as a man. In practice, 80 % of the surviving partners are women in my sample.

When studying financial responses to spousal death, I consider net wealth, home equity, and mortgage debt. Net wealth is defined as total assets minus total debt. Total assets is defined as the sum of housing wealth, bank deposits and the market value of stocks and bonds. Total debt is defined as the sum of mortgage debt and all debt to banks, including bank loans and credit card debt. Housing wealth is the total value of all owned property based on appraisals by the Danish Tax Authorities used for tax purposes. Mortgage debt is defined as the total debt to mortgage institutions measured by the market value of the underlying bonds. Home equity is defined as the difference between total housing wealth and total mortgage debt.

When studying housing responses to spousal death, I consider moving, homeownership, home size and a calculated ratio of housing consumption to income. Moving is based on information about the home address and whether this is changed in the Danish Civil Registration System. Homeownership is defined as having positive housing wealth or living with a partner who has positive housing wealth.[9] Hence, according to my definition, someone is a homeowner if he or she, or the partner, owns property. In my sample, almost 90 % of those defined as homeowners also owns the property that they live in.[10] Home size is defined as the area of the house (in square meters) used for habitation. I define the ratio of housing consumption to income as the rental value of the house divided by income. To get information about rental values, I assign households a high or a low square meter price based on their home address and information about geographical

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a couple in one of the following four ways: 1) Married couple, 2) Civil partnership, 3) Cohabiting couple with children: Two people who are not married or in civil partnership, but live together and have a least one child together, or 4) Cohabiting couple without children: Two people of opposite gender, less than 15 years of age-difference, no children together, no close family ties (not siblings and not each other's parent/child), only two adults in the household (at the same address).

[9]Hence, I measure homeownership at the household level.

[10]This can be observed in a separate owner register with owner personal identification numbers and property identification numbers. The housing records also contain information about whether the home is occupied by the owner. Both measures show that around 90 % of those who own property, also own their own home. I choose to base the homeownership measure on property ownership from the tax records, because the timing of registration of ownership is precisely known (by the end of the year), which is not the case for the other registers. Furthermore, since mortgage debt is not observed at the property level, but only as a total at the individual level, I have to measure home equity responses for all owned property, and I think it is then more correct to look at property ownership as the extensive margin. My results are robust to only including homeowners (following my current definition) who also live in a home which is owner-occupied.

rental prices from the most recent report of the Danish National Construction Fund (Landsbygge-fonden 2016). I then multiply the square meter rental price by the home size in square meter to get the total rental value.

All outcomes are measured on an annual basis, recorded by the end of the year (status by the end of the year for stock variables and amounts during the year for flow variables). All outcomes are winsorized at the 1st and the 99th percentile in the distribution for the full population each year, and are reported in 2016-prices. Note that while I follow individuals (widows and widows-to-be) over time in the DD analysis, all outcomes are measured at the household level. In the descriptive life-cycle graphs below I consider outcomes at the individual level, except for homeownership which is a household based measure as just described.

In the descriptive life-cycle graphs, I use data for the full Danish population over the period 1995-2013; a total of a little more than 7m unique individuals. My main analysis in section 4 is based on a sample of individuals who are observed all years from 1998-2013 and has a partner dying in the period 2004-2013. I require all individuals to be on retirement throughout the period, and the partner to be on retirement as well as long as he/she is alive. I furthermore restrict the sample to individuals who have the same partner up to death of that partner, who are homeowners up to death, and who stay single after they are widowed. Hence, in practice, I am following households over time who start out as a couple-household and turn into a single-household when one of the partners dies. This gives me an analysis sample of 201,440 unique household-year observations (12,590 households each year). I divide the analysis sample into a treatment and a control group, to be described in detail in section 4.1. The treatment group consists of 108,976 household-year observations, and the control group consists of the remaining 92,464 household-year observations. In parts of the analysis, I divide the treated households into three groups: those who stay in the house, those who move and continue as homeowners, and those who move and exit homeownership after spousal death.[11]

Table 2 shows summary statistics for samples at different steps in the sample selection process, including the final analysis sample. Column 1 is based on a sample of households who are retired throughout the period 1998-2013 (as long as they are observed in the data, i.e. alive and not emigrated). Column 2 is based on the same sample, but also restricted to households who are

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[11]Those who are categorized as staying must stay in the house for at least four years after spousal death, those moving and continuing as homeowners must move at least once in the first four years after death but be homeowners in all four years, and those moving into rental homes must move at least once and exit homeownership at some point during the first four years.

widowed in the years 2004-2013. The last column shows statistics for the final analysis sample described above.

3.3 Descriptives

To start out by illustrating the retirement savings puzzle, figure 1 shows average net wealth and income across ages in the Danish population of 2013. This clearly shows that while income has an inverted U-shape over ages, and declines at retirement age, net wealth builds up over ages and is not decumulated during retirement.

Panel A of figure 2 shows average total wealth over ages for different time periods. The level of total wealth across all ages, except the very young ones, has increased over time. The overall life-cycle pattern of savings is consistent over the different time periods; with a fast accumulation of assets in the beginning of adulthood, a moderate accumulation in the mid-ages, and a slow decumulation in old age. For the most recent time period, the average person at all ages in retirement, up to age 90, has more than DKK 1m in total wealth (around USD 150,000). The timing of the change in pace of accumulation, or the change from build-up to drawdown of wealth, has shifted a few ages to the right between the earliest periods and the latest periods.

Focusing only on homeowners, in panel B of figure 2, there is less decumulation of wealth, especially in the age profiles from more recent time periods where wealth rather accumulates during retirement. This indicates that people, at least on average, do not draw down savings while they are still in owner-occupied housing.

It could be the case that homeowners do not decrease total assets with ages, but instead tap into the home equity by mortgaging. Figure 3, panel A, shows the share of homeowners with a mortgage over ages for different time periods. It shows that mortgage rates are falling sharply from around the age of retirement. Around the age of 70-75, less that half of the homeowners have a mortgage. While the share of homeowners with a mortgage in the very old ages seems to have decreased over time, the overall age profile of when homeowners are free of the mortgage is consistent across time periods.

It is also not the case that the homeowners who stay in the mortgage market then tap into the home equity to an extent that turns the asset accumulation late in life into net decumulation. Panel B of figure 3 shows the age profiles of home equity among homeowners for different time periods. This shows that home equity grows rapidly in most years of the working-ages and continues to grow in retirement, though at a lower pace. Home equity especially builds up over ages in reti-

rement in the graphs based on data from more recent years, presumably driven by the boom in house prices in Denmark over the last 10-15 years.

If net wealth is not decumulated over life among homeowners, a crucial question is how homeowner rates evolve as people age. This is shown in figure 4. There is a clear life-cycle pattern: people enter the housing market in their mid- to late-20ies, and many exit again at the time of retirement. However, many also stay in homeownership throughout life, and even at the very old ages, homeowner rates are still above 30 %. In combination with the fact that people on average tend to not draw down assets while in homeownership, high homeowner rates in old age seem to be important for the overall lack of wealth decumulation, as also pointed out in Nakajima and Telyukova (2016) on data for several developed countries.

One striking thing about the age profiles of homeowner rates is how consistent they are over the different time periods. However, while the graphs with age profiles of savings and ownership across different time periods are informative about the differences at each age in each period, they do not directly show cohort effects. To detect cohort effects in homeownership, figure 5 shows homeowner rates over ages for different cohorts. The figure shows three different parts of life: the early part of adulthood, the mid-life ages, and the old ages, respectively. It is clear from the figure that there are essentially no cohort effects in the "equilibrium" homeowner rate reached in the middle of life; this is stable at around 70 % for all cohorts. However, there are cohort effects in the timing of entry into and exit out of homeownership. Later cohorts enter the housing market later in life and they also exit later. This is consistent with a gradual shift over time in the timing of life-events such as graduation, marriage, parenthood, and retirement, and explains why asset age profiles have also shifted slightly to the right as described above.

In summary, there is a slow decumulation of wealth over ages in retirement which seems to be highly driven by (i) no drawdown of assets, in particular home equity, among homeowners and (ii) high homeowner rates in old age. Household balance sheet volumes vary over time, but the life-cycle profile of homeownership (the extensive margin of housing wealth) has been very persistent over the last 20 years and shows essentially no cohort effects, despite the fact that mortgage regulation, mortgage interest rates, and taxation of housing has varied a lot over the period. This suggests that homeownership responds little to financial incentives, which might as well be key for understanding saving behavior in old age.[12]

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[12]The low responsiveness of homeownership to financial incentives is supported by the finding in Gruber, Jensen and Kleven (2017) who carry out a long-term study of the effect of the mortgage interest deduction on homeownership and find a zero effect.

The findings for Denmark are consistent with studies on other countries, for instance the age profiles of portfolios documented in the cross-country study of Nakajima and Telyukova (2016) and the non-existence of cohort effects in homeownership that Poterba and Samwick (2001) find on American survey data.

The aggregate age profile graphs provide great insight about saving behavior and homeownership over the life-cycle and in retirement. However, in order to understand the incentives behind the large holdings of home equity and the high homeowner rates among the elderly, it is important to do a more focused analysis of behavior at the household level. The next section therefore studies the financial and housing-related responses among elderly homeowners to the drop in income induced by death of a spouse.

4   Responses to Spousal Death in Old Age

This section presents results on the effects of spousal death on financial outcomes, including net wealth, mortgage debt, and home equity, and housing-related outcomes, including moving, homeownership, home size, and housing consumption to income. Changes in portfolios, asset ownership, and moving around spousal death have been studied in the existing literature. However, to the best of my knowledge, there is no study with a setup that allows for causal interpretation, where households are observed several years before and after spousal death, and with precise measures of the outcomes of interest, especially home equity and moving which are often misreported in surveys, and housing outcomes with are often not observed.

4.1   Empirical Strategy

The main challenge of studying how households adjust to shocks, for instance spousal death, is that I do not observe counterfactual paths for how outcomes of shocked households would have evolved in absence of the shock. In existing work, researchers have usually compared households where a spouse dies to households where both remain alive. This is problematic. Studies have shown that, for instance, wealth and income are correlated with health (e.g. Cutler, Deaton and Lleras-Muney 2006), meaning that the non-shocked households are not necessarily a credible control group for the shocked ones.

The analysis in the current paper is based on a difference-in-difference (DD) design, where I exploit the variation in timing of death among a group of households that all experience spousal

death within a defined period of time. The idea is that households who are widowed at a certain point in time are not comparable to non-widowed households in terms of health, income, saving behavior, etc. However, whether a household is widowed in the current year or a few years later is considered (and shown by test of parallel trends) to be random with respect to the outcomes of interest. This method is developed by and applied in Fadlon and Nielsen (2015) who look at labor supply responses to health and mortality shocks.

I refer to spousal death as a shock, but want to emphasize that this is not an unexpected shock. Hence, I am not analyzing how widowed households act differently compared to households who never experience widowhood. I am analyzing how they adjust compared to households who are widowed a few years later. Death of a spouse in general is not a shock, but the timing is unknown which is what I am exploiting for identification. This allows me to have a control group of households who are comparable in terms of saving behavior, life expectancy, and other potential confounding factors, but who are not experiencing death at the time studied, i.e. are not treated.

In particular, I take a group of households where the partner dies in one year, denoted year D, and use them as the treatment group. I then take another group of households where the partner dies in year $D + h$, h being a small number of years, and use them as the control group. I refer to a group of households where the partner dies in the same year as a death cohort, meaning that death cohort 2004, for instance, refers to households where the partner dies in year 2004.

The estimated effect of death on a certain outcome is given by the the difference in outcomes between the treatment and the control group after treatment (where treatment refers to death in the treatment group) minus the difference in outcomes between the two groups before treatment, hence a DD estimate. For the reported DD estimates in the graphs, I use the second last year before death to calculate the pre-treatment difference, and I use the first year after death to calculate the post-treatment difference.

Let y_t^T denote the outcome of the treatment group in event time t, and let y_t^C denote the outcome of the control group in event time t. For all households, in a given calendar year, event time is defined by the number of years relative to the year of spousal death in the treatment group (i.e. $t = Year - D$), such that $t = 0$ is the year of treatment. The DD estimate of the treatment effect, as reported in the graphs, is then given by[13]

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[13]I report DD estimates comparing the difference two years before death and one year after death ($t = -2$ and $t = 1$, respectively), to allow for some adjustment right around death (the spouse could die early or late in the year $t = 0$). All outcomes are measured by the end of the year. Alternative DD estimates based on other pre- and post-death years (for instance $t = -2$ and $t = 2$) are salient and easy to calculate from the graphs. For the main outcomes, DD estimates of all event times relative to $t = -2$ are also reported in the tables.

$$(y_1^T - y_1^C) - (y_{-2}^T - y_{-2}^C) \tag{1}$$

Note that the estimation strategy allows for the baseline levels of outcomes of the two groups to be different. This means for instance that the control group can have more home equity on average than the treatment group. I only explore the change in the difference in levels, i.e. the difference in trends. The identifying assumption is that households where the partner dies in year D are comparable to households where the partner dies in year $D + h$. This means that in absence of the death shock in year D, the first households would have behaved like the households where the death shock hits in year $D + h$. For this to be a reasonable assumption, I should see that the two groups have parallel pre-trends up to the death event. This is why access to a long panel data set with a sufficiently large sample is important.

Figure 6 illustrates the identification strategy. It shows income over time for the different death cohorts of the years 2004-2013. Levels of income differ across death cohorts, but trends are very similar. Based on this, if studying income, later death cohorts look like decent control groups for earlier ones. It seems reasonable to assume that in absence of spousal death in a certain death cohort, income would have evolved the way it does for the cohorts where the spouse is dying a few years later. This is the idea behind the DD strategy, and comparison of trends up to the first event (treatment) is a way to check its validity.

The empirical design allows me to observe responses for a post-shock period of $h - 1$ years, i.e. the years up to when the control group is treated (the spouse in the control group dies). This illustrates the trade-off with this method between a short gap between treatment and control group (a small h) and a long post-shock period to study ($h - 1$ years), as also discussed in Fadlon and Nielsen (2015). I choose a time span (an h) of five years, resulting in a four-year post-period, to get comparable treatment and control groups but also a substantial post-shock period. The results are robust to changing this time span. I show results for a six-year pre-period. As described in section 3.2, I use death cohorts for the years 2004-2013. Hence, I pair treatment death cohort 2004 with control death cohort 2009, I pair treatment death cohort 2005 with control death cohort 2010, etc., and show graphically the average outcomes for treatment and control groups over the event timeline.

For the key outcomes in the analysis, I also show regression estimates of the DD effect for each

event time, relative to the baseline two years prior to death, similar to the graphical evidence in the graphs. The estimates for the pre-death years are useful in order to check the assumption of parallel trends and the estimates for the post-death years are useful in order to know the dynamic effects (though this can be seen from the graphs as well). To be specific, I estimate the following regression:

$$Y_{it} = \alpha \cdot T_i + \sum_{j \neq -2} \gamma_j \cdot I[t = j] + \sum_{j \neq -2} \beta_j \cdot T_i \cdot I[t = j] + v_{it} \tag{2}$$

Where Y_{it} denotes the outcome of interest for individual i at event time t. This is regressed on a dummy for being in the treatment group, T, a full set of event time-dummies (the second term on the right-hand side), and an interaction between all event time-dummies and the treatment-dummy. In the set of event time-dummies, I have excluded event time $t - 2$, which is the second last year before death of the spouse in the treatment group. This means that the coefficients β_j on the interactions between event time-dummies and the treatment-dummy show the effect of a spouse dying on Y, in a given event time relative to two years before spousal death. The regressions are run on a period of six pre-event years and four post-event years, similar to what is shown in the graphs, but the tables only show estimates for the four pre- and the four post-years.

4.2 Financial Responses to Spousal Death

The reason for looking at spousal death to study precautionary motives and housing consumption responses in old age, is that spousal death induces a substantial fall in income for the household. Presumably, the death of one part of the household also affects consumption needs. I do not observe general consumption, but I observe the size of the house that the household lives in and the new house it potentially moves to which are reasonable measures of housing consumption. I expect the household to lower housing in response to the income loss from spousal death.[14] The most effective way to change housing, and the only way to change it substantially, is by moving to a different house.[15] Hence, I would expect most households to move after spousal death. If the household has accumulated home equity as an insurance, to be able to smooth consumption around spousal death, I would expect the household to maintain the pre-death level of consumption, including staying in the house or moving to a similar one, and to tap into the home equity

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[14]Assuming that housing is a normal good and that the widowed household has the same consumption and saving preferences as before widowhood. This is true both if I assume that the couple each got utility from (consuming) half of the house before death of one of them, and if I assume that they both got utility from all of the house.

[15]It is known from American data (see for instance Davidoff 2006) that elderly households spend less on home maintenance than younger homeowners, which is one way to reduce housing consumption without moving. However, it is unlikely that this channel is sufficient to compensate for an income shock of the size considered here.

to finance this. Accordingly, the current study is a good way to test (i) whether home equity in old age serves as an insurance against income changes, and (ii) the responsiveness of housing to income in old age - both of which are informative about the motives behind the lack of dissaving towards the end of life.

Figure 7 shows the "first stage" of the analysis. It shows the effect of spousal death on household income. If households were perfectly insured against death, there would be no effect and it would not be interesting to study financial and housing responses. However, as evident from the figure, this is not the case: household income drops by more than 25 % and stays this low after death.

The question then is whether households spend some of their wealth to compensate for the fall in income. Figure 8 shows the responses with respect to net wealth, in panel A, and home equity in particular, in panel B. When a spouse dies, net wealth drops by around 20 % and home equity by almost one-third of the levels in the control group. These are considerable amounts, but not enough to maintain pre-death income levels for many years for the average household, considering that income is a flow variable and wealth is a stock.[16]

The reductions in wealth, most notably home equity, indicate that accumulated wealth in old age serves as an insurance against income shocks, but does not prove it. If this is driven by an insurance motive, I would expect wealth reductions to be made through excess mortgaging rather than housing downsizing for those who stay in homeownership, and I would expect reductions to be largest for the households who stay in the same house or move but do not downsize. These are the households that choose to maintain pre-death levels of housing consumption.

Figure 9 shows the general mortgage debt response to spousal death. In contrast to what I would expect from the precautionary motive, mortgage debt is reduced rather than increased. Hence, the reduction in home equity comes from reductions in housing wealth. The mortgage response only for those who stay in the house after spousal death is shown in figure 10. Among these households, there is essentially no response. If anything, there is a small drop in mortgage debt after spousal death, the opposite of what I would expect if home equity was used as an insurance. Mortgage debt increases slightly over the next few years, but is still not significantly

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[16]When measuring home equity, one concern is that the administrative appraisal is not a realistic measure of what the actual home value and housing wealth is. To control for this, I have run two alternative versions of the graph in panel B of figure 8: one where household housing wealth is adjusted by the local (municipality) year-specific ratio of sales price to appraisal on all sold houses in the year, and one where it is adjusted by the year-specific ratio of sales price to appraisal for all houses sold by elderly owners (above age 60). The results are shown in appendix figure A.I. All levels are higher due to the adjustment, but the estimated responses are essentially the same.

higher than the level in the control group four years after death. This result raises doubts about the precautionary motive as a main driver of home equity accumulation in old age.

When home equity is decumulated on average, but not by the households staying in the house, the response must come from the moving households. Figure 11 shows the home equity response for households who move and continue as homeowners.[17] There is a substantial drop in home equity for this group meaning that they move to a smaller/lower-quality house or take out more mortgage debt in the new house. If households move to houses of equal value and take out more mortgage debt, this could be a sign that they were for some reason not able to extract home equity in the existing house. However, as evident from appendix figure A.III, this is not the case. Households moving and continuing in homeownership after spousal death decrease, rather than increase, mortgage debt when they move. Hence, home equity is reduced as a result of downsizing which will be analyzed further in section 4.3.

The largest reduction in net wealth is seen among those who move and exit homeownership, as evident from figure 12. For this subgroup, net wealth is reduced by almost 40 % of the level in the control group. Net wealth includes all large investments, such as those in property, stocks, and bonds. Hence, a natural question is whether all of this drop in net wealth, mostly from liquidated home equity, is spent on consumption. Appendix figure A.IV provides three checks of where the money might otherwise go.

Panel A of the figure shows the evolution of total net wealth of all children of the widow (and widow-to-be for the control group). It shows that there is essentially no effect on children's net wealth. Panel B shows the evolution of net wealth of the widow, similar to the main figure, but adjusted for the gap between the sales price and the appraisal when she sells the house and move. Since the analysis covers a period of a house price boom in Denmark, this adjustment only increases the net wealth effect (appraisals are below sales prices). In the last panel of the figure, I condition on the widow not moving into a housing cooperative. Investments in Co-Op housing are not registered as housing wealth in the tax records, since the Co-Op and not the individual is the legal owner. This slightly reduces the net wealth effect, but the reduction remains substantial. Hence, these checks suggest that liquidated home equity among households who move into rental housing is mostly spent on consumption or investments not observed in the data, such as a car, a boat or other durables.

Table 3 shows the DD estimates on all event time dummies for the key financial outcomes of

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[17]Appendix figure A.II shows the response with respect to net wealth for this group.

the analysis, based on the regression model in equation 2. The estimates on event time $t = 1$ correspond to the DD effects reported in the graphs. The regression results confirm what was already clear from the graphical evidence, but makes it easier to check significance and exact estimated dynamic effects in the four-year post-period.

As described in section 3.1, there is very little uncertainty about income and expenses for Danish retirees. Compared to for instance the American context, it is much less likely that Danish households keep savings after spousal death as an insurance against unexpected changes to income or expenses. However, to check whether some of the wealth is saved for and spent in the last years of the widow's life, figure 13 shows the average net wealth and home equity for all widowed households up to there own death (event time $t = 0$ in the graph). This figure is based on a sample with the same restrictions as the main analysis sample, but is extended to include spousal death cohorts 1999-2012 and restricted to widows who die at least one year after the spouse and before 2013. The figure clearly shows that it is not the case that net wealth and home equity specifically is saved to be spent in the very last part of the widow's life.

In summary, the results on financial responses to spousal death do not bring support to the precautionary motive as a main driver of the lack of wealth decumulation late in life. Net wealth and home equity is reduced on average after spousal death, but households who stay in the same house do not take out more mortgage debt, though they should have a strong consumption smoothing motive to do so, as they do not change housing. There is also no excess mortgaging among the moving households. All home equity reductions are driven by households who move from the house and reduce housing wealth. This response is not clearly driven by an insurance motive, unless the households who move into rental housing maintain pre-death housing consumption which I will investigate below.

4.3   Housing Responses to Spousal Death

The financial responses to spousal death in retirement, showing that home equity reductions after spousal death are driven solely by reductions in housing wealth for households that move, makes it important to understand mobility and responses with respect to housing. In the following, I look at moving and homeownership responses to determine the size of the group who stays, moves to other owner-occupied housing, and moves to rental housing, respectively, after spousal death, and I look at the extent to which those who move also reduce housing.

Figure 14, panel A, shows the cumulative moving rate for the treatment and the control group.

Cumulative moving is defined as the share of households who have moved since 1998, the first pre-death year of the first death cohort. By the first year after spousal death, there is a 19 %-points higher share of the treated households who have moved, compared to the control group. By the end of the period, four years after spousal death, the excess share of treated households who have moved is 25 %-points. Considering the low rate of cumulative moves up to death, the response after death is substantial. However, the majority of households still have not moved four years after death of the spouse.[18] The financial results showed that the non-moving households do not tap into the home equity when the spouse dies, and hence, the most common response for households is to stay in the same house and not touch the home equity.

In the analysis of financial responses, I divided the moving households into those who do and do not, respectively, continue to be homeowners after spousal death. It is therefore important to look at homeownership responses to see how large each group is. The financial responses showed that home equity reductions are largest for those moving into rental homes, and previous studies of life-cycle saving behavior (for instance Nakajima and Telyukova 2016) have shown that declines in homeownership tend to be correlated with declines in net wealth. Panel B of figure 14 shows homeowner rates for the treatment and the control group. By definition of the analysis sample, the homeowner rate stays at 100 % for the control group. For the treatment group, it has dropped by 26 %-points after the first year and is down to 66 % four years after spousal death. This is a substantial reduction showing that most of those who move also exit homeownership.

A next interesting outcome to look at is housing consumption. This is not easily measured. In the literature, it is often modeled as a housing service flow gained from living in the house which equals the rents saved (for instance in Sinai and Souleles 2005). For tax purposes, the returns to owner-occupied housing are defined by the imputed rental value minus the user costs (Poterba 1992). In this analysis, I evaluate responses with respect to home size (in square meter) and with respect to rental value divided by income, which I refer to as the housing consumption to income ratio, as explained in section 3.2. While home size is only one aspect of the total amount of housing that households consume, it is a very direct and transparent measure of housing consumption which does not fluctuate with house prices. Rental value has the advantage of reflecting both home size and rental prices, and the ratio of rental value to income shows how households prefer housing relative to other consumption goods.

When income drops, I would expect households to lower housing to keep the same housing to

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[18] An extra 30 % have moved compared to the year before death; this is 5 % in the control group

income ratio, or to draw down savings, maintain the same level of housing, and thereby keep the ratio constant. However, the financial responses showed that those who stay in the same house, and most clearly do not change housing, do not tap into the home equity. The results on moving showed that the non-movers are a majority. The question then is how this translates into overall responsiveness of housing to the income drop from spousal death; essentially, the extent to which those who move change housing. In particular, it is interesting to see whether those who liquidate the home equity by moving into rental housing downsize or use the extracted wealth to maintain the same level of housing.

Figure 15 shows the estimated effect of spousal death on home size, in panel A, and housing consumption to income, in panel B. The effect on home size is small with an average decrease of 9 square meter (97 square foot) after the first year, and remains small in the following years. When the change in home size is converted to rental value and considered relative to income, it shows a substantial change in the ratio of housing consumption to income, as evident from panel B of the figure. This ratio has increase by 10 %-points in the first year after death, relative to an already high level of around 35 %. Hence, there is little changing of housing in response to the income drop induced by spousal death.

Figure 16 shows the home size changes of the two subgroups of households who move and stay homeowners and move and discontinue homeownership, respectively. It shows that the changes are very similar for the two groups over the four years after spousal death. The responses are large compared to the average effect which is not surprising given the limited ability to adjust the size of the home without moving. Especially the housing responses for those moving into rental homes are interesting. This is the group which reduces net wealth, including home equity, the most. If they used accumulated wealth as an insurance to maintain pre-death levels of housing and other consumption, I would expect them not to downsize.

As for the financial responses, table 4 shows the DD estimates on all event time dummies for the key housing outcomes, based on the regression in equation 2. The estimates for event time $t = 1$ correspond to the DD effects reported in the graphs and event time $t = -2$ is the baseline.

In summary, the results on housing responses to spousal death show little adjustment of housing consumption after spousal death, despite the substantial drop in household income. This is to a great extent driven by the fact that the majority of households do not move from the house that they lived in before death. As a result, the share of housing to income increases substantially. The largest downsizing is seen among the households who also reduce home equity the most which is

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difficult to reconcile with precautionary motives.

4.4 Determinants of Housing Mobility

The financial and housing responses in combination showed that when income drops, home equity is only drawn down if households move, and few decide to move. This suggests that if households were more mobile or if households who stay in the house were more able or willing to take out mortgage debt, dissaving would be larger. This raises two main questions: why are not more households moving when income declines, and why are not more households taking out home equity loans if they decide not to move?

In the following, I will mainly concentrate on the first question by analyzing how housing mobility vary with household and local housing market characteristics and relate that to potential policies to facilitate consumption smoothing in old age. I will briefly discuss the unwillingness or inability of elderly homeowners to take out home equity loans in the end of the section, but unfortunately, I am not able to answer this question in the current study.

Determinants of mobility in old age is studied in Banks et al. (2012) in a comparative study of Britain and the U.S. They find geographical distribution of amenities and subsidized rental housing to be important explanatory factors. To the best of my knowledge, there is little, if any, existing evidence on determinants of mobility around spousal death or other shocks to income in retirement.

If housing is not changed in response to drops in income, there could be several economic explanations for that. I could think of a model similar to the one developed in Chetty and Szeidl 2007 where there are transaction costs associated with changing the consumption of housing. Housing consumption is only adjusted when the utility loss from not adjusting housing exceeds the costs of it. Another model is one in which households get utility from living in the same house over time, for instance because they are attached to the house or the neighborhood. This is similar to the model in Cocco and Lopes (2015) who find that these "psychological reasons" for remaining in the same house can partly explain high homeowner rates late in life. The model in Nakajima and Telyukova (2012) also allows for attachment to the current house. They, however, do not model moving between owner-occupied housing but only the decision of moving out of homeownership and into rental housing. Yet another possibility is to think of a model where households have preferences such that owner-occupied housing is a good of which consumption is not adjusted when income changes (zero income elasticity of demand; housing is just consumed in a fixed amount).

These different models, and motives behind low mobility, are difficult to test against each other empirically, and I am not able to do that in the current paper. However, the analyzed determinants of moving can bring more or less support to the different frameworks. If this is a story of transactions costs, I would expect to see moving vary positively with the utility loss suffered from not changing housing consumption after spousal death and negatively with the costs of moving. If some widows stay in the house because they have a particular preference for that house, or because housing is simply not responsive to income changes, it is not clear why moving should vary with transaction costs.

The reasons for low housing mobility are important for policy. If households are not moving - not adjusting housing consumption and not liquidating home equity - because moving costs are high, then policies aimed at lowering the costs could be desirable. If households are not moving because they prefer to stay in the same house, it could be desirable to have policies that enable them to decumulate savings while staying in the house.

In the current section on mobility, I focus on the households in the treatment group from the DD analysis, i.e. death cohorts 2004-2008. A widow is defined to be moving after spousal death if she moves in the year of spousal death or in the first year after to capture the moving responses that are closely related to the death event.

Following the model in Chetty and Szeidl (2007), I start by looking at how the propensity to move after spousal death varies with the ratio of housing consumption to income one year before spousal death. If this ratio is already high, households have to reduce consumption of other goods from an already low level (relative to income) if they choose not to move. This could be associated with a large utility loss, and I would expect moving to be increasing in the pre-death ratio of housing to income. As shown in figure 17, panel A, this is confirmed in the data: there is a difference of around 20 %-points in moving propensity between households with the highest housing to income ratio, of 70 %, and households with the lowest ratio of 15 %. Consistent with the model of transaction costs, panel B of the same figure shows that the propensity to move is also increasing in pre-death interest expenses relative to income. This is consistent with the idea that if "committed consumption" related to housing is high, households are more likely to pay the cost and move when income drops.

At last, I look at whether moving varies with the transaction costs of owner-occupied housing. It is difficult to measure these directly, but one thing that could impact the costs of selling the house and finding a new one, is how liquid the local housing market is. Figure 18 shows how

moving varies with local housing market turnover in the year before spousal death. Turnover is measured as the share of property sold at least once during the year out of total property, only including property used for habitation. This is calculated within municipalities, and Denmark had 271 municipalities for the period used in the analysis.[19] The figure clearly shows that widows are more likely to move if they live in a liquid housing market, with a gap in moving propensity of 15-20 %-points between the most and the least liquid market. This again supports the model of transaction costs associated with changing housing consumption.

To test the idea that mobility might be low because households prefer to stay in the same house, I look at how moving varies with attachment to the house and the area. I measure this by the best proxies for attachment that I can find in the data: number of years the household has lived in the current house, and whether the widow has children living nearby. Figure 19, panel A, shows that mobility after spousal death is highly correlated with the number of years living in the house. The share of widows moving is less than 10 % for those who have lived in the house for more than 30 years and almost 50 % for those who have moved within the last five years. It could be the case that those with long tenure in the house are also the ones with high transaction costs; the costs have been too high for them to move in the past, and they are also not moving now when the spouse dies. However, considering that those with the highest housing tenure have been in the same house since their mid-ages, costs that are high enough to prevent adjustment over all these years (covering the income drops from transition to retirement and now widowhood) seem unlikely. The negative correlation between tenure in the house and mobility at spousal death suggests that a special preference for the same house could drive some of the sluggish adjustment of housing in retirement.

Figure 19, panel B, shows how mobility varies with whether the widow has children living nearby. It shows that, with respect to mobility after spousal death, there is essentially no difference between not having children and having children that do not live nearby (live outside of the municipality). However, having children living nearby - in the same municipality or parish as the widow - tends to decrease mobility.[20] The difference though between the least mobile and the most mobile widows split by location of children is only a few %-points which is modest compared to the results on years spent in the house. In summary, the results in figure 19 support the idea that

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[19]Death cohorts 2002-2008 are included in the analysis of this section with turnover rates measured in 2001-2007 (one year prior to spousal death). Denmark had a municipality reform in 2007 which reduced the number of municipalities to 98, meaning that turnover rates for the last death cohort are calculated within larger areas. The results are robust to excluding death cohort 2008 (turnover rates from 2007).

[20]Denmark has around 2,000 parishes, which is the smallest administrative unit. The number varies slightly by year.

attachment to, and a special preference for, the same house and area could drive some of the low mobility in old age.

The model of utility from staying in the same house is difficult to distinguish from a model where the household just consumes housing in a fixed amount regardless of income. To test this, one should know whether the household would get the same utility from living in a similar house (consuming the same "amount"), but not that exact same house. Regardless of what the right model is, life-cycle patterns of housing consumption show great persistence over ages, despite the decline in income in retirement. Figure 20 shows housing mobility over ages for different time periods. Mobility is high in the first 10-15 years of adulthood, but then stays low with around 5-10 % of each age group moving during a year. Given that housing is primarily adjusted through moving, this means that housing consumption for many households stays constant throughout mid and old age. Strikingly, the age profile of housing mobility essentially has not changed over the last 20 years shown in the graph. It seems unlikely that all of the persistence in moving, and therefore housing consumption, can be explained by moving costs. For this to be true, moving costs must be so high that it is not desirable for households to change housing at any point during mid and old age (though the life-cycle profile of income to a great extent is known to them).

I find support for both a model where transaction costs of changing housing result in low mobility among elderly, and a model where attachment to the house, or just zero income elasticity of housing consumption, makes households unlikely to move despite large drops in income. Hence, the results do not lead to clear policy recommendations. Policies to facilitate consumption smoothing in old age should probably both aim to lower transaction costs and aim to ease access to home equity lending for the households that prefer to stay in the same house.

Reverse mortgages should enable elderly households to exactly extract home equity and stay in the same house, and yet numbers from the U.S. show that take-up is low. Several studies, including Nakajima and Telyukova (2017) and Cocco and Lopes (2015), conclude that features of the loan contracts and high costs partly account for the low demand. Based on my results, I cannot answer the question of why households who do not move are not taking out more mortgage debt. Reverse mortgages are not available in Denmark, and though mortgage interest rates are comparably low, mortgaging would increase fixed costs to debt servicing substantially for the average retiree. Increased fixed costs of staying in the house and a fear of "running out" of home equity before time, might be one reason for the widows who stay in the house not to withdraw home equity. The concern of increased fixed costs and lifetime uncertainty is especially important

if the widows put a high value of staying in the same house, which my results suggest that many do.

The results presented in this section on drivers of mobility around spousal death are based on correlations. In order to make any causal statements, I would need exogenous variation in for instance pre-death committed consumption, costs of selling the house, or attachment to the house and area. This would be an interesting direction of future research in order to more clearly identify and distinguish between the drivers of mobility and housing consumption in old age.

5 Conclusion

In most countries, life-cycle profiles of income and wealth for households show a puzzling pattern: while income increases in the beginning of life and falls when entering retirement, wealth accumulates fast in the mid-ages and is not drawn down during retirement. Hence, most households die with substantial wealth. The two most prominent explanations for this in the literature are precautionary motives and bequest motives, but many studies have also come to the conclusion that these two motives cannot fully account for old age savings. High homeowner rates throughout life, and little home equity decumulation among homeowners, points to housing preferences and mobility of elderly homeowners as potential important drivers of the overall lack of wealth decumulation towards the end of life.

Despite a large literature on saving behavior in old age, there is little causal evidence on how households adjust portfolios and consumption in response to shocks to income and expenses in old age. This makes it difficult to identify the motives underlying the retirement savings puzzle. Existing studies have documented that home equity drawdown is correlated with death and health shocks to the household, and also seems to be linked to moving and declines in homeowner rates. However, due to the use of survey data, they lack the ability to follow households over a longer period of time, to set up an empirical design that allows for causal interpretation of the changes, and to observe precise measures of the outcomes of interest.

With access to administrative data from Denmark, I am able to overcome these empirical challenges in the current study. Using a DD design which exploits the randomness in timing of spousal death across households, I estimate the causal effect of spousal death on net wealth, home equity, mortgaging, moving, homeownership, home size, and housing consumption relative to income.

My results show that net wealth and home equity is reduced as a result of spousal death,

but that this is driven by reductions in housing wealth of the households who move. There is no increase in mortgaging, also not for the group of households who stay in the same house, though they are especially expected to have an insurance motive to dissave in order to smooth consumption. These results suggest that precautionary motives are not a dominant driver of the lack of dissaving in old age.

With respect to housing responses, I show that mobility is low: most households choose to stay in the same house after spousal death. The low mobility, and the inability to change housing consumption substantially without moving, leads to a low home size response of only a 7 % reduction, compared to the 25 % drop in income caused by spousal death. This leads to an increase in the ratio of housing consumption to income of 10 %-points from and already high share of 35 %. The households who reduce housing the most are also the ones to reduce home equity the most, which is difficult to reconcile with precautionary motives.

In combination, the results on financial and housing responses suggest that elderly households would dissave to a greater extent if mobility was higher or if they were able and willing to take out mortgage debt while staying in the same house. To get a better understanding of housing mobility, I investigate how it varies with household and local area characteristics. I show evidence suggesting that both transaction costs of changing housing consumption and attachment to the current house are driving the low mobility and responsiveness of housing consumption to income changes in old age.

My results suggest that policies to facilitate consumption smoothing in old age should focus on mobility and housing preferences and should aim at lowering the transaction costs and making it easier for households to tap into the home equity while staying in the house. My results do not suggest that excess provision of social insurance in old age would increase drawdown of wealth, and home equity in particular. In order to provide more clear policy recommendations, more work is needed on the drivers of mobility and housing consumption adjustment in old age.

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Figure 1: Age Profiles of Net Wealth and Income in 2013
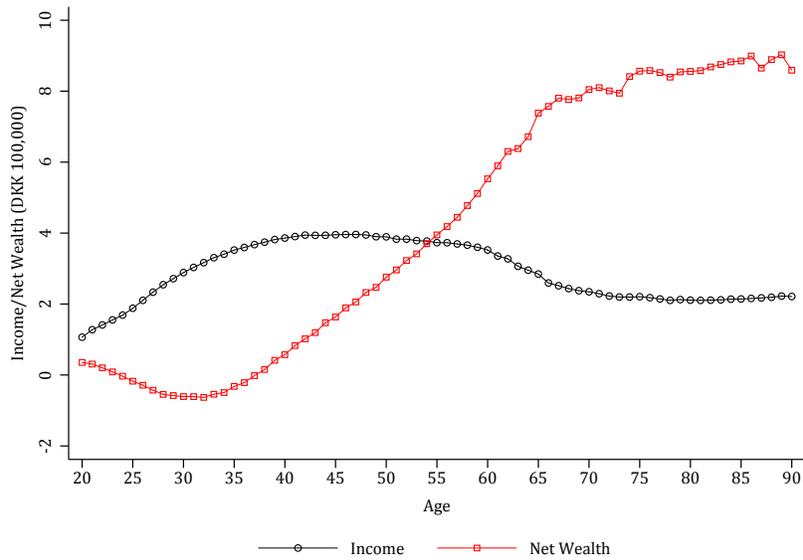
Notes: The figure shows the age profiles of net wealth and income for individuals in the Danish population between age 20-90 in 2013. Net wealth is defined as total wealth (bank deposits, value of stocks and bonds, and value of owned property) minus total debt (mortgage debt and all debt to banks, including bank loans and credit card debt). Income includes wage income, social transfers, pension payouts and interest income, and is measured before taxes. Outcomes are in 2016-prices in Danish Kroner (DKK).

Figure 2: Age Profiles of Total Wealth

A: Age Profiles of Total Wealth
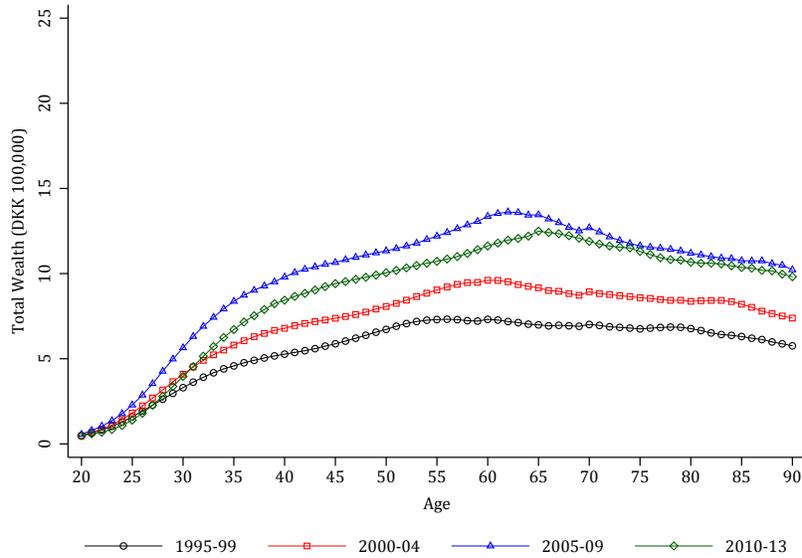
B: Age Profiles of Total Wealth among Homeowners
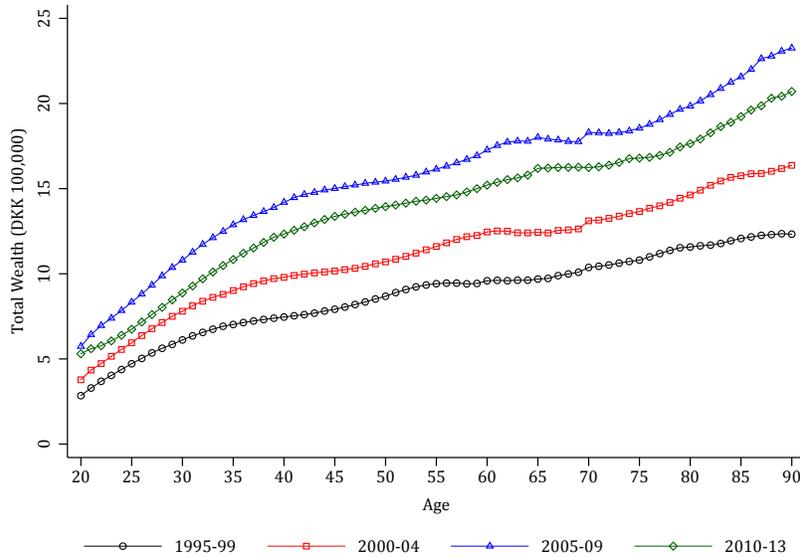
Notes: The figure shows the age profile of total wealth for individuals in the Danish population between age 20-90 over four different time periods. Panel A includes the full population, and panel B is restricted to homeowners. Homeownership is defined as described in section 3.2. Total wealth is defined as the sum of bank deposits, total value of stocks and bonds, and total value of owned property. Outcomes are in 2016-prices in Danish Kroner (DKK).

Figure 3: Age Profiles of Mortgaging and Home Equity among Homeowners

A: Age Profiles of Mortgage Rate among Homeowners

B: Age Profiles of Home Equity among Homeowners
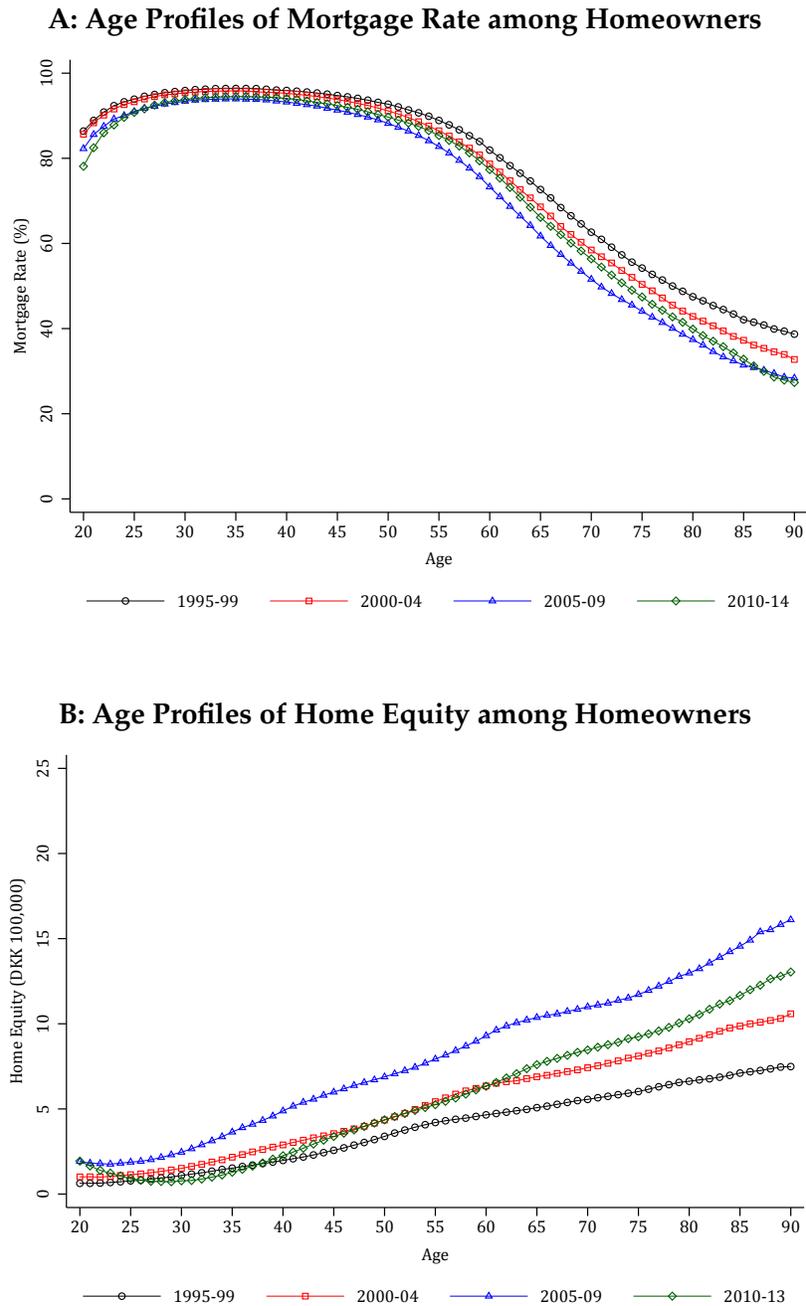
Notes: Panel A of the figure shows the age profile of mortgage rates among homeowners in the Danish population between age 20-90 over four different time periods. Homeownership is defined as described in section 3.2. The mortgage rate measures the share of individuals in each age group where the individual or his/her partner owns at least one mortgage. Panel B of the figure shows the age profile of home equity among homeowners in the Danish population between age 20-90 over four different time periods. Home equity is defined as the difference between total housing wealth and total mortgage debt. Home equity is in 2016-prices in Danish Kroner (DKK).

Figure 4: Age Profiles of Homeownership
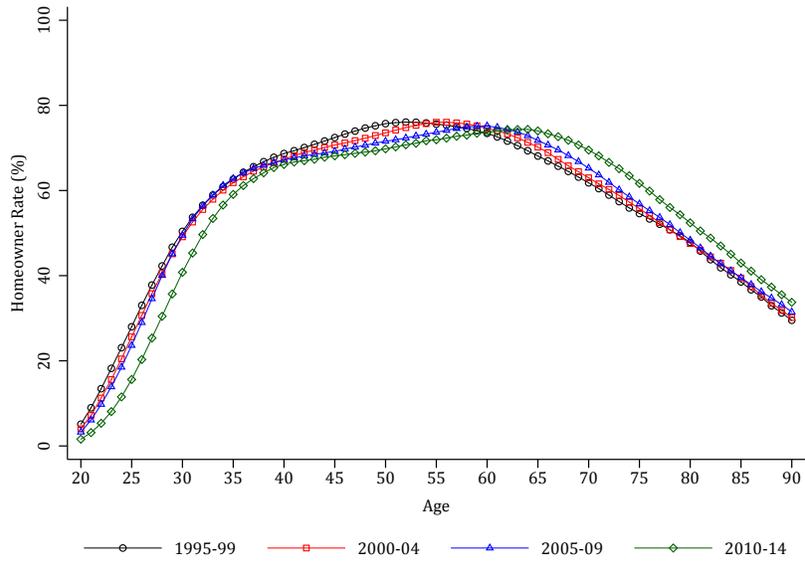
Notes: The figure shows the age profile of homeownership in the Danish population between age 20-90 over four different time periods. Homeownership is defined as described in section 3.2.

Figure 5: Age Profiles of Homeownership by Cohorts

A: Start Age 20

B: Start Age 40
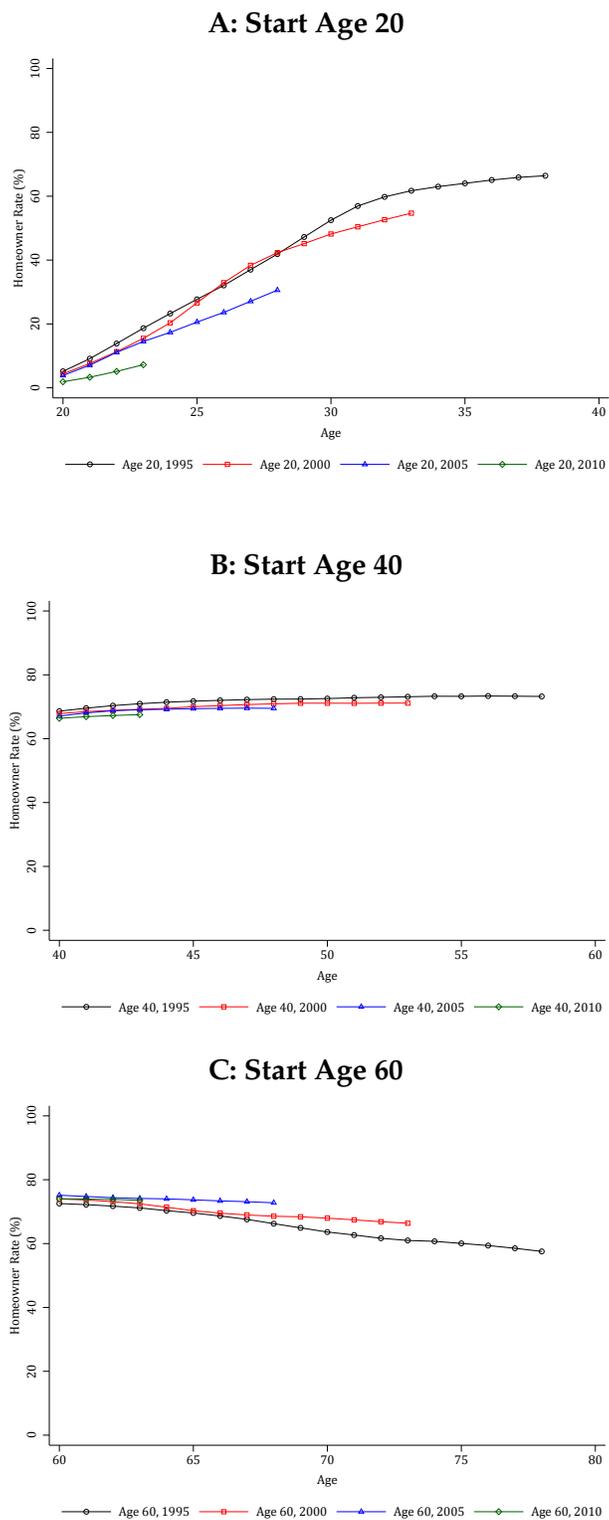
C: Start Age 60

Notes: The figure shows homeowner rates over ages for different cohorts from the Danish population. Each panel shows different start ages: age 20, 40 and 60, respectively. Homeownership is defined as described in section 3.2.

Figure 6: Income over Time by Death Cohorts
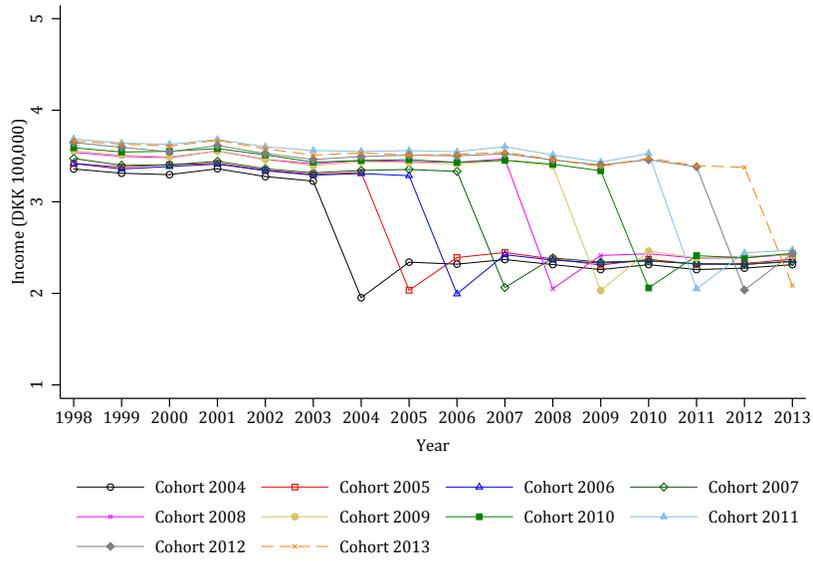
Notes: The figure shows the evolution of income over time for different "death cohorts" from the analysis sample. A death cohort is defined by the year in which the spouse dies. Income includes wage income, social transfers, pension payouts and interest income, is measured before taxes, and is stated in 2016-prices in Danish Kroner (DKK).

Figure 7: Effect of Spousal Death on Income
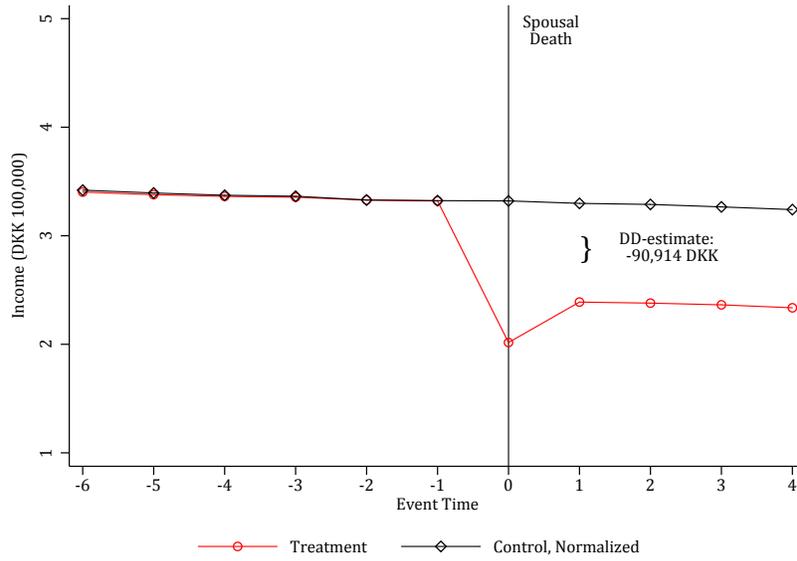
Notes: The graph shows income for the treatment and the control group, respectively, around the event of spousal death in the treatment group. The graph is based on my analysis sample, described in section 3.2. The treatment group consists of death cohorts 2004-2008, and the control group consists of death cohorts 2009-2013. The reported DD estimate is the effect of spousal death on the outcome in the first year after the event, relative to two years prior to the event, based on equation 1. Income includes wage income, social transfers, pension payouts and interest income, is measured before taxes, and is stated in 2016-prices in Danish Kroner (DKK).

Figure 8: Effect of Spousal Death on Net Wealth and Home Equity

A: Effect of Spousal Death on Net Wealth

B: Effect of Spousal Death on Home Equity
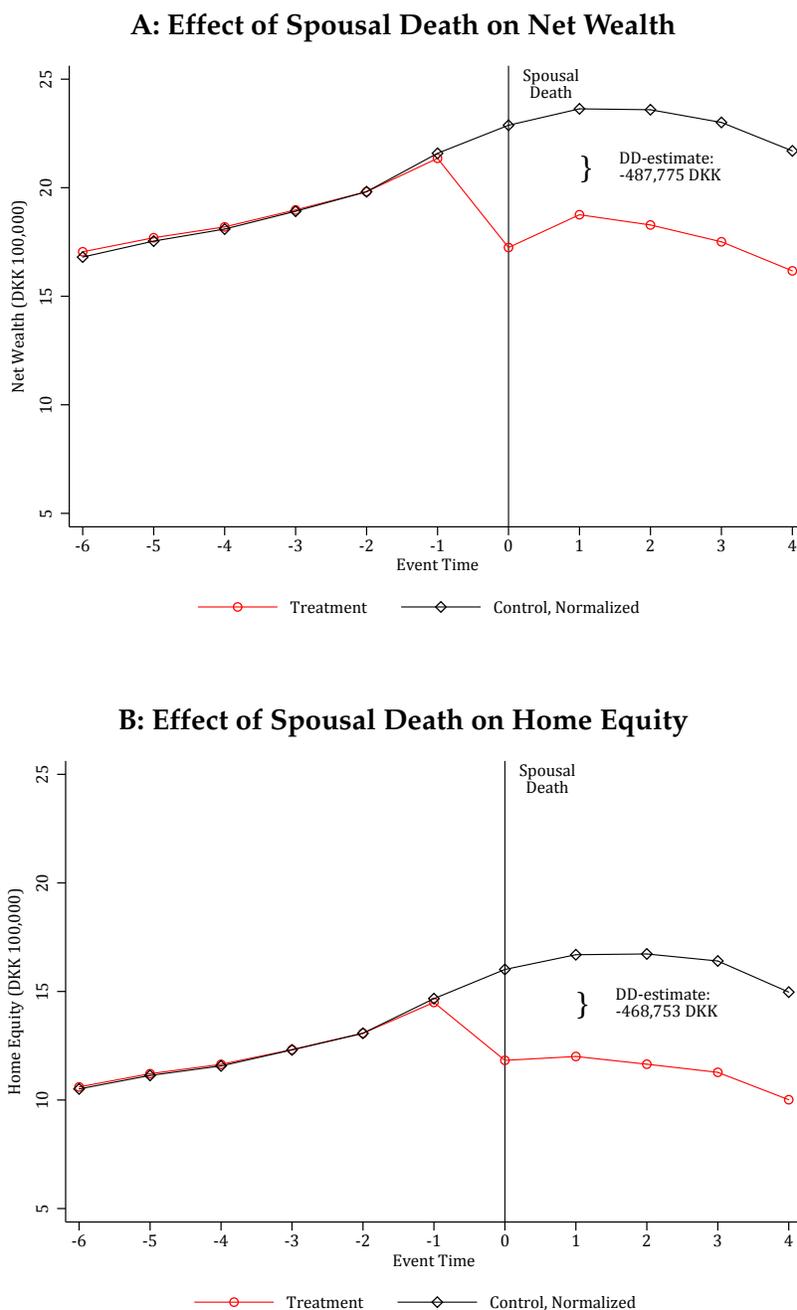
Notes: Both panels of the figure are constructed in the same way as figure 7, but with net wealth and home equity, respectively, as the outcome variables. Net wealth is defined as total wealth (bank deposits, value of stocks and bonds, and value of owned property) minus total debt (mortgage debt and all debt to banks, including bank loans and credit card debt). Home equity is defined as the difference between total housing wealth and total mortgage debt. Outcomes are in 2016-prices in Danish Kroner (DKK).

Figure 9: Effect of Spousal Death on Mortgage Debt
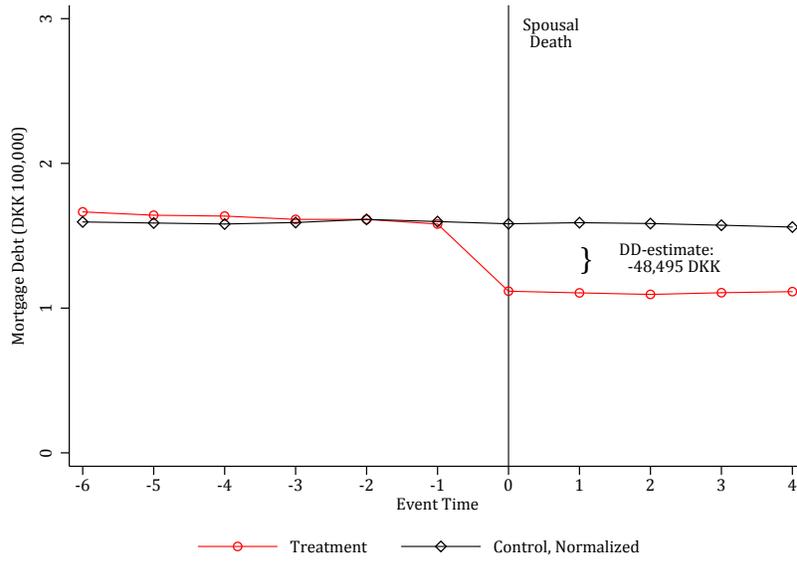
Notes: The figure is constructed in the same way as figure 7, but with mortgage debt as the outcome variable. Mortgage debt is in 2016-prices in Danish Kroner (DKK).

Figure 10: Effect of Spousal Death on Mortgage Debt among Non-Movers
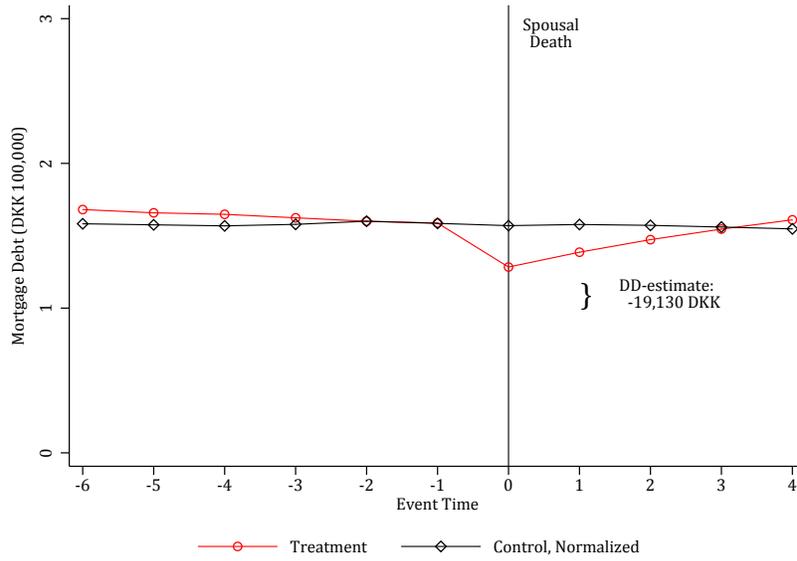
Notes: The figure is constructed in the same way as figure 9, but only using the households of the treatment group who stay in the same house in all four years after spousal death.

Figure 11: Effect of Spousal Death on Home Equity - Continuing Homeowners Moving
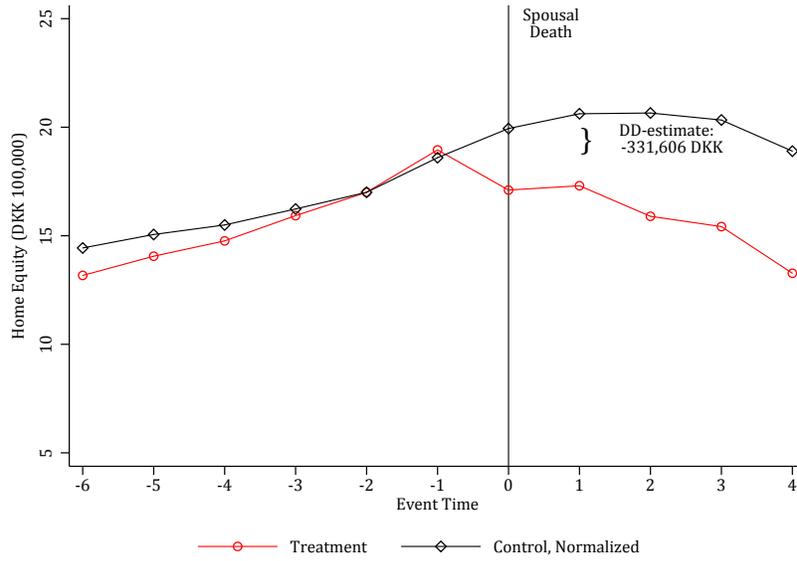
Notes: The figure is constructed in the same way as panel B of figure 8, but only using households of the treatment group who move within the first four years after spousal death and continue to be homeowners in all four post-death years.

Figure 12: Effect of Spousal Death on Net Wealth - Homeowners Moving to Rental Homes
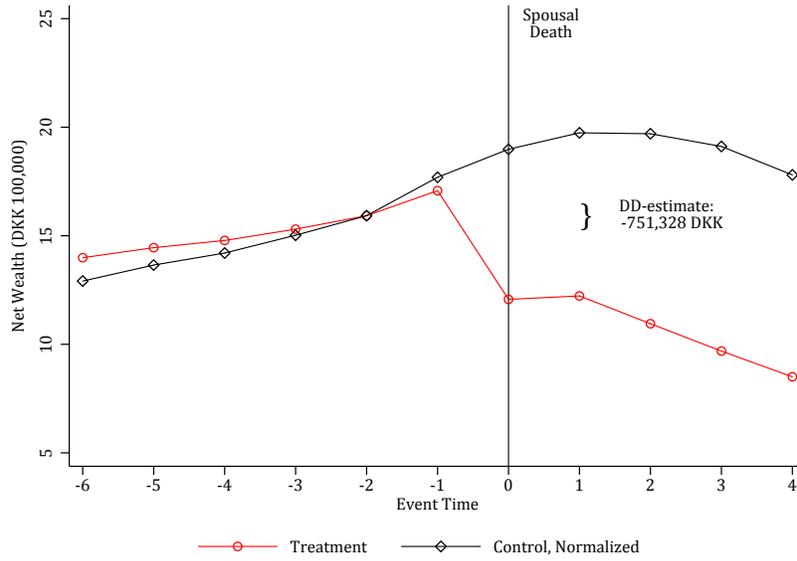
Notes: The figure is constructed in the same way as panel A of figure 8, but only using households of the treatment group who move within the first four years after spousal death and do not continue to be homeowners in all four post-death years.

Figure 13: Widow Balance Sheets until Death

A: Net Wealth of Widows until Death
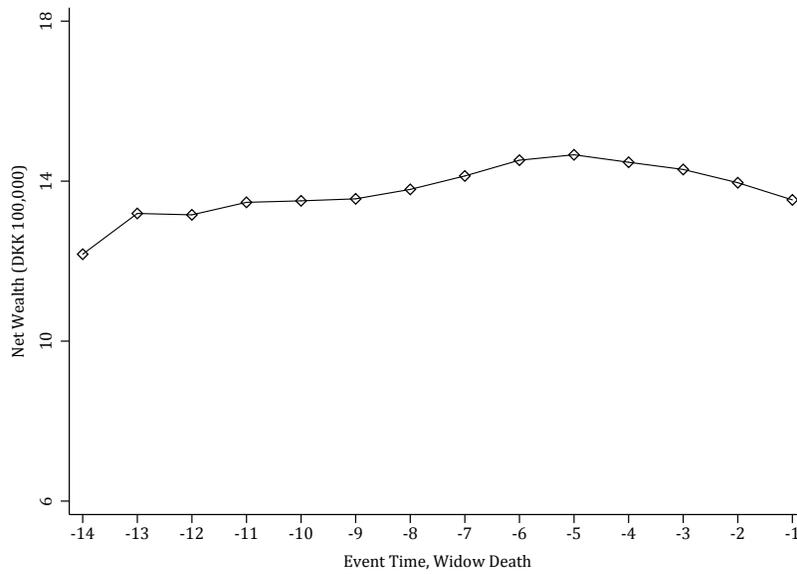
B: Home Equity of Widows until Death
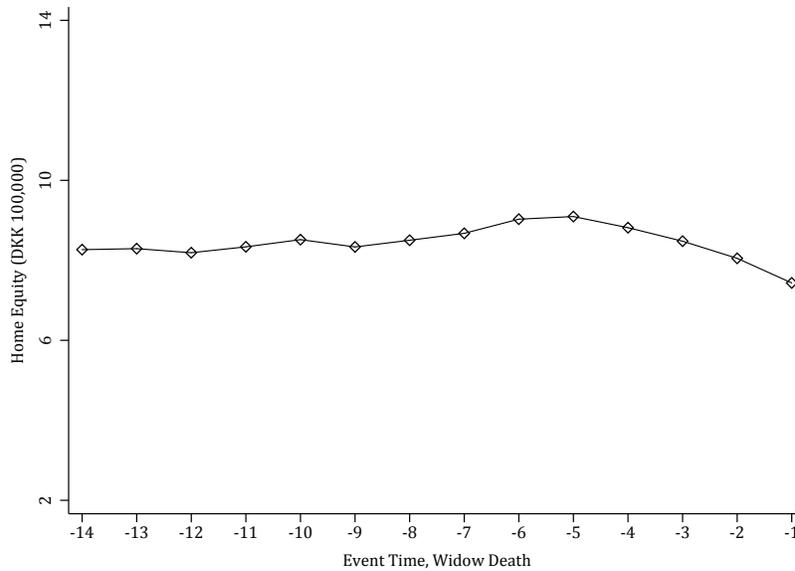
Notes: The figure is based on a sample with the same selection criteria as the main analysis sample describe in section 3.2, but extended to include death cohorts 1999-2012, i.e. households who experience spousal death in one of the years 1999-2012. Furthermore, the sample is restricted to widows who also themselves die in the period 2000-2013 and live minimum one year longer than the spouse. The graphs show net wealth and home equity, in panel A and B, respectively, for the widowed households over the years between the spouse has died and the widow dies herself. Net wealth is defined as total wealth (bank deposits, value of stocks and bonds, and value of owned property) minus total debt (mortgage debt and all debt to banks, including bank loans and credit card debt). Home equity is defined as the difference between total housing wealth and total mortgage debt. Outcomes are in 2016-prices in Danish Kroner (DKK).

Figure 14: Effect of Spousal Death on Moving and Homeowner Rate

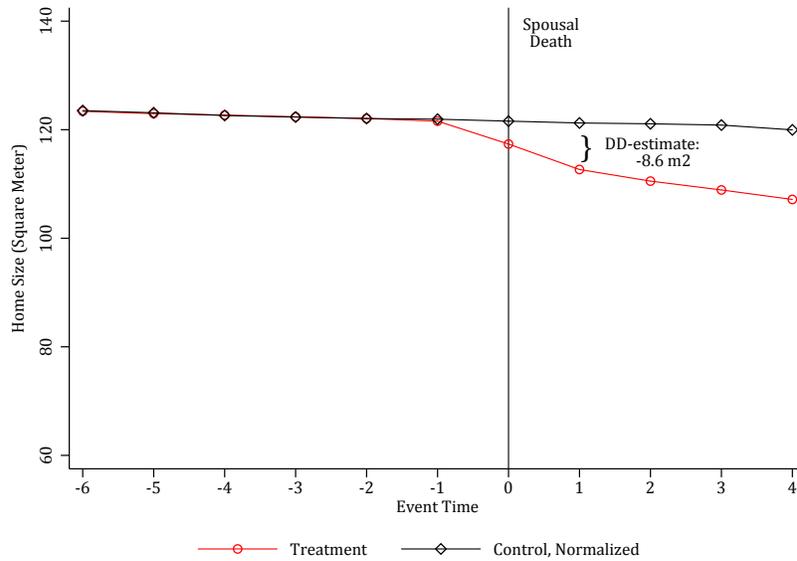**A: Effect of Spousal Death on Moving (Cumulative)**
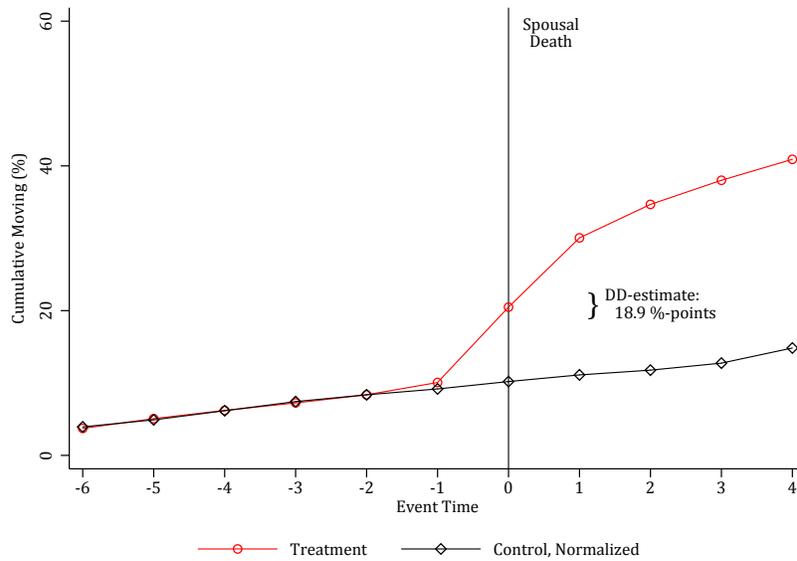
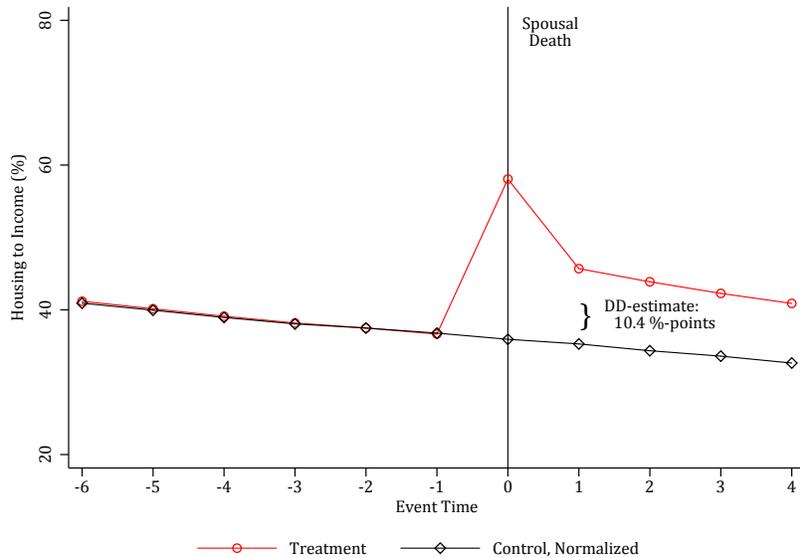**B: Effect of Spousal Death on Homeowner Rate**
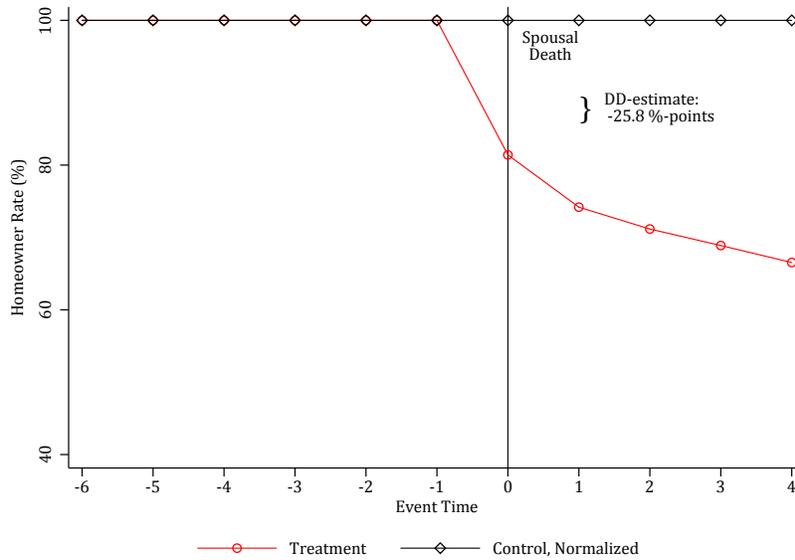
Notes: Both panels of the figure are constructed in the same way as figure 7, but with cumulative moving and homeownership, respectively, as the outcome variables. Cumulative moving is defined by a dummy for whether the household has moved at least once since 1998. Homeownership is defined as described in section 3.2.

Figure 15: Effect of Spousal Death on Home Size and Housing to Income
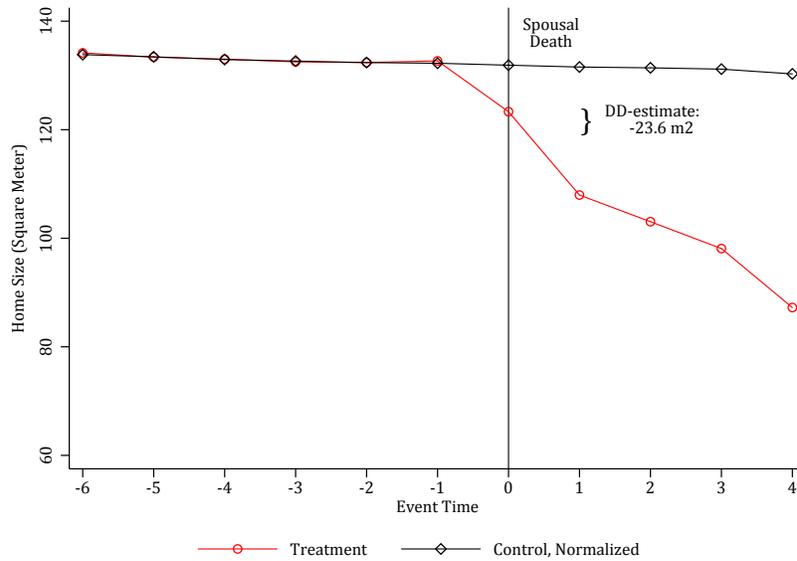
A: Effect of Spousal Death on Home Size

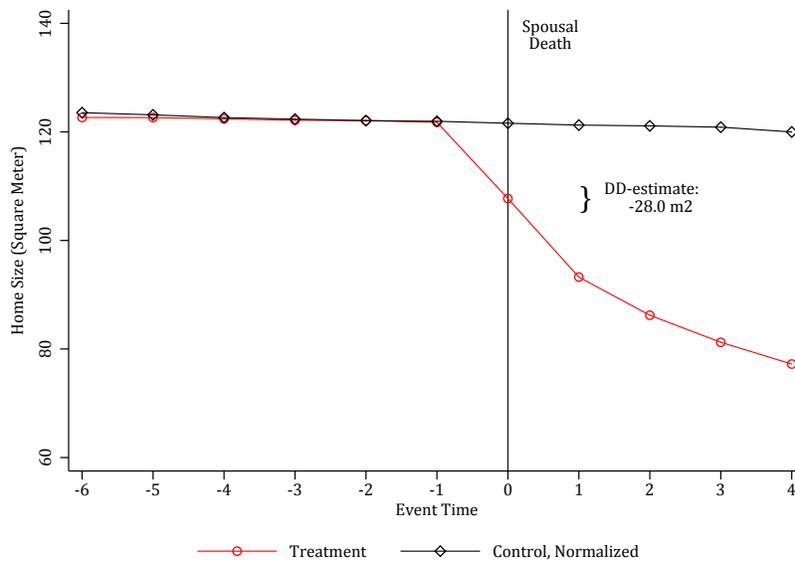**B: Effect of Spousal Death on Housing to Income**

Notes: Both panels of the figure are constructed in the same way as figure 7, but with home size and housing consumption to income, respectively, as the outcome variables. Home size is defined by the area of the home (in square meter) used for habitation. Housing to income is defined as the ratio of rental value of the home divided by household income, as described in section 3.2.

Figure 16: Effect of Spousal Death on Home Size for Movers

**A: Effect of Spousal Death on Home Size - Continuing Homeowners Moving**

**B: Effect of Spousal Death on Home Size - Homeowners Moving to Rental Homes**

Notes: Both panels of the figure are constructed in the same way as panel A of figure 15, but only including the sub-group of treated households who move and continue to be homeowners in panel A, and only including the sub-group of treated households who move and discontinue homeownership in panel B.

Figure 17: Moving and Financial Situation
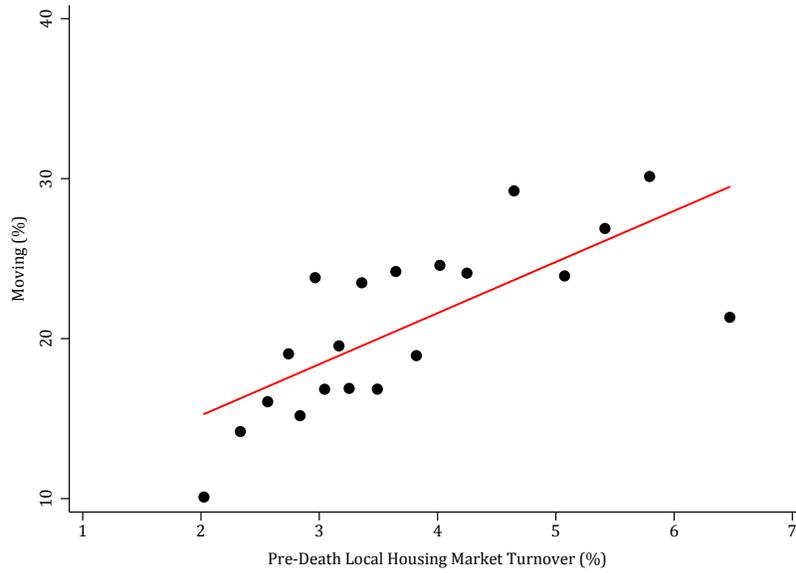
A: Moving by Pre-Death Housing to Income
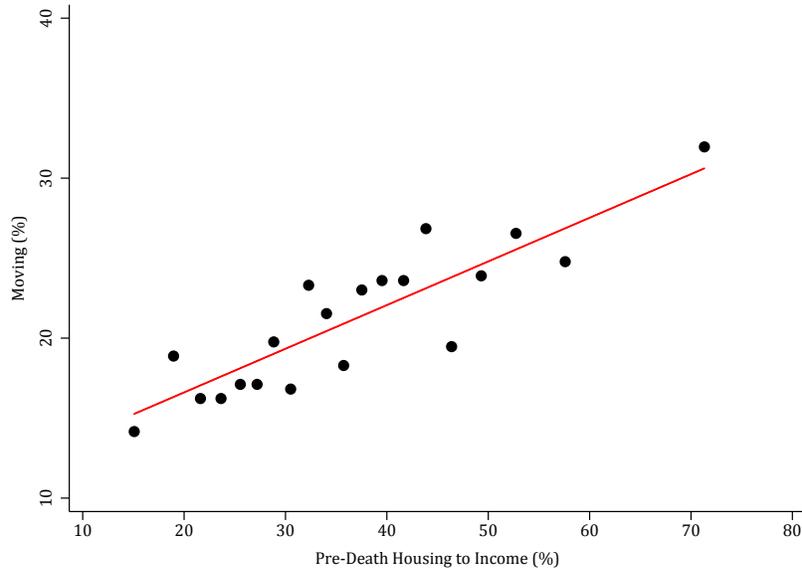
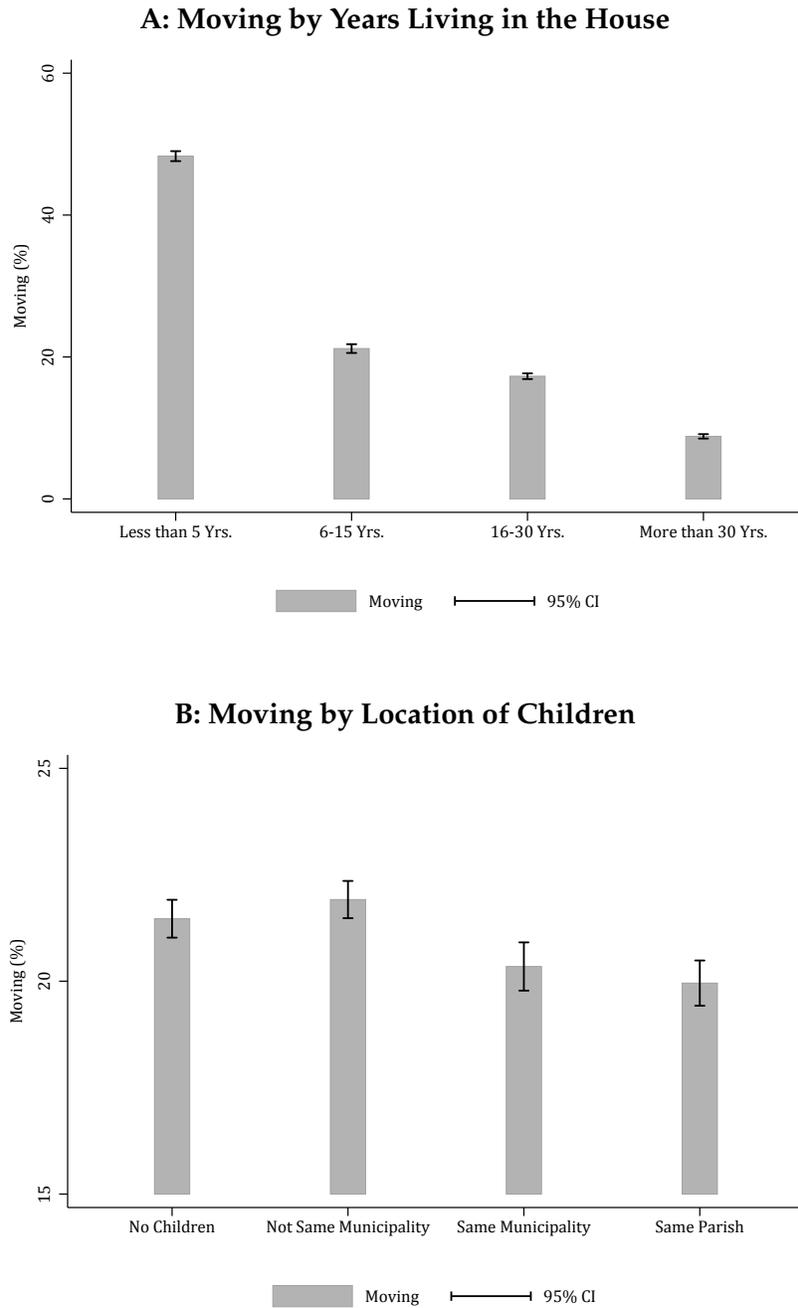## B: Moving by Pre-Death Interest Expenses to Income
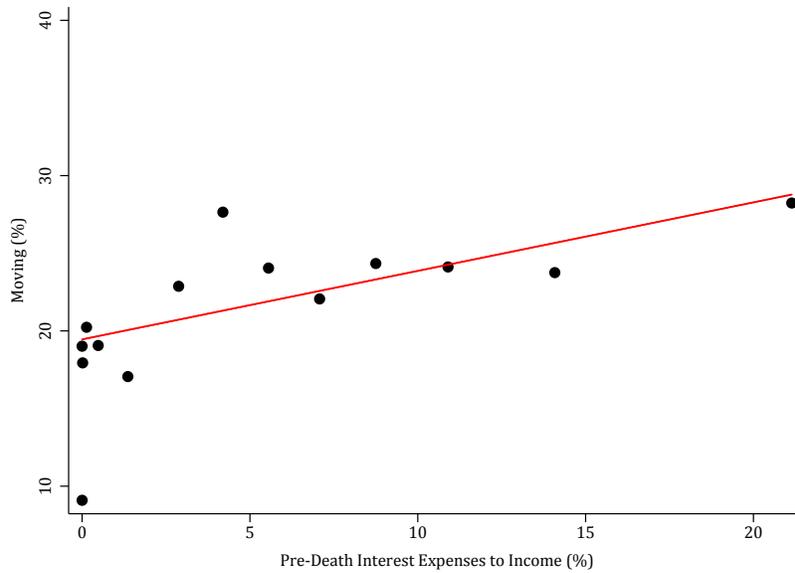
Notes: The figure is based on the treatment group from the analysis sample, i.e. death cohorts 2004-2008. Panel A of the figure shows a binned scatterplot of the propensity of widows to move by the pre-death housing consumption to income ratio. Panel B of the figure shows a binned scatterplot of the propensity of widows to move by pre-death interest expenses relative to income. Pre-death outcomes are measured one year before spousal death. The widow is defined as moving if she moves in the year of spousal death or in the first year after spousal death. Housing consumption to income is defined as the ratio of rental value of the home divided by household income, as described in section 3.2. Interest expenses include interests paid on all types of debt, including mortgage debt and bank loans. Income includes wage income, social transfers, pension payouts and interest income, measured before taxes. The binned scatterplots show the average of the variable on the y-axis and the average of the variable on the x-axis by 20 bins of equal size (number of observations) based on the x-axis variable.

Figure 18: Moving and Local Housing Market Turnover

Notes: The figure is constructed in the same way as figure 18, but with pre-death local housing market turnover on the x-axis. Turnover is calculated within municipalities, and is measured as the share of property sold at least once during the year out of total property, only including property used for habitation. Denmark had 271 municipalities at the time of the analysis.

Figure 19: Moving and Attachment to the House and Area

A: Moving by Years Living in the House

Moving (%)

Less than 5 Yrs.   6-15 Yrs.   16-30 Yrs.   More than 30 Yrs.

Moving   95% CI

B: Moving by Location of Children

Moving (%)

No Children   Not Same Municipality   Same Municipality   Same Parish

Moving   95% CI

Notes: The figure is based on the treatment group from the analysis sample, i.e. death cohorts 2004-2008. Panel A of the figure shows average moving propensity of the widow by number of years lived in the house, measured one year before spousal death. Panel B of the figure shows average moving propensity by whether the widow has children, and whether they live nearby, also measured one year before spousal death. The widow is defined as moving if she moves in the year of spousal death or in the first year after spousal death.

Figure 20: Age Profiles of Housing Mobility
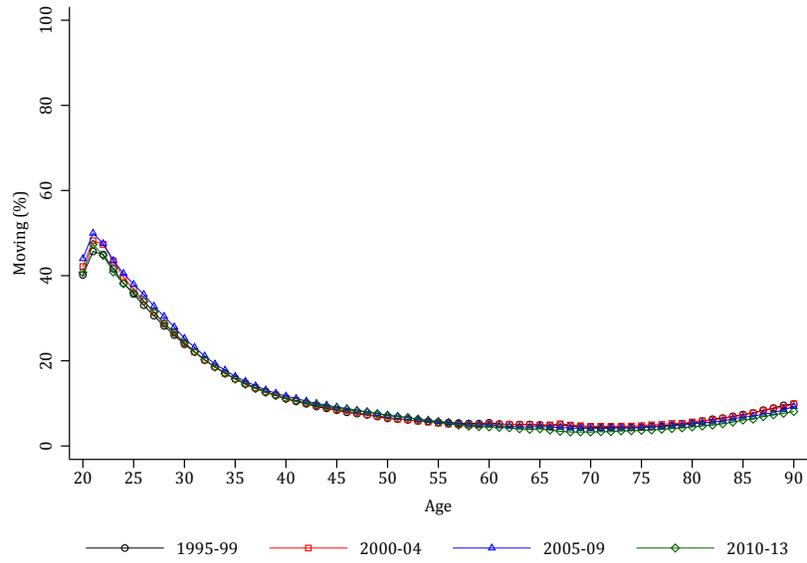
Notes: The figure shows the age profile of moving of individuals in the Danish population between age 20-90 over four different time periods. A move is defined as a change of home address in the Danish Civil Registration System.

Table 1: Portfolios of Danish Households in 2015

Portfolio Components	All Households	Couples	Couples above Age 59
Net Wealth, Mean	1,834,974.2	2,711,663.3	4,458,308.7
Net Wealth w/o Pension, Mean	996,949.2	1,412,610.1	2,449,773.8
Total Wealth, Mean	2,688,998.6	4,050,179.2	5,496,058.4
Total Property Wealth, Mean	1,350,006.1	2,153,612.0	2,473,658.7
Owner-Occupied, Share (%)	78.5	111.4	123.2
Summer House, Share (%)	5.9	9.7	16.8
Other Property, Share (%)	15.6	23.5	29.3
Total Financial Wealth, Mean	405,247.9	551,090.9	949,139.0
Bank Deposits, Share (%)	50.8	70.1	108.5
Bonds, Share (%)	4.3	5.9	12.7
Stocks, Investment Funds, Share (%)	44.9	44.1	48.2
Total Pension Wealth, Mean	838,025.0	1,299,053.2	2,008,534.9
Life-Long Annuities, Share (%)	63.2	61.9	66.2
Fixed Annuities, Share (%)	22.9	23.8	19.6
One-Time Payout, Share (%)	13.5	13.8	13.4
Other Wealth, Mean	95,719.6	152,613.2	169,193.0
Total Debt, Mean	854,024.4	1,338,515.9	1,037,749.7
Total Secured Debt, Mean	638,933.3	1,028,397.7	802,479.0
Mortgage Institutions, Share (%)	94.0	94.2	94.0
Banks, Share (%)	5.1	5.1	4.6
Local Government, Share (%)	0.5	0.3	1.2
Other Secured Debt, Share (%)	0.4	0.4	0.3
Total Other Debt, Mean	215,091.0	310,118.1	235,270.7
Bank Loans, Share (%)	85.5	87.2	90.9
Credit Card, Student Loans, Share (%)	14.3	12.6	9.1
Local Government, Share (%)	0.3	0.1	0.1
Other Household Statistics			
Number of Households	2,913,147.0	1,252,968.0	449,181.0
Income, Mean	494,958.2	696,726.7	575,770.8
Income after Taxes, Mean	353,983.2	495,595.8	441,383.6

Notes: The table is based on information from Statistics Denmark's online data source Statistikbanken (www.statistikbanken.dk), from the table FORMUE1.

Table 2: Summary Statistics

Means, 1998	(1) Retired 1998-2013	(2) Widowed 2004-2013	(3) Analysis Sample
Age	77.3	73.8	72.0
Woman	0.7	0.7	0.8
Children	0.5	0.7	0.7
Single	0.6	0.0	0.0
Homeowner	0.5	0.7	1.0
Income (DKK)	238,352.9	310,852.7	352,375.2
Total Wealth (DKK)	842,950.3	1,225,632.0	1,830,819.0
Total Debt (DKK)	75,629.2	130,122.2	201,226.9
Net Wealth (DKK)	767,321.2	1,095,510.0	1,629,593.0
Housing Wealth (DKK)	447,673.2	712,541.5	1,142,467.0
Mortgage Debt (DKK)	65,672.0	113,838.6	179,635.2
Home Equity (DKK)	382,001.2	598,702.9	962,831.5
Home Size (Square Meter)	100.7	110.2	125.3
Home Tenure (Years)	15.7	18.0	20.0
Observations	568,223	45,766	12,590

Notes: The table shows summary statistics for three different samples. Column 1 is based on a sample of households who are retired throughout the period 1998-2013 (as long as they are observed in the data, i.e. alive and not emigrated). Column 2 is based on the same sample, but restricted to households who are widowed in the years 2004-2013. The last column shows statistics for the final analysis sample described in 3.2. Age, Woman, Children, Single, and Homeowner are dummy variables, all DKK-variables are in 2016-prices, home size is defined by the area of the home used for habitation (in square meter), and home tenure is defined as the number of years that the household has lived in the current house since 1971. All statistics are from 1998, the first pre-death year of the DD analysis.

Table 3: Effects of Spousal Death on Financial Outcomes

Year Relative to Spousal Death	Outcomes			
	(1)	(2)	(3)	(4) Mortgage,
	Net Wealth	Home Equity	Mortgage	Not Moving
-4	10,010	7,290	5,483	7,959
	(7,123)	(6,220)	(2,917)	(3,317)
-3	6,122	1,436	2,162	4,504
	(4,995)	(4,715)	(2,164)	(2,391)
-1	-23,326	-17,531	-1,734	217
	(6,504)	(6,027)	(2,173)	(2,602)
0	-563,253	-418,754	-46,553	-28,626
	(13,621)	(11,750)	(3,608)	(3,833)
1	-487,775	-468,753	-48,495	-19,130
	(14,704)	(14,071)	(4,153)	(4,296)
2	-530,862	-507,761	-48,965	-9,860
	(15,947)	(15,470)	(4,393)	(4,554)
3	-549,725	-512,911	-46,630	-1,434
	(16,629)	(15,773)	(4,686)	(4,918)
4	-552,596	-495,660	-44,614	6,241
	(15,601)	(14,581)	(5,002)	(5,259)
Observations	138,490	138,490	138,490	106,359

Notes: The table shows estimates of the effect of spousal death on different financial outcomes for each event time, from four years prior to spousal death to four years after spousal death ($t = -5$ and $t = -6$ were included in the regression, but are not shown). The baseline is $t = -2$ (two years before spousal death). The results are based on the regression in equation 2, and the results for event time $t = 1$ correspond to the DD effects reported in the graphs. Column 1 shows the effects on net wealth, column 2 shows the effects on home equity, column 3 shows the effects on mortgage debt, and column 4 shows the effects on mortgage debt but on a sample which only includes those of the treated households who do not move within four years after spousal death. Standard errors are clustered at the household level. All outcomes are in 2016-prices in Danish Kroner (DKK).

Table 4: Effects of Spousal Death on Housing Outcomes

	Outcomes			
Year Relative to Spousal Death	(1) Cumulative Moving	(2) Home-ownership	(3) Home Size	(4) Housing to Income Ratio
-4	0.000	-0.000	0.077	0.002
	(0.003)	(0.000)	(0.179)	(0.001)
-3	-0.002	-0.000	0.031	0.001
	(0.002)	(0.000)	(0.115)	(0.001)
-1	0.009	-0.000	-0.364	-0.001
	(0.002)	(0.000)	(0.139)	(0.001)
0	0.103	-0.186	-4.218	0.221
	(0.004)	(0.005)	(0.284)	(0.002)
1	0.189	-0.258	-8.574	0.104
	(0.005)	(0.005)	(0.361)	(0.002)
2	0.229	-0.288	-10.563	0.095
	(0.006)	(0.005)	(0.389)	(0.002)
3	0.253	-0.311	-11.953	0.087
	(0.006)	(0.006)	(0.413)	(0.002)
4	0.261	-0.335	-12.821	0.082
	(0.007)	(0.006)	(0.437)	(0.002)
Observations	138,490	138,490	137,160	137,142

Notes: The tables is constructed in the same way as table 3, but shows effects on housing outcomes. Column 1 shows the effect on cumulative moving, column 2 shows the effect on homeownership, column 3 shows the effect on home size in square meter, and column 4 shows the effect on the housing to income ratio as defined in section 3.2. The number of observations are slightly lower in the last two columns, as a few household-year observations have missing information about home size and rental value.
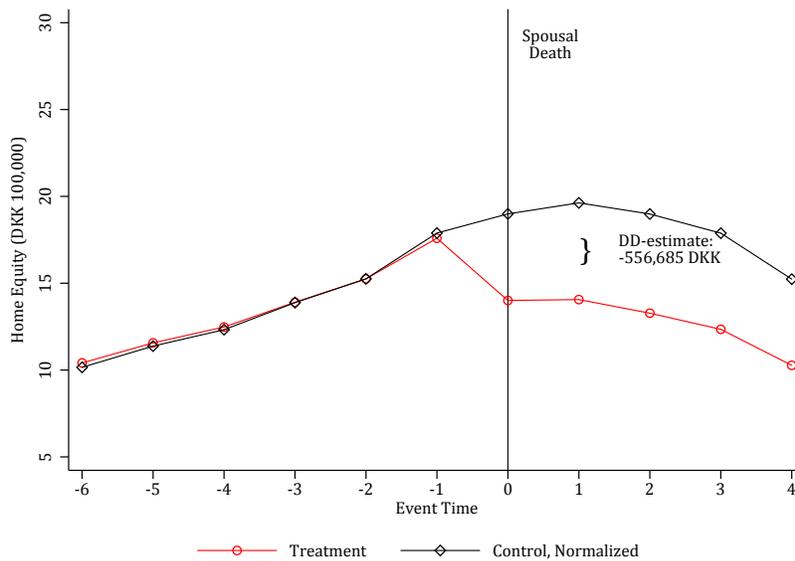
A   Appendix

Figure A.I: Effect of Spousal Death on Home Equity - Adjusted for Sales Prices

A: Effect of Spousal Death on Home Equity - Adjusted for Local Sales Prices
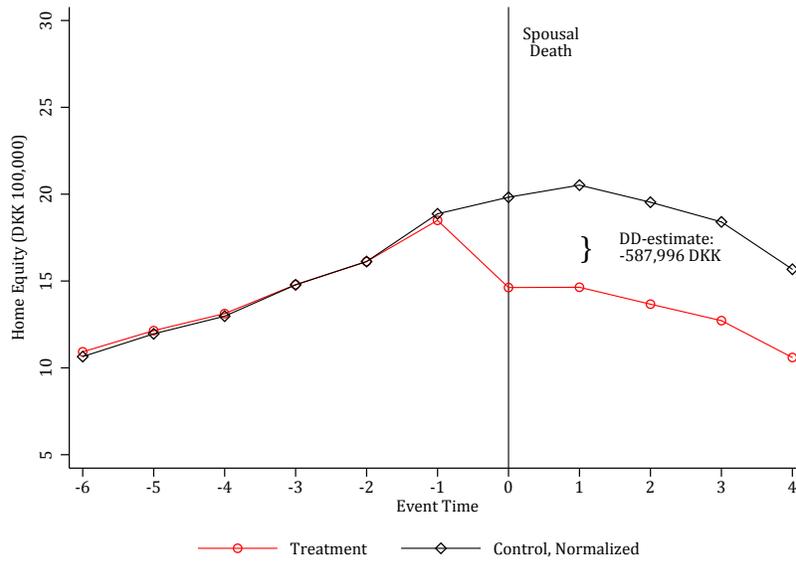
## B: Effect of Spousal Death on Home Equity - Adjusted for Sales Prices of Elderly Sellers


Notes: The figure is similar to panel B of figure 8, but shows adjusted measures of home equity. Panel A shows home equity adjusted for the sales price/appraisal ratio of all sold houses in the household's municipality in the year. Panel B shows home equity adjusted for the sales price/appraisal ratio of all houses sold by elderly owners (above age 60) in the year. The calculations of sales price/appraisal ratios only include houses used for habitation.

Figure A.II: Effect of Spousal Death on Net Wealth - Continuing Homeowners Moving
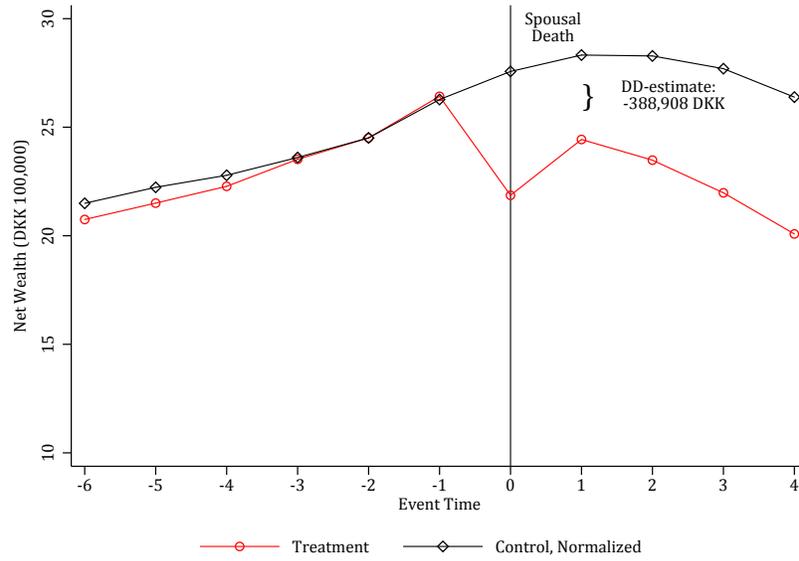
Notes: The figure is constructed in the same way as Panel A of figure 8, but only using the households of the treatment group who move at least once within the four years after spousal death and stay homeowners throughout all four years.

Figure A.III: Effect of Spousal Death on Mortgage Debt - Continuing Homeowners Moving
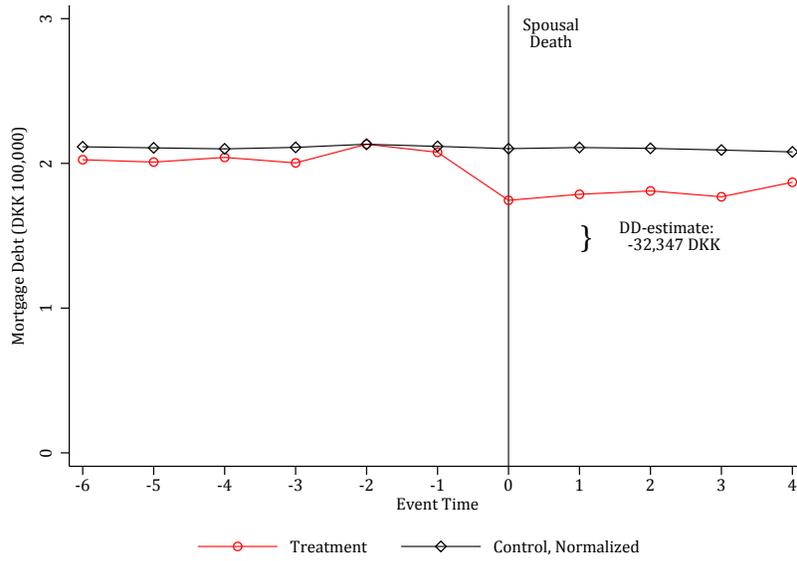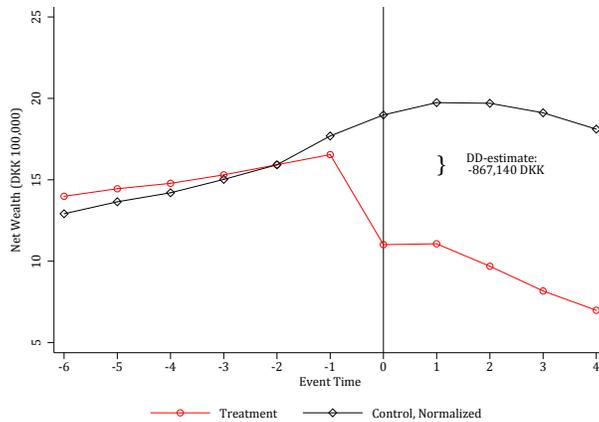

Notes: The figure is constructed in the same way as figure 9, but only using the households of the treatment group who move at least once within the four years after spousal death and stay homeowners throughout all four years.

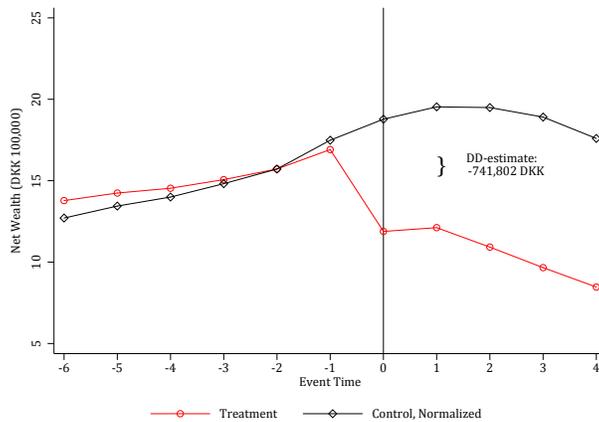Figure A.IV: Effect of Spousal Death on Net Wealth - Homeowners Moving to Rental Homes

A: Effect of Spousal Death on Net Wealth of Children
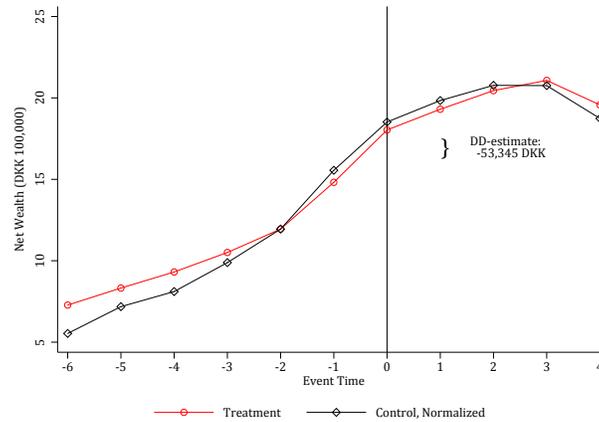
B: Effect of Spousal Death on Net Wealth - Adjusted for Price-Appraisal Gap

C: Effect of Spousal Death on Net Wealth - Not in Co-Op Housing

Notes: The figure is constructed in the same way as figure 12, but with other outcome variables. Panel A shows total net wealth of the widow's children. Panel B shows net wealth (of the widowed household, as in the main analysis) where net wealth is adjusted for the gap between the sales price and the appraisal of the house that the widow sells and moves from after spousal death. Panel C shows net wealth on a restricted sample not including treated households who move into Co-Op housing at some point over the four years after spousal death.