Pensions and Homeownership after the Great Recession

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Abstract

This paper explores how the relative risk between a defined benefit plan versus a defined contribution plan caused changes in homeownership and renting among retirees due to the Great Recession. I find that households with a defined contribution plan were around 10 percent less likely to own a home and around 10 percent more likely to rent after the Great Recession compared to household with a defined benefit plan. Due to the increased risk associated with a defined contribution plan and their increasing popularity, future cohorts of retirees may be more willing to consume housing equity via moving from owning to renting to offset these risks.

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1 Introduction

Approximately 75 percent of Americans have retirement savings in a defined benefit plans (DB plan) or a defined contribution plan (DC plan) (Chen et al., 2019). DB plans are managed by the employer and provide a guaranteed source of income in retirement for the remainder of the employee's life based on years of service.[1] Employees usually bear little risk from a DB plan. DC plans – such as a 401(k) or 403(b) – are managed by the employee and often receive some level of matching from their employer. Employees bear all of the risk with a DC plan as they are sensitive to the portfolio and asset allocation decisions of the they make (Poterba et al., 2007). Over the last few decades, employers have shifted away from DB plans in favor of DC plans (Butrica et al., 2009; Hurd and Rohwedder, 2010), likely increasing the average risk of the total savings portfolio for households in retirement.

The Great Recession of 2007-2009 was one of the most severe economic downturns in American history. From October 2007 to March 2009, the S&P 500 declined by 46 percent (Yahoo Finance) and the Case-Shiller Home Price Index fell by 17 percent (S&P Dow Jones Indicies LLC). Unemployment rose from 4.7 percent in October 2007 to 10 percent in October 2009 (Bureau of Labor Statistics). Households with a DC plan were much more susceptible to losses in total wealth than households that had the guaranteed income of a DB plan. Losses in total wealth can affect a households consumption in retirement. In this paper, I investigate how retirees with a DC plan extracted equity in their house by moving from owning to renting to offset losses in wealth compared to retirees with a DB plan.

With nearly 80 percent of Americans aged 65 and older owning a home (US Census Bureau, 2021), housing equity constitutes a large portion of the total savings and wealth for retirees (Begley and Chan, 2018; Eggleston et al., 2020; Moulton et al., 2016). The Life-Cycle Hypothesis (LCH) suggests that households should spend down their wealth and savings (including housing wealth) in retirement to smooth consumption (Modigliani and Brumberg, 1954). However, many older

[1] DB plans vary in terms from employer to employer as to how much income they get, when beneficiaries are eligible to start collecting, and whether the pension can be passed on to a spouse in the event of death.

Americans have historically chosen not to use their housing equity, with half of Americans dying as homeowners (Engelhardt and Eriksen, 2021).

Most Americans prefer to live in their house throughout retirement (Binette and Vasold, 2018; Munnell, Soto and Aubry, 2007), which is reflected by very low housing transition rates for retirees (Munnell et al., 2020; Venti and Wise, 2001, 2004). Those that do move are just as likely to upsize as to downsize (Calvo, Haverstick and Zhivan, 2009; Clark, Deurloo and Dieleman, 2003; Venti and Wise, 1989). Nearly half of Americans die as homeowners (Engelhardt and Eriksen, 2021) but only around 2 percent of households extract housing equity through reverse mortgages (Moulton and Haurin, 2019; Nakajima and Telyukova, 2017).

Much of the past research studying retirees' use of housing equity focuses on older cohorts of retirees who are more likely to have a DB plan compared to current and future retirees.[2] Retirees with a DB plan have guaranteed income in retirement and are less susceptible to the negative financial effects associated with a decline in the stock market, which may have precluded them from considering consuming their housing equity in retirement. Using the geocoded version of the Health and Retirement Study, I find that households with a DC plan had a 13 percent larger decrease in non-housing wealth, were around 10 percent less likely to own a home and around 10 percent more likely to rent after the Great Recession, relative to households with a DB plan.

Prior to the Great Recession, house prices had generally increased year over year since the 1970s. With the decline in housing prices during the Great Recession, it is possible that some households now view housing wealth as a riskier asset. In fact, it has not been uncommon to see articles in the news about "the next housing bubble" since the Great Recession supporting this notion (see Feldman (2021), Trapasso (2018), Thomas (2016), and Olick (2015) for examples). Since households with a DC plan already have a riskier savings portfolio and some may now view housing wealth as risky, those that do could be choosing for forgo homeownership and store their wealth in other assets besides housing after the Great Recession. While it is not possible to rule other explanations out, retirees with a DC plan are more willing to part with homeownership after

[2] Section 2 provides background information on retirees and their use of housing equity

the Great Recession compared to reitirees with a DB plan.

Even with this decline in homeownership for households with a DC plan, most retirees in this group still own a house, thus, this is not a full explanation as to why retirees do not consume their housing wealth in retirement. However, the findings of this paper are important because households under age 65 are significantly less likely to have a DB plan and will likely bear more risk entering and during retirement than households of older cohorts. Future retirees will be increasingly likely to have large parts of their savings portfolios in potentially risky assets without the guaranteed income from a DB plan. The results of this paper can help future generations of retirees understand the role of housing equity in retirement planning so that they may act accordingly. These results also help policymakers understand the changing dynamics of retirees' savings, housing, and mobility decisions and will help shape local and regional policy for the 21st century as the American population ages.

2 The Use of Housing Equity by Older Americans

A retirees wealth can be modeled[3] in year t as

$$W_t = (W_{t-1} + P_t + DB_t + HE_t - C_t) \cdot [1 + \alpha S_t + (1-\alpha)B_t] + H_t \tag{1}$$

where P_t is the Social Security Payment in year t, DB_t is the payment from a DB plan in year t, C_t is consumption in year t, α is the percentage of investments invested in stocks (with $1-\alpha$ percent invested in bonds), S_t is the rate of return on stocks, and B_t is the rate of return on bonds. H_t is housing wealth at time t, which evolves using the model in Murray and Dunn (2022*b*) as $H_t = H_{t-1}(1-\delta+I_t)$, where δ is the rate of depreciation and I_t is the rate of investment into home improvement and upkeep. HE_t is the the value of any housing wealth that has been extracted.

Murray and Dunn (2022*a*,*b*) and Davidoff (2006) show that some households extract hous-

[3] This model is an extension of the model presented in Cobb, Murray and Smith (2022) to include housing wealth and DP plan payments

ing wealth (HE_t) by reducing investment in home improvement and upkeep (I_t) and Mayer and Moulton (2020) show that some households extract housing equity through traditional mortgage instruments (e.g., Home Equity Line of Credit). However, historically, most households likely are not extracting as much of their housing wealth as the LCH suggests they should (e.g., the housing-equity puzzle). A line of research has been dedicated to trying to understand the housing-equity puzzle. Both in how households could extract wealth from H_t into HE_t, and why many households don't.

Many retirees intend to leave a bequest (Ameriks et al., 2011) and since there are favorable tax provisions on inheriting housing[4], bequeathing a house may be an attractive way for households to pass on wealth to the next generation. Previous researchers have found that bequest motives do explain why some wealth, including housing wealth , H_t, is not extracted in retirement (De Nardi, French and Jones, 2010; Lockwood, 2018; Nakajima and Telyukova, 2020). However, a bequest motive is not enough to fully explain the housing-equity puzzle as 80 percent of housing wealth is available to help smooth and increase consumption in retirement net of intended bequests (Engelhardt and Eriksen, 2021). Despite its intuitive appeal, it does not appear that housing bequests is a driving force behind why many retirees are not extracting housing equity in retirement.

One way in which older homeowners can extract housing wealth is moving, either from owning to renting or downsizing. Transaction costs associated with moving can be high as homeowners typically spend time and money on realtor fees, home repair, capital gains taxes, relocation, psychic costs, etc. Some of these costs can be even higher for older homeowners (e.g., psychic costs of moving to a new neighborhood with less social capital, spending money on repair and fees with a reduced income, etc.) and can also vary based on state and local policies (e.g., Proposition 13 in California). Since most retirees prefer to age in place and not move (Binette and Vasold, 2018; Munnell, Soto and Aubry, 2007), high transaction costs are not likely a major component as to why

[4] Inherited property receives a stepped-up basis, meaning the value of the house for tax purposes is the market value of the house when inherited, not the value of the house when the original owner purchased it. This reduces the amount of capital gains that may need to be paid on the house in the event it is sold after inherited.

many retirees do not use their housing equity to support consumption. However, for households that may not have a strong preference to age in place, they may stay in their home longer than they otherwise would have, thus delaying the extraction of housing equity.

Many retirees have high out-of-pocket costs on medical care because Medicare only covers 65 percent of retirees medical expenses (Cubanski et al., 2018; De Nardi et al., 2016). A major medical expense for retirees is long-term care, which is not covered by Medicare. Half of people over the age of 50 will live in a nursing home before they die (Hurd, Michaud and Rohwedder, 2014) and can cost around $80,000 per year (De Nardi et al., 2016; Fisher et al., 2007). Since fewer than 20 percent of older Americans have long-term care insurance (Engelhardt and Eriksen, 2021; Murray, 2020) and uncertainty of if or when long-term care might be needed, some homeowners may choose to use their accumulated housing equity as precautionary savings to pay off higher than expected medical expenses (Costa-Font, Frank and Swartz, 2019; Fisher et al., 2007; Poterba, Venti and Wise, 2011). Murray (2020) found that if retirees had total coverage of health-care expenses, then up to 13 percent of households would choose to forgo homeownership. Holding on to housing equity for precautionary savings indeed accounts for a portion of the housing-equity puzzle but does not explain everything.

A final reason that some retirees may not use their housing equity is that households may derive utility from the non-pecuniary benefits of owning a house. As people age, they are less likely to view the house as an asset, which may be explained by the Socioemotional Selective Theory (SST). SST is a lifespan theory of motivation popular in psychology that proposes that people monitor time horizons and adjust motivations, goals, and preferences as they age. Older people are more likely to perceive time as finite. Thus, they may place more importance on finding emotional meaning and satisfaction from life while investing fewer resources into gathering information and expanding horizons (Carstensen, 2006). Fisher et al. (2007) noted that if this is the case, older Americans may hold on to their home because they are more driven by emotional attachment than financial gain. How people view their home and the relative importance of non-pecuniary benefits in the utility function, to my knowledge, have not been well studied by economists and something

that warrants future attention as it could be an important factor as to how retirees may use (or not use) their housing equity.

In this paper, I explore an alternative explanation that was not observed prior to the Great Recession. DB plans are less common for recent retirees and those who are about to retire compared to older generations on whom many previous studies were conducted. In addition, the coinciding losses in wealth and house value during the Great Recession provides a unique opportunity to examine how having the guaranteed income from a DB plan may have mitigated these losses compared to other households. The potential willingness of some households with a DC plan to part with their house after the Great Recession (extracting H_t to HE_t) shows how a DB plan may have influenced the historical decision of so many older Americans to not use their housing equity to increase consumption in retirement. It is possible that due to having a guaranteed source of income from a DB plan, households never considered the house when making retirement decisions.

3 Data

This paper uses individual and household level data from eight waves of the restricted geocoded version of the Health and Retirement Study (HRS) from 1996-2016 to study the role of pensions on the homeownership decision before and after the Great Recession. The HRS is a longitudinal survey that includes about 20,000 households over age 50, representative of the overall United States population in that age group. The HRS defines an observational unit as an eligible household containing at least one person born within a given time period (which varies by phase)[5]. The HRS is administered by the University of Michigan Institute for Social Research in partnership with the RAND Center for the Study of Aging. The original target population for the HRS when the study was initiated in 1992 is adults born between 1931-1941 (designated 'HRS Cohort') and those born before 1924 (AHEAD cohort). Every six years the survey adds a new cohort starting in 1998 with those born between 1924-1930 (Children of the Depression) and 1942-1947 (War Babies Cohort).

[5] For more information on the HRS and its sample selection, see https://hrs.isr.umich.edu/publications/biblio/9047 (HRS Staff, 2008).

In 2004 those born between 1948-1953 (Early Baby Boomers Cohort) were added; and the last group added was in 2010 with the addition of those born between 1954-1959 (Mid-Baby Boomers Cohort).

This study uses the HRS due to its specific focus on older Americans. While much of the research on housing uses the American Housing Survey, the HRS includes more information on retirement plans, asset composition, and spending in addition to demographical and housing characteristics, making it more appealing for this study.

This study restricts attention to households where the financial respondent is aged 50 or older in single households or where the male is aged 55 or older in married households. The main specification specifically looks at households that are retired[6], but a falsification test is conducted using working households. Urban and rural households are determined by the United States Department of Agriculture Rural-Urban Continuum Codes[7] included in the HRS. Metropolitan areas are classified as urban and non-metropolitan areas are classified as rural. All monetary values in the HRS are reported in nominal dollars and have been converted into real 2009 dollars using the PCE chain-type price index taken from the Federal Reserve Economic Database.[8]

The key variable used in this paper is whether a household has a DB plan or a DC plan. From 1996-2010 the HRS asks respondents if it had a DB plan or a DC plan at their current or former job. Starting in 2012, the HRS asks more detailed questions about pension types at their current job and for all former employment. I define a person to have a DC plan if they report having a DC plan prior to 2012 and if they report having a 401K, 401A, 403B, or DC plan in 2012 and later. If a household reports having a DB plan, they are defined as having a DB plan, even if they also have a DC plan because the DB plan still provides the guaranteed income in retirement. The HRS asks respondents about having a multitude of possible retirement plans; I only use responses for their

[6] Retirement is determined using the retirement variable provided in the RAND HRS file.

[7] More information on the USDA Rural-Urban Continuum Codes are available at https://www.ers.usda.gov/data-products/rural-urban-continuum-codes/.

[8] Downloaded from the Federal Reserve Economic Database (https://fred.stlouisfed.org/series/PCEPI) on 5/13/2017 (Bureau of Labor Statistics).

primary and secondary retirement plans when constructing this variable.

Other variables used in this analysis include income, non-housing wealth, years of education, number of children, marital status, age, and race.

4 Household Wealth and Homeownership Rates

Following the Great Recession, many households saw declines in their non-housing wealth. Figure 1 shows the mean non-housing wealth for DB and DC households before and after the Great Recession. Mean non-housing wealth was 19.9 percent lower for households with a DC plan after the Great Recession compared to 6.8 percent for households with a DB plan. Figure 2 shows homeownership and rental rates from 1996-2016. Prior to the Great Recession (1996-2008), 93.3 percent of households with a DB plan owned a home and 93.4 percent of households with a DB plan owned a home. After the Great Recession, homeownership for households with a DB plan was 91.5 percent and 82.1 percent for households with a DC plan. There is a similar pattern for renters, 5.5 percent of households with a DB plan and 5.9 percent with a DC plan rent prior to the Great Recession. After the Great Recession, 8.2 percent of households with a DB plan rent compared to 17.5 percent of households with a DC plan. Figure 2 shows a clear trend that homeownership dropped, and that the rental rate increased for households with a DC plan after the Great Recession whereas homeownership and renter rates remained more consistent for households with a DB plan. These patterns will be further analyzed using regression analysis.

5 Empirical Strategy

My empirical strategy looks at the changes in homeownership and the rental rate before and after the Great Recession. To do this, I estimate an event-study model that allows me to see relative homeownership and rental rates over time while controlling for fixed differences between

states and years. The model estimated is:

$$prob(y_{ist} = 1|X) = \beta_0 + DC_{it} \times \sum_{\substack{z=1996 \\ z \neq 2006}}^{2016} \beta_z Year_t + \gamma' X_{it} + \phi_s + \lambda_t + \varepsilon_{ist} \quad (2)$$

Where the dependent variable, y_{ist}, is the homeownership or the rental rate for household i at time t located in state s. DC_{it} is a dummy variable that defines the treatment and control groups. This variable takes the value of 1 if the household has a DC plan (treatment group) and a 0 if the household has a DB plan (control group). Since this study focuses on the years 1996-2016, $Year_t$ is an indicator variable for each year in the study, with 2006, the HRS wave prior to the Great Recession, being the omitted year. X_{it} is a vector of controls that include the inverse hyperbolic sine (IHS) of income, the IHS of non-housing wealth, years of education, number of children, age, age squared, age cubed, an indicator for marital status, and an indicator for race. The IHS has many of the desirable properties of logged values but allows for values that are zero and negative (Bellemare and Wichman, 2020; Burbidge, Magee and Robb, 1988; Pence, 2006). Additionally, I include ϕ_s as a state fixed-effect and λ_t as a year fixed-effect.

In addition to the event-study models, I also estimate a difference-in-difference (DID) model that pools the effect in the years after the Great Recession. The DID model takes the following form:

$$prob(y_{ist} = 1|X) = \beta_0 + \beta_1 DC_{it} + \beta_2 Post_t + \beta_3 (DC_{it} \times Post_t) + \gamma' X_{it} + \phi_s + \lambda_t + \varepsilon_{ist} \quad (3)$$

All the variables in Equation 2 are the same as Equation 1 except for $Post_t$, which is an indicator variable taking a 1 in the years after the Great Recession (2010-2014) and a 0 in the years before. To test for possible heterogenous effects across geographical regions, I also estimate Equations 1 and 2 separately restricted to urban and rural households.

To ensure that the event study and DID models are comparing similar groups of households, there needs to be balance in pre-treatment characteristics between households with a DC plan

and a DB plan. To improve the balance of pre-treatment characteristics, the comparison group is weighted using inverse probability weights, $\frac{\hat{p}(x)}{1-\hat{p}(x)}$ (Abadie, 2005; Cunningham and Goodman-Bacon). Where $\hat{p}(x)$ are propensity scores that are estimated using a probit model.[9] Table 1 shows means of the control variables for households with a DC plan and the weighted and unweighted difference in means from households with a DB plan. Using the inverse probability weights greatly improves the balance in pre-treatment characteristics.

6 Results

6.1 Homeownership

I first estimate the impact of the Great Recession on homeownership for households with a DC plan and a DB plan. Panel A of Figure 3 graphically shows the results of the event-study for all households and Column 1 of Table 2 shows the point estimates of the event-study and DID models. The results from the event-study show that that point estimates prior to the Great Recession were near zero. Each estimate was individually statistically insignificant, and a joint test fails to reject the null hypothesis that the point estimates are jointly statistically different from zero. This provides some evidence of parallel trends for homeownership for households with a DC plan and a DB plan prior to the Great Recession, one of the necessary conditions for the DID estimates to be valid. In each year after the Great Recession (2010-2016), the event-study shows there is a statistically significant decrease in homeownership by 8.6-11.2 percent for households with a DC plan relative to households with a DB plan between. The DID estimates show that there was a 9.6 percent decline in homeownership for households with a DC plan relative to households with a DB plan. This effect is significant at the 1 percent level.

The Great Recession more severely impacted urban households than rural households (Mattingly, Smith and Bean, 2011; Thiede and Monnat, 2016). This is likely because many rural areas

[9] The distribution of propensity scores can be found in Figure A1 to show that the distributions between treatment and control groups are similar.

were already suffering with a troubled labor market due to lower levels of education and aging populations and aided by declines in the manufacturing sector that had already produced economic hardships in these areas (Slack, 2014). Because of this, I separately estimate Equation 1 separately for urban and rural households to see the effect of the Great Recession on homeownership in these areas respectively. Panel B of Figure 3 graphically shows the results of the event-study for urban households and Column 2 of Table 2 shows the point estimates of the event-study and DID models. The results for the event-study show that homeownership declined between 9.5-14.4 percent or household with a DC plan relative to households with a DB plan. The DID estimates show a 10.1 percent decline in homeownership for households with a DC plan, an effect that is statistically significant at the 1 percent level. Panel C of Figure 3 and Column 3 of Table 2 show the results of the event-study and DID models restricted to rural households.

While the event-study estimates for rural households are individually and jointly insignificant prior to the Great Recession, the 95 percent confidence intervals are large and there appears to be a positive trend between households with a DB plan and a DC plan. Additionally, the decreasing effect also appears to being prior to the Great Recession. Even though the DID estimates are similar in magnitude to the other models, I cannot say with certainty that these estimates are valid for rural households. Like previous research has suggested, this is likely due to factors that had already influenced economies in rural areas prior to the Great Recession.

6.2 Renting

As discussed earlier in this paper, one of the ways retirees can extract housing equity is moving from owning to renting. To see if the decline in homeownership is associated with an increase in renting, I repeat the event-study and DID analysis for the rate of renting. The graphical depiction of the event-study results can be found in Figure 4 and the point estimates of the event-study and DID models can be found in Table 3. Like with homeownership, the event-study models for renting show that that point estimates prior to the Great Recession were near zero and both individually and jointly statistically insignificant, providing some evidence of parallel trends. The

results show that the decline in homeownership is offset by a corresponding increase in the rate of renting. The event-study models show a 9.2-12.3 increase in the rate of renting when including all households with a DC plan relative to households with a DB plan. The DID models show a 9.9 percent increase. When restricting he sample to just urban households, the event-study model shows a 10.5-14.7 percent increase in the rate of renting and the DID models show a 10.4 percent increase in the rate of renting for households with a DC plan relative to households with a DB plan. Like with homeownership, the event-study for rural households appear to a trend prior to the Great Recession and insignificant differences between households with a DC plan and DB plan after the Great Recession.

7 Sensitivity and Robustness Checks

7.1 Sensitivity Analysis

In addition to parallel trends prior to treatment, another condition for the DID estimates that have been presented to be valid, is the decision to own a home should be exogenous to observable factors. To test to ensure that observable factors did not change significantly before or after the Great Recession, I conduct a series of balance tests to ensure that the observed estimates are not being influenced by changes in observables. The results of these tests can be found in Table 3.

Additionally, I estimate a series of alternative specifications to check the sensitivity of the DID estimates. Figure 5 shows the results of these point estimates. The DID estimates with no controls and fixed-effects, no IPW weights, no controls and only fixed-effects, all controls, and controls that have different specification of the age profile (linear, quadratic, and cubic) all show a very similar and stable point estimate for both homeownership and renting. This shows that the DID results are robust to model specification and controls.

Lastly, I conduct a permutation test using random inference to test if the decrease in homeownership and increase in renting is due to the Great Recession or due to other factors. This permutation test randomly assigns treatment and estimates the regression model. This is done

1,000 times and the distribution of outcomes is plotted in Figure 6. Most of the random estimates are less than zero for homeownership and greater than zero for renting. Next, I compare the randomized estimates to the actual estimate. The randomized inference p-value is the percent of the random estimates where the absolute value is greater than the point estimate from Equation 1. The p-values from the permutation test are statistically significant showing a decrease in homeownership and increase in renting for households with a DC plan relative to households with a DB plan. The results of the permutation test using randomized inferences are consistent with the DID results from Equation 1.

7.2 Placebo and Falsification Tests

To further asses the validity of this empirical approach, I conduct several "placebo" and "falsification" tests using a series of event-study analyses, the results of which can be found in Figure 7. First, Panel A shows the results when restricting this analysis to only working households. Prior to the Great Recession, all the estimates are near zero and statistically insignificant, suggesting parallel trends. After the Great Recession, the estimates remain close to zero and statistically insignificant, indicating that there was no difference in homeownership and renting for working households with DB and DC plans after the Great Recession.

Second, Panel B shows the results of an event-study analysis using the 2001 recession as the treatment period instead of the Great Recession. The estimates prior to the 2001 recession are near zero and statistically insignificant and remain that way after the 2001 recession. This provides evidence that the 2001 recession did not affect homeownership of renting differently for households with a DB or DC plan.

Lastly, Panel C shows the results of an event-study looking at households who live in "other" housing accommodations. "Other" housing accommodations includes any living arrangements besides homeownership and renting (e.g., living in a nursing home or living with a family member). The results of this event-study show that the Great Recession did not affect the percent of households living in "other" housing accommodations differently for households with a DB or DC

plan.

The near-zero and statistically insignificant effects of these "placebo" and "falsification" tests support the robustness of the main results of this study.

8 Conclusions and Discussion

The Great Recession was one of the most severe economic downturns in contemporary American history. Households experienced declines in income, savings, and property values. For Americans that were retired, these losses could be difficult if not impossible to recover. Having a DB plan may have possibly mitigated some of the losses that may have been suffered in other assets. Households with DC plans saw losses in their retirement portfolio and wealth without the security that a DB plan provides. In this paper, I find that households with a DC plan were 9.6 percent less likely to own a home and 9.9 percent more likely to rent after the Great Recession compared to households with a DB plan. This effect is strong for households living in urban areas, but the evidence is not there to suggest the same for rural areas, which may have already been suffering economic hardship prior to the Great Recession.

Engelhardt and Eriksen (2021) show that nearly half of all homeowners will transition to renting before they die. The results of this study suggest that one possible reason for this may be the high prevalence of DB plans and the guaranteed income they provide in past cohorts of retirees. One of the interpretations of the findings of this study is that homeowners may transition to renting in future cohorts because they will have more risky savings and retirement portfolios with the increase rate of DC plans.

Since house values declined during the Great Recession, another interpretation of the results of this study is that retirees with DC plans may be more aware of the potential risk that could be associated with housing wealth because their retirement income is not guaranteed. By moving from owning to renting, these households could extract their housing equity and store that wealth in other assets. With future cohorts of retirees being more likely to have a DC plan than a DB plan,

this may be something future retirees consider as well.

While the exact reason why some households with a DC plan have chosen to forgo homeownership after the Great Recession is not clear, it does appear that more households are behaving in a way that is consistent with the LCH. However, most households with DB and DC plans still own a home in retirement, inconsistent with the predictions of the LCH. As America's population ages and people live longer in retirement, understanding how Americans finance their retirement – and how this will change in the future – is important as federal, state, and local policymakers look to shape policy for the 21st century. More research is needed in this field to better understand the issues and decisions older Americans make when it comes to retirement and housing wealth.

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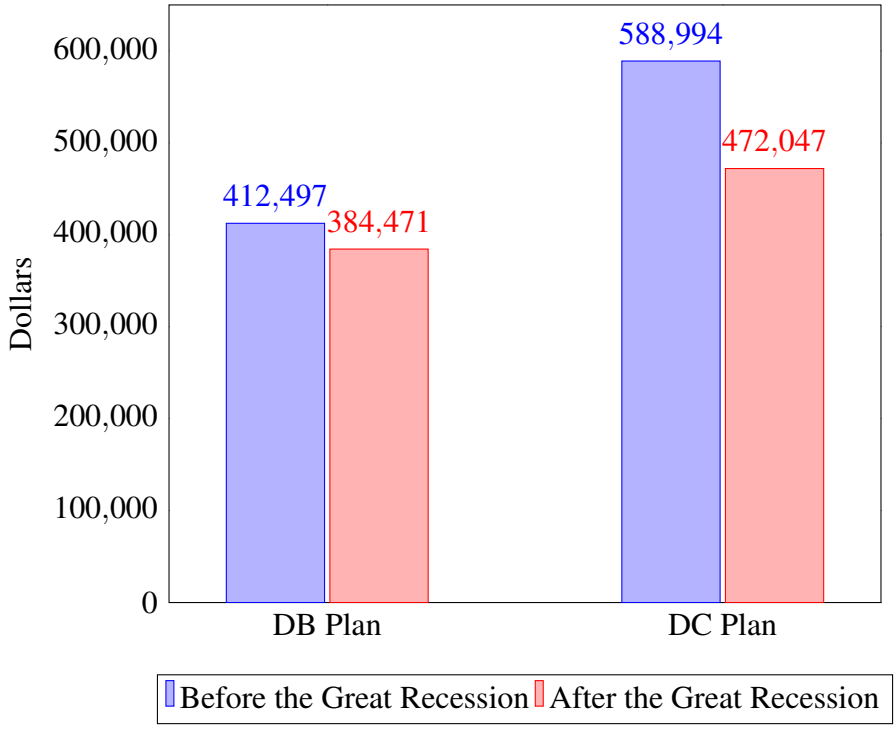
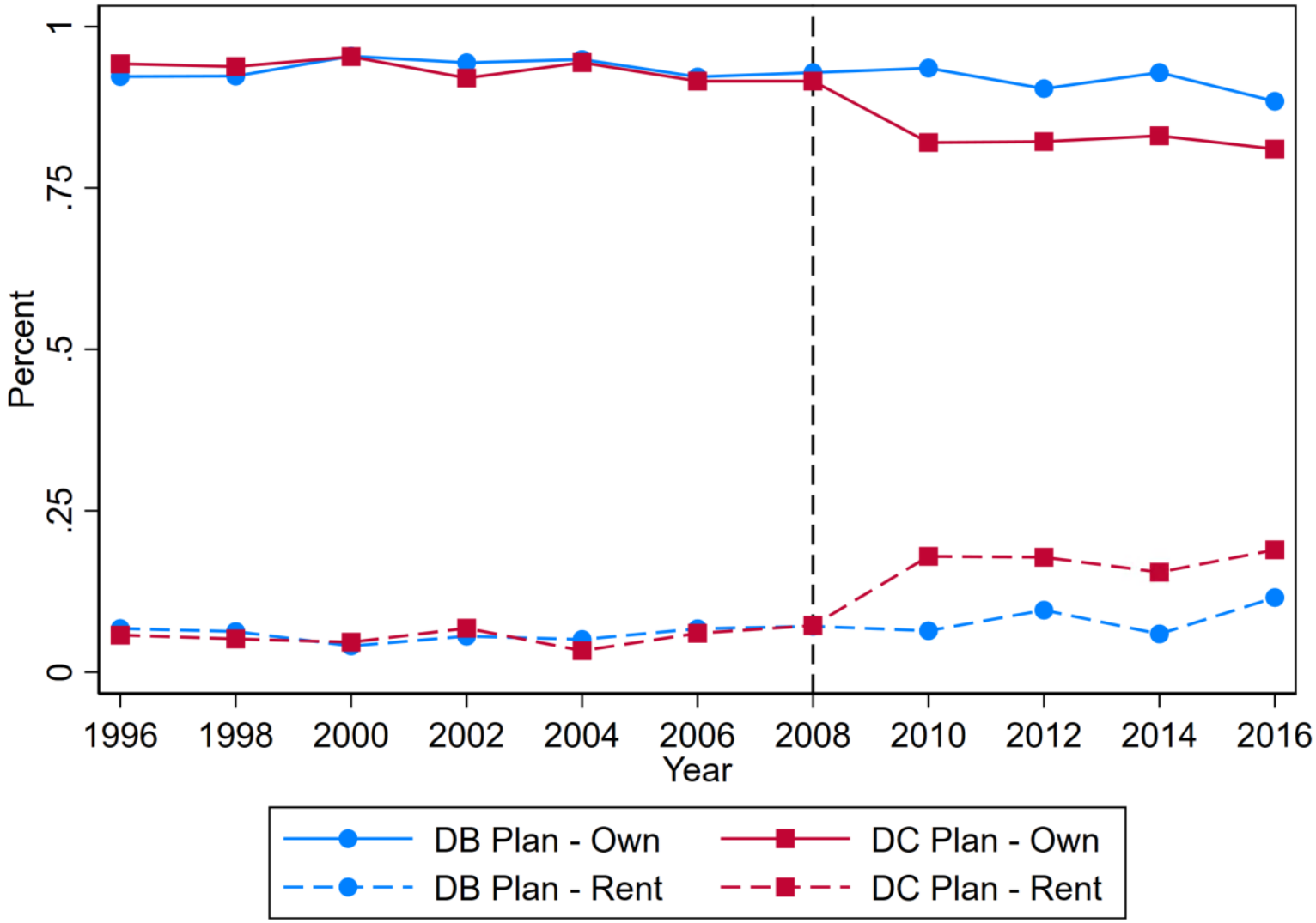
Figure 1: Mean Non-Housing Wealth



Source: Author's calculations from the Health and Retirement Study.

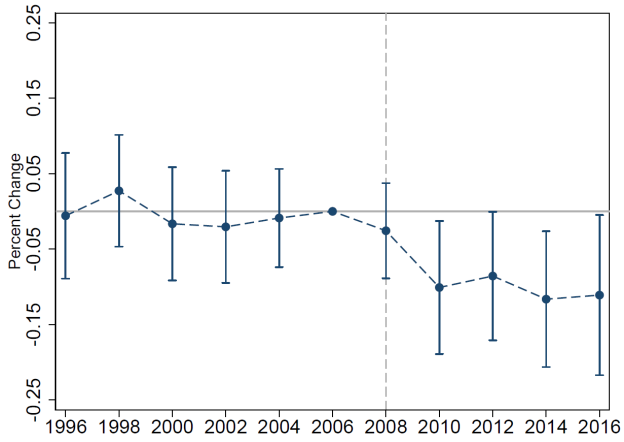
Figure 2: Homeownership and Renter Rates by Pension Plan Type, 1996-2016



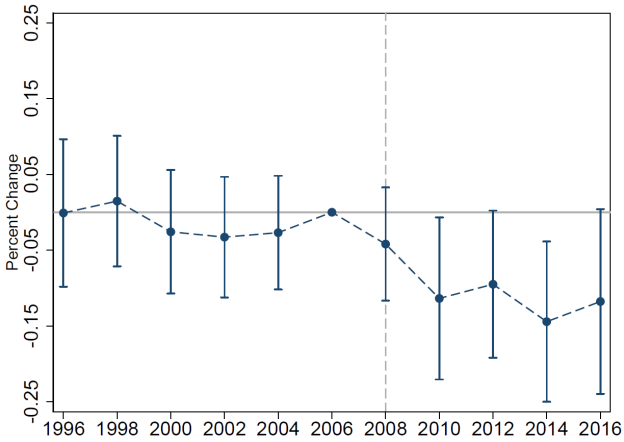
Notes: These graphs show annual means for homeownership and rate of renting for households with a defined contribution plan and a defined benefit plan. Source: Author's calculations from the Health and Retirement Study.

Figure 3: Effect of the Great Recession on Homeownership

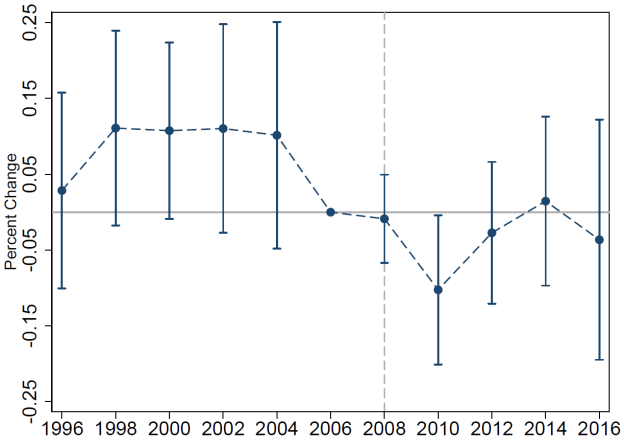
(a) All Households



(b) Urban Households



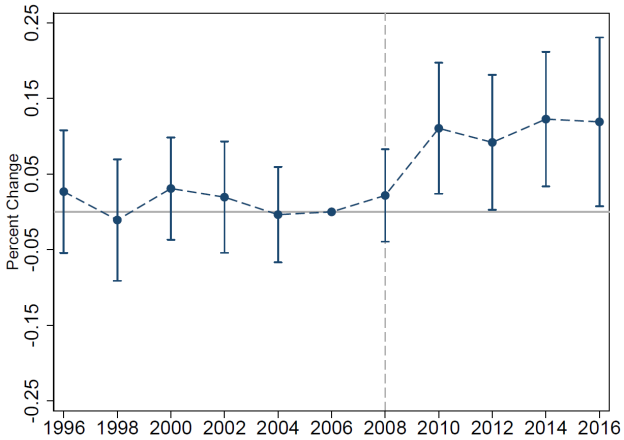
(c) Rural Households



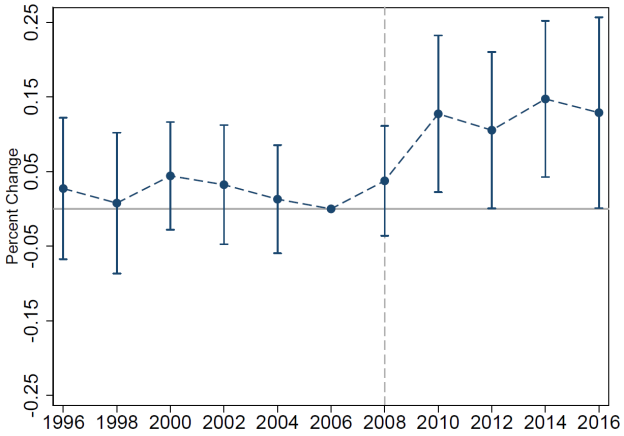
Notes: These graphs report the coefficient estimates of β_z from the Event-Study specification for the outcomes on homeownership. The coefficients represent the difference in outcomes for households with a DC Plan relative to households with a DB Plan, as compared to the period prior to the Great Recession, 2006. Estimates are presented with 95% confidence intervals clustered at the household level.

Figure 4: Effect of the Great Recession on Renting

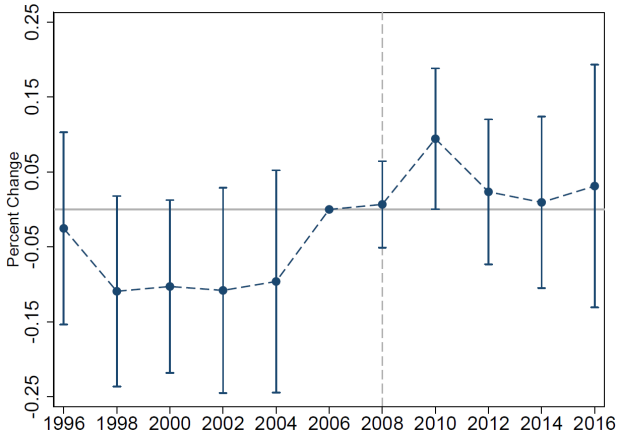
(a) All Households



(b) Urban Households

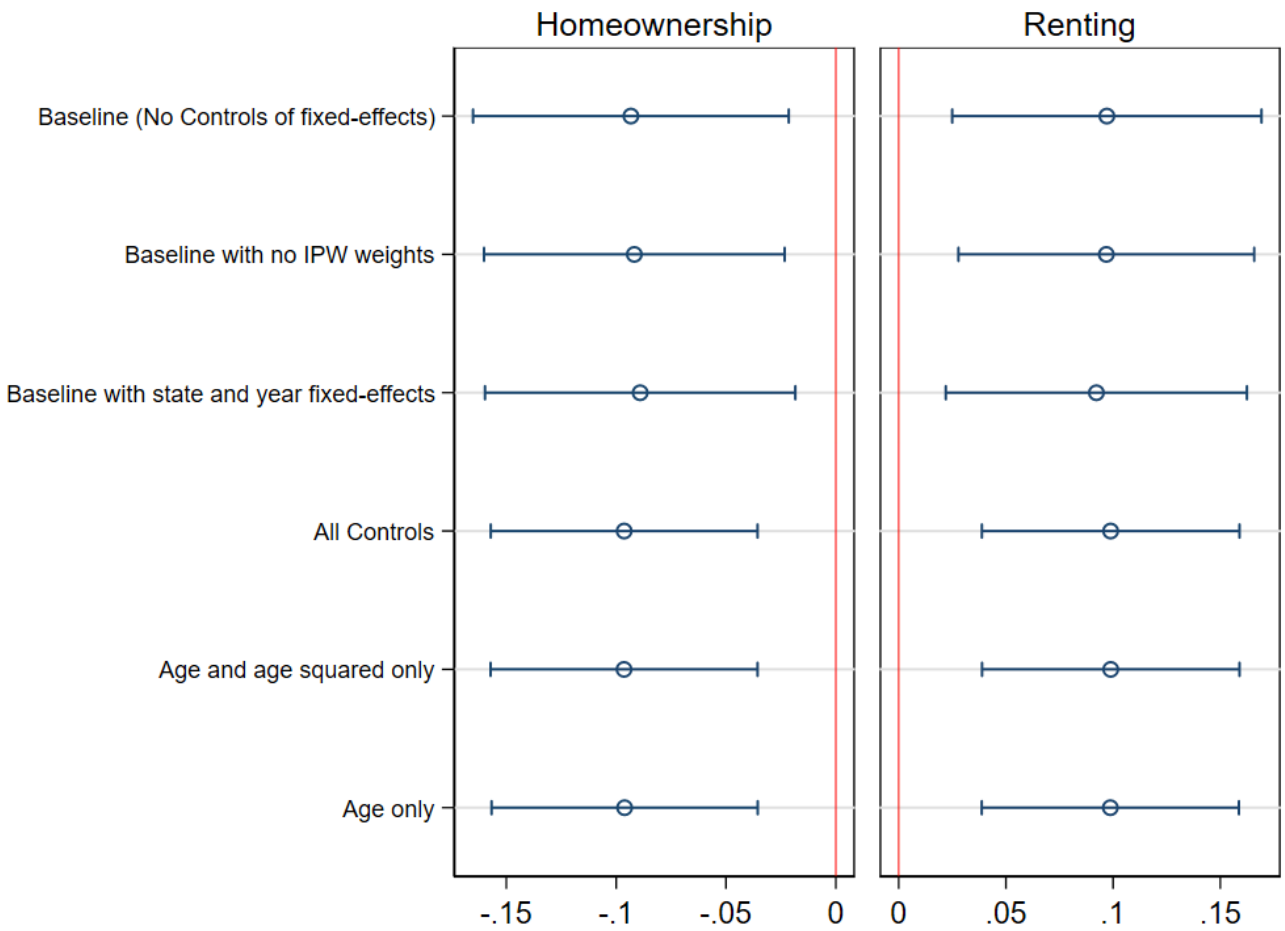


(c) Rural Households



Notes: These graphs report the coefficient estimates of β_z from the Event-Study specification for the outcomes on renting. The coefficients represent the difference in outcomes for households with a DC Plan relative to households with a DB Plan, as compared to the period prior to the Great Recession, 2006. Estimates are presented with 95% confidence intervals clustered at the household level.

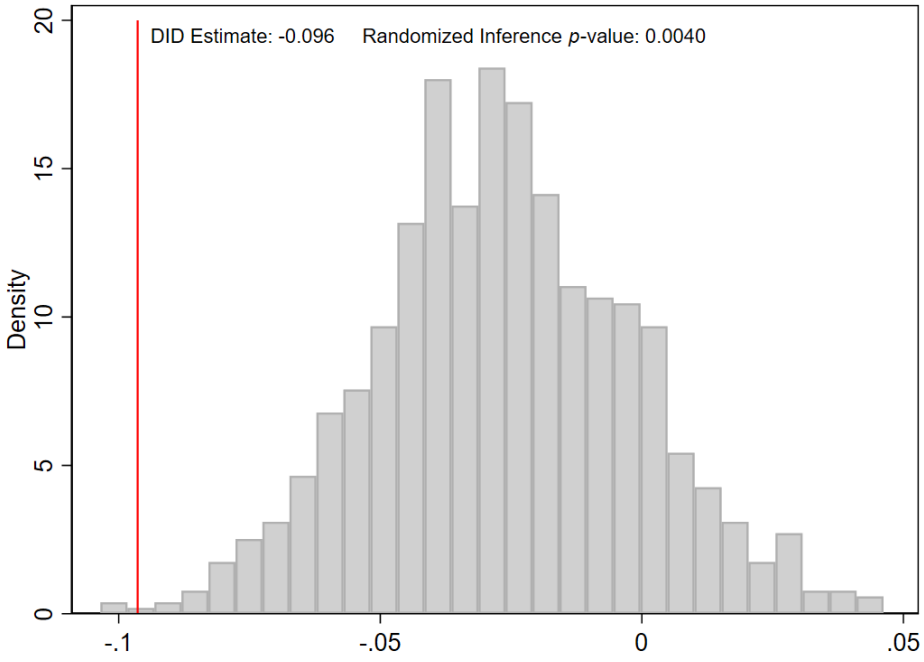
Figure 5: Effect of the Great Recession on Homeownership and Renting: Alternative Specifications



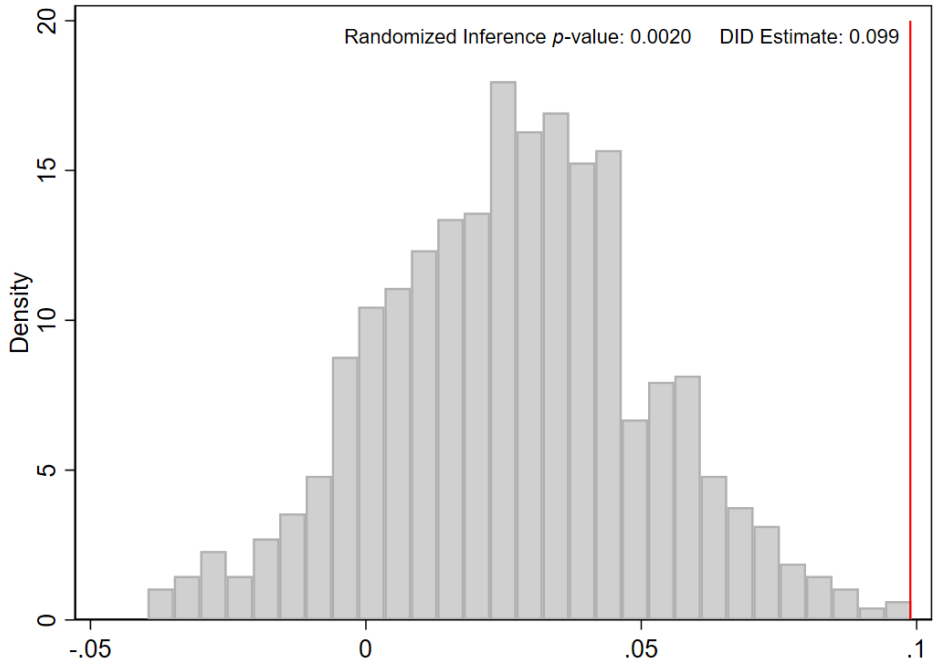
Notes: This figure plots the difference-in-difference estimates for alternative specifications to Equation 1 that includes a baseline model with no controls and no fixed-effects; the baseline model without inverse probability weights; the baseline model with state and year fixed-effects; the model with all controls as laid out in Equation 1; all controls but omitting age^3; and all controls omitting age^2 and age^3. All estimates are plotted with 95% confidence intervals.

Figure 6: Distribution of Difference-in-Difference Coefficients from Randomized Inference

(a) Homeowners



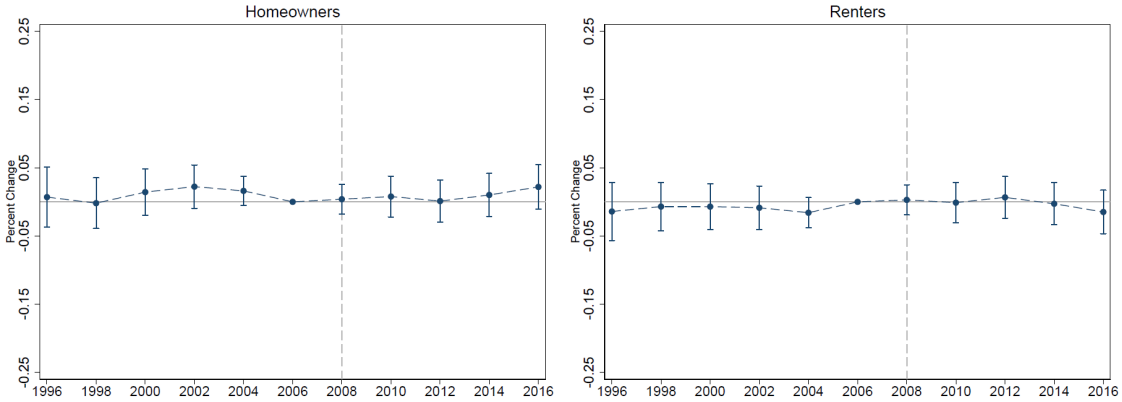
(b) Renters



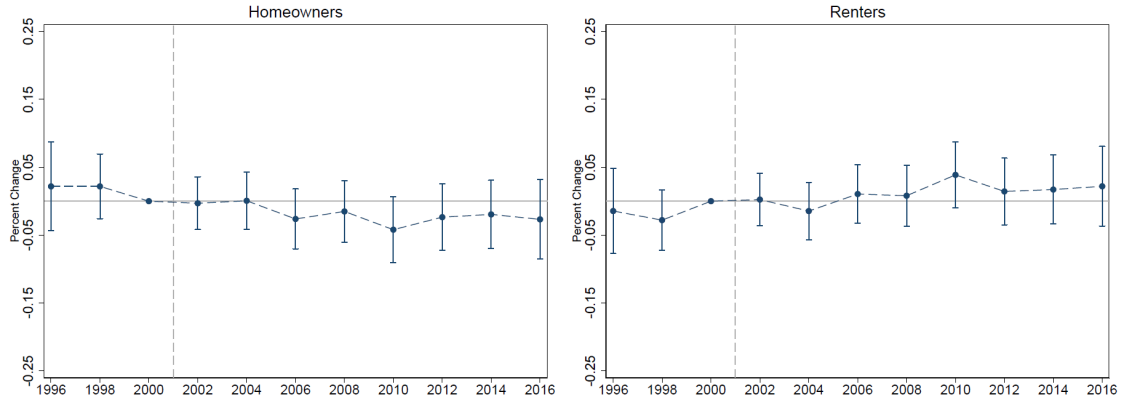
Notes: These figures present the distribution of the difference-in-difference coefficient estimates by randomizing treatment status with 1,000 placebo simulations using randomized inference. The red line shows the main difference-in-difference estimate from Equation 1 and reported in Column 1 of Tables 2 and 3. The randomized inference *p*-value is the percent of the 1,000 placebo estimates greater in absolute value than the main difference-in-difference estimate.

Figure 7: Placebo and Falsification Tests

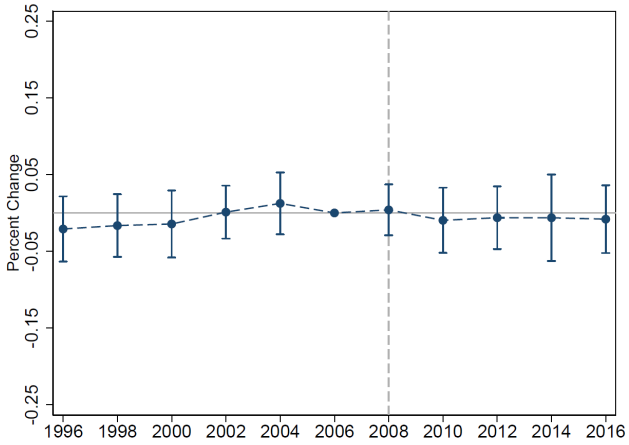
(a) Working Households



(b) Effect of the 2001 Recession



(c) Other Housing Accommodations



Notes: These graphs report the coefficient estimates of β_z from the Event-Study specification for the outcomes in homeownership and renters restricted working households in Panel A. Panel B shoes the results of the event study using the 2001 recession as the treatment time instead of the Great Recession. Panel C shows the change in the percent of people who live in other housing accommodations (e.g., nursing home, living with children, etc). The coefficients represent the difference in outcomes for households with a DC Plan relative to households with a DB Plan, as compared to the period prior to the Great Recession, 2006 in Panels A and C and compared to 2000 in Panel B. Estimates are presented with 95% confidence intervals clustered at the household level

Table 1: Balance in Pre-Treatment Characteristics between DC and DB Households

	All Households (1)			**Urban Households** (2)			**Rural Households** (3)		
	DC Plan	Difference for DB Plan		DC Plan	Difference for DB Plan		DC Plan	Difference for DB Plan	
	Mean	Unweighted	Weighted	Mean	Unweighted	Weighted	Mean	Unweighted	Weighted
$\sinh^{-1}$ (*Income*)	11.505	-0.103**	-0.024	11.535	-0.065	-0.055	11.423	-0.279***	-0.226**
$\sinh^{-1}$ (*Non–Housing Wealth*)	11.354	-0.626**	0.281	11.438	-0.462	-0.123	10.843	-1.543***	-0.834
Years of Education	13.163	-0.643***	-0.285	13.386	-0.414***	-0.226	12.010	-1.964***	-1.582***
Number of Children	2.825	-0.113	0.151	2.633	-0.299***	1.851	3.875	0.896***	0.382
Married	0.770	-0.003	-0.003	0.751	-0.031	-2.035	0.885	0.005	0.012
Age	66.977	0.717**	0.602	66.624	0.233	0.744	68.606	2.402***	2.352***
Black	0.132	0.028	-0.05**	0.135	0.022	-0.025	0.125	-602.875	0.069
Other Race	0.002	-0.034***	-0.001	0.002	-0.039***	0.002	0.000	-0.010	-0.014

Notes: The first column for each panel provides the mean of the treatment group. The second and third panel for each panel shows the difference between the means of the treatment and comparison groups for the weighted and unweighted sample. Weighting is done using the Inverse Propensity Score (IPW). * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

Table 2: Difference-in-Difference Estimation Results for Homeowners

	All Households	**Urban Households**	**Rural Households**
	(1)	(2)	(3)
Difference-in-Difference Models			
DC Plan × Post	-0.096***	-0.101***	-0.097**
	(0.031)	(0.036)	(0.041)
Observations	2,969	2,484	442
R^2	0.306	0.312	0.562
Event Study Models			
1996	-0.006	-0.001	0.029
	(0.042)	(0.050)	(0.065)
1998	0.027	0.015	0.111*
	(0.038)	(0.044)	(0.065)
2000	-0.016	-0.026	0.108*
	(0.038)	(0.042)	(0.059)
2002	-0.021	-0.033	0.110
	(0.038)	(0.041)	(0.069)
2004	-0.009	-0.027	0.101
	(0.033)	(0.038)	(0.075)
2006 (Omitted)	0	0	0
2008	-0.026	-0.042	-0.009
	(0.032)	(0.038)	(0.029)
2010	-0.101**	-0.114**	-0.102**
	(0.045)	(0.054)	(0.050)
2012	-0.086**	-0.095*	-0.027
	(0.043)	(0.049)	(0.047)
2014	-0.116**	-0.144***	0.015
	(0.046)	(0.054)	(0.056)
2016	-0.111**	-0.118*	-0.036
	(0.054)	(0.062)	(0.080)
p-value for joint test that 1996–2004 estimates equal zero	0.702	0.709	0.292
Observations	2,969	2,482	442
R^2	0.307	0.313	0.576

Notes: Standard errors are clustered at the household level. Controls include $\sinh^{-1}(Income)$, $\sinh^{-1}(Non\text{–}Housing\ Wealth)$, Years of Education, Number of Children, age, age^2, age^3, an indicator for marital status, and an indicator for race. All specifications include a state and year fixed-effect.* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

Table 3: Difference-in-Difference Estimation Results for Renters

	All Households	**Urban Households**	**Rural Households**
	(1)	(2)	(3)
Difference-in-Difference Models			
DC Plan × Post	0.099***	0.104***	0.098**
	(0.031)	(0.035)	(0.041)
Observations	2,969	2,482	442
R^2	0.301	0.305	0.546
Event Study Models			
1996	0.027	0.027	-0.025
	(0.041)	(0.048)	(0.065)
1998	-0.011	0.008	-0.109*
	(0.041)	(0.048)	(0.064)
2000	0.031	0.044	-0.103*
	(0.034)	(0.037)	(0.058)
2002	0.019	0.032	-0.108
	(0.038)	(0.041)	(0.069)
2004	-0.004	0.013	-0.096
	(0.032)	(0.037)	(0.075)
2006 (Omitted)	0	0	0
2008	0.022	0.038	0.007
	(0.031)	(0.037)	(0.029)
2010	0.110**	0.127**	0.094**
	(0.044)	(0.053)	(0.047)
2012	0.092**	0.105*	0.024
	(0.045)	(0.053)	(0.049)
2014	0.123***	0.147***	0.024
	(0.046)	(0.053)	(0.058)
2016	0.119**	0.129**	0.031
	(0.057)	(0.065)	(0.082)
p-value for joint test that 1996–2004 estimates equal zero	0.709	0.722	0.303
Observations	2,969	2,482	442
R^2	0.301	0.305	0.558

Notes: Standard errors are clustered at the household level. Controls include $\sinh^{-1}(\textit{Income})$, $\sinh^{-1}(\textit{Non–Housing Wealth})$, Years of Education, Number of Children, age, age^2, age^3, an indicator for marital status, and an indicator for race. All specifications include a state and year fixed-effect.* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

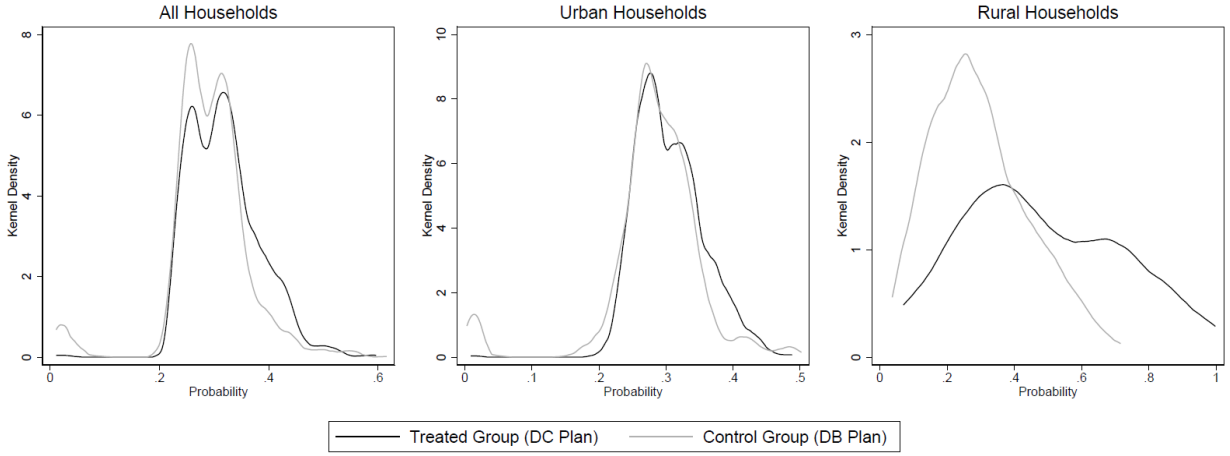
Table 4: Balance in Pre-Treatment Characteristics between DC and DB Households

Dependent Variable	**All Households**	**Urban Households**	**Rural Households**
$\sinh^{-1}(Income)$	0.09	0.07	-0.10
	(0.11)	(0.12)	(0.18)
$\sinh^{-1}(Non\text{–}Housing\ Wealth)$	0.04	0.14	-1.31
	(0.57)	(0.61)	(1.33)
Years of Education	0.30	0.36	-0.27
	(0.23)	(0.26)	(0.63)
Number of Children	0.22	0.26	0.94**
	(0.15)	(0.18)	(0.45)
Married	0.00	-0.03	0.02
	(0.04)	(0.04)	(0.08)
Age	-0.75	-0.62	-0.25
	(0.65)	(0.74)	(1.47)
Black	0.04	0.04	0.12*
	(0.03)	(0.03)	(0.07)
Other Race	0.00	0.00	0.02
	(0.00)	(0.00)	(0.02)

Notes: Standard Errors are clustered at the household level. Each cell represents a separate regression. Comparison units are weighted with IPW, $\frac{\hat{p}(x)}{1-\hat{p}(x)}$. All specifications include a state and year fixed-effect.
* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

A Appendix

Figure A1: Propensity Score Distributions



Notes: This figure shows the kernel density estimates by treatment status of the propensity score for homeowners and renters to show that they are similar.