

# Household Portfolio Choice Before and After House Purchase <sup>\*</sup>

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## Abstract

We document the temporal patterns of household portfolio choice of liquid wealth over a 7-year period around house purchase, using unique administrative panel data from Denmark. We find that (i) households accumulate significantly more liquid wealth in a few years before a house purchase and convert around 61% of them to down payments when buying a house; (ii) the risky asset participation rate drops 2 percentage points – a 6.2% decline – at the year of house purchase; and (iii) conditional on participation, the risky asset share of liquid wealth decreases and reaches the lowest point 1 year before a house purchase, but it jumps immediately after. This suggests that of the three channels identified in the literature that could affect the conditional risky share of liquid wealth after house purchases, the diversification effect and the debt retirement channel dominate the concern of liquidity demand. Liquidity demand, however, does have a larger effect on the portfolio choice of poorer households after a house purchase.

*JEL classification:* D14; G11; R21

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<sup>\*</sup>The views expressed in this paper are those of the authors. No responsibility for them should be attributed to the Bank of Canada. All errors are our own.

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# 1 Introduction

Housing is the largest and most important asset for most households. The salient features of housing are that it is difficult to diversify, highly leveraged, and costly to adjust. Before buying a house, households need to accumulate liquid wealth for down payment.<sup>1</sup> After buying a house, they face expenditure risk due to committed mortgage payments and house price risk. As a result, households usually plan well ahead before buying a house. These suggest that house purchase could be closely linked to the accumulation of liquid wealth and the portfolio choice of liquid wealth.

This paper estimates the development of households' liquid wealth, risky asset participation (the extensive margin), and the conditional risky asset share of liquid wealth (the intensive margin) through the period from 3 years before to 3 years after a house purchase using unique administrative panel data from Denmark. Ultimately, we attempt to document the temporal patterns of liquid wealth accumulation and households' investment in risky financial assets over a 7-year period around house purchase.

Previous studies have attempted to examine the effects of mortgage debt and home equity on household portfolio choice. These studies have relied mostly on the analysis of cross-sectional data and have not found a systematic relationship between housing and portfolio choice of liquid wealth. For example, [Fratantoni \(1998\)](#) finds that the elasticity of the risky asset share (the stock share) with respect to mortgage debt is negative, and [Yamashita \(2003\)](#) finds that households with a high house-to-net-worth ratio hold a lower proportion in stocks. On the other hand, [Heaton and Lucas \(2000\)](#) and [Cocco \(2005\)](#) show that in cross-sectional OLS regressions in which property value is included as a covariate, the stock share is positively associated with mortgage debt. In a recent paper, [Chetty, Sándor, and Szeidl \(2017\)](#) isolate plausibly exogenous variation in home equity and mortgages. They find that for homeowners an increase in mortgage debt reduces the share of liquid wealth held in stocks, while an increase in home equity raises the stock share of liquid wealth with CRRA preference. They implement a cross-sectional instrument variable (IV) strategy using microdata from the Survey of Income and Program Participation (SIPP). They also make use of the panel feature of SIPP to test whether individuals who buy a larger house reduce their stock share of liquid wealth more than those who buy smaller houses. Given that the SIPP is a short panel, the authors can only observe household portfolios 1 year before and 1 year after a house purchase for a small sample, which diminishes much of the benefit of a panel data set.

In this paper, we exploit a rich administrative panel data set from Denmark that contains the entire Danish population and spans 11 years from 2002 to 2012. The data

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<sup>1</sup>Liquid wealth in this paper refers to non-pension financial assets. It is defined as the sum of the market value of stocks and risky mutual fund investments, the market value of bond, and bank deposits. In the literature, some also use financial asset to refer to the same concept.

includes detailed household demographics, income, as well as asset and debt holdings. Based on this administrative data, we construct our main sample comprising households that bought houses in one of the years 2005—2009. The panel structure of the data ensures that both observed and unobserved time invariant household characteristics and calendar year fixed effect that presents uniformly to all households will not bias our results. Thus, we provide new and more reliable evidence on the relationship between house purchase and households' portfolio choice of liquid wealth.

We find a significant increase in liquid wealth before a house purchase.<sup>2</sup> On average Danish households hold about DKK 205,000 (about USD 37,000 or EUR 28,000) in liquid wealth 3 years prior to a house purchase.<sup>3</sup> Liquid wealth increases to DKK 295,000 (about USD 53,000 or EUR 40,000) 1 year before a house purchase, an increase of 44%. At the year of house purchase, households convert around 61% of their liquid wealth to down payments. After a house purchase, liquid wealth remains low for 2 years and starts to increase after 3 years.

Portfolio theories predict that the risky asset participation rate will drop before a house purchase. Households become more risk averse before buying a house as they face borrowing constraints (Paxson, 1990; Grossman and Vila, 1992; Teplá, 2000). When there are information and/or other types of participation costs (e.g., set-up fees, monitoring costs, etc.) associated with risky asset investment, a higher risk aversion leads to a lower participation rate. For our sample households, we find that the risky asset participation rate decreases 2 percentage points at the year of house purchase, which is a 6.2% decline relative to the participation rate 1 year before the house purchase (32.2%) and statistically significant at the 1% level. For households with wealth above the median level, the decline in the risky asset participation rate is even larger. Thus, our results provide strong evidence that housing investments have induced households to withdraw funds from the risky asset market. We also find that from 3 years before to 1 year before a house purchase, the risky asset participation rate slightly increases by about 1 percentage point. This overall gain in participation rate comes from households with wealth below the median level, reflecting that some of these households might be taking more risk by participating in the stock market in the hope of earning higher returns in the stock market so that they can buy a house.

After a house purchase, the overall risky asset participation rate continues to fall slightly for 2 years, and it starts to increase 3 years after the house purchase. Note that households have low liquid wealth immediately after a house purchase, and they benefit less from risky asset participation. Therefore, the risky asset participation rate is low if

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<sup>2</sup>There is tax penalty to withdraw pension savings before retirement in Denmark. Hence, it is unlikely that the increase in liquid wealth before buying a house is due to withdrawals of pensions.

<sup>3</sup>This is equivalent to 7.23 times the average monthly household labor income after tax and deductions in Denmark.

certain costs are associated with the participation.

Conditional on participation, the risky asset share of liquid wealth decreases in a few years before a house purchase, and it reaches the lowest point (24%) 1 year before a house purchase. Overall, the conditional risky asset share falls 2 percentage points from 3 years before to 1 year before a house purchase. This is likely due to the increased risk aversion before the house purchase.

Regarding the conditional risky asset share of liquid wealth after a house purchase, there are three theoretical arguments in the literature: the diversification effect (Yao and Zhang, 2005), the debt retirement channel (Becker and Shabani, 2010), and the liquidity demand hypothesis (Fratantoni, 2001; Hu, 2005).<sup>4</sup> The first two suggest that the conditional risky asset share of liquid wealth will immediately increase following a house purchase, while the third argues for the opposite. We find that, conditional on participation, the risky asset share immediately jumps at the year of purchase. It continues to increase in the next 2 years following the house purchase. As a result, the conditional risky asset share of liquid wealth is 3.3 percentage points higher 2 years after the house purchase than 1 year before the house purchase (a 13.8% increase). Overall, our results suggest that the diversification effect and the debt retirement channel have a dominating effect over the liquidity demand hypothesis.

Our findings in Denmark, an economy with a relatively low minimum down payment requirement<sup>5</sup>, convenient and low cost mortgage refinancing and prepayment terms<sup>6</sup>, as well as a mature stock market, indicate that there could be an even stronger linkage between house purchase and households' portfolio choice of liquid wealth in countries and economies where households face stricter borrowing constraints and stock markets are

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<sup>4</sup>The next section provides more details on these three theoretical arguments.

<sup>5</sup>In Denmark, for owner-occupied housing households can borrow up to 80 percent of property value as mortgage loan, according to the Act on mortgages and mortgage bonds § 5 by the Danish FSA (Finanstilsynet). The remaining 20 percent can be borrowed as a bank loan from commercial banks. During our sample period, there is no legal minimum down payment requirement, although most households do make down payments when buying a house. From November 1st 2015, every household is required to have at least 5% down payment when buying a house. For more details see "Lov om realkreditlån og realkreditobligationer m.v." (in Danish): <https://www.finanstilsynet.dk/AttachedFiles/%7B07a5ca67-9613-4ac2-a9ed-df786a2f5e7b%7D.%7Ba2fd5696-0b38-407b-9429-954fc7ace0e4%7D.lo-454-af-10062003-realkreditlaen.pdf>.

<sup>6</sup>A standard Danish mortgage contract allows households to borrow long-term (up to 30 years) at fixed rates with an option to make prepayment. The prepayment can be made by either buying back the underlying covered bonds at the market price (i.e., exercise the delivery option) or at par (i.e., exercise the call option). Borrowers will typically exercise the delivery option if the underlying bond is priced below par (when interest rate increases) and will be charged a trading fee of 0.10-0.30% depending on the size of the loan. This debt restructuring environment also allows borrowers in Denmark to benefit from a decline in interest rates, to avoid the lock-in effect from a potential increase in the market value of his debt, and to enjoy tax deduction on mortgage interest payment. On top of this, deregulation and mortgage banks' adoption of new technologies in the 1990s gave rise to a wide range of loan types for borrowers to choose from. Borrowers can refinance their mortgages to reduce their interest rate and extend loan maturity without cashing out, even when they have negative home equity. For more details on the supply side of Danish mortgage see: The Danish Mortgage Banks' Federation, Frankel, Gyntelberg, Kjeldsen, and Persson (2004), Willemann and Svenstrup (2006), and Rasmussen, Madsen, and Poulsen (2014).

more volatile.

The rest of the paper is organized as follows. Section 2 presents theory and predictions on how house purchases can affect household portfolio choice both before and after the purchase. Section 3 describes the data. Section 4 explains our empirical strategy, and Section 5 presents the results. Section 6 concludes.

## 2 Theoretical Considerations

A rich theoretical and empirical literature has studied household portfolio choices along both the extensive participation margin (the decision to hold a certain type of financial asset) and the intensive allocation margin (the share of financial wealth held in a given asset), see [Guiso, Haliassos, and Jappelli \(2002\)](#), [Campbell \(2006\)](#), and [Guiso and Sodini \(2013\)](#), among others.<sup>7</sup> Household portfolio choices are found to be affected by a variety of factors including risk preferences, financial characteristics, demographic characteristics, background risk, information and participation costs, etc. The literature has provided theoretical guidance for our empirical investigations.

In this paper, we are interested in the magnitude and temporal patterns of household portfolio choice of liquid wealth around a house purchase. Buying a house is the most important financial decision for the majority of households. We expect that households likely form expectations about their upcoming house purchase and accumulate more liquid wealth to pay for down payment.

Regarding households' portfolio choices of liquid wealth before a house purchase, our empirical model builds on the theoretical contributions of [Paxson \(1990\)](#), [Grossman and Vila \(1992\)](#), and [Teplá \(2000\)](#). These studies show that when facing a borrowing constraint, households become more risk averse in anticipation of the possibility that the constraint might be binding in the near future. If information costs and other participation costs are associated with stock investments, a higher risk aversion leads to lower risky asset participation.<sup>8</sup> Thus, we expect that the risky asset participation rate will fall before a house purchase. Moreover, before a house purchase and conditional on risky asset participation, households are likely to rebalance their portfolios of liquid wealth from risky to safe assets due to a reduced willingness to take on risk. We expect that the impact is stronger closer to the time of house purchase.

After a house purchase, households have less liquid wealth to invest in risky asset market than before and benefit less from risky asset participation. Moreover, when leveraged

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<sup>7</sup>Some studies have focused on the role of housing in influencing households' portfolio choice. See [Grossman and Laroque \(1990\)](#), [Flavin and Yamashita \(2002\)](#), [Cocco \(2005\)](#), and [Yao and Zhang \(2005\)](#).

<sup>8</sup>Stock market participation costs could be one-time or per-period costs. Previous studies by [Basak and Cuoco \(1998\)](#); [Vissing-Jorgensen \(2002\)](#); [Haliassos and Michaelides \(2003\)](#); [Gomes and Michaelides \(2005\)](#); [Alan \(2006\)](#) have suggested that costs can significantly impact stock market participation.

real estate represents a significant background risk, the household's willingness to take on stock market risk is also reduced. Hence, we expect that the risky asset participation rate will remain low after house purchase. As households build up their liquid wealth over time, the risky asset participation rate will likely increase.

We also study the post-house purchase risky asset share of liquid wealth conditional on participation. Here too, a number of theoretical papers guide our empirical test. These papers identify three channels that provide different incentives for households to rebalance their liquid wealth toward more risky or safer positions. First, [Yao and Zhang \(2005\)](#) study how households optimally choose their portfolios of liquid wealth when they also decide whether to rent or own a house using a life-cycle model. When indifferent between owning and renting, the authors show that investors choose substantially different portfolio compositions when owning a house versus when renting a house. When owning a house, investors reduce the equity share in their total wealth (i.e., the sum of bonds, stocks, and home equity), reflecting the substitution effect of home equity for risky stocks, but they hold a higher equity share in their liquid financial portfolio (i.e., bonds and stocks), reflecting the diversification effect. The diversification effect is due to a low correlation between stock and housing returns and the high equity risk premium that makes holding stocks relatively attractive.

Second, [Becker and Shabani \(2010\)](#) explore the debt retirement channel and argue that when households hold mortgage debt after a house purchase, conditional on stock market participation, they should increase the equity share of their liquid wealth. Investing their liquid wealth in stocks allows them to earn a higher expected return than the return on safe assets (i.e., risk-free rate). Otherwise, these households can be better off by using the liquid wealth to pay back the mortgage debt, as retirement of mortgage debt offers households a return equal to the interest rate on their mortgage loan, which is almost always greater than the return to investing in safe assets.

Third, [Fratantoni \(2001\)](#) and [Hu \(2005\)](#) emphasize the importance of liquidity demand. They argue that homeowners with a mortgage face expenditure risk due to committed mortgage payments over a long horizon. When the labor income is uncertain, there is a liquidity concern facing homeowners. Therefore, buying a house has a negative impact on the risky asset share, as bonds provide liquidity to make mortgage payments in case of income shortfalls.

Based on the discussions above, the first two channels suggest that the conditional risky asset share of liquid wealth will immediately increase following a house purchase, while the third channel argues for the opposite.

To summarize, to the extent that households foresee an upcoming house purchase, we expect households accumulate more liquid wealth. Before a house purchase, the stock market participation rate will likely fall, and households reallocate their liquid wealth

from risky assets to safe assets. After a house purchase, liquid wealth is low due to investment in housing, and we expect that the risky asset participation rate remains low. As households build up liquid wealth over time after a house purchase, the risky asset participation rate will gradually increase. Regarding the conditional risky asset share of liquid wealth after a house purchase, economic theory offers three channels through which house purchases can affect the demand for risky assets. However, the net impact is ambiguous. Hence, it is an empirical question to investigate which channel dominates and the overall net impact.

### 3 Data

We exploit administrative panel data from Statistics Denmark that contains the entire Danish population for 11 calendar years throughout the period 2002 - 2012. For each individual, we have access to annual data on demographics, income, as well as asset and debt holdings, which include information on real estates. All these variables are available on December 31 for each year. We then aggregate all the financial variables into “household” level using a family identifier available from Statistics Denmark and use household head’s age, marital status, and highest educational attainment as household characteristics. We choose “household” as opposed to “individual” as our research unit because buying a home and associated housing investment are commonly a shared household decision.

We select a number of demographics and financial characteristics as control variable based on portfolio choice theories (see: [Haliassos and Bertaut \(1995\)](#); [Guiso, Haliassos, and Jappelli \(2002\)](#); [Christiansen, Joensen, and Rangvid \(2008\)](#)): age,  $age^2$ , marital status, number of children<sup>9</sup>, highest education obtained<sup>10</sup>, labor income after tax and deductions, compulsory pension savings, bank loans<sup>11</sup>, net wealth<sup>12</sup>, profit and losses from stock investment. Our goal is to estimate the magnitude and temporal patterns of

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<sup>9</sup>Children include those under 25 who are the child of at least one other person in the household. Furthermore, the person is only counted as a child in the household if he/she does not have children of his/her own and have never been married or in a registered partnership.

<sup>10</sup>Education is defined in categories: 1 denotes lower than primary education; 2 denotes primary education, 9 years of schooling; 3 denotes preparatory courses, 10 years of schooling; 4 denotes upper secondary education, 11 years of schooling; 5 denotes high school and apprenticeship, 12 years of schooling; 6 denotes shorter cycle higher education, 14 years of schooling; 7 denotes vocational bachelor’s education, 15 years of schooling; 8 denotes a bachelor’s degree, 16 years of schooling; 9 denotes a master’s degree, 18 years of schooling; 10 denotes a PhD, 20 years of schooling.

<sup>11</sup>Bank loans include consumer loans and the proportion of a loan for a house which is not covered by mortgage. Maximum lending limits for Danish mortgage are set up for each type of properties and documented in the Act on mortgages and mortgage bonds § 5. For owner-occupied homes, cooperative homes and housing projects, mortgage loans can represent up to 80 percent of the property value. The remaining 20 percent can be borrowed from a commercial bank with a rate that is typically higher than the mortgage rate and lower than the consumer loan rate.

<sup>12</sup>Net wealth includes property value, bank deposits, shares, bonds, and debt in different financial institutions including mortgage and consumer debt. This measure does not include value of cars, boats, cash, and share purchases in cooperative housing.



household portfolio choice of liquid wealth around a house purchase. In particular, the outcome variables we are interested in are: total liquid wealth, risky asset participation, and the risky asset share of liquid wealth. We start out by having 24,638,954 observations for 2,966,014 unique households in the period from 2002 to 2012.

We restrict our sample based on several criteria: (i) We keep only households with head aged between 28 to 59 at the year of house purchase in order to avoid noisy effect of early retirement or being in full-time education on household portfolio choice; (ii) We require the event of “house purchase” to occur during the period 2005 to 2009 to ensure that we have household information in at least 3 years prior to and 3 years after the house purchase. The year of house purchase is defined as the first time “taxable property value” appears greater than zero; (iii) For those who bought houses during the period 2005-2009, we further impose a strict requirement that the households should not own a house in the 3 years leading up to the house purchase year.

After applying these sample selection criteria, the panel is balanced based on the list of covariates and outcome variables. This gives us 44,970 unique households (463,523 observations), i.e., these households bought a house during the period 2005-2009 and have complete information on outcomes and covariates for at least the 7 years around a house purchase (3 years before to 3 years after). The sample of these 463,523 observations is referred to as our main sample.

We select another sample as the “control group”. Since there is no natural control group, we select households who did not purchase a house between the whole sample period 2002-2012. This leaves us 9,404,682 observations or 1,446,908 unique households. We then apply the same age restriction as the main sample, and assign the control group a random house purchase year within 2005-2009. Finally, we keep only observations with information throughout all the 7 relative artificial house purchase years. This gives us 5.15 million observations or 480,304 unique households.

Using register-based data for the whole population eliminates the concern of attrition bias usually present in survey data and ensures that our results do not suffer from sampling error. The large sample size increases the external validity of our results and allows us to perform various sub-sample test while having enough observations in each specification to produce robust inferences. The detailed information available also gives us a broad spectrum of control that captures the background risk to the largest extend. Finally the panel data structure allows us to account for time-invariant unobserved household heterogeneity which is a pervasive problem in cross-sectional analysis.



Table 1: House Purchase from 2005 to 2009

Purchase Year	Frequency	Percentage	Cumulative Frequency
2005	12,495	27.79	27.79
2006	9,834	21.87	49.65
2007	9,171	20.39	70.05
2008	7,332	16.30	86.35
2009	6,138	13.65	100.00
Total	44,970	100.00	

Table 1 shows the number of households who bought a house during the period 2005 to 2009 in our main sample. About 28% of our sample households bought a house in 2005, and the percentage gradually decreases along the five year period. This trend is consistent with aggregate level data provided by Statistics Denmark.<sup>13</sup>

Table 2 presents summary statistics for the main sample in a representative year 2010 and in 3 years before/after a house purchase, where T represents the year of house purchase. The riskiness of household portfolio is measured by the ratio of the market value of stocks and risky mutual fund investments at year end to liquid wealth (i.e., the risky asset share).

The average household in our main sample in 2010 is: 41 years old, has 12-14 years of schooling, household labor income is DKK 529,842, has DKK 389,831 bank loans outstanding, household net wealth is DKK 22,918, makes a profit of DKK 2,259 in stock investment, owns liquid wealth of DKK 194,961, of which DKK 31,870 is risky. 32.12% of our main sample households are stock holders in 2010. Among those who participate in stock markets, on average 26.32% of their liquid wealth is invested in risky asset.

From 3 years before to 3 years after a house purchase, households have more children on average, receive higher labor income, accumulate higher net wealth and more pension. More households become married. Bank loans increased 106% from T-1 to T, indicating that households, on top of their mortgages, often borrow from banks to buy a house, as mortgages can represent only up to 80% of the property value at the time of purchase. The summary statistics also show that households' liquid wealth (i.e., financial asset) continuously increases before a house purchase. The average liquid wealth falls at the year of house purchase and only starts to recover 3 years after. Safe assets follow the same pattern. Households tend to reduce the riskiness of their liquid portfolio before a house purchase. On average, the share of risky asset reaches its lowest point at 1 year before the house purchase and jumps immediately after the house purchase. This is the case for both conditional and unconditional risky asset shares. There seems no clear pattern of stock market participation rate around house purchase. On average, risky asset participation stays rather stable with a slight increase during the 7-year period.

<sup>13</sup>See variable "Sales of real property (EJEN88)."

Table 2: Summary Statistics: Main Sample

	2010	T-3	T-2	T-1	T	T+1	T+2	T+3
<b>Demographics:</b>								
Age	40.99 (8.35)	34.65 (8.25)	35.64 (8.25)	36.64 (8.25)	37.64 (8.25)	38.64 (8.25)	39.64 (8.25)	40.64 (8.25)
Married	55% (50%)	36% (48%)	39% (49%)	42% (49%)	46% (50%)	50% (50%)	53% (50%)	55% (50%)
Education	5.75 (2.34)	5.25 (2.48)	5.40 (2.45)	5.52 (2.42)	5.61 (2.39)	5.67 (2.37)	5.72 (2.35)	5.75 (2.34)
Number of Children	1.13 (1.12)	0.74 (1.01)	0.80 (1.02)	0.88 (1.04)	0.95 (1.05)	1.02 (1.07)	1.07 (1.09)	1.12 (1.11)
<b>Income &amp; Debt:</b>								
Compulsory Pension Contribution	11,630.72 (43416)	6,498.38 (24588.59)	6,677.79 (27432.58)	6,732.14 (30601.28)	7,936.41 (34172.36)	8,808.13 (36770.08)	9,792.45 (39218.89)	10,943.53 (41910.05)
Labor Income	529,842.10 (342381.5)	340,389.30 (227180.5)	374,448.10 (236013.6)	418,312.80 (249066.5)	459,972.20 (262773.9)	487,715.40 (283612.8)	508,204.70 (306069)	521,360.20 (329182.8)
Bank Loans	389,831.10 (766759.2)	153,206.00 (273523.5)	165,205.50 (334595.3)	200,198.10 (416786.3)	412,033.00 (627708.7)	405,341.50 (911305.2)	400,279.50 (913148.6)	386,757.40 (691970.6)
Net Wealth	22,918.08 (1372024)	-32,370.88 (510498.1)	-17,544.32 (603787.8)	-79,354.88 (837695.3)	132,572.10 (1321940)	161,257.70 (1400118)	197,634.90 (1419992)	143,108.90 (1336426)
Stock Income	2,259.46 (77079.53)	1,129.25 (93661.84)	1,277.56 (49762.27)	1,513.24 (53686.61)	2,126.37 (59976.83)	1,780.26 (53892.19)	2,195.05 (76801.54)	1,889.78 (64085.95)
<b>Outcomes:</b>								
Financial Asset	194,961.10 (507155.2)	128,435.70 (337166.1)	154,712.40 (420564.5)	202,516.20 (524832.3)	177,167.30 (778585)	176,009.00 (1037932)	177,679.20 (738956.6)	182,442.70 (488786.6)
Risky Asset	31,870.21 (180025.2)	18,161.31 (132103.7)	24,286.03 (186002.6)	27,402.12 (216725.8)	28,694.61 (339990)	29,709.01 (319846.7)	27,165.21 (221680.1)	27,088.95 (168433.4)
Safe Asset	163,090.90 (425158.9)	110,274.30 (273029.8)	130,426.40 (322906.7)	175,114.10 (411083.5)	148,472.70 (513074.9)	146,300.00 (761275.6)	150,514.00 (578804.6)	155,353.70 (415597.3)
Stockshare % (unconditional)	8.58 (20.01)	7.63 (18.59)	8.26 (19.33)	7.98 (18.93)	8.54 (19.79)	9.10 (20.76)	8.67 (20.25)	8.08 (19.49)
Stockshare % (conditional)	26.32 (27.58)	25.87 (26.47)	27.27 (26.74)	25.71 (26.43)	27.79 (27.19)	28.83 (28.23)	27.06 (27.98)	25.03 (27.43)
Stock Market Participation Rate	32.12% (46.69%)	28.83% (45.30%)	29.68% (45.68%)	30.54% (46.06%)	30.33% (45.97%)	31.05% (46.27%)	31.50% (46.45%)	31.75% (46.55%)

Note: This Table reports summary statistics (mean value) based on our main sample of 463,523 observations (44,970 unique households). Column 1 reports the summary statistics in the base year of our regressions 2010. T represents the year of house purchase. Column 2-8 show the summary statistics for a 7-year period before and after house purchase, from 3 years before to 3 years after, respectively. Where applicable, values are in Danish Kroner (DKK) and measured at the end of each year. Standard deviation in parentheses.

## 4 Empirical strategy

In this paper, we estimate the magnitude and temporal patterns of household portfolio choice before and after a house purchase. We use two empirical strategies to address this issue.<sup>14</sup>

### 4.1 Main Empirical Strategy

We adopt a similar approach from the job loss literature (Jacobson, LaLonde, and Sullivan, 1993; Davis and von Wachter, 2011; Basten, Fagereng, and Telle, 2016). The empirical strategy is illustrated by the following specification:

$$Y_{it} = \eta_i + \gamma_t + \sum_{k=-3}^{k \leq 3} \delta_k D_{it}^k + \beta X_{it} + \varepsilon_{it}. \quad (1)$$

where dependent variable  $Y_{it}$  is a particular outcome for household  $i$  in year  $t$ . The outcomes we focus on in this paper are liquid wealth, the risky asset participation status, and the share of risky asset in liquid wealth. Equation 1 includes a vector of dummies for seven relative years around the year of house purchase:  $D_{it}^k = \{D_{it}^{-3}, D_{it}^{-2}, D_{it}^{-1}, D_{it}^0, D_{it}^1, D_{it}^2, D_{it}^3\}$ , where the relative year zero is the year of house purchase. Let  $D_{it}^k = 1$  if year  $t$  is  $k$  years relative to the house purchase year.<sup>15</sup>  $X_{it}$  contains a broad spectrum of controls on households' demographics and financial characteristics: household head's age,  $age^2$ , marital status, highest education attainment, number of children, household's total labor income after tax and deductions, compulsory pension savings, bank loans and net wealth. We also control for household fixed effects ( $\eta_i$ ) and calendar year fixed effects ( $\gamma_t$ ).<sup>16</sup> This means that time-invariant household heterogeneity and aggregate calendar-year variation

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<sup>14</sup>Another intuitive method is to match households who have similar demographic and financial characteristics and did not purchase a house during 2005 - 2009 with the main sample. Then, the differences in portfolio choice between the two otherwise similar groups will be the effect of house purchase. However, the nature of our research topic violates an important assumption of propensity matching method, which is that the treatment (house-purchaser vs. non house-purchaser) has to be exogenous to the outcome (household portfolio choice). For similar reasons, difference-in-difference method will not work in our setting neither. The standard regression DID model relies on a common trends assumption for causal interpretations. In other words, it assumes that portfolio outcomes for treatment group would have developed on a parallel path as the control group had they not bought the house. A key challenge of implementing DID method to this study is that house purchase is an anticipated decision. The pre-house-purchase evolution in portfolio outcomes between the two groups is likely to be unparallelled. The nonparallel evolution in portfolio outcomes of the treatment and control groups is confirmed in Section 5.2. In this case, the resulting DID estimates would be spurious.

<sup>15</sup>For example, when  $k = -2$ ,  $D_{it}^{-2} = 1$  means year  $t$  is 2 years before household  $i$  bought a house; and when  $k = 3$ ,  $D_{it}^3 = 1$  means year  $t$  is 3 years after household  $i$  bought a house.

<sup>16</sup>Our empirical strategy has significant advantage compared to cross-sectional regression. For example, some may be concerned that the households who bought a house when prices surged during 2005 to 2007 might be fundamentally different from those who bought a house when prices fell (2008 and 2009). The two groups could have different levels of risk aversion. Or, there might exist some common factors that affect both the timing of households' house purchase and their portfolio choices. Our strategy directly accounts for the selection effects and produces unbiased results and robust inferences.

(i.e., macroeconomic condition such as interest rate, stock market return, mortgage regulation), which may potentially affect both the timing of house purchase and household portfolio decisions, will not bias our result.  $\delta_k$  are our parameters of interest, which describe the time path of portfolio choice outcome from 3 years before to 3 years after a house purchase.  $\varepsilon_{it}$  is an idiosyncratic error term. The observations are assumed to be independent across households but not necessarily across time.

For the risky asset market participation decision (the extensive margin), we adopt a fixed effect Logit model. Let  $y^*$  be a latent variable that represents households' net utility of holding risky asset. Assume  $y^*$  is determined by  $y^* = \eta_i + \gamma_t + \sum_{k=-3}^{k=3} \delta_k D_{it}^k + \beta X_{it} + \varepsilon_{it}$ .  $y^*$  is not observed. However, we observe  $Y$  for each household at each time period as a choice people make according to the rule  $Y = 1$  if  $y^* > 0$  and  $Y = 0$  if  $y^* \leq 0$ . Then the probability that a positive holding choice is made is illustrated by the following functional form:

$$Pr(Y_{it} = 1|Z) = F(\eta_i + \gamma_t + \sum_{k=-3}^{k=3} \delta_k D_{it}^k + \beta X_{it}) \quad (2)$$

where  $Y_{it}$  denotes a binary variable indicating whether or not a household holds risky assets.  $Z$  is a vector of dependent variables that include seven relative year dummies around house purchase, control variables and fixed effects.  $F(\cdot)$  is the cumulative logistic distribution function.  $\varepsilon_{it}$  is assumed to follow a logistic distribution. We allow a household's behavior to be correlated through time, therefore report cluster-robust standard errors. Maximum likelihood estimation is then used to estimate the parameters of interest.

For liquid wealth and the risky asset share (the intensive margin), Equation 1 is estimated using a panel data two-way (household-calendar year) fixed-effects model with cluster-robust standard errors, clustering at household level. Households' behavior is assumed to be independent from each other, but correlated through time. The results should be interpreted as the development of household decisions over time instead of differences in decisions across households. Additionally, when estimating the risky asset share, we add one more covariate, profit and losses from stock investment at year end, to  $X_{it}$ . In doing so, we attempt to isolate the change in risky asset share that is driven by active rebalancing of the portfolio instead of pure market movements. Finally, to shed light on the reliability of our empirical strategy, we will repeat our analyses by looking at households by wealth, age, family disposable income, and regions, respectively.

## 4.2 Randomly Assign Artificial House Purchase Year to Control Group Sample

Although we have included a rich set of control variables in our main empirical strategy, concerns may still remain as to whether our results are driven by macroeconomic trends or

whether the sample selection criteria induce any spurious pattern in the data. To address these concerns, our second empirical strategy is to consider a control group households subjected to exactly the same criteria as our main sample but who do not buy a house throughout the entire sample period 2002–2012.

The control group households consists of both homeowners (i.e., those have owned a house since 2002) and non-homeowners. Since none of these households bought a house throughout the entire sample period 2002–2012, we randomly assign an artificial house purchase year (in 2005–2009) to each of the control group households. We then merge these households with our main sample. As households in the control group did not actually buy houses in 2002–2012, we have no reason to expect any significant pattern of household portfolio choices around the randomly assigned house purchase year. If this is the case, and we simultaneously find clear patterns of household portfolios related to the actual house purchase, it would present further evidence on the relationship between house purchase and portfolio choice of liquid wealth. We run the following regression:

$$Y_{it} = \eta_i + \gamma_t + \sum_{j=0}^{j=1} \sum_{k \geq -3}^{k \leq 3} \delta_{kj} \tau_j D_{it}^k + \beta X_{it} + \varepsilon_{it}. \quad (3)$$

Equation 3 estimates the magnitude and temporal patterns of household liquid portfolio choice around the artificially assigned house purchase year and actual home purchase year. Let  $\tau_0$  be a dummy for the control group (i.e.,  $\tau_0 = 1$  for the control group) and  $\tau_1$  be a dummy for the main sample (i.e.,  $\tau_1 = 1$  for the main sample).  $\delta_{k0}$  is the first column of a 7 by 2 matrix that contains the parameters which measure the effect of artificially assigned house purchase years on portfolio outcomes. And  $\delta_{k1}$  is the second column of that matrix that contains the parameters which capture the effect of actual house purchase years on portfolio outcomes. For the extensive margin,  $Y_{it}$  is a binary variable indicating whether or not the household is a stockholder. We estimate this equation using a logistic regression with cluster-robust standard errors. For liquid wealth and the intensive margin (the risky asset share), a two-way (household-calendar year) fixed effect model with cluster-robust standard error is implemented as in our first empirical strategy. We expect the magnitude and temporal patterns of household portfolio outcomes to hold for those who actually bought a house during 2005 - 2009, while we should not observe any systematic relation between portfolio outcomes and the artificial house purchase year.

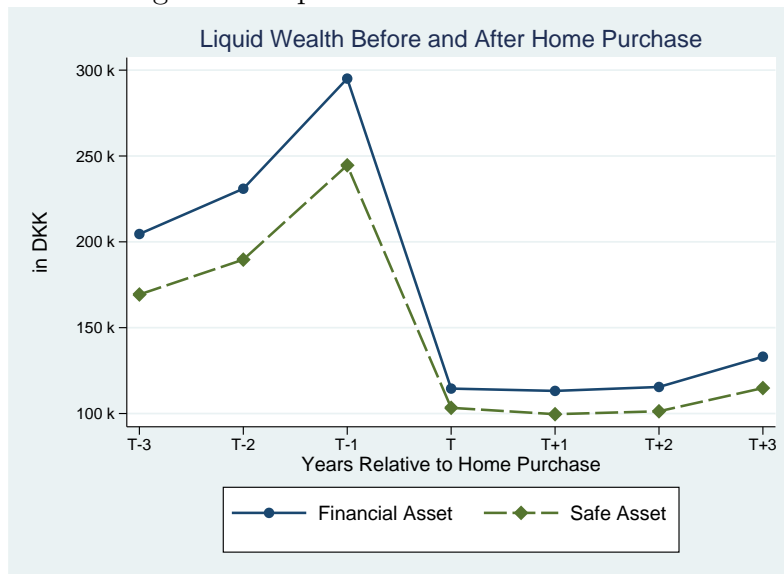
## 5 Results

In this section, we report our findings for the two empirical strategies. We also perform robustness checks to test the validity of our estimations.

## 5.1 Results from the Main Empirical Strategy

We focus on the development of liquid wealth, the risky asset participation rate, and the risky asset share of liquid wealth around a house purchase.<sup>17</sup> Not surprisingly, households accumulate more liquid wealth before a house purchase. Figure 1 shows that Danish households on average hold DKK 204,558 (about USD 37,000 or EUR 28,000) in liquid wealth 3 years prior to a house purchase. Liquid wealth keeps increasing and reaches its highest level of DKK 295,082 (about USD 53,000 or EUR 40,000) one year before house purchase. There is a sharp decline in liquid wealth at the year of house purchase. We estimate the magnitude of the decline to be DKK 180,549 (about USD 32,000 or EUR 24,000), which accounts for 61.19% of the liquid wealth 1 year before the house purchase. Liquid wealth stays at a low level for the next two years following the house purchase and only starts to increase 3 years later. By the end of the third year after a house purchase, liquid wealth is DKK 18,589 higher than that at the end of the house purchase year, a 16.23% increase.

Figure 1: Liquid Wealth and Safe Assets



### 5.1.1 Extensive Margin

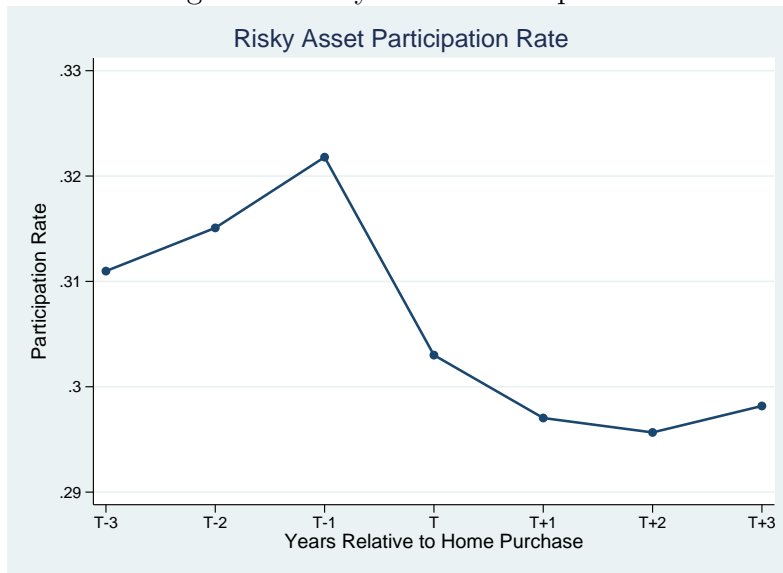
Figure 2 shows the risky asset participation rate before and after house purchases. The pattern of risky asset participation around a house purchase follows a similar pattern of liquid wealth accumulation. Before house purchase, the risky asset participation rate increases about 1 percentage point in two years from T-3 to T-1. At the year of house purchase, the risky asset participation rate falls by 2 percentage points, which is statisti-

<sup>17</sup>Tables 3 and 5 in the Appendix show the corresponding predicted outcome from regressions for liquid wealth (Figure 1), the participation rate (Figure 2), and the risky asset share (Figure 3). Table 4 in the Appendix shows the regression coefficients.

cally significant at the 1% level and represents a 6.2% decline relative to the participation rate 1 year before house purchase. Households use a significant portion of their liquid wealth as down payment when buying a house. Our finding that the risky asset participation rate decreases at the year of house purchase provides strong evidence that housing investments have induced households to withdraw funds from the risky asset market.

After house purchase, the risky asset participation rate falls another 0.7 percentage points in the next 2 years. As households hold very low liquid wealth immediately after a house purchase, we suspect the further decline in the participation rate is related to the liquidity demand facing some households. We will test whether the pattern of risky asset participation differs by wealth level and income groups in the section of robustness check. In 3 years after house purchases, participation in the risky asset market starts to increase.

Figure 2: Risky Asset Participation

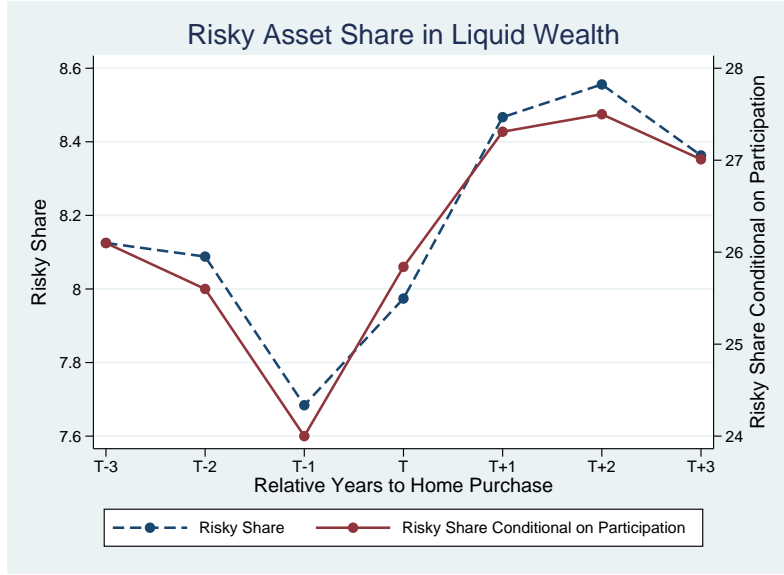


### 5.1.2 Intensive Margin

For the intensive margin, Figure 3 shows the temporal pattern of the risky asset share of liquid wealth before and after a house purchase. Both conditional and unconditional on stock market participation, households rebalance their portfolios of liquid wealth from risky to safe assets before a house purchase, which is consistent with the theoretical prediction that investors become more risk averse when facing borrowing constraints (Paxson, 1990; Grossman and Vila, 1992; Teplá, 2000). Conditional on participation, the risky asset share falls 2.1 percentage points from 3 year before (26.10%) to 1 year before house purchase (24.0%), which is an 8% decline.



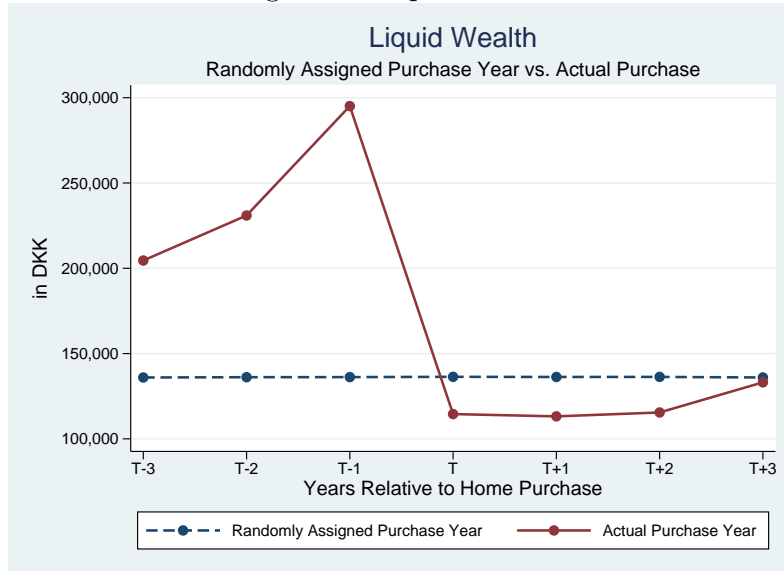
Figure 3: Risky Asset Share



There are three theoretical arguments about the risky asset share of liquid wealth conditional on stock market participation after a house purchase: the diversification effect (Yao and Zhang, 2005), the debt retirement channel (Becker and Shabani, 2010), and the liquidity demand hypothesis (Fratantoni, 2001; Hu, 2005). The first two channels predict that the conditional risky asset share will immediately increase following a house purchase, whereas the third channel suggests a decrease. We are not able to estimate the effect of each channel separately. However, our results suggest a strong dominating effect for the first two channels. The conditional risky asset share jumps from 24.0% one year before house purchase to 25.8% at the year of house purchase. The jump is statistically significant at 1% level. Households' risky asset share continues to increase in the next 2 years following the house purchase. Overall, the conditional risky asset share is 3.3 percentage points higher 2 years after house purchase than 1 year before house purchase, a 13.8% increase.

## 5.2 Result for Randomly Assigned Artificial House Purchase Year

Figure 4: Liquid Wealth



In this section, we report the results from the second empirical strategy.<sup>18</sup> By randomly assigning an artificial house purchase year to households who did not purchase a house, we intend to address the potential bias caused by sample selection criteria or macroeconomic trends in our analysis.

As shown in Figure 4, households accumulate liquid wealth before actual house purchase. They use a large portion of it to finance down payments at the year of actual purchase, and then slowly save up after the purchase. Thus, the result from the main sample remains the same. On the other hand, we do not observe any notable change in liquid wealth before and after the artificial house purchase year. Households' liquid wealth stabilizes around DKK 136,000 for the control group sample. Note that households in the control group sample have significantly less liquid wealth compared to those in the main sample during pre-house-purchase period, but they have higher liquid wealth in the few years immediately after house purchase.

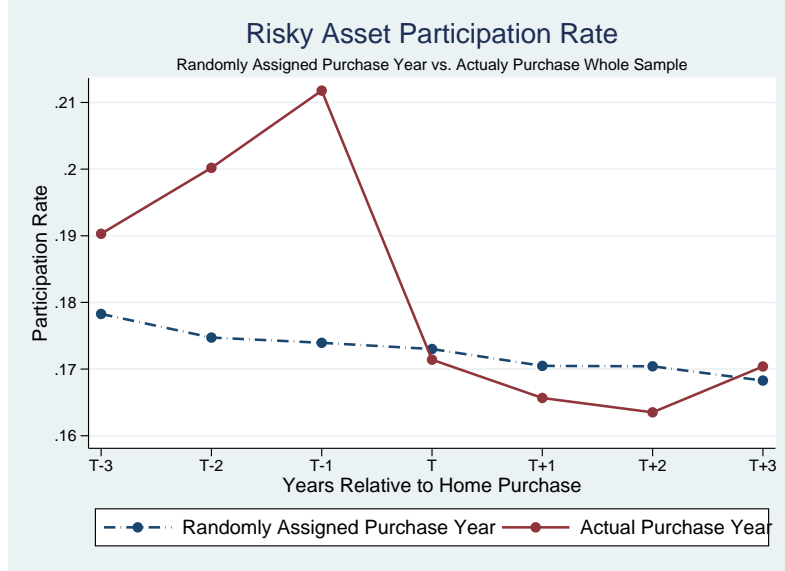
### 5.2.1 Extensive Margin

Figure 5 shows the temporal pattern of risky asset participation rates before and after a house purchase for the main sample (with actual house purchase year) and the control group sample (with artificial house purchase year). We observe the same pattern and magnitude of participation decision for households who actually bought a house during 2005

<sup>18</sup>Table 6 in the Appendix shows the corresponding regression coefficients for liquid wealth (Figure 4), participation rate (Figure 5), and risky asset share (Figure 6).

- 2009. However, there is no significant relationship between the artificial house purchase year and the development of the risky asset participation decision. The participation rate hovers around 17.3% for the control group sample.

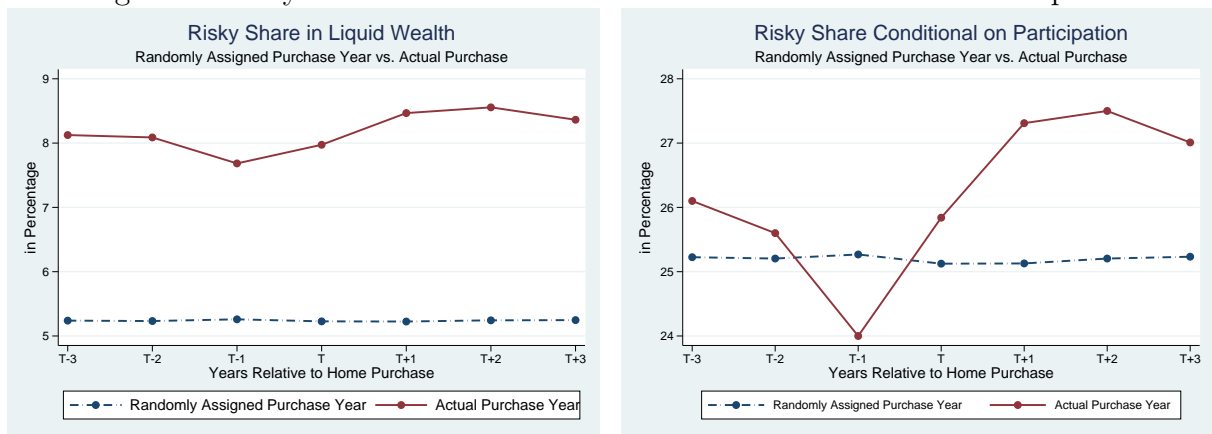
Figure 5: Risky Asset Participation Rate



### 5.2.2 Intensive Margin

Figure 6 reports the time path of the risky asset share before and after the actual and artificial house purchase year. The time path of both conditional and unconditional risky asset share around actual house purchase year remains the same as reported in the main results. Again, for our control group sample, we do not observe any systematic relationship between the risky asset share and the artificial house purchase. For example, conditional on participation, the risky asset share is around 25.2% before and after the artificial house purchase year.

Figure 6: Risky Asset Share: Unconditional vs. Conditional on Participation



Overall, we find no significant correlations between household portfolios and the artificial house purchase year, while temporal patterns of household portfolio outcomes for those who actually bought a home during 2005-2009 remain unchanged. This finding suggests that concerns about macroeconomic trends or sample selection criteria do not bias our results.

### 5.3 Robustness Check

This section conducts robustness checks for our main empirical strategy. We address concerns over wealth (more financially constrained households versus wealthier households), life-cycle stage, labor income, and macroeconomic conditions in different regions, respectively. Moreover, we test our results for two groups of households in particular: those who experienced large capital gains and those who experienced capital losses.

#### 5.3.1 By Wealth

In the main empirical strategy, we control for the level of wealth by including the household net wealth reported at the year end by Statistics Denmark in the two-way fixed effect model or by including the log transformed value in the logistic regression as a control variable. In order to compare the more financially constrained households (i.e., the poor households) with wealthier households, we split the population by the median value of household net wealth and estimate the two-way fixed effect model and logistic model on two sub-samples.

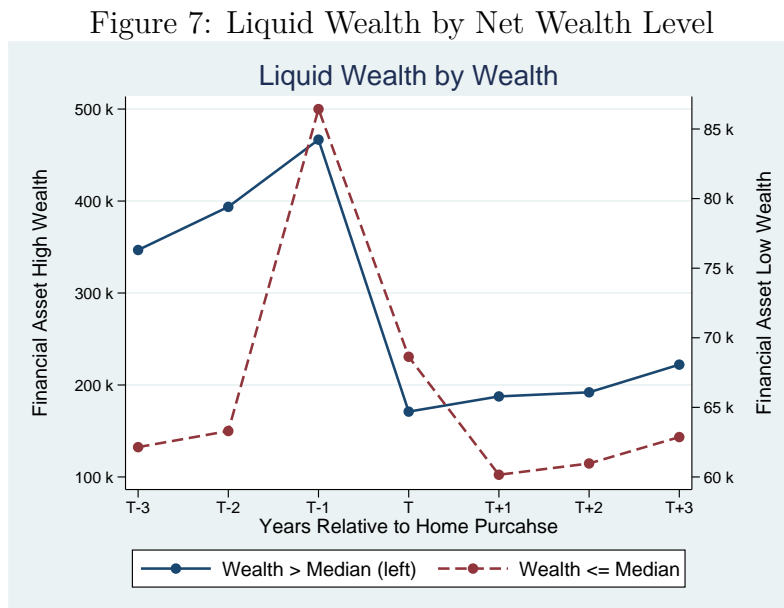


Figure 7 shows a big gap in terms of liquid wealth for these two sub-samples (DKK 86,500 vs. DKK 470,000 in 1 year before house purchase). Although the overall pattern

of liquid wealth accumulation around house purchase year is similar, there is one key difference. Liquid wealth dropped further 1 year after house purchase for the low-wealth households, while it started to increase for the high-wealth households. This suggests that liquidity issue is a bigger concern facing the low-wealth households after buying a house, which could affect their portfolio choice as discussed next.

Figure 8: Risky Asset Participation by Net Wealth Level

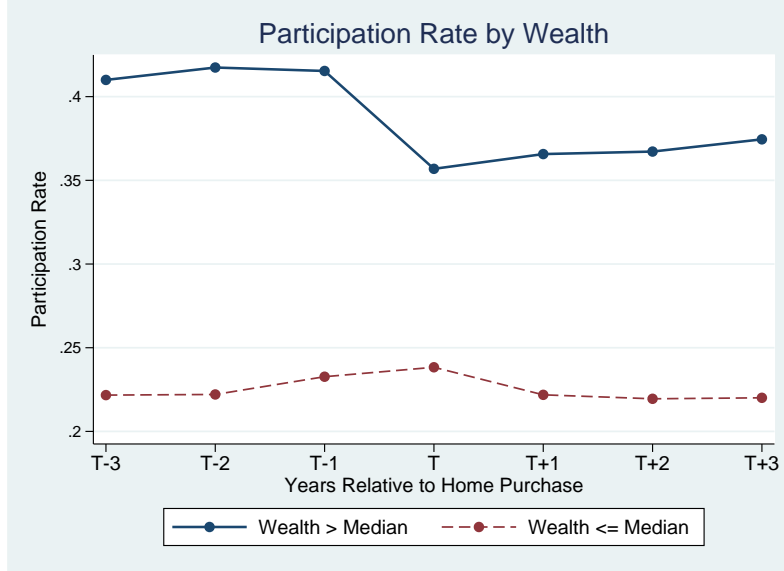
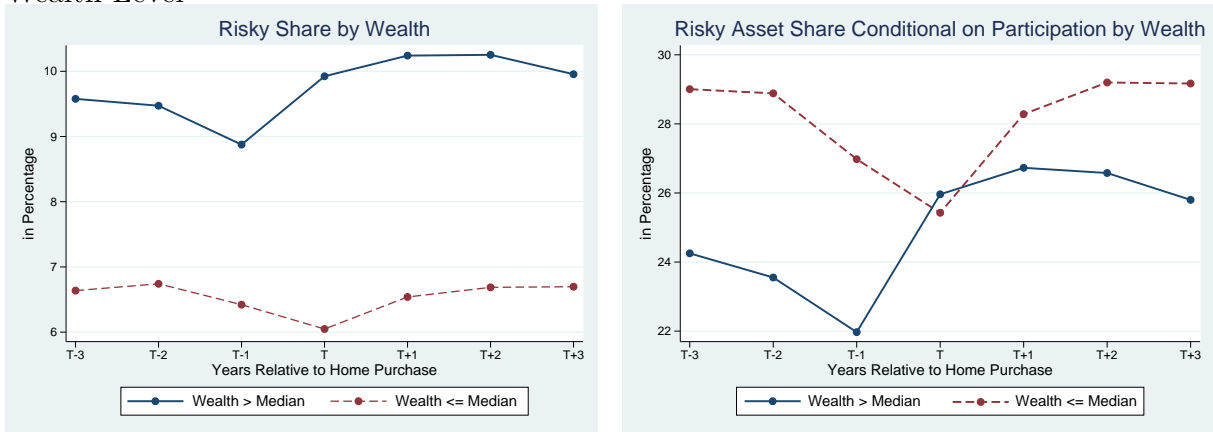


Figure 9: Risky Asset Share: Unconditional vs. Conditional on Participation by Net Wealth Level



For wealthier households, the risky asset participation rate stays relatively flat before a house purchase, and it falls 5.85 percentage points at the year of purchase (Figure 8). On the other hand, for the low-wealth households, the risky asset participation rate increased slightly before a house purchase, and it further increased at the year of house purchase. This suggests that instead of becoming more risk averse, a small portion of low-wealth households in our main sample is actually taking on more stock market risk immediately

before and during the period of buying a house. In doing so, these households might be hoping to earn higher returns from stock market to relax their borrowing constraints. This behavior likely reflects a channel suggested by [Chetty and Szeidl \(2007\)](#) that housing commitment affects risk preferences. For some low-wealth households, housing commitment creates an incentive to take bets that have large payoffs by participating in risky investment (i.e., similar to buying a lottery ticket). The analysis also provides evidence for the finding in [Figure 2](#) that the big drop in the overall participation rate in house purchase year is driven by the high-wealth households.

[Figure 9](#) presents the risky asset share of liquid wealth conditional and unconditional on participation by wealth level. The pattern of the conditional risky asset share around a house purchase for the high-wealth households is similar to the overall result reported in [Figure 3](#). In particular, there is a jump for the conditional risky asset share at the house purchase year. However, for the low-wealth households, the conditional risky share of liquid wealth dropped at the year of house purchase. This may suggest that the liquidity demand is indeed a big concern for the low-wealth households, resulting in a lower risky asset share as in [Fratantoni \(2001\)](#) and [Hu \(2005\)](#).

### 5.3.2 By Age

Life-cycle consideration is an important determinant for household portfolio choice, and it is well studied in the literature (e.g., [Cocco, Gomes, and Maenhout \(2005\)](#)). Age and  $age^2$  are included in our main analysis as control variables. In order to make a comparison between household portfolio choice around a house purchase for different age groups, we split the sample into three sub-groups: households aged 28 to 38, 39 to 48, and finally 49 to 59. We have 238,519 observations in the youngest group, 122,661 observations in the middle-age group, and 63,057 observations in the age group of 49 to 59.

Figure 10: Liquid Wealth by Age

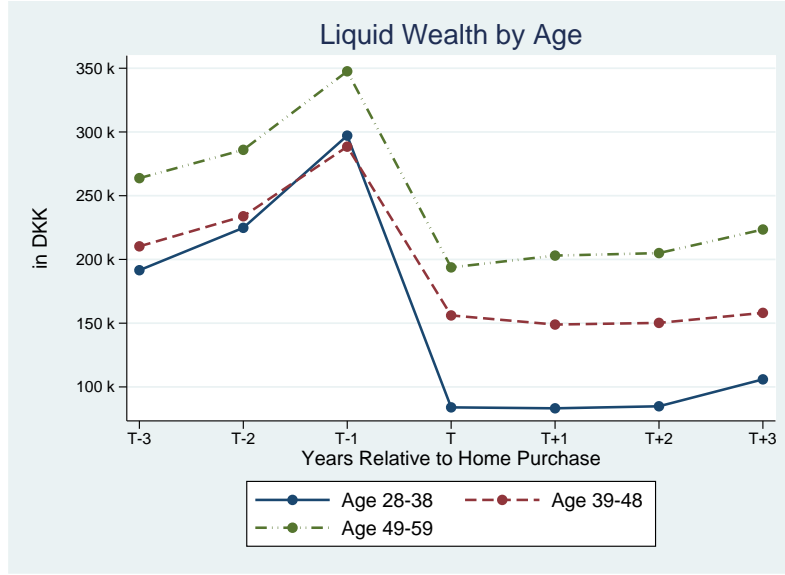
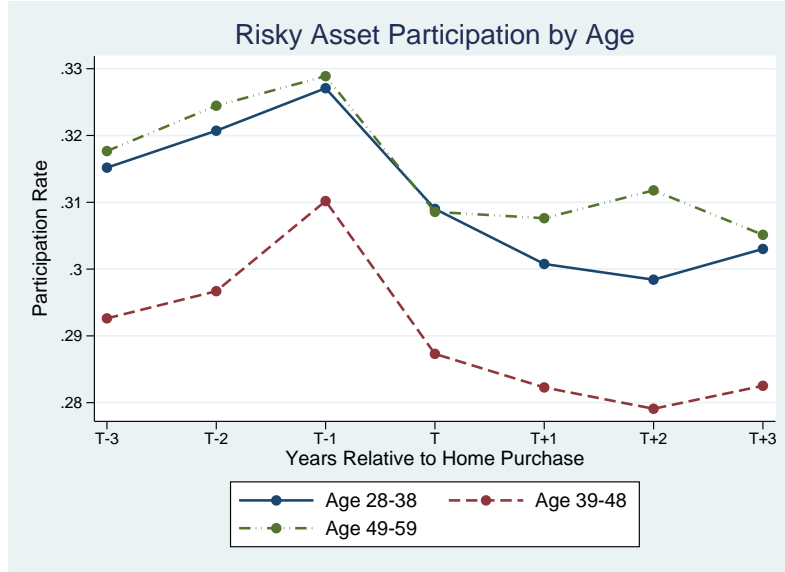


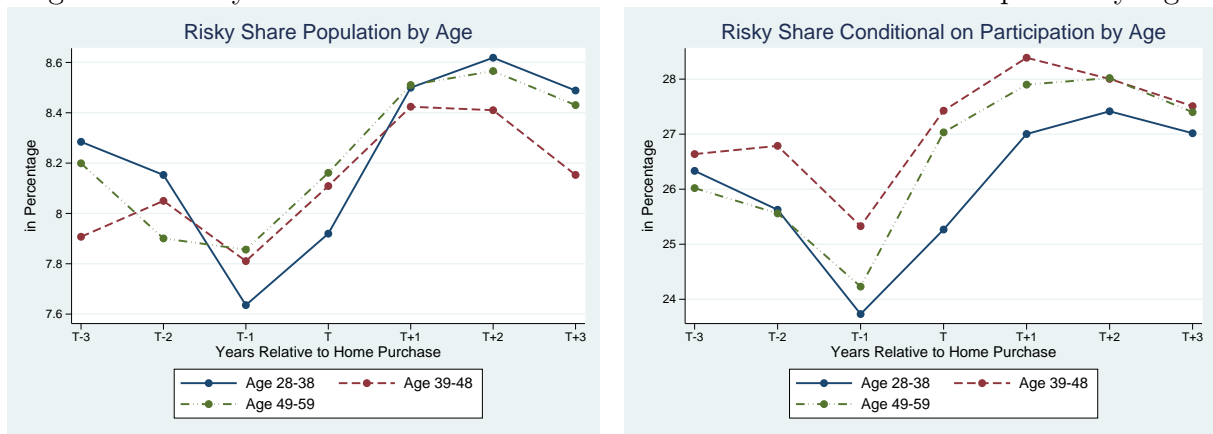
Figure 11: Risky Asset Participation by Age



As expected, older households have higher savings than the other two groups, but the patterns of liquid wealth accumulation around house purchases are similar for all the three sub-groups (Figure 10). Figure 11 and 12 show the time path for the risky asset participation and the risky asset share, respectively. Overall, the temporal patterns of household portfolio outcomes for different age groups remain the same as in the main sample. Thus, age consideration does not change our results.



Figure 12: Risky Asset Share: Unconditional vs. Conditional on Participation by Age



### 5.3.3 By Income

After buying a house, households are subject to the committed housing expenditure risk. Liquidity demand may be a concern for homeowners. As income is closely linked to liquidity, we compare the time path of portfolio choice outcomes around a house purchase among different income groups. The main sample is divided into four sub-groups by income quartile.

Figure 13: Liquid Wealth by Income

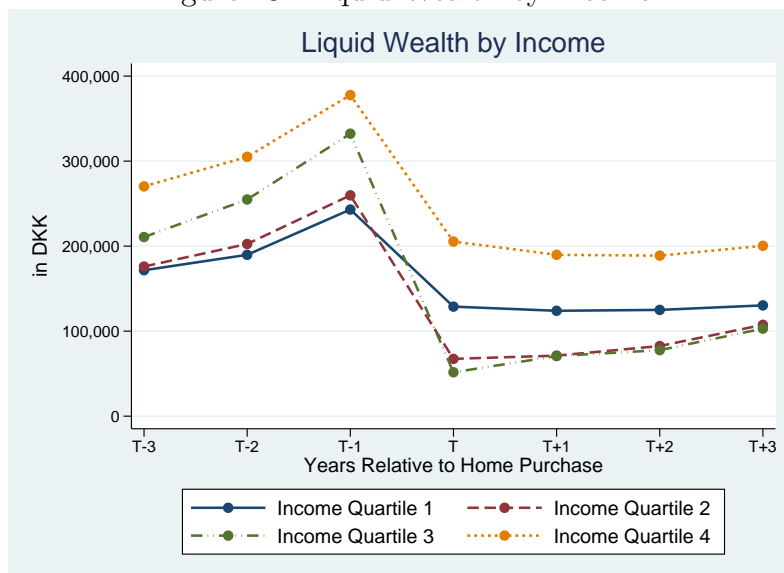


Figure 14: Risky Asset Participation by Income

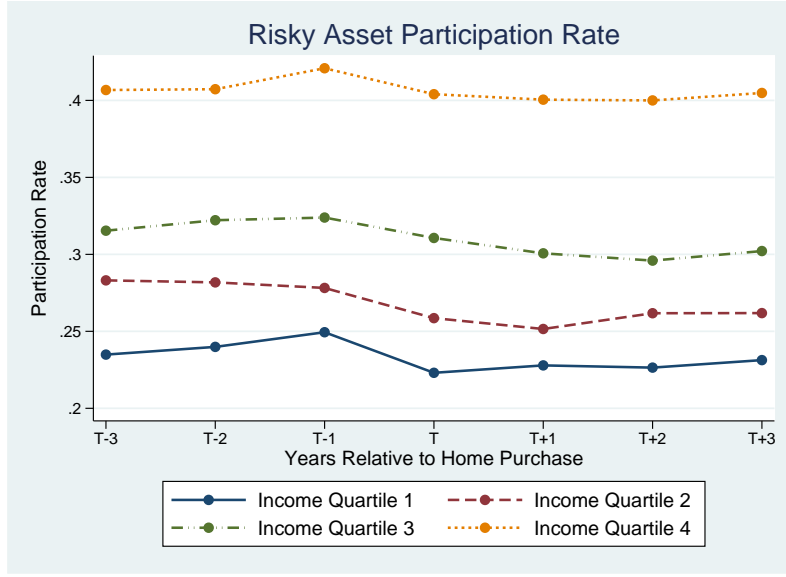


Figure 15: Risky Share Population vs. Conditional on Participation by Income

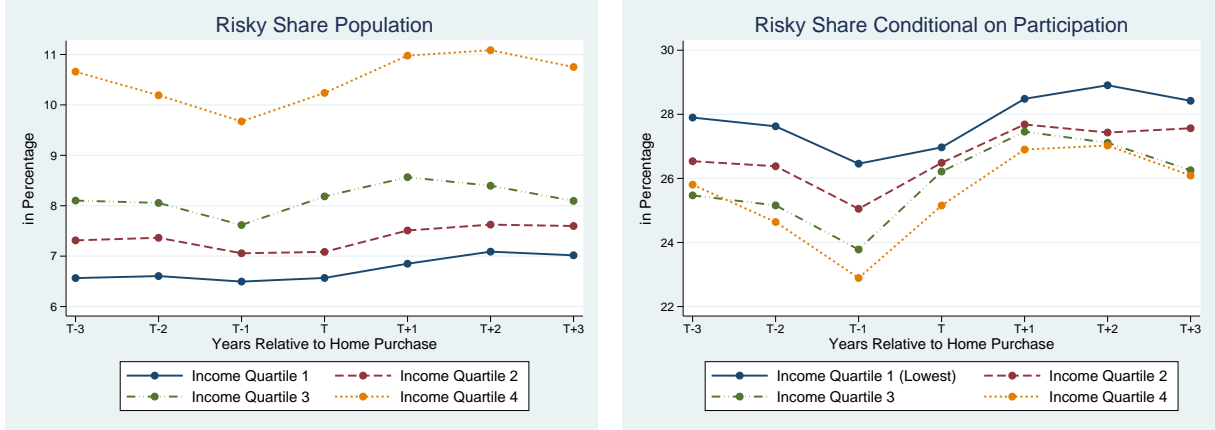


Figure 13 shows the liquid wealth around the year of house purchase by income groups, while Figure 14 and Figure 15 show the risky asset participation and the risky asset share, respectively. The patterns are similar to what we find for the main sample. For example, the risky asset participation rate drops for all income groups in the year of house purchase. Both low-income and high-income households increase their risky asset share after house purchase, confirming a dominating effect from the diversification and the debt retirement channels over liquidity demand as in the main sample.

### 5.3.4 By Region

We compare the development of household portfolio outcomes among different regions, as different demographics and socio-economic environment in each region may influence households' portfolio choice of liquid wealth and house purchase decisions.

Figures 16, 17 and 18 show the temporal patterns for liquid wealth, the risky asset participation, and the risky asset share of liquid wealth by region, respectively. The patterns in each region are not significantly different from the patterns we reported in the main results.

Figure 16: Liquid Wealth by Region

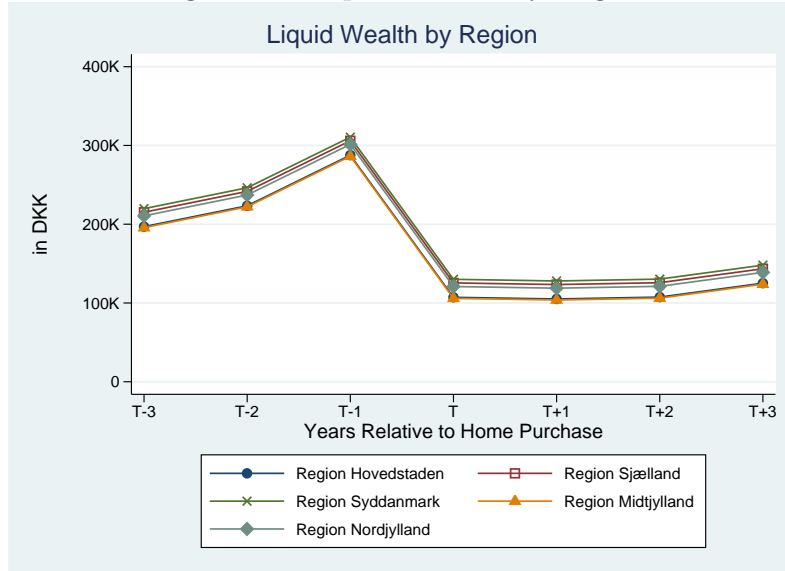


Figure 17: Risky Asset Participation by Region

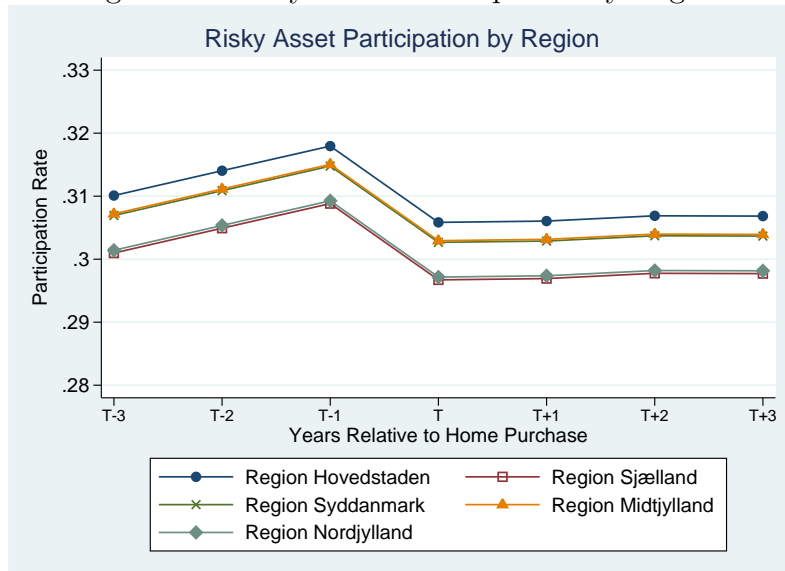
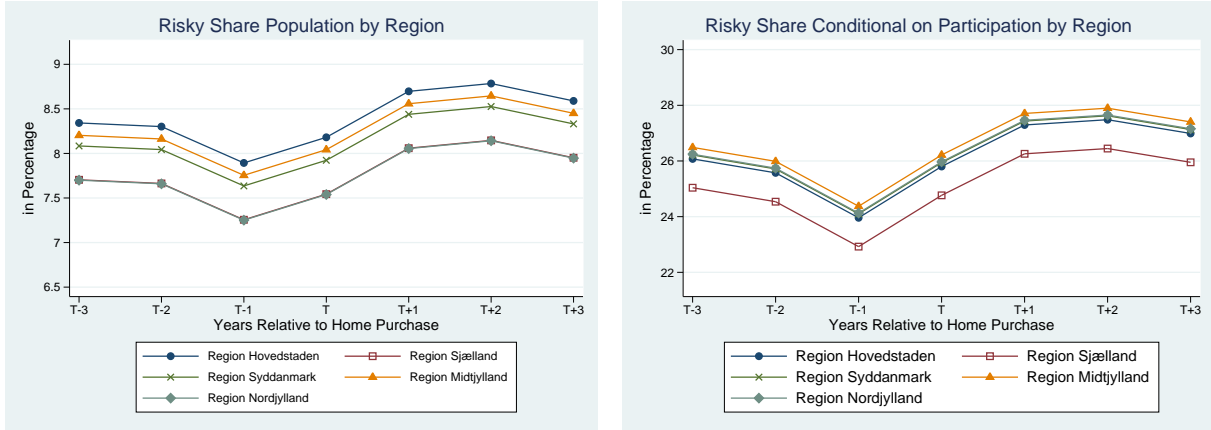


Figure 18: Risky Asset Share: Unconditional vs. Conditional on Participation by Region



### 5.3.5 Capital Gain/Losses

Finally, we address the concern that households' risky investment return may affect their house purchase decision/timing, then in turn affect their liquid wealth accumulation pattern and financial investment decision around the house purchase event. Households who have experienced large capital gains from the stock market may be able to buy a house early and/or finance their down payment with the risky investment return. On the other hand, those who have experienced capital losses may have to postpone buying a house and reduce risky asset holdings. We then test our main findings for these two particular types of households. Again, we find robust evidence on the same temporal pattern of liquid wealth accumulation and investment in risky financial assets over the 7-year period around house purchase.

Figure 19: Liquid Wealth for 2 Types of HHs

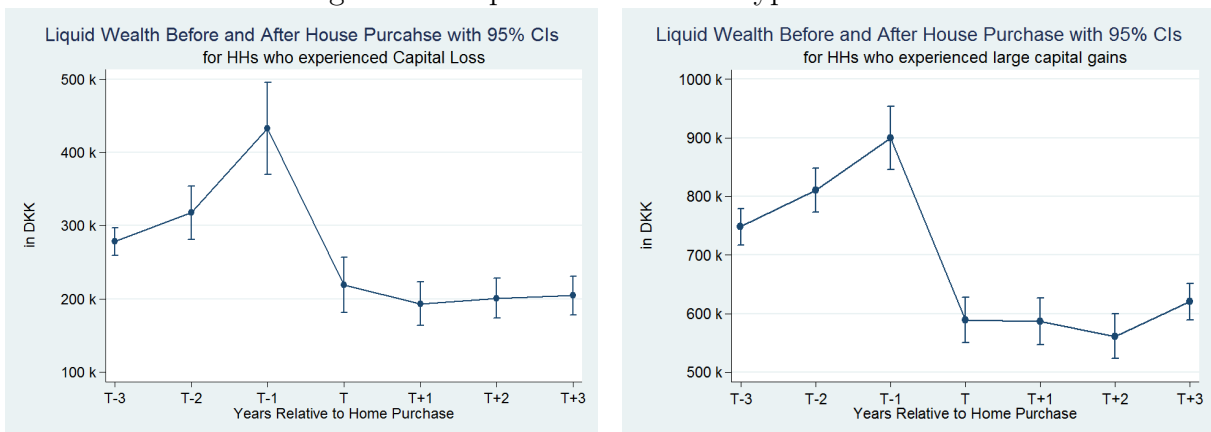


Figure 20: Risky Asset Participation for 2 Types of HHs

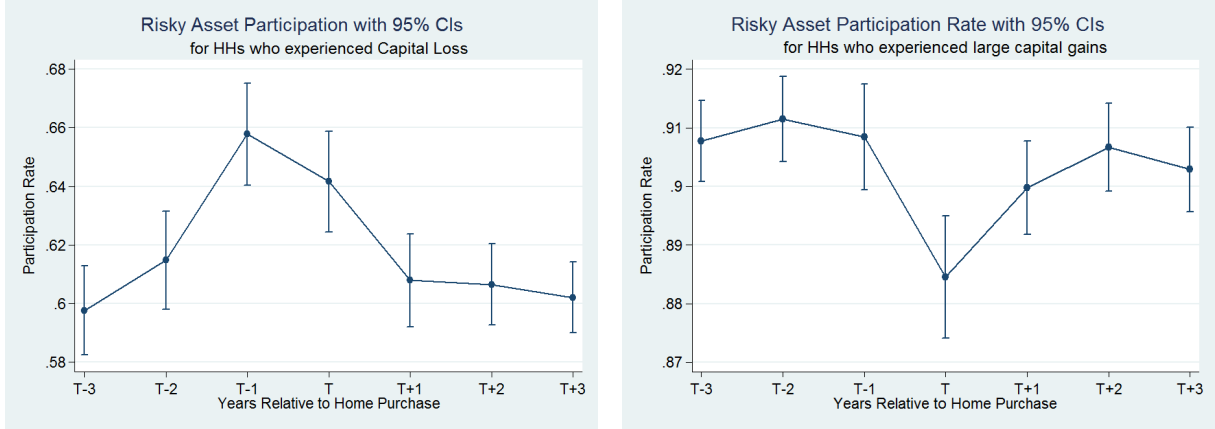
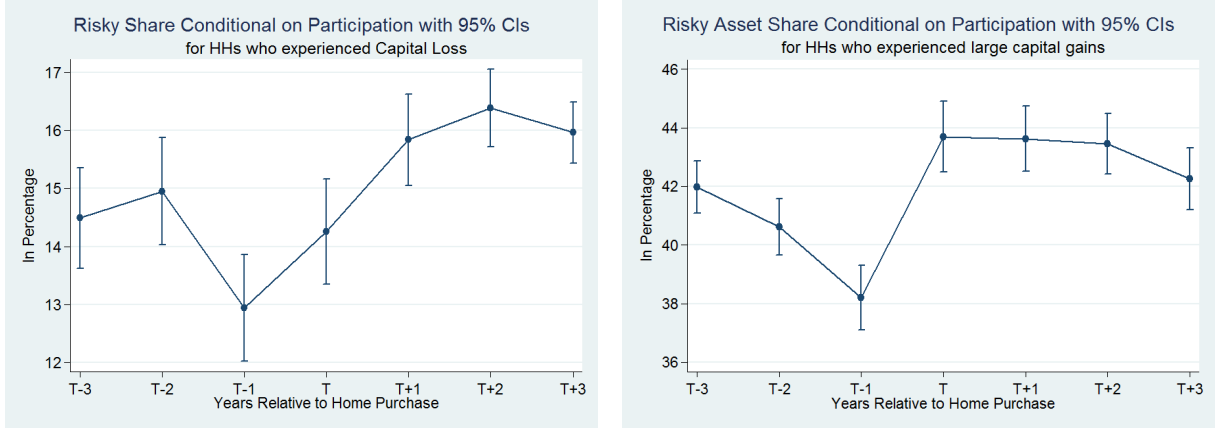


Figure 21: Risky Asset Share: Conditional on Participation for 2 Types of HHs



## 6 Conclusion

Housing is the single most important asset for the majority of households. Many theoretical studies have shown that housing decisions have a great influence on households' saving decisions and portfolio choice. The purpose of this paper is to provide empirical evidence on the magnitude and temporal patterns of households' portfolio choice of liquid wealth both before and after house purchase. We make use of unique administrative panel data from Denmark that spans 11 years from 2002 to 2012 with a broad spectrum of controls on households' demographics and financial characteristics.

We find that households accumulate significantly more liquid wealth in a few years before a house purchase and they convert 61% of it into home equity at the year of house purchase. After house purchase, households slowly save up liquid wealth. The risky asset participation pattern around a house purchase follows the similar pattern of liquid wealth accumulation. The participation rate increases slightly before a house purchase, and there is a significant drop in the risky asset participation rate at the year of house purchase.

After house purchase, the risky asset participation rate continues to drop slightly in the next 2 years and starts to increase 3 years after a house purchase. Conditional on participation, the risky asset share of liquid wealth decreases before a house purchase, likely reflecting a reduced willingness to take on risk before house purchase. As the stock investment is risky, holding a relatively safe form of assets reduces the probability of becoming credit constrained in the near future. After a house purchase, the risky asset share jumps immediately to a level that is higher than 2 years prior to the house purchase. The literature has identified three channels that could affect the conditional risky asset share after a house purchase. Our results suggest that the diversification effect and the debt retirement channel have a dominating effect over the liquidity concern.

Our analysis provides new evidence on the relationship between house purchase and households' portfolio choice of liquid wealth. There seems to be a clear linkage between stock market and housing market. The reduction in demand for risky assets due to house purchases could contribute to the volatility in asset prices. It is also important to bear in mind that our results stem from an economy with a relatively low minimum down payment requirement, convenient and low cost mortgage refinancing and prepayment terms, as well as a mature stock market. In countries where households face stricter borrowing constraints and stock markets are more volatile, there could be an even stronger linkage between house purchase and households' portfolio choice of liquid wealth.

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# Appendix

Table 3: Risky Asset Participation

	(1)
VARIABLES	Stockholder
T-3	0.297*** (0.00232)
T-2	0.301*** (0.00240)
T-1	0.308*** (0.00250)
T	0.288*** (0.00242)
T+1	0.282*** (0.00229)
T+2	0.281*** (0.00221)
T+3	0.283*** (0.00220)
Controls	X
Household -Year fixed Effect	X
R Squares	0.057
Observations	463,523

Note: cluster-robust standard errors in parentheses, clustering at household level, \*\*\*  $p < 0.01$ , \*\*  $p < 0.05$ , \*  $p < 0.1$ . This logistic regression includes household head's age, age-squared, marital status, highest education attainment, number of children, household's total labor income after tax and deductions, compulsory pension savings, bank loans and net wealth as control variables. Additional, we control for household and year fixed effect. The outcome variable is a binary variable indicating whether or not the household hold stocks. T represents house purchase year.

Table 4: Main Result: Coefficients

VARIABLES	(1) Financial Asset (in DKK)	(2) Safe Asset (in DKK)	(3) Participation	(4) Risky Share (in %)	(5) Risky Share (%) Conditional on Participation
<b>T-3</b>	32,263*** (10,282)	23,740*** (6,966)	0.0346*** (0.0107)	-0.0532 (0.0929)	-0.469* (0.258)
<b>T-2</b>	58,653*** (17,270)	44,043*** (11,590)	0.0552*** (0.0124)	-0.0899 (0.114)	-0.965*** (0.308)
<b>T-1</b>	122,787*** (27,781)	98,992*** (18,166)	0.0885*** (0.0133)	-0.494*** (0.128)	-2.573*** (0.342)
<b>T</b>	-57,762** (26,893)	-42,269** (18,031)	-0.00568 (0.0131)	-0.204 (0.131)	-0.725** (0.350)
<b>T+1</b>	-59,107*** (20,095)	-45,988*** (13,127)	-0.0362*** (0.0120)	0.289** (0.123)	0.739** (0.328)
<b>T+2</b>	-56,818*** (17,276)	-44,292*** (11,242)	-0.0433*** (0.0102)	0.379*** (0.106)	0.929*** (0.283)
<b>T+3</b>	-39,173*** (11,427)	-30,762*** (7,407)	-0.0304*** (0.00811)	0.186** (0.0863)	0.436* (0.231)
<b>Controls</b>	X	X	X	X	X
<b>HH-Year Fixed Effect</b>	X	X	X	X	X
<b>Observations</b>	463,523	463,523	455,335	463,523	141,465
<b>R-squared</b>	0.705	0.670	0.623	0.630	0.670

Note: cluster-robust standard errors in parentheses, clustering at household level, \*\*\* p<0.01, \*\* p<0.05, \* p<0.1. Columns 1,2,4,5 are estimated with two-way fixed effect model. Column 4 is estimated with Logistic regression. Numbers reported in this Table are regression coefficients. Regressions include household head's age, age-squared, marital status, highest education attainment, number of children, household's total labor income after tax and deductions, compulsory pension savings, bank loans and net wealth as control variables. Column 1,2,4,5 include an additional control: profit and losses from stock investment. Additional, we control for household and year fixed effect. The outcome variables from column 1 to 5 are: financial asset, safe asset, risky asset participation, risky asset share, and risky asset share conditional on participation respectively. T represents house purchase year.

Table 5: Main Result: Predicted Outcomes

VARIABLES	(1) Financial Asset (in DKK)	(2) Risky Share (in %)	(3) Risky Asset (in DKK)	(4) Safe Asset (in DKK)	(5) Risky Share conditional on participation (in %)
T-3	204,558*** (12,132)	8.125*** (0.0633)	35,219*** (4,100)	169,339*** (8,095)	26.10*** (0.179)
T-2	230,947*** (19,113)	8.088*** (0.0686)	41,305*** (6,470)	189,642*** (12,715)	25.60*** (0.189)
T-1	295,082*** (29,632)	7.684*** (0.0760)	50,491*** (10,461)	244,591*** (19,302)	24.00*** (0.206)
T	114,533*** (24,856)	7.974*** (0.0763)	11,202 (8,229)	103,330*** (16,703)	25.84*** (0.208)
T+1	113,187*** (18,031)	8.467*** (0.0722)	13,577** (6,374)	99,611*** (11,766)	27.31*** (0.194)
T+2	115,477*** (15,227)	8.556*** (0.0640)	14,170*** (5,444)	101,308*** (9,897)	27.50*** (0.171)
T+3	133,122*** (9,407)	8.363*** (0.0586)	18,285*** (3,432)	114,837*** (6,100)	27.01*** (0.161)
Controls	X	X	X	X	X
Household - Year Fixed Effect	X	X	X	X	X
Observations	463,523	455,335	463,523	463,523	141,465

Note: cluster-robust standard errors in parentheses, clustering at household level, \*\*\* p<0.01, \*\* p<0.05, \* p<0.1. All columns are estimated with two-way fixed effect model. Numbers reported in this Table are not regression coefficients, but predicted outcomes. Regressions include household head's age, age-squared, marital status, highest education attainment, number of children, household's total labor income after tax and deductions, compulsory pension savings, bank loans, net wealth and profit and losses from stock investment as control variables. Additional, we control for household and year fixed effect. The outcome variables from column 1 to 6 are: financial asset, risky asset share, risky asset, safe asset, financial asset conditional on stock market participation, risky asset share conditional on participation respectively. T represents house purchase year.

Table 6: Result for Randomly Assigned Artificial Purchase Year

VARIABLES	Fixed Effect			Logistic Regression
	(1) Risky share	(2) Risky share Conditional on Participation	(3) Financial Asset	(4) Participation Rate (Odds Ratio)
T-3	-0.0133 (0.0208)	-0.0506 (0.0778)	670.0** (299.8)	1.017*** (0.00291)
T-2	-0.0197 (0.0259)	-0.0716 (0.0968)	886.5** (359.4)	0.992** (0.00342)
T-1	0.00623 (0.0292)	-0.0248 (0.110)	980.7** (451.2)	0.987*** (0.00377)
T	-0.0254 (0.0295)	-0.170 (0.112)	1,269** (560.0)	0.981*** (0.00375)
T+1	-0.0275 (0.0276)	-0.171 (0.104)	1,530** (607.9)	0.963*** (0.00340)
T+2	-0.00896 (0.0238)	-0.0846 (0.0915)	1,708*** (570.4)	0.963*** (0.00302)
T+3	-0.00507 (0.0231)	-0.0400 (0.0893)	81.28 (181.9)	0.948*** (0.00258)
T-3 *treated	-0.0191 (0.0955)	-0.487* (0.269)	44,689*** (6,055)	1.121*** (0.0144)
T-2 *treated	-0.0292 (0.118)	-0.936*** (0.323)	84,614*** (10,955)	1.194*** (0.0178)
T-1 *treated	-0.419*** (0.136)	-2.605*** (0.361)	183,472*** (21,563)	1.282*** (0.0208)
T *treated	-0.235* (0.136)	-0.524 (0.367)	-94,824*** (15,977)	0.987 (0.0160)
T+1 *treated	0.263** (0.128)	0.967*** (0.344)	-97,390*** (14,065)	0.947*** (0.0141)
T+2 *treated	0.338*** (0.111)	1.091*** (0.298)	-98,094*** (13,825)	0.932*** (0.0119)
T+3 *treated	0.162* (0.0905)	0.558** (0.247)	-67,448*** (10,015)	0.980** (0.0101)
HH-Year Fixed Effect	x	x	x	x
Controls	x	x	x	x
Observations	4,978,605	1,081,894	5,152,225	5,152,225
R-squared	0.647	0.672	0.899	0.114

Note: cluster-robust standard errors in parentheses, clustering at household level, \*\*\* p<0.01, \*\* p<0.05, \* p<0.1. Columns 1-3 are estimated with two-way fixed effect model. Column 4 is estimated with logistic regression. Numbers reported in this Table are regression coefficients. All regressions include household head's age, age-squared, marital status, highest education attainment, number of children, household's total labor income after tax and deductions, compulsory pension savings, bank loans and net wealth as control variables. Column 1-3 include another control variable: profit and losses from stock investment. Additionally, we control for household and year fixed effect. The outcome variables from column 1 to 4 are: risky asset share, risky asset share conditional on participation, financial asset and risky asset participation rate respectively. T represents house purchase year. \*treated denote results for households who actually bought a house during 2005 to 2009, whereas the first 7 rows without \*treated show results for control group sample.