ESSAYS IN MACROECONOMICS AND HOUSEHOLD FINANCE

by

Eirik Eylands Brandsaas

A dissertation submitted in partial fulfillment of
the requirements for the degree of

Doctor of Philosophy

(Economics & Finance)

at the

UNIVERSITY OF WISCONSIN–MADISON

2021

Date of final oral examination: 28/4/21

The dissertation is approved by the following members of the Final Oral Committee:
Dean Corbae, Professor, Economics & Finance
Erwan Quintin, Professor, Finance
Ananth Seshadri, Professor, Economics
Corina Mommaerts, Assistant Professor, Economics

To Inga Hlíf

For unwavering support.

ACKNOWLEDGMENTS

First and foremost, I am grateful to my main advisors, Prof. Dean Corbae and Prof. Erwan Quintin, for their continued valuable advice and guidance. Prof. Ananth Seshadri always pushed me to look at the bigger picture and finding the right puzzles to solve, while Prof. Corina Mommaerts straightened out kinks and solved problems.

I would also like to thank my fellow students at Wisconsin, especially Joel McMurry, Francesco Celentano, Jason Choi, Joanna Venator, Mark Rempel, and Anson Zhou, for their help, motivation, and companionship.

Four individuals stand out and deserve thanks for the role they played before I started doctoral studies. Manudeep Bhuller, who introduced me to research and took a chance on me. Kristrún Mjöll Frostadóttir, without whom I'd failed even more courses at Háskóli Íslands. Mathias Dahle Bryde-Erichsen and Otto Sevaldson Lillebø, without whom I'd kept on collecting D's in college.

Finally, thank you, Gunnlaugur Eylands Eiriksson, the light of my world, who arrived just in time to help me through the hardest time.

CONTENTS

LIST OF TABLES

LIST OF FIGURES

ABSTRACT

This dissertation studies how family resources interact with financial constraints in households' savings and investment decisions.

The first chapter quantifies the contribution of parental transfers to the homeownership rate of the young. Parents and children interact without commitment in an incomplete markets life-cycle overlapping generations model with housing. Transfers increase homeownership by relaxing borrowing constraints and reducing risks associated with homeownership. Moreover, children with wealthy parents may overinvest in housing to extract larger future transfers from their parents. I find that transfers increase the homeownership rate among households aged 25-44 by 15 p.p. (31%). Finally, I show that policies that reduce sales costs are more effective than relaxing financial constraints or purchase costs at decreasing the role of parental wealth in children's housing outcomes.

The second chapter studies whether homeownership can explain the low stock market participation rate in the United States. I first show that the low participation rate is driven by high exit rates among participants and that exit is frequently tied to house purchases. I then extend a workhorse life-cycle model of portfolio choice to include housing. After estimating the models, with and without housing, I find that housing improves model fit. In particular, housing reduces the unexplained participation rate between the model and the data by 71%. Moreover, housing improves model fit by increasing the exit rate among young and middle-aged households and decreasing homeowners' liquid wealth.

The third chapter studies the effect of parental wealth on a household's risk-taking in asset and labor markets. Together with my co-authors, we show that households with wealthier parents take more risk in their portfolio and labor market choices. Since risk in one dimension can be offset by choices in other assets, we develop a combined risk measure robust to this concern. Our results have implications on the persistence of wealth across generations and wealth inequality. Our results provide one explanation for the finding that returns to wealth are increasing in wealth since wealth is correlated over generations.

1 ILLIQUID HOMEOWNERSHIP AND THE BANK OF MOM AND DAD

Abstract

Housing is the largest asset in U.S. households' portfolios, but parental transfers are important for children's housing outcomes. In this paper, I ask how much of the homeownership rate among young households is accounted for by parental transfers? I build and estimate a life-cycle overlapping generations model with housing, in which children and parents interact without commitment. I find that parental transfers account for 15 percentage points (31%) of the homeownership rate of young adults. Transfers from wealthy parents increase homeownership by relaxing borrowing constraints and reducing housing risk. Policies and regulations that decrease the sales cost of housing increase homeownership and weaken the link between parent wealth and housing outcomes. Finally, I study how housing illiquidity affects the commitment frictions between parents and children. Children with wealthy parents increase their consumption of illiquid housing to extract larger future transfers.

1.1 Introduction

Housing is the largest asset in US households' portfolios and among middle-class households represents the primary means of wealth accumulation. There are growing concerns about housing affordability and inequality in access to housing. One contributing factor to inequality in housing outcomes is parental transfers. Around 30% of American first-time homebuyers received downpayment assistance from parents in 2009-2016. Parental downpayment assistance averaged $48,000 among receiving households.[1] Owner-occupied housing bears adjustment costs that make it illiquid.

[1]Data from the Survey of Household Economic Decisionmaking and the Transfer Supplement of the 2013 Panel Study of Income Dynamics (see Section 1.2).

In addition, households must meet a downpayment requirement to obtain a mortgage. These two frictions, transaction costs and credit constraints, increase the importance of transfers for homeownership. First, transfers directly alleviate borrowing constraints. Second, future transfers decrease the probability that households have to sell their house after experiencing adverse income shocks. Third, illiquid housing acts as a commitment device that the child uses to extract future transfers.

In this paper, I ask: how much of the homeownership rate among young (25-44) households is accounted for by parental transfers? In addition, I quantify how much different financial and housing regulations affect the link between parental wealth, transfers, and their children's housing outcomes. Finally, I study how housing illiquidity affects the commitment problem between children and parents.

To answer these questions, I merge the literatures on models of housing, which ignore transfers, with models of parental transfers, which ignore housing. I build a life-cycle overlapping generations model with altruistic parents and a rent or own decision. Children and parents interact, without commitment, through both inter-vivos transfers and bequests at death from the parent. My key innovation to the altruism framework is to include illiquid housing, which interacts with transfers. In models without housing (e.g., Boar, 2018; Altonji et al., 1997; Barczyk and Kredler, 2014), the only transfer motive is to increase the child's goods consumption when they are up against a borrowing constraint. Illiquid housing introduces two additional transfer motives. First, young adult children enter the economy with low wealth and low income and they must save to buy a house. Parents, who are at the life-cycle peak of wealth and income, may choose to transfer money to alleviate minimum downpayment requirements. Second, children who own a house and experience income losses may avoid costly downsizing by receiving parental transfers. Moreover, children can extract future transfers from their parents by shifting liquid wealth to illiquid housing ("house-rich, cash-poor"). On the other hand, as in all models of transfers, future transfers decrease the savings motive, decreasing the homeownership rate.

I estimate the model by matching data on homeownership, savings, and transfers from the Panel Survey of Income Dynamics (PSID). I then compute a counterfactual homeownership rate by simulating the model without parental transfers. Without parental transfers, the model collapses to a standard life-cycle model with housing. I find that parental transfers account for 15 p.p. (32%) of the young homeownership rate. Two frictions, a minimum downpayment requirement and an adjustment cost on housing, account separately for 77% and 61% of the parental transfer effect on homeownership, respectively. In the benchmark model the supply of owner-occupied housing is perfectly elastic, but my results are robust to other supply elasticities. I use my model to quantify the contribution of parental transfers to the black-white homeownership gap: in the US young white households are twice as likely to be homeowners as black households. I find that parental transfers account for 30% of the black-white homeownership gap.

After documenting that parental wealth and transfers are an important determinant of homeownership I study how policies that increase homeownership also affect the link between parental wealth and children's housing outcomes. Decreasing minimum downpayments strengthens the link between parental wealth and children's housing outcomes since households with wealthy parents find homeownership more attractive. Increasing liquidity, by decreasing sales and purchase costs, weakens the link between parental wealth and children's housing outcomes by reducing the risk of ownership which is more important for households with poorer parents. Finally, I study how housing illiquidity affects the strategic behavior introduced by the lack of commitment. I find that 13% of young households prefer to face sales costs as they can reduce liquid wealth by over-investing in housing and thus extract larger future transfers. On the other hand, sales cost increase precautionary savings motives, and so households with less wealthy parents save more, decreasing the need for future transfers.

By introducing parental transfers to models of housing, my paper contributes to the literature studying the determinants of homeownership over the life-cycle. Recent papers focus on marriage and family formation (Fisher and Gervais, 2011; Chang, 2020; Khorunzhina and Miller, 2019), housing demand in old-age (McGee, 2019; Barczyk et al., 2020), and changing borrowing constraints (Paz-Pardo, 2019; Mabille, 2020). These studies highlight the importance of credit constraints and minimum down payments in constraining demand for owner-occupied housing. However, by considering parent-child interactions, I show a dichotomy based on parent wealth in the importance of constraints. For households with poorer parents, the sales and purchase costs decrease ownership by it riskier to own. This risk is less important for households with richer parents making mortgage credit constraints more important. My results highlight that policies that increase ownership by subsidies to first-time buyers will lead to increased housing inequality.

I contribute to the growing literature that studies altruistic households who interact without commitment by studying how illiquid housing affects the commitment problem. In these models children undersave to increase parental transfers (e.g., Altonji et al., 1997; Boar, 2018; Barczyk and Kredler, 2014). However, adjustment costs on housing impose future expenditure commitments (Chetty and Szeidl, 2007; Shore and Sinai, 2010). I show that expenditure commitments have two distinct effects on child-parent interactions. First, the child can buy a house and bring no liquid wealth to the next period. If the parent does not give a transfer, the child must sell his house and pay adjustment costs or decrease consumption drastically. A wealthy altruistic parent likes neither of these outcomes and responds by transferring. Second, by giving gifts that push the child to buy the parent makes future undersaving more expensive since the child cannot easily sell his house. Both mechanisms are quantitatively meaningful. First, 17% of 25-year old households prefer their housing to be illiquid to extract future transfers. Second, illiquid housing increases the child-parent wealth ratio from 0.09 to 0.11.

Finally, I contribute to the literature on parental transfers and life-cycle outcomes by focusing explicitly on how parental transfers to young adult households change their savings choices through homeownership. My results show that households with wealthier parents are willing to buy sooner, take higher leverage, and need to hold less liquid precautionary savings. My results highlight how parental wealth increases the persistence of wealth inequality by affecting household risk-taking. Previous literature has generally studied parental investment in their children's human capital (e.g., Lee and Seshadri, 2019; Daruich, 2018) or transfers from adult children to retired parents (e.g., Mommaerts, 2016; Barczyk and Kredler, 2018; Barczyk et al., 2020), instead of the effect of parental wealth on household portfolio choices.

The paper proceeds as follows. In Section 1.2, I describe the data sources, summary statistics, and document that parental wealth is associated with better housing outcomes. Section 1.3 describes the quantitative model and Section 1.4 discusses the structural estimation. Section 1.5 performs the main quantitative exercise and robustness tests. Finally, Section 1.6 studies how policies intended to increase homeownership also affect the role of parent wealth and housing illiquidity.

1.2 Data on Transfers, Family, and Housing

I first present the estimation sample, taken from 1997-2017 waves of the Panel Study of Income Dynamics (PSID). I also use two other surveys to discuss the time trends in the reliance on parental transfers for house down payments. Finally, I use the estimation sample to show that parental wealth is positively associated with better housing outcomes.

1.2.1 Panel Study of Income Dynamics

The primary data source is the Panel Study of Income Dynamics (PSID), which follows a nationally representative sample of US households and their descendants over time since 1968. The PSID is the only publicly available US dataset that satisfies this paper's three requirements. First, it has detailed wealth, income, and housing data for both parents and adult children. Second, it has some information about inter-vivos transfers from parents to children. Third, it follows households over time, so we can observe the transitions from renting to owning and how the transition relates to parental wealth.

I use data from 1999 to 2017. In 1999 the PSID started to collect detailed wealth data every other year. In most waves of the PSID, there is limited transfer data, and the main question is whether households received gifts or bequests over $5,000 dollars in the last two years. In 2013 the PSID collected more detailed transfer data in the Family Roster and Transfer Module. They asked parents how much they gave their children in the last calendar year and how much they had given over their lifetime for school, house purchases, or other purposes. Household characteristics such as age, gender, and education refer to the household head. I classify top-coded values as missing observations. All monetary variables are expressed in constant 2016 US dollars (in thousands).

Sample Selection: Throughout this paper, the sample includes all households aged 25-84 in the PSID, excluding the Survey of Economic Opportunity and the Latino sub-samples to obtain a representative sample. All summary statistics are calculated using the provided family weights.

Matching Parents with Children: I use the Parent/Child file from the PSID's 2013 transfer supplement. I can observe each household's reported transfers to and from parents and children. This leads to discrepancies, where the child and parent does not agree on the amount given from the parent to the child. I only use the parent's reported transfer. First, there may be some stigma about receiving transfers, which may induce receiving children to under-report. Second, in the model, parents determine the size of the transfer they give to their child. I treat each parent-child pair as separate so that two siblings with the same parent household are counted as two independent households.

Definition of Transfers: The 2013 transfer supplement asks all parent households whether they gave money, gifts, or loans of $100 or more to their children in 2012. There is no identifying information on whether these transfers are gifts or loans, and I treat all as gifts.[2] Since this paper focuses on transfers that are a) related to housing and b) quantitatively meaningful, I set transfers below $500 to $0.[3]

1.2.2 Descriptive Statistics: Who Receives Transfers?

I now discuss descriptive statistics from the PSID sample in 2013 for households aged 25-44 with a non-missing parent household. Tables 1.1 and A.4 contain the sample means and medians, broken down by age, wealth, marriage, house tenure,

[2]While transfers may be given as a loan, we know that parental loans are often not-repaid, are interest-free, and are loans in name only.

[3]Ignoring small transfers decreases the transfer rate from 32% to 24% and increases the mean transfer from $2,921 to $3,944.

and whether households received transfers in the last year. In panel a), the first two columns compare the whole sample, broken down by whether they received transfers or not in the last calendar year. The mean transfer is relatively high at \$3,940, and 27% of households received transfers in the last year. Both groups have similar wealth levels, but transferring parents are much wealthier, with a median wealth of \$339,000 relative to non-transferring parents who had \$96,860. Recipients are more likely to be college-educated, white, and a little younger. Receivers are somewhat less likely to be homeowners (39% vs. 43%).

By breaking down the sample by marital status, we see that married or cohabiting households are wealthier, have higher household income, are more likely to be white, slightly older, and have approximately three times the homeownership rate of single households. Married households are somewhat more likely to receive transfers and receive slightly larger transfers. Next, I break the sample down by whether they are renting or owning. Homeowners have ten times the wealth of renters and also have significantly wealthier parents. There is no difference between renters and owners in the receipt rates, but transfers to owners are on average \$1,000 larger. Only 6% of renters owned in the previous period, while 21% of owners rented in the previous period. Further, receivers are more likely to switch from renting to owning: 21% of receiving owners rented two years ago, compared to 15% of non-receiving owners.

Next, I break the sample into five age groups from 25-44. We see that household's wealth, income, and homeownership rates increase with age. As households become wealthier they are less likely to receive transfers. Interestingly, owners are more likely to receive transfers than renters: among households aged 29-32, 32% of non-receivers and 40% of receivers were homeowners. Not only are those who received more likely to own, they are also likelier to be new homeowners: Only 13% of owning non-receivers are new homeowners, compared to 21% of owning receivers.

Table 1.1: Descriptive Statistics (Means), Households Aged 20-44

	All		Single		Married		Renter		Owner	
Receiver	No	Yes	No	Yes	No	Yes	No	Yes	No	Yes
Transfer	0.00	3.94	0.00	3.49	0.00	4.49	0.00	3.91	0.00	4.00
Wealth	78.41	108.33	30.71	56.93	126.76	171.11	13.42	42.02	163.53	210.84
Wealth Parent	404.94	1028.86	325.54	1038.78	485.26	1016.56	241.36	1016.47	619.05	1048.00
Income	72.70	74.24	46.08	47.16	99.69	107.32	46.79	52.84	106.65	107.32
College	0.35	0.51	0.35	0.49	0.35	0.53	0.28	0.47	0.45	0.58
White	0.73	0.85	0.64	0.82	0.83	0.90	0.65	0.81	0.84	0.92
Owner	0.43	0.39	0.22	0.19	0.64	0.64	0.00	0.00	1.00	1.00
Owner t-2	0.41	0.37	0.21	0.17	0.62	0.63	0.06	0.06	0.85	0.79
Age	33.98	32.90	32.79	31.45	35.19	34.66	32.22	31.33	36.29	35.32
Observations	2404	656	1094	304	1310	352	1453	400	951	256

Age	25-28		29-32		33-36		37-40		41-44	
Receiver	No	Yes	No	Yes	No	Yes	No	Yes	No	Yes
Transfer	0.00	4.09	0.00	4.12	0.00	3.28	0.00	5.28	0.00	2.97
Wealth	33.65	46.23	37.63	78.53	54.21	125.35	118.43	154.32	173.42	212.88
Wealth Parent	320.86	1221.09	379.41	1193.31	361.26	835.07	339.04	643.02	649.47	975.38
Income	43.43	47.88	63.03	69.73	71.47	86.00	93.38	91.86	102.47	102.73
College	0.34	0.55	0.35	0.58	0.32	0.52	0.34	0.43	0.41	0.39
White	0.68	0.83	0.69	0.83	0.73	0.87	0.79	0.88	0.80	0.89
Owner	0.19	0.16	0.32	0.38	0.47	0.47	0.60	0.61	0.66	0.59
Owner t-2	0.14	0.14	0.28	0.30	0.43	0.43	0.60	0.60	0.65	0.53
Age	26.49	26.49	30.48	30.45	34.50	34.33	38.49	38.46	42.62	42.40
Observations	572	195	566	163	562	127	384	99	320	72

Wealth Quintile	Quintile 1		Quintile 2		Quintile 3		Quintile 4		Quintile 5	
Receiver	No	Yes	No	Yes	No	Yes	No	Yes	No	Yes
Transfer	0.00	2.88	0.00	2.46	0.00	3.04	0.00	5.29	0.00	4.95
Wealth	-53.90	-53.15	-1.08	-1.64	8.15	8.25	39.97	42.02	339.67	403.71
Wealth Parent	231.92	464.99	108.63	270.87	218.55	559.62	391.03	1111.01	938.08	2046.24
Income	59.21	53.99	32.94	33.66	45.83	46.19	77.58	78.29	131.73	123.11
College	0.47	0.58	0.14	0.15	0.21	0.40	0.37	0.52	0.52	0.68
White	0.73	0.85	0.56	0.68	0.71	0.81	0.78	0.95	0.84	0.88
Owner	0.27	0.17	0.08	0.13	0.18	0.16	0.63	0.49	0.87	0.76
Owner t-2	0.28	0.14	0.10	0.11	0.19	0.22	0.56	0.44	0.80	0.67
Age	33.04	31.57	32.43	33.03	32.56	31.29	34.17	33.14	36.95	34.77
Observations	459	148	478	91	518	121	471	137	478	159

Notes: Data from the PSID Transfer, Individual, and Family modules. Weighted using family weights. Transfer, wealth, and income measured in 1000s of 2016 USD.

Finally, I break down the sample by wealth quintiles. Within each wealth quintile, receivers and non-receivers have virtually identical wealth, income, and age. Still, receivers are slightly more likely to be white and college-educated within each quintile. The largest difference is that the receiver's parents are much wealthier. We also see the clear inter-generational correlation of wealth: Parents with children in the top quintile have four times the wealth of parents with children in the bottom quintile.

I now briefly summarize the main results. In 2013, 27% of young households received a transfer, and transfers averaged \$3,940. Receivers have significantly richer parents, have similar wealth and income as non-receivers, and are less likely to own. Receiving transfers increases the probability of transitioning from renting to owning, especially in the age groups where households are most likely to buy. Parents' wealth is strongly correlated with the probability of receiving a transfer.

1.2.3 Parental Transfers for Owners Over Time

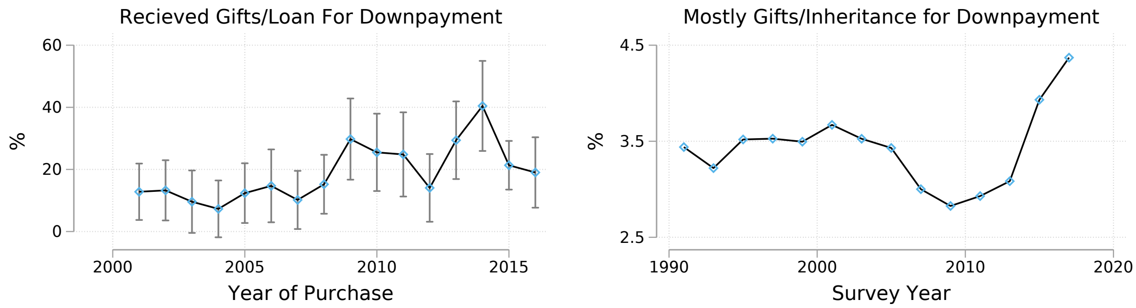
From the PSID transfer supplement, we have seen how those who receive transfers differ from their counterparts in 2012. Two additional data sources show that parental transfers for housing have increased over the last two decades.

Survey of Household Economics and Decisionmaking (SHED): To better understand US households' financial health, the Federal Reserve first conducted the SHED in 2013. It is an annual cross-sectional survey with a focus on financial well-being. In 2015 and 2016, the survey asked homeowners when they bought their home and how they funded the downpayment.[4] The results are plotted in the left panel of Figure 1.1. The main observation is the large increase in the role of inter-vivos transfers for homeowners since 2001. In 2001-2007, only 5-18% of first-time buyers received transfers, while 20-40% received transfers after 2009.

In 2013, 2014, and 2016 the SHED contained a question asking renters why they rent. The main barrier to homeownership was borrowing constraints: 57% of US households mentioned that they could not afford a down-payment or did not qualify

[4]The data were recorded for owners who bought since 2001 in the 2015 wave and those who bought since 2015 in the 2016 wave.

Figure 1.1: Increased Reliance on Parental Transfers for Down Payments



Notes: The left panel uses data from the SHED. First-time homeowners are defined as those who did not use proceeds from previous property sales for the downpayment. Bars indicate 95% confidence intervals. The right panel uses data from the public AHS file. Left panel plots answers by year of purchase while right panel plots answers by survey year.

for a mortgage. In addition to borrowing constraints, the survey reveals that illiquidity the associated with owner-occupied decreases homeownership: 26% mentioned that renting was more convenient and 23% that planning to move as reasons for renting.

American Housing Survey: I use the AHS to obtain a time series back to 1991. The AHS follows roughly 60,000 housing units over time and asks households in owner-occupied units how they funded the downpayment (right panel of Figure 1.1). We see a relatively flat trend in the '90s, followed by a quick decline in 2005-2008 as more households were using mortgages with low down payments. Finally, we see a dramatic increase in the years after the housing bubble. The horizontal axis denotes the survey year and not the year of purchase. Small changes thus indicate large changes among new owners who are a small subset of all owners.

1.2.4 Hypothesis I: Households With Wealthier Parents Are Less Likely To Downsize

If parent wealth provides insurance, households with wealthier parents should be less likely to downsize after income losses. I perform an event study on the effect of unemployment on housing consumption to test this hypothesis.

The sample is limited to household heads who are unemployed only once between ages 25 and 45. The consumption value of owner-occupied housing is set to 6% of the market value as in Boar et al. (2020). For renters, I use the rental payment. The log growth rate is defined as the difference in log housing consumption between t and $t-2$.[5] I use parental wealth as a proxy for transfers since transfers were only observed in 2013. I divide the sample by whether a household's parents were in the top parental wealth quartile at the time of unemployment.

I then compare the housing consumption responses when households become unemployed by parental wealth to examine whether households with wealthier parents are less likely to downsize. The results are displayed in Figure 1.2. Households with non-wealthy parents decrease the growth rate of housing consumption from 4% to 6%, a significant change at the 5% level. Households with parents in the top 25% have no statistically significant decrease in housing consumption growth rates. Moreover, I replicate this event study using simulated data from the quantitative model and show that the results are similar (see Section 1.4.4 and Figure 1.4).

1.2.5 Hypotheses II: Parental Wealth Affects House Purchases

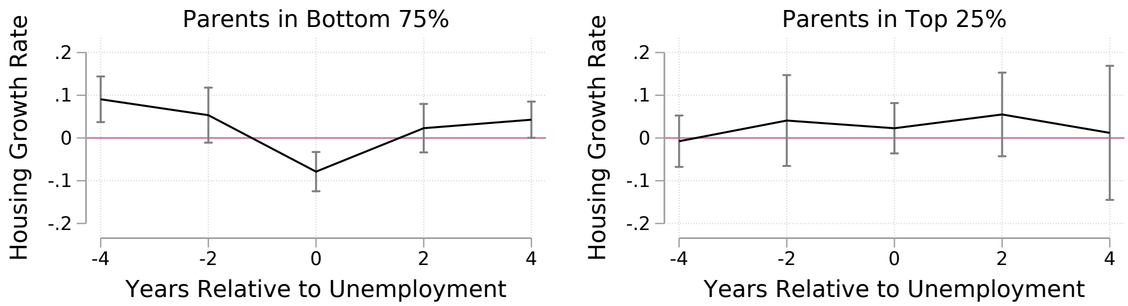
The previous results provide strong evidence that parent wealth provides insurance against downsizing after income losses. I now show that households with wealthier parents also buy more expensive houses and are less likely to be behind on mortgage payments, controlling for household characteristics.

Households With Wealthier Parents Buy Larger Houses

I run an ordinary least square (OLS) regression on house values at purchase for first-time buyers and test whether parent's wealth is positively associated with larger

[5]This methodology is inspired by Chetty and Szeidl (2007) who find that housing consumption responds less to unemployment than non-durable consumption, as predicted by a model with illiquid housing. I focus on showing that parental wealth supports a household's housing consumption. Further details are in Appendix A.1.2, where I also report results separately for renters and owners. I report results from the event study with control variables in Appendix A.1.2, and the results are quantitatively similar.

Figure 1.2: Event Study: Housing Consumption at Unemployment by Parental Wealth



Notes: Solid lines denote means, and bars denote the 95% confidence interval. Sample consists of households aged 25-45 with exactly one unemployment spell and without changes in head and/or spouse in the four years before and after unemployment.

house purchases, controlling for net worth, income, education, age, family size, and race:

$$\ln HouseSize_i = \beta_1 \ln(Wealth)_{p(i),t-2} + \beta_2 \ln(Income_{i,t-2}) + \beta_3 \ln(NetWorth_{i,t-2}) + \gamma X_{i,t} + \varepsilon_i,$$

Parent's wealth, as well as household income and net-worth, are logged. Households are denoted by i, their parents by $p(i)$, and X_i, t denotes a vector of controls including time, age, education, state and race dummies.

Column 1 of Table 1.2 reports the results from an OLS regression of house values among first-time buyers. We can see that households with wealthier parents buy larger houses: A 1% increase in parental wealth is associated with a 0.042% increase in the purchase value of the child's house. The effect of parental wealth is almost as large as that own the child's own net worth (0.068%).

Households With Wealthier Parents Are Less Likely to Have Mortgage Difficulties

I now show that households with wealthier parents are less likely to be behind on their mortgages, even though they buy more expensive houses. Since 2009 the PSID has collected information on whether households are behind on their mortgages. The percentage of households behind on mortgage payments has decreased from 3.8% in 1999 to 1.8%. Overall, 8.6% of the sample have been behind at least once. This result stresses that parental transfers relax borrowing constraints and also reduce the downsides of illiquid housing. Households who take out large mortgages and cannot follow the payment plan may be behind on mortgage payments, ultimately ending in foreclosure. Being behind on mortgage payments is an indicator of financial stress and is typically expensive due to fees. I now measure whether parental wealth decreases households' probability of being behind on mortgage payments, controlling for demographic variables.

I perform OLS regressions of the following form:

$$EverBehind_i = \beta_1 \ln(Wealth)_{p(i),t-2} + \beta_2 \ln(Income_{i,t-2}) + \beta_3 \ln(NetWorth_{i,t-2}) + \gamma X_{i,t} + \varepsilon_i,$$

where the sample is limited to the first time a household is observed as owners. In column (2) of Table 1.2, I report results when the outcome variable is whether households are ever behind on mortgage payments, and we see that parental wealth in the period before purchase decreases the probability that a household will ever be behind: A 1% increase in parent wealth decreases the probability of being behind by 0.019 percentage points, and is significant at the 1% level. The effect of parental wealth is larger than the effect of the child's net worth but smaller than the effect of the child's income. In Column (3) the outcome variable is whether households are behind in the first period, and we see coefficients and significance levels are virtually unchanged.

I also report the results from two specifications where I follow the same households as in Column (2) after purchase. I report results from random effects and household fixed effects regressions in Columns (4) and (5), respectively. Once we follow households over time, the effect of parental wealth decreases. With household fixed effects the effect is no longer significant. However, the FE regressions must be interpreted with caution since there is little time variation in parental wealth within a family. Indeed, the random effects and the fixed effect coefficient are almost the same (0.007

Table 1.2: Housing Choices and Parental Wealth

	(1) House Size	(2) Ever Behind	(3) Behind First	(4) Behind RE	(5) Behind FE
Parent					
Wealth (t-2)	0.052**	-0.019*	-0.022**	-0.008*	-0.007
	(0.019)	(0.008)	(0.007)	(0.004)	(0.009)
Child Household					
Net Worth (t-2)	0.068***	-0.010	-0.013+	-0.008*	-0.003
	(0.015)	(0.007)	(0.007)	(0.003)	(0.005)
Income (t-2)	0.309***	-0.004	0.017	-0.002	0.014
	(0.033)	(0.015)	(0.013)	(0.008)	(0.012)
High School=1	0.260***	-0.017	-0.074*	-0.003	-0.000
	(0.067)	(0.032)	(0.032)	(0.021)	(0.095)
College =1	0.538***	-0.034	-0.064+	-0.029	0.007
	(0.078)	(0.036)	(0.036)	(0.023)	(0.103)
White=1	0.056	-0.057*	0.035	0.004	0.000
	(0.057)	(0.027)	(0.023)	(0.015)	(.)
Family Size	0.094*	0.027	0.008	0.007	-0.011
	(0.046)	(0.021)	(0.019)	(0.010)	(0.022)
N	884	709	372	2,057	2,057

Notes: Standard errors in parentheses. 'Behind' refers to whether the households is behind on a mortgage. Wealth, income, parental wealth, mortgage, family size, and house values are logged. All regressions include year and state fixed effects and control for age and age-squared of both the child and parent. Specifications 1-3 uses ordinary least squares while specifications 4 and 5 use random and fixed effects, respectively.

vs 0.008). Overall, the results support the hypothesis that parental wealth decreases the probability of being behind on mortgage payments.

1.3 A Quantitative Model of Parental Transfers and Homeownership

This section describes my life-cycle model of housing choices with overlapping generations, idiosyncratic earnings risk, and altruistic inter-vivos transfers from parents to children ("kids"). The model has two main building blocks. The first is altruism and no commitment. Parents are altruistic towards their children and derive utility from their kid's utility, and they can affect their kid's choices by transferring non-negative amounts in any period. Altruism without commitment creates strategic behavior, where both households understand how their choices affect the other's future behavior.

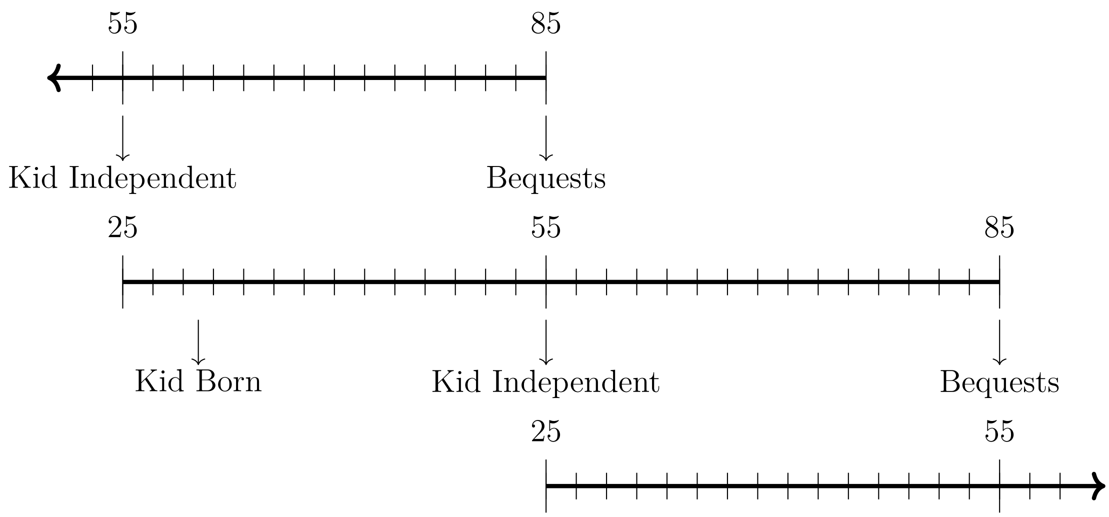
The second building block is the introduction of illiquid housing into an altruism model. When housing is liquid, the only interaction with altruism is that parental transfers relax mortgage borrowing constraints. With illiquid housing, children and parents both expenditure commitments. The model also becomes a two-asset model, in which both wealth and portfolio compositions matter for transfers. In particular, owning children with low liquid wealth ('house-rich cash-poor') have a high marginal utility of non-housing consumption and may receive transfers. Finally, when housing is illiquid and income is uncertain, a risk of owning is that households may have to sell after receiving adverse income shocks. However, wealthy parents provide partial insurance against both income losses and may even transfer to ensure that their child can stay in their house and not pay the sales cost.

1.3.1 Demographics, Preferences and Technologies

Time is discrete and finite. Each period consists of two years. At the beginning of each period, a constant mass of new households enter and exit the economy. The only economic agents in the model are households.

Demographics: Households are economically active from age $a \in \mathcal{A} = \{25, 27, \ldots, 83\}$. A family consists of one adult kid k household (25-53) and a parent p household (55-83). New households are born to the adult kid at age 30, but the new kid is economically inactive until age 25. When a kid turns 55, three things happen simultaneously. First, the parent at age 85. Second, the kid's kid becomes economically active. Third, the kid is now a parent. Thus, each parent-kid pair overlaps for 15 periods (30 years) with an age gap of 30 years and only two households are economically active in any dynasty at a time. Figure 1.3 shows the life cycle of two generations.

Figure 1.3: Individual's Life Cycle



Altruism: The parent is altruistic towards the kid in the sense of Barro (1974). The parent places weight η on the utility of the adult kid. Altruism to later generations is not explicitly modeled.

Inter-Generational Transfers: In each period, the parent can transfer a non-negative amount t_p that the child receives immediately. Additionally, any wealth left after death is bequeathed to the child. If transfers and bequests were not allowed, the policy functions would be identical to a model without altruism ('autarky').

Income Endowment: Households supply one unit of labor inelastically each period. All households face a common age-dependent deterministic life-cycle earnings l_a. Children (25-53) face persistent idiosyncratic age-dependent productivity shocks $y_{i,a} \in \mathcal{Y}_a = \{y_1, \ldots, y_{N_y}\}$. The process follows an age-dependent Markov chain, where $\pi_a(y'|y)$ denotes the probability of switching from state y to y' at age a. Parents face no income uncertainty. The earnings of household i receives at age a is thus

$$w_{i,a} = l_a y_{i,a} \; \forall a \in \{25, 27, \ldots, 53\}, \tag{1.1}$$

$$w_{i,a} = l_a \; \forall a \in \{55, 57, \ldots, 83\}. \tag{1.2}$$

While this dichotomy in labor income risk is primarily chosen to reduce the state space, it is also largely consistent with the empirical fact that labor income risk is decreasing with age (Sanchez and Wellschmied, 2020). Furthermore, this paper focuses on the role of parental transfers for kid's housing choices, so parental income risk is not a primary concern. However, I perform robustness exercises with income and health expenditure risk for parents in Appendix A.3.1.

Housing: Households value consumption and housing services. They can obtain housing services from the rental market or the owner-occupied market. They can rent housing of size h_r, or own houses of size h_o. The unit price of housing is p, and q denotes the rent-to-price ratio. Homeowners pay deprecation and maintenance δ on their housing. I assume adjustment costs that are proportional to the market value for owner-occupied housing, as in Yang (2009)

$$adj(h_{a+1}, h_a) = \begin{cases} m_b p h_{a+1} & \text{if } h_a = h_r \ \& \ h_{a+1} \neq h_r, \\ m_s p h_a & \text{if } h_a \neq h_r \ \& \ h_{a+1} = h_r, \\ 0 & \text{if } h_{a+1} = h_a, \end{cases} \tag{1.3}$$

where m_s and m_b denote selling and purchasing costs. In this notation, h_a is the house a household enters the period with and h_{a+1} the house chosen in the given period. These adjustment costs make housing illiquid since households cannot freely adjust their housing choices.

Financial Market: Households can save in a one-period risk-free bond with a return r. Borrowing against collateral (owner-occupied housing) is allowed, but households must satisfy a loan-to-value (LTV) constraint. I model borrowing as a one-period mortgage that is rolled over each period. The mortgage has an interest rate of $r + r^m$, where $r^m \geq 0$ is the mortgage premium. Since the mortgage premium is positive, households will never simultaneously hold both a mortgage and save in the risk-free bond. Let b denote the net position in bonds. The interest rate households face is

$$r(b) = \begin{cases} r & \text{if } b \geq 0, \\ r + r^m & \text{if } b < 0. \end{cases} \tag{1.4}$$

The borrowing constraints take the following form depending on the rent/own decision

$$\begin{cases} b \geq -LTV \times ph_{a+1} & \text{if } h_{a+1} = h_o, \\ b \geq 0 & \text{if } h_{a+1} = h_r. \end{cases}$$

Initial Conditions of the New Kid: A household's starting wealth and productivity at age 25 is stochastic and allowed to be correlated with the parent's wealth and productivity at age 53, $x_{25}, y_{25} \sim F(x_{53}, y_{53})$. All households start as renters but are allowed to purchase housing in the first period. The distribution of F is crucial to generate sufficient inter-generational correlations in initial conditions.[6]

Preferences: Parents and children have time-separable expected utility preferences over consumption and housing services. Households discount the future at rate β. The per-period utility function for kids is age-independent

$$U_k(c_k, h_k) = u(c_k, h_k) = \frac{\left(c^{\xi} s(h)^{1-\xi}\right)^{1-\gamma} - 1}{1-\gamma}, \tag{1.5}$$

where s denotes housing services, γ measures risk aversion, and ξ the expenditure shares on non-housing consumption. The function $s()$ maps housing qualities into values comparable to consumption and takes the following form

$$s(h) = \begin{cases} h_r & \text{if renting } (h_{a+1} = h_r), \\ \chi h & \text{if owning } (h_{a+1} = h_o). \end{cases} \tag{1.6}$$

The parameter χ measures the owner-occupied utility premium and captures any enjoyment households derive from owning rather than renting. It also serves as a proxy for any pecuniary benefits associated with owning that is not explicitly modeled (e.g., tax benefits).

Finally, the parent's per-period utility function is identical, just augmented by

[6]While this paper abstracts from parental investment in their child's human capital, these are important part of the initial conditions (Daruich, 2018; Lee and Seshadri, 2019). This specification of the stochastic initial conditions allows me to match the intergenerational correlation in both wealth and income.

the altruistic utility derived from the kid:

$$U_p(c_p, h_p, c_k, h_k) = u(c_p, h_p) + \eta u(c_k, h_k). \tag{1.7}$$

Timing: First, the productivity state of children is realized first. Dynasties with newly economically active kids (aged 25) also draw the initial wealth level of the kid from F. Next, the parent chooses consumption c_p, non-negative inter-vivos gifts t_p, bond position b_p, and housing choice h_p. The kid chooses consumption c_k, housing h_k, and savings b_k after observing the parent's choices. The parent moves first to be consistent with mortgage regulation in the US, which requires gifts to be deposited before mortgages are approved.

State Variables: The state variables of a parent p are the beginning of period wealth for the kid $x_k \in X = [0, \infty)$, the parent's starting wealth $x_p \in X$, the housing states $h_k \in H = \{h_r, h_o\}$, $h_p \in H$, the child's productivity $y_k \in Y_a = \{y_1, \ldots, y_{N_y}\}$, and the age of the child $a_k \in A_k \in \{25, 27, \ldots, 53\}$. Let the state variable of the parent be denoted by $\mathbf{s}_p \equiv (x_k, x_p, y_k, h_k, h_p, a_k)$.

Due to the model's timing assumption, the child makes choices after the parent. The parent's choices affect the kid's feasible choice set (transfers t_p increases cash-on-hand x_k) and next period state variables (the parents choices for net-bond position b_p and housing h_p). At the beginning of the second stage, the state space of the child expands to $(x_k, x_p, y_k, h_k, h_p, a_k; t_p, b'_p, h'_p)$, where $'$ denote next-period state variables. The kid is indifferent between a change in own wealth or transfers but cares about disposable wealth including transfers $\tilde{x}_k \equiv x_k + t_p$. Further, since the child moves after the parent, the parent's starting wealth x_p and housing h_p are redundant for the kid, so we can rewrite the state space to be $\mathbf{s}_k = \left(b'_p, h'_p, x_k + t_p, y_k, h_k, h'_p, a_k\right)$. Let $V_k(s_k)$ denote the kid's value function in the second stage.

1.3.2 Household Decision Problems

I now describe the recursive formulation of the household's decision problems. Households take all prices as given. Each household's decision problem is divided into a discrete owning/renting choice. Households first find the optimal consumption, savings, and transfer policies conditional on a housing choice and then pick the housing choice that maximizes utility.

Decision Problems of the Kid-Parent Pair

I now show the decision problems of both households, conditional on them choosing to own $h'_k = h_o$. Appendix A.2.2 contains the problems conditional on renting and for the final period of life of the parent.

Kids - Second Stage: The kid chooses consumption, savings, and housing:

$$\begin{aligned} V_k(\mathbf{s}_k) = \quad & \max_{c_k, b'_k, h'_k = h_o} u(c_k, h'_k) + \beta \mathbb{E}\left[V_k(\mathbf{s}'_k)\right] \\ & \text{s.t.} \quad b'_k = x_k + t_p + w_k - c_k - ph'_k - adj(h_k, h'_k) \\ & \qquad\ \ x'_k = b'_k(1 + r(b'_k)) + ph'_k(1-\delta) \\ & \qquad\ \ b_k \geq -LTV p h'_k. \end{aligned} \tag{1.8}$$

$$\begin{aligned} \text{Where } \mathbf{s}_k &= \left(b'_p, h'_p, x_k + t_p, y_k, h_k, h'_p, a_k\right), \\ \mathbf{s}'_k &= (b^*_p(\mathbf{s}'_p), h^*_p(\mathbf{s}'_p), x'_k + t^*_p(\mathbf{s}'_p), y'_k, h'_k, a_k + 2). \end{aligned}$$

Transfers from parents increase kid's cash-on-hand. In addition to this wealth effect, a transfer may relax the borrowing constraint. The transfer does not directly interact with the adjustment cost, but, as discussed in Section A.7, the adjustment costs incentivizes kids to overconsume housing. Kids takes into account how their choices, by affecting the parents state $\mathbf{s}'_p$, affect the parent's next-period choices. Denote the resulting policy functions by $c^*_k(\mathbf{s}_k), h'^*_k(\mathbf{s}_k), b'^*_k(\mathbf{s}_k)$, where the superscript asterisk denote the optimal choices. It will be convenient to denote next-period wealth by $x'^*_k(\mathbf{s}_k)$.

Parents - First Stage: The parent chooses consumption, savings, housing and the transfer:

$$
\begin{aligned}
V_p(\mathbf{s}_p) = \max_{c_p, b'_p, h'_p = h_o, t_p} \; & u(c_p, h_p) + \eta u\left(c^*_k(\mathbf{s}_k), h'^*_k(\mathbf{s}_k)\right) + \beta \mathbb{E}\left[V_p(\mathbf{s}'_p)\right] \\
\text{s.t.} \quad & b'_p = x_p + w_p - c_p - t_p - ph'_p - adj(h_p, h'_p) \\
& x'_p = b'_p(1 + r(b'_p) + p'h'_p(1-\delta) \\
& t_p \geq 0, \\
& b'_p \geq -LTV \times ph'_p.
\end{aligned}
\tag{1.9}
$$

$$
\begin{aligned}
\text{Where } \mathbf{s}_k &= \left(b'_p, h'_p, x_k + t_p, y_k, h_k, h'_p, a_k\right), \\
\mathbf{s}_p &= (x_k, x_p, y_k, h_k, h_p, a_k) \\
\mathbf{s}'_p &= \left(x'^*_k(\mathbf{s}_k), x'_p, y'_k, h'^*_k(\mathbf{s}_k), h'_p, a_k + 2\right).
\end{aligned}
$$

The parent moves first and takes into account how his choices will affect the choices of the kid in the second stage. There are two distinct strategic considerations. First, the parent affects the kid's consumption in this period. Second, the parent affects the kids housing tenure and savings choices. For example, it may be that the parent observes that the kid will sell his house without transfers. However, the parent can prevent this by transferring sufficient funds to keep this 'house-rich and cash-poor' kid in their home.

1.3.3 Measures of Households

I now define the measures of households and the related laws of motion. The state-space of a parent household is $S_p = X_k \times X_p \times Y_k \times H_k \times H_p \times A_k$, with $\mathbf{s}_p$ denoting generic elements therein and $\mathcal{S}_p$ the associated Borel-σ algebra. The state space of a kid household is $S_k = B_p \times H_p \times X_k \times Y_k \times H_k \times A_k$, where $B_p = \mathbb{R}$. For conciseness, I omit further definitions for the kid. Let $\psi_p(\mathbf{s}_p)$ be a probability measure over $(S_p, \mathcal{S}_p)$ so that $\psi(\mathbf{s}_p)$ denote the measure of households with state $\mathbf{s}_p$ (i.e., after the shock is realized but before choices are made). Finally, Ψ_p denotes the corresponding cumulative distribution function. The mass of households for each age is normalized to 1/15.

Law of Motion for Dynasties with Kids Aged 25-51: The mass of households with state $\mathbf{s}_p$ is the mass of families that choose policies for housing and savings such that they can end up in this state multiplied by the probability of that specific income shock

$$\begin{aligned}\psi(\mathbf{s}_p') = \int_{\mathbf{s}_p \in \mathcal{S}_p} & \mathbf{1}_{\left\{x_p' = x_p'^*(\mathbf{s}_p)\right\}} \mathbf{1}_{\left\{h_p' = h_p'^*(\mathbf{s}_p)\right\}} \mathbf{1}_{\left\{x_k' = x_k'^*(\mathbf{s}_k(\mathbf{s}_p))\right\}} \mathbf{1}_{\left\{h_k' = h_k'^*(\mathbf{s}_k(\mathbf{s}_p))\right\}} \times \\ & \pi(y_k'|y_k)\, \mathrm{d}\psi(\mathbf{s}_p).\end{aligned} \tag{1.10}$$

Note that the kid's state $\mathbf{s}_k(\mathbf{s}_p)$ in these expressions depend on the choices of the parent which depend on their state.

Law of Motion for Kids Aged 53: In this special case, the distribution will depend on the choices of the new parent (old kid), the now deceased parent and the stochastic initial conditions of the new kid.

$$\begin{aligned}\psi(\mathbf{s}_p'; a_k = 25) = \int_{\mathbf{s}_p \in \mathcal{S}_p} & \mathbf{1}_{\left\{x_p' = x_p^*(\mathbf{s}_p) + x_k^*(\mathbf{s}_k(\mathbf{s}_p))\right\}} \mathbf{1}_{\left\{h_p' = h_p^*(\mathbf{s}_p)\right\}} \mathbf{1}_{\left\{h_k' = h_r\right\}} \times \\ & F(x_k', y_k'|x_k, y_k)\, \mathrm{d}\psi(\mathbf{s}_p; a_k = 53),\end{aligned} \tag{1.11}$$

where we limit s_p to only include the subset of the state-space where $a_k = 53$. The initial wealth and productivity of the child depends on the wealth x_k and productivity y_k of the new parent at age 53. Further, all kids start out as renters, and the next-period wealth of the new parent is savings plus bequests.

Finally, the function $\mathcal{H}$ operates on the distribution $\psi(\mathbf{s}_p)$ and policy functions and maps them into a new distribution in accordance with equations (1.10, 1.11):

$$\psi_{n+1} = \mathcal{H}(\psi_n, g^*), \tag{1.12}$$

where the subscript denotes the iteration of the distribution. A stationary distribution is then a fixed point of equation (1.12).

1.3.4 Equilibrium Definition

A stationary equilibrium, which is also Markov Perfect, is a collection of value functions $V_k(\mathbf{s}_k)$ and $V_p(\mathbf{s}_p)$, policy functions of the kid $c_k'^*(\mathbf{s}_k)$, $b_k'^*(\mathbf{s}_k)$, $h_k'^*(\mathbf{s}_k)$ and the parent $c_p'^*(\mathbf{s}_p)$, $b_p'^*(\mathbf{s}_p)$, $h_p'^*(\mathbf{s}_p)$, $t_p'^*(\mathbf{s}_p)$, and a distribution of households $\psi(\mathbf{s}_p)$ such that:[7]

1. In each repetition of the parent-kid stage-game:

   a) The parent's policy functions are optimal given the kid's policy functions.

   b) The kid's policy functions are optimal given the parent's policy functions.

2. The measure of households is invariant.

Finally, since this is an infinitely repeated game the equilibrium need not be unique. However, I experiment with different starting positions and verify that they all yield the same equilibrium.

1.3.5 Model Discussion

Several properties of this setup are worth noting. The lack of commitment generates strategic interactions. The parent faces the Samaritan's Dilemma, where the kid undersaves to receive larger transfers. Second, the parent may be able to give 'gifts-to-autarky', where the parent can push the kids into self-sufficiency (see Section A.7 for details). Further, both households internalize fully how their behavior will affect the other in current and future periods. Since households lack a commitment technology, there is only limited risk-sharing between parents and kids, a result well-established in the empirical literature (Boar, 2018; Attanasio et al., 2018).

In models with rental and owner-occupied markets potential homeowners buy housing if, and only if, the benefits of owning exceed those from renting. Thus, differences in an individual's desire to own will be affected by differences in net

[7] In Section 1.5.3 I additionally include endogenous supply of owner-occupied units, where the supply depends on the price p.

benefits. What is the impact of altruism and illiquid housing on the relative benefits of owning? There are four distinct mechanisms that I now discuss in detail.

First, the introduction of altruism lowers the kid's savings motive. Since households only buy once they cross a wealth threshold, the decreased savings motive lowers homeownership.

Second, the LTV constraint introduces another transfer motive. Consider a child that would benefit from owning but cannot satisfy the LTV constraint. When the LTV constraint is binding, the marginal utility of wealth is high, and so transfers are more valuable. This mechanism increases homeownership.

Third, transfers decrease the downside risk of illiquid housing when there is income risk. A child that owns and receives a sequence of bad income shocks will sell and pay the sales cost m_s, unless the parent transfers. This channel increases the expected net benefit of owning for households with wealthier parents and so increases homeownership.

Fourth, illiquid housing can increase future transfers. A child who spends all his wealth on buying a house in a given period will in the next period either have low goods consumption or will sell the house, pay the sales cost, and balance housing and non-housing consumption. In the first case, the parent may want to transfer since the child's marginal utility of non-housing consumption is high. In the second case, the parent may want to transfer to keep the child in the house, keeping the sales cost in the family. Thus, the child may want to over-invest in illiquid housing to extract future transfers.

The model has implications for the propensity to be liquidity-constrained (hand-to-mouth). Households who are liquidity constrained have higher marginal propensities to consume and are important drivers of aggregate consumption responses (Kaplan and Violante, 2014). The downside of being liquidity constrained is lower with altruism since transfers may provide insurance against income shocks. The upside is also larger since 'house-rich, cash-poor' households may receive additional transfers. A policy rebate targeted to hand-to-mouth households may then disproportionately flow to households who a) would get parental transfers without the policy, b) have wealthier parents, and c) have strategically chosen to have low liquidity. Further, Boar et al. (2020) show that heterogeneity in discount factors and risk aversion may be an important element in the propensity to be hand-to-mouth. However, having wealthier parents decreases savings rates and increases consumption, which is observationally similar to higher discount rates or higher intertemporal elasticity.

1.3.6 Stylized Two-Period Model

In Appendix A.7, I solve a more tractable stylized two-period model based on the workhorse model of Altonji et al. (1997). I use this model to show the effects of sales costs on the transfer behavior in a setting where the only frictions are the lack of commitment and a sales cost on housing. I find that, with illiquid housing and no commitment, a) children with wealthy parents prefer sales costs, b) these children invest in illiquid housing to extract future transfers increasing their discounted utility, and c) these results are true under a broad set of utility functions.

1.4 Parameter Selection

To quantify the effects of parental assistance on homeownership and evaluate counterfactual policies, I estimate the model using data from the PSID. I follow a standard two-step estimation procedure. In the first step I estimate parameters that do not require the model structure directly from the data or take them from the literature. In the second step I estimate the remaining parameters using simulated method of moments (SMM). After estimating the model I validate the model using non-targeted moments from the PSID as well as experimental evidence from previous empirical work.

All data moments come from the 1999-2017 waves of the PSID. Income, wealth, and housing values are all winsorized at the 1st and 99th percentiles to limit the role of outliers when calculating ratios. All calculations use family weights.

1.4.1 Parameters Chosen Independently and Externally

All externally calibrated parameters and values are summarized in Table 1.3.

Period Length: Each decision period is calibrated to be two years to overlap with the PSID interview frequency. I report all parameters in their bi-annualized forms (e.g., the interest rate is the two-year interest rate).

Income Process: The income processes consist of a deterministic life-cycle component l_a for all ages and shocks y_a for kids. I first find the weighted average household income by age and year. I weight each year equally to obtain the life-cycle profile. I then regress average income on a fifth-order polynomial of age. I use the predicted values from this regression as the deterministic life-cycle component of income l_a for households aged 25-63. Next, to find retirement income l_r, I take the average income for households aged 65-83 and divide it by the predicted income at age 63. Multiplying this ratio by the predicted income at age 63 l_{63} gives retirement income l_r. Figure A.6a displays the data and predicted values.

To calibrate the stochastic income process $y_{i,a}$, I first set $N_y = 3$ to obtain a three-state Markov Chain. The sample is divided into age-specific income tertiles. I then find the empirical age-dependent transition matrices, plotted in Figure A.6c. To find the values $v_{i,a}$ for each tertile, I normalize each household's income by the median income within each age group and then find the median income within each tertile. The results are plotted in Figure A.6b.

Initial Conditions of the Young $y_{k,25}, x_{k,25} \sim F(x_{k,53}, y_{k,53})$: This joint distribution is important to match intergenerational correlations in initial wealth and productivity. To provide a simple and intuitive method, I estimate it nonparametrically. First, I use $N_k^x = 4$ quantiles for wealth and the N_y productivity tertiles for households aged 25. For the parents, I divide wealth into $N_p^x = 4$ quantiles for each of the productivity tertiles. I then find the probability of each parent-kid combination in the data and use this as the PDF.

Housing Parameters: I set the rental-rate $q = 0.10$ as is standard in the literature and estimated in Davis et al. (2008). Housing depreciation and maintenance δ is set to 0.05 to match depreciation of existing housing capital as estimated in Harding et al. (2007). The sales cost m_s is set to 7.5% and the purchase cost $m_b = 2\%$, based on Yang (2009).

Financial Parameters: I set $LTV = 0.80$, a standard value in the literature which also matches the average LTV ratio at loan origination for prime mortgages from Freddie Mac. The interest rate on savings is set to be $r = 0.04$.

Risk Aversion and Housing Expenditure Share: I set the risk aversion parameter $\gamma = 2.0$ a standard value in the literature. The risk aversion parameter γ is the strength of the transfer motive, as it pins down the slope and curvature of the utility functions. To aid comparisons with the literature, I set $\gamma = 2.0$ as in Boar (2018).[8] The parameter ξ pins down the expenditure share of housing consumption and is set to 0.175. This parameter is typically set to be around 0.15-0.2 (e.g., Kaplan et al., 2020; Chatterjee and Eyigungor, 2015; Paz-Pardo, 2019) based on the share of nominal housing expenditures in nominal personal consumption expenditures. However, I internally estimate the discount factor β since there are no standard values for it in a model with housing and transfers.[9]

1.4.2 Moments and Identification

The remaining six parameters $\theta = (\beta, \eta, \chi, r^m, p, h_o)$ are chosen to minimize the distance between eight simulated moments and empirical moments. All empirical moments are taken from the 1999-2017 PSID, and are listed in Table 1.5 along with the simulated moments. I now discuss how each moment is estimated in the data and give a heuristic explanation of why the moments identify the parameters. For each moment (e.g., median wealth), I aggregate over age bins (25-44 & 55-74) and years. To remove year effects, I aggregate over all years giving each year equal weight.

I target two moments related to wealth accumulation over the life-cycle that are important for altruism intensity η and the discount factor β: median wealth of young (\$23,500) and old (\$206,700) households. I target the median for two reasons. First, this paper is not about the wide dispersion and fat tails in the US wealth distribution, so targeting the mean will make households too rich. Second, parental transfers for

[8] I have experimented with estimating this parameter internally. However, it is difficult to jointly identify risk aversion γ and η without introducing other sources of risk that would help determine risk aversion.

[9] To the best of my knowledge, my paper is the first life-cycle model with transfers and both rental and owner-occupied housing.

Table 1.3: Summary of Externally and Independently Estimated Parameter

Parameter		Value	Source
Period Length	–	2 years	PSID Frequency
Rental Price	q	0.10	Standard
Deprecation	δ	0.05	Standard
Risk-free Rate	r^f	0.04	Standard
Expenditure Share Housing	ξ	0.175	Standard
Risk Aversion	γ	2.0	Standard
Max Loan-to-Value	LTV	0.8	Standard
Rental Size	h_r	1.0	Normalization
Initial Distribution	$F(x_{53}, v_{53})$	Fig. A.6d	PSID
Deterministic Income	l_a	Fig. A.6a	PSID
Productivity Shocks for Kids	$y, \Pi(y'\|y)$	Fig. A.6b,A.6c	PSID
Selling & Buying Cost	(m_s, m_b)	(0.075,0.02)	Yang (2009)

Notes: Rental price q, depreciation δ, and the risk-free rate r are bi-annualized (two-year values). All moments estimated from the PSID use waves from 1999-2017.

housing are most important for dynasties who are neither poor nor rich, so matching the middle of the wealth distribution is more important. The peak of life-cycle income is largely determined by the discount factor β. At the same time, the wealth of young households help to identify altruism η: when the parent is more altruistic their children increase overconsumption, decreasing wealth.

I target two moments directly related to housing: the homeownership rate of young households (49.4%) and the rent-to-income ratio for young renters (0.23).[10] The young homeownership rate is a crucial moment to match for this paper. The rent-to-income ratio ensures correct selection into homeownership by income. Both of these moments depend on many of the parameters but are particularly affected by the price level p and the relative size of the owner-occupied unit h_o. In particular, higher prices increase the rent-to-income ratio, while lower house sizes increase the homeownership rate.

Next, I target two moments related to the timing of first purchase: average

[10]Rent-to-income values outside $(0, 1)$ are coded as missing.

LTV (0.67) and average age (32.5) when households become first-time homeowners. LTV at purchase is defined as the mortgage balance over house value in the period households are first observed as homeowners. Age at purchase is similarly defined.[11] It is important to match these moments so that the rent-to-own transition happens while households are young, have not accumulated too much wealth, and take out large mortgages, as in the data. The LTV at purchase is affected by the mortgage premium r^m, as a lower premium decreases the costs of borrowing, while the age at purchase is pinned down by the price level (higher prices delays ownership) and the ownership preference shifter χ.

Finally, I target two moments related to transfers: the average transfer rate to young kids (35.8%) and the transfer rate around first-time purchases (39.0%). Both moments are estimated from matched child-parent pairs from the 2013 transfer supplement. I ignore transfers of less than $500, as these transfers are not quantitatively important but increase the transfer rate significantly. For transfers around first-time home purchases, I include transfers given in the period before, during, and after purchase. I include transfers after purchase since the empirical results suggest that future transfers increase the relative benefit of owning. Further details about the estimation of transfer moments are in Appendix A.2.1. These moments are important to ensure that the transfers frequencies are correct. The transfer rate pins down the altruism intensity η. The transfer rate around purchase is most informative about the price level, as an excessively high price level implies that children who own are so wealthy that parents do not transfer.

1.4.3 Model Fit

I estimate the remaining six parameters by the simulated method of moments (SMM). I first draw a large set of quasi-random parameter vectors from a Sobol sequence. For each parameter vector, the model fit is defined as the squared distance between the

[11] LTVs above 1 are coded as missing. I cannot observe time of purchase for households who enter the sample as homeowners. To be consistent with the model, such households who enter at age 25 or 26 have an age-at-purchase of 25, while the others are coded as missing.

Table 1.4: Estimated Parameters

	Parameter	Value	Std. Err.	Ident. Moment
β	Discount Factor	0.925	0.004	Median Wealth (55-74)
η	Altruism	0.457	0.068	Parent Transfers (55-74)
χ	Ownership Pref.	1.379	0.156	Age First Own (25-44)
r_k^m	Mortg. Prem	0.019	0.006	LTV at purchase (25-44)
$\frac{h_o}{h_r}$	Size Ratio	3.120	0.291	Rent / Income (25-44)
p	House Price	81.966	6.610	Owner (25-44)

Notes: Standard errors calculated from estimating the model to 100 bootstrapped samples. The table lists one main identifying moment.

eight simulated moments m^s and the empirical moments m^e

$$\hat{\theta} = \arg\min \sum_{j=1}^{8} \frac{(m_j^d - m_j^e)^2}{m_j^e}, \tag{1.13}$$

where the squared distance of each moment is normalized by its empirical mean. The parameter vector that minimizes the objective (1.13) is the approximate global optimizer. I use this vector as the starting point for a local optimizer that uses a simplex algorithm to the find the local minimum. In Appendix A.5.2 I show how this method can verify that each parameter is identified and how each moment is affected by the different parameters.

The estimated parameters are reported in Table 1.4 and are in line with previous literature and their direct empirical counterparts. The main preference parameters β and η are in line with estimates in related papers (e.g., Boar 2018; Daruich 2018; Lee and Seshadri 2019). The ownership preference shifter indicates that households gain 38% more housing services by owning relative to renting and is somewhat lower than in related papers (e.g., Corbae and Quintin 2015; Chang 2020; Fisher and Gervais 2011). The mortgage premium r_m is estimated to be 0.019, or 1% per annum. This is low relative to the true mortgage premium in the US which is estimated to be around 2-4% (e.g., Boar et al. (2020); Cocco (2005)). However, standard theory suggests the interest rate on risk-free one-period bonds would be lower than on long-term bonds

Table 1.5: Targeted Moments

Moment	Data	Model
Median Wealth (25-44)	23.54	23.49
Median Wealth (55-74)	206.67	206.82
Owner (25-44)	0.49	0.48
Rent / Income (25-44)	0.23	0.21
Age First Own (25-44)	32.53	32.89
LTV at purchase (25-44)	0.67	0.66
Parent Transfers (55-74)	0.36	0.45
Transfers Around Purchase (25-44)	0.39	0.38
Sum Squared Distances		0.03

Notes: All moments calculated from the 1999-2017 waves of the PSID, using households aged 25-83, except transfers which is from the 2013 PSID Transfer Supplement. Wealth is measured in 1000s of 2015 US dollars.

with default. The owner-occupied size is 3.12, relative to a rental size normalized to 1, and the price is estimated to be $81,966 in 2015 dollars per housing unit. This implies that the owner-occupied house costs $255,734. In the PSID the average market value of owner-occupied units among households aged 25-44 is $232,918. The size ratio is hard to compare between models and depends on the number of house sizes. Still, my estimate of 3.12 is in the middle of the range estimated in Kaplan et al. (2020). I expand on verifying identification in Appendix A.5.2.

Table 1.5 shows that the model matches targeted moments well. It matches wealth, the homeownership rates, rent-to-income, age of first ownership, and LTV at purchase very precisely. It overpredicts the two-year transfer rate somewhat (36% vs 45%) but matches the transfer rate around kid's house purchases. It should be noted that the transfer moments are also least precisely estimated since they only use data from a single wave of the PSID.

1.4.4 External Validity

To validate the model, I show that the model also matches non-targeted moments. In addition, a simulated panel from the model replicates reduced-form estimates on the role of parental wealth and transfers on children's housing outcomes covered in Section 1.2.4.

First, the model replicates the correlation between parental wealth and children's homeownership. In the PSID, young homeowners' parents are 2.52 times as wealthy as young renters' parents. I call this ratio the parental wealth gradient (in homeownership). This number is useful to summarize the role of parental wealth in their kids' housing outcomes. The model predicts a very similar ratio of 2.49. The value of the parental wealth gradient will be one of the main outcomes of interest in counterfactual exercises and positive policy analysis.

Next, I show that the model matches other moments related to homeownership and housing purchase decisions. First, the aggregate homeownership among households aged 25-73 is 65%, while the model predicts 60%. Second, the wealth at purchase of \$45,690 in the model is slightly higher than in the data (\$33,360), but almost with the bootstrapped standard error of \$10,438. The slightly high wealth at purchase is likely a result of the slightly high minimum downpayment in the model (LTV=0.8), while some households do have access to mortgages with lower down payments (Corbae and Quintin, 2015; Hatchondo et al., 2015). In the PSID, young homeowners' average outstanding mortgage balance is \$143,950, while the model equivalent is \$123,930.

The last row reports the effect of receiving larger transfers on the probability of becoming a home owner, controlling for a set of observables. In particular, I replicate the regression from Lee et al. (2020), Tables 7-8. These regressions use a linear probability model to estimate the effect of receiving a transfer over \$5,000 on the probability of becoming a homeowner in the PSID and the HRS[12]. The estimated treatment effect varies from 0.03-0.08, while the simulated panel finds that the effect,

[12]Similar regressions are also used in Engelhardt and Mayer (1998); Guiso and Jappelli (2002); Blickle and Brown (2019), who find roughly similar magnitudes. A full description of the regression specification is in Appendix A.5.4. These results should not be interpreted causally: for example, households may receive transfers specifically because they are buying a house.

Table 1.6: Non-Targeted Moments

Moment	Data	Model
Parent Wealth Gradient (25-44, median)	2.52	2.49
Owner (25-73)	0.65	0.60
Wealth at Purchase (25-44)	33.36	45.69
Mortgage (25-44)	143.95	123.93
$Prob(NewOwner \| t_p > \$5000, Controls)$ $-Prob(NewOwner \| t_p \leq \$5000, Controls)$	(0.03-0.08)	0.07

Notes: All moments calculated from the 1999-2017 waves of the PSID, using households aged 25-83. Wealth is measured in 1000s of 2015 US dollars. The last row reports the regression results from Lee et al. (2020) and the simulated panel (see discussion in the main text and Section A.5.4 for details).

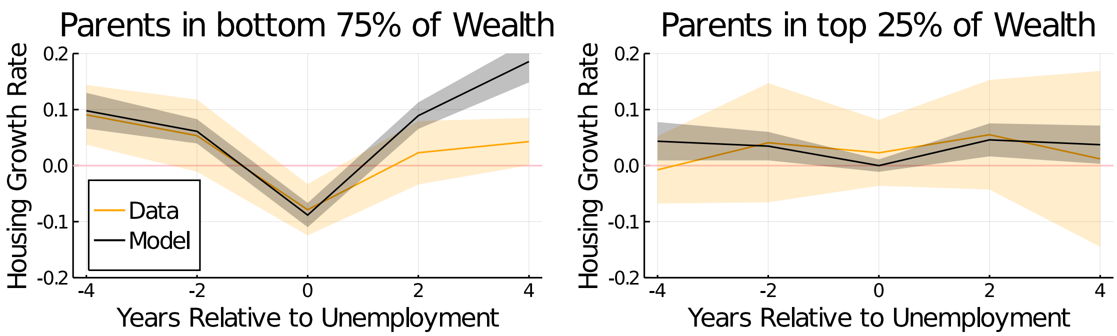
after controlling for wealth, income, and age, is 0.07.

As a final external validation, I show that the model approximately replicates the reduced-form evidence from the event study in Section 1.2.4 by repeating the event study in the simulated panel. Households are counted as unemployed if their productivity state drops to the lowest level for only one period. Otherwise, I mimic the exercise exactly. Figure 1.4 shows the results. We see that the simulated model matches both the qualitative and quantitative patterns from the empirical sample (Figure 1.2). Households with non-wealthy parents decrease housing consumption by 8% and 9% in the simulated and empirical samples, and the two confidence intervals overlap. We cannot reject the null hypothesis of no effect for wealthy households in either the empirical or simulated data.

1.5 Homeownership Rates Without Transfers?

In this section I answer the question: what would the homeownership rate be without transfers? I simulate the model under the same parameters but set $\eta = 0$ in order to eliminate transfers and bequests. The model is then a standard life-cycle housing model.

Figure 1.4: Event Study: Housing Consumption at Unemployment by Parental Wealth



Notes: Lines denote means, and shaded areas indicate 95% confidence intervals. The light orange area denotes the empirical estimates (Section 1.2.4), and the darker black areas denote the results from the simulated panel. Unemployment in the model is defined as the lowest productivity level. The sample consists of households aged 20-45 with exactly one unemployment spell and without changes in head or spouse in the four years before and after unemployment.

Importantly, I assume that the supply of housing is perfectly elastic (i.e. that the house price does not change). While this assumption is prima facie incorrect, keeping prices constant allows for a clean decomposition of the various mechanisms that change the homeownership rates with and without transfers. However, while homeownership of the young decreases significantly without transfers, the aggregate ownership rate falls less, limiting the scope of price adjustments. Finally, I show that the results are not sensitive to an endogenous housing supply for any supply elasticity.

1.5.1 Results with Constant Prices

Table 1.7 reports how the moments change without altruism and transfers. Homeownership rates go down by 15 pp. from 49, a decrease of 31% among young (25-44) households. This is a large decrease – in comparison, homeownership only decreased by 8 percentage during the financial crisis.

What are the drivers of this decrease in homeownership? Without altruism, the median wealth doubles among the young and is unchanged among parents, all else equal, increasing homeownership. However, the age at first purchase increases from

Table 1.7: Homeownership Decreases while Wealth Increases Without Altruism

Moment	Data	Altruism $\eta > 0$	No Altruism $\eta = 0$
Targeted Moments			
Median Wealth (25-44)	23.54	23.47	42.13
Median Wealth (55-74)	206.67	206.78	208.20
Owner (25-44)	0.49	0.48	0.33
Rent / Income (25-44)	0.23	0.21	0.20
Age First Own (25-44)	32.53	32.89	37.52
LTV at Purchase (25-44)	0.67	0.66	0.46
Parent Transfers (55-74)	0.36	0.45	0.00
Transfers Around Purchase (25-44)	0.39	0.37	0.00
Non-Targeted Moments			
Parent Wealth Gradient (med)	2.53	2.49	1.25
Owner (25-73)	0.65	0.60	0.55
Wealth at Purchase (25-44)	33.36	46.85	74.31
Mortgage (25-44)	143.95	123.93	60.25

33 to 37.5. The change is driven by changes in the threshold where owning becomes more attractive than renting: i) the LTV at purchase decreases from 0.66 to 0.46, ii) wealth at purchase increases by $28,000, and iii) households are less willing to take out mortgages and debt among owners decreases by 50%. The overall homeownership rate (25-70) falls by only 5 pp. (8%). Finally, without altruism the parental wealth gradient falls from 2.46 to 1.25, with the remaining effect driven by persistent productivity through initial conditions $F()$. The LTV at purchase falls without transfers, implying that the LTV constraint is no longer binding for most households.

There are three takeaways from this experiment. First, parental transfers are important for the homeownership rate of young households. Second, this effect is driven not by a wealth effect but that homeownership is less attractive without transfers. Third, transfers, not intergenerational persistence in productivity, is the main driver behind the correlation between parent wealth and housing outcomes.

1.5.2 Which Frictions Generate a Role for Transfers?

Why are transfers so important for the housing decisions of young households that they account for 15 percentage points (31%) of the homeownership rate? To understand this question, I now decompose the effect of three frictions: i) LTV requirement, ii) illiquidity of housing, and iii) uninsurable income risk. The LTV requirement accounts for 77%, illiquidity for 61%, and income risk for 97% of the parental transfers effect on the homeownership rate of young adults. The results are reported in Table A.3.

Removing the LTV requirement: When there is no minimum downpayment ($LTV = 1.0$) all renters can afford to buy, and all owners can afford to stay in their house. In this case, the homeownership rate increases to 55% with altruism, and to 51% without. Parental transfers account for $\frac{0.04}{0.55} = 7\%$ of the homeownership rate when there is no downpayment requirement. The LTV friction thus accounts for $1 - \frac{0.07}{0.31} = 77\%$ of the parental transfer effect in homeownership. LTV requirements increase the role of parent wealth since transfers relax borrowing constraints.

Making housing liquid: Housing is liquid when both sales m_s and purchase costs m_b are 0. At this point housing is risk-free since the price is constant, and households can sell their house without loss if they experience a bad shock. Homeownership now increases to 51% with altruism, and to 45% without altruism, and transfers account for 12% of the homeownership rate with liquid housing. Thus, the illiquidity of housing accounts for $1 - \frac{0.12}{0.31} = 61\%$ of the parental transfer effect. Illiquidity increases the role of parent wealth for two reasons. First, parents provide partial insurance against having to pay the sales cost. Second, some households with wealthy parents invest in housing because it is illiquid to extract future transfers. An interesting side effect, which I explore in Section 1.6.2 below, is that the parental wealth gradient decreases from 2.49 to 1.62 when housing is liquid.

Removing income uncertainty: To remove income risk while not changing average income, I set the productivity shifter within each age to the average level at that age. With certain income the homeownership rate increases to 62% with altruism, and 61% without, and transfers account for $\frac{0.01}{0.62} = 1\%$ of the homeownership rate without income risk. and uninsurable income risk accounts for $1 - \frac{0.01}{0.31} = 97\%$ of the parental transfer effect in homeownership of the young.

1.5.3 Endogenous House Prices

In this section, I show that the decrease in homeownership rates without parental transfers remains even with endogenous supply of owner-occupied housing and a market clearing price. Since the fall in overall homeownership is much smaller than among young households (15 and 5 percentage points, respectively) there is only limited room for endogenous adjustment to affect the results. As shown in Greenwald and Guren (2020), how one closes the housing market has large impacts on how changes in demand and credit conditions affect aggregate homeownership rates.[13]

I close the housing market by introducing an exogenous reduced-form housing supply equation

$$\ln H^S = \alpha_0 + \alpha_1 \ln p, \tag{1.14}$$

where α_1 is the aggregate elasticity of supply to prices, and H^S denotes the level of supplied housing. Letting $\alpha_1 \to \infty$ yields a perfectly elastic supply function which keeps the prices constant, which is the same experiment as in the main quantitative exercise (Table 1.7). When $\alpha_1 = 0$, housing supply is in perfectly inelastic, and the price must decrease to keep the homeownership rate constant. The benefits of this approach are its transparency and agnosticism on the drivers of housing supply changes. I calibrate the housing supply elasticity from equation (1.14) as follows. For any elasticity α_1, I set α_0 to be such that housing supply would equal housing demand in the benchmark model with altruism: $\alpha_0(\alpha_1) = \ln(H^d) - \alpha_1 \ln p$, where p is estimated price in Table 1.4.

[13] It is also important how rental rates q are determined, especially for the potential of so called “rental traps” where high rental prices make saving for a down payment difficult. The degree of segmentation between the rental market and housing market is usually modeled with full or no segmentation. If there is full segmentation (e.g., Favilukis and Van Nieuwerburgh, 2017; Justiniano et al., 2019) there is a constant supply of owner-occupied housing. Any change that makes homeownership more likely must then increase the house price (relative to rents). The other extreme is to have perfectly elastic supply of rental units (e.g., Kaplan et al., 2020), typically through deep-pocketed landlords who convert rental units to owner-occupied units if the market price exceeds the present value of rents. I follow the latter approach.

Table 1.8: Housing Supply Elasticities Not Quantitatively Important

Moment	Altruism Benchmark	Without Altruism Elastic	Middle	Inelastic
Aggregate Moments				
Supply Elasticity		∞	5.00	0.00
House Price	81.97	81.97	80.89	77.85
Owner (25-73)	0.60	0.55	0.56	0.60
Targeted Moments				
Median Wealth (25-44)	23.47	42.13	42.24	43.00
Median Wealth (55-74)	206.78	208.20	209.95	206.32
Owner (25-44)	0.48	0.33	0.35	0.37
Rent / Income (25-44)	0.21	0.20	0.20	0.19
Age First Own (25-44)	32.89	37.52	36.72	36.81
LTV at Purchase (25-44)	0.66	0.46	0.48	0.49
Parent Transfers (55-74)	0.45	0.00	0.00	0.00
Transfers Around Purchase (25-44)	0.37	0.00	0.00	0.00

I report results when house prices are perfectly inelastic, perfectly elastic, and one intermediate case with an elasticity of 5.[14] Table 1.8 reports the results. The main takeaway from these results is that allowing house prices to adjust does not matter a great deal for the aggregate outcomes in steady state. Given the small difference in the overall homeownership rate with and without altruism this is as expected. Even in the extreme case of perfectly elastic housing supply, prices fall by only 5.0%. None of the moments are sensitive to supply elasticity. In the benchmark experiment, with elastic supply, transfers account for 15 percentage points of the homeownership rate. Transfers still account 11 percentage points (22%) of the homeownership rate even when housing supply is perfectly inelastic.

[14]I use twice the long-run elasticity estimated in Aastveit et al. (2020) to allow for more adjustment as I ignore other equilibrium effects.

1.5.4 Black-White Homeownership Gap

Racial differences in economic and financial outcomes, and among them homeownership, have recently received increased attention.[15]. In the United States, young white households are almost two times as likely to be owners as young black households. I find that differences in parental transfers, driven only by racial differences in income, accounts for 30% of the black-white homeownership gap of 48%.

Ashman and Neumuller (2020) use a life-cycle model and find that the black-white income gap of 40% can explain most of the black-white wealth gap of 90%. In a similar vein, Aliprantis et al. (2020) show that a reduction in the income gap will take a long time to close the wealth gap. While these papers do include racial differences in inheritances, they do not include inter-vivos transfers. Second, on the asset side, the biggest difference between poor and middle-class households is whether they own and rent. Bond and Eriksen (2020) find that parental wealth accounts for 28% of the black-white mortgage application gap and that the most important variable predicting whether households remain homeowners is parental wealth. Similarly, Charles and Hurst (2002) find that differences in parental wealth account for 25% of the black-white mortgage application gap.

To study the contribution of parental transfers to the black-white homeownership gap, I follow the methodology in Ashman and Neumuller (2020) and Aliprantis et al. (2020) closely. I shift down the deterministic life-cycle by racial differences in income: In the matched parent-child household white households have 8% higher income and black households 47% lower.I then solve the model for white households. When I solve the model for black households, I reduce the size of housing by 23% to match the rent-to-income ratio and the homeownership rate of young black households. I then solve the models without altruism. The results are reported in Table 1.9.

The black-white homeownership gap among young households is $1 - \frac{0.28}{0.54} = 48\%$ in the data and 46% in the model with altruism. Without altruism the black-white homeownership gap decreases to 32%. Transfers account for 14 percentage points or $\frac{0.32}{0.46} = 30\%$ of the black white homeownership gap. Transfers are less important for

[15] For example, “Top of the list [policies reducing racial inequality] is tackling housing segregation that is central to America’s racial economic inequality” (The Economist (July 9th), p 8).

young black households mainly because their parents have accumulated less wealth than white parents, and most moments change less when altruism is turned off for black households than for white. My results show that differences in parents wealth and income, which affect transfers, are significant contributors to racial inequality in housing outcomes. However, my model omits many other factors that affect the black-white homeownership gap such as discriminatory lending and price evaluations (e.g., Shapiro (2004)). However, these results combined with my policy analysis suggests that policies such as tax rebates for low-income first-time buyers, as suggested by President Elect Biden, will not significantly affect the black-white homeownership gap.

Table 1.9: Black-White Homeownership Rate

	White			Black		
Moment	Data	Altr	No Altr.	Data	Altr.	No Altr.
Targeted Moments						
Median Wealth (25-44)	32.99	26.76	47.02	3.70	20.38	21.98
Median Wealth (55-74)	265.40	227.86	233.34	39.26	105.12	98.47
Owner (25-44)	0.54	0.52	0.37	0.28	0.28	0.23
Rent / Income (25-44)	0.22	0.20	0.19	0.24	0.25	0.25
Age First Own (25-44)	31.94	32.56	36.73	34.87	36.02	37.40
LTV at Purchase (25-44)	0.69	0.67	0.49	0.57	0.42	0.37
Parent Transfers (55-74)	0.40	0.47	0.00	0.21	0.20	0.00
Transfers Purchase (25-44)	0.45	0.45	0.00	0.20	0.06	0.00
Non-Targeted Moments						
Parent Wealth Gradient	1.79	2.49	1.28	2.91	2.23	1.43
Owner (25-73)	0.70	0.67	0.62	0.44	0.41	0.37
Wealth Purchase (25-44)	37.33	42.36	69.57	16.19	80.81	86.94
Mortgage (25-44)	147.57	124.63	62.98	107.15	59.05	42.17

1.6 Policy, Illiquidity, and Parental Wealth

1.6.1 Policies and the Importance of Parental Transfers

Policies in many countries intend to increase homeownership rates among households, and recent years have seen an increased focus on housing affordability and delayed transitions into ownership (Goodman and Mayer, 2018; Mabille, 2020). Several policies have been proposed to combat the decrease in homeownership. I now evaluate how three different policies impact the role of parental wealth in housing outcomes.

I study the impact of three policies: increasing LTV ratios, decreasing purchase costs, and lowering sales costs. To trace out the impact of these policies, I use the following procedure. I solve the model with one policy change, where the policy change is only relevant for households aged 25-43.[16] I then take the stationary distribution (without policy changes) and simulate it for 15 periods (an entire generation) with the new policy functions and find the new distribution to understand the immediate impact of this policy.

Lowering Downpayments: The economic literature typically thinks of the downpayment requirement as the main detriment to homeownership, particularly in combination with high real house prices. Many cities have introduced grants or loans that decrease the downpayment among first-time buyers. I increase the LTV from 0.8 to 0.85 to study such policies' impact on homeownership and the parent wealth gradient.

Decreasing Purchase Costs: Related to lower minimum down payments, some cities and countries have decreased mandatory taxes, fees, and closing costs for first-time homebuyers. These policies intend to make it easier to transition from renting to owning, just as one would decrease the downpayment. To study these policies, I decrease the purchase cost (m_b) from 2% to 0%.

Decreasing Sales Costs: The results from the quantitative model have highlighted the role of illiquidity, particularly the interaction between transfers and the sales cost

[16]The policies are typically targeted to young households and first-time buyers. Keeping track of first-time buyers would require the introduction of another state variable.

m_s. To understand whether this policy would increase homeownership rates and its effect on the parent wealth gradient, I decrease the sales cost m_s from 7.5% to 5.5%.

Decreasing Costs Decrease Role of Parental Wealth

Table 1.10 reports all results, while Figure 1.5 plots the homeownership rates of young households by policy change and whether the parent's wealth is above/below the median. First, increasing the LTV increases homeownership rates among the young by 6pp (12.5%) by increasing the size of mortgages and decreasing wealth at purchase. However, the parent wealth gradient also increases, and parents of owners are now 3.36 times richer than parents of renters. Relaxing the LTV constraint increases homeownership among households whose parents' wealth was above (below) median wealth of parents by 12 (1) percentage points.

Policies that decrease purchasing costs m_b increase homeownership rates only by 1 percentage point. When purchase costs fall, owning is more attractive, and households require less wealth and lower mortgages. Unlike when the LTV constraint is relaxed, the increase in homeownership is equal among households with poor and wealthy parents. The parental wealth gradient only decreases slightly since the change in homeownership is small and almost independent of parent wealth

The last column of Table 1.10 reports the result when the sales cost is decreased, and we see that the homeownership rate actually decreases by 1 percentage point. While this result may seem counterintuitive, it can be explained by selection into ownership. Homeownership among children with wealthy parents decreases by 3 percentage points, while the homeownership among children with poor parents increases by 1 percentage point, leading to a net decline. This has a large impact on the parent wealth gradient, which now falls to 2.27 from 2.49. There are two mechanisms at play. First, housing is less risky and so parent wealth is less important, increasing ownership of households relatively more among households with poor parents. Second, since housing is more liquid, it is harder for households with wealthy parents to extract future transfers, decreasing the homeownership rate among children with wealthy parents (Figure 1.5c).

Table 1.10: Evaluating the Impact of Policies on Parent Wealth Gradient

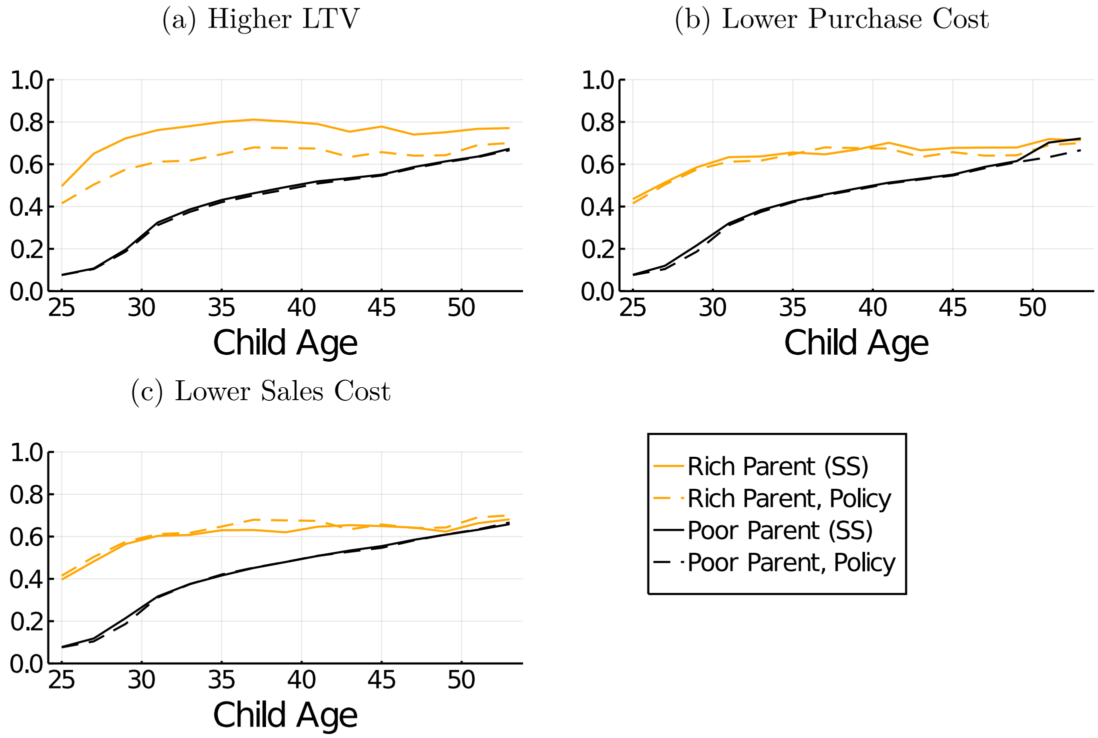
Moment	Benchmark	LTV 0.85	$m_b = 0.0$	$m_s = 0.055$
Targeted Moments				
Median Wealth (25-44)	23.47	17.66	25.83	19.21
Median Wealth (55-74)	206.78	204.28	208.94	206.78
Owner (25-44)	0.48	0.54	0.49	0.47
Rent / Income (25-44)	0.21	0.21	0.21	0.21
Age First Own (25-44)	32.89	31.92	33.03	32.95
LTV at Purchase (25-44)	0.66	0.68	0.65	0.66
Parent Transfers (55-74)	0.45	0.46	0.44	0.44
Transfers Purchase (25-44)	0.37	0.37	0.35	0.36
By Parent Wealth				
Owner (25-44), Top 50%	0.61	0.73	0.62	0.58
Owner (25-44), Bot 50%	0.34	0.35	0.35	0.35
Parent Wealth Gradient	2.49	3.36	2.51	2.27

Notes: All experiments start with the stationary distribution. I then find the decision rule after changing one policy parameter for young households (25-43) and simulate the model for 15 periods to trace out the impact of the policy on the next generation. Wealth is measured in 1000s of 2015 US dollars.

These experiments highlight two main results. First, parent wealth is an important determinant of homeownership, and having richer parents make households more likely to prefer owning to renting. Some common policies intended to increase homeownership rates change the role of parental wealth in housing outcomes. Relaxing credit constraints increase homeownership but also the role of parental wealth, since housing is more attractive to households with wealthier parents.

However, increasing liquidity, either through reducing purchase costs or sales costs, decrease the role of parent wealth. Increasing liquidity can have negative effects on homeownership, as children of wealthy parents can no longer use it as a commitment device to receive larger transfers.

Figure 1.5: Effect of Policy Changes on Homeownership by Parent Wealth



Notes: Dashed lines indicate homeownership rates in the benchmark stationary distribution, while solid lines indicate homeownership rates after the policy change, after one generation.

1.6.2 Which Households Prefer Adjustment Costs?

The previous section established that sales cost can increase the demand for owner-occupied housing for households with wealthy parents. I now show that some households with wealthy parents in fact prefer sales costs.

First, I take the benchmark stationary distribution. I then see how many child households prefer that they and future children in their own dynasty do not face sales costs ($m_s = 0$). This hypothetical is equivalent to each child answering whether they would prefer that a benevolent agent pays the sales cost for all children in the dynasty forever. Parents always prefer their childrens' housing to be liquid. Table 1.11 breaks down the characteristics by whether the child supports the elimination of

Table 1.11: Household Observables and Support for Keeping Adjustment Cost

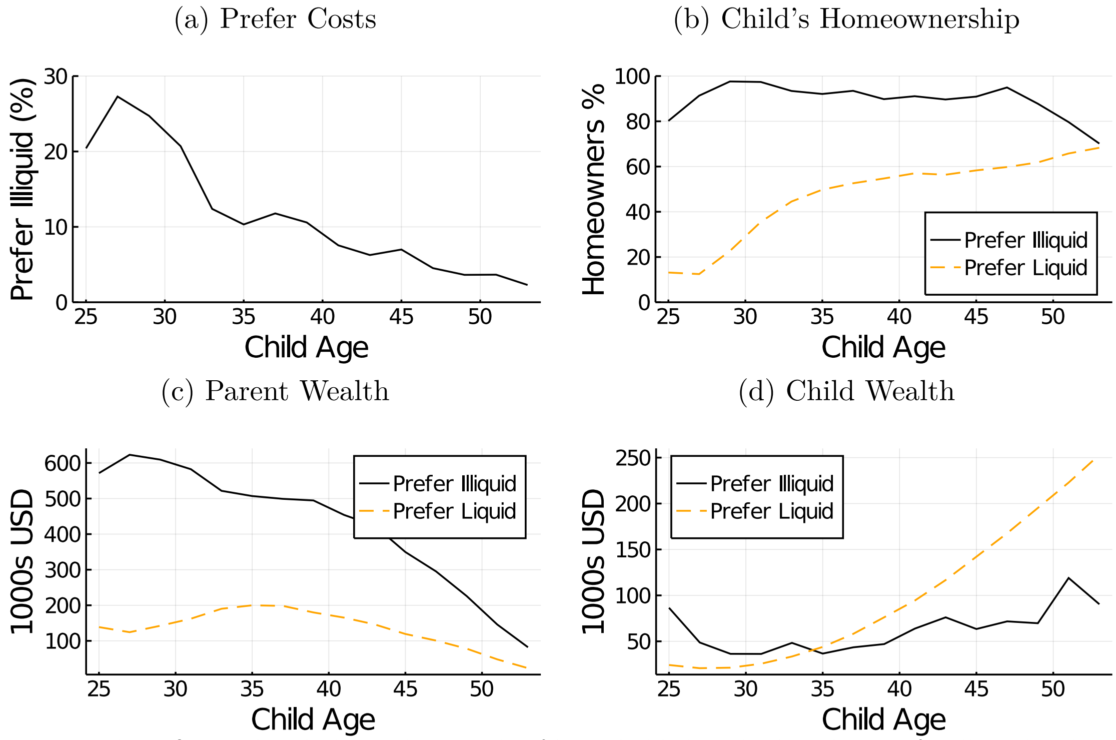
	Dislike Costs	Prefer Costs	All Children
Fraction of Children	0.89	0.11	1.00
Child Wealth	16.74	30.28	26.38
Parent Wealth	165.50	523.48	197.68
Child Ownership Rate	0.44	0.91	0.49
Transfer Rate	0.40	0.69	0.43
Transfer Size	6.48	20.40	8.00

Notes: Only includes dynasties where the child household is aged 25-44. Wealth is measured in 1000s of 2015 US dollars.

adjustment costs. First, we can see that 11% of children prefer to keep sales costs. These children are twice as rich than those who do not. The most dramatic difference between the two groups is parent wealth: the parents of children who prefer cost are three times richer. Perhaps surprisingly, households who own are more likely to prefer sales costs on their own housing. Children who prefer costs are also more likely to receive transfers (69% vs 40%), and the transfers they receive are three times larger.

We can better understand why some households prefer illiquidity by studying the age patterns. To that end, Figure 1.6a plots the fraction of children who would prefer to keep housing illiquid. We see illiquidity preference is decreasing with age. As the child ages, parenthood is closer, and no parents prefer their child's housing to be illiquid. Next, Figure 1.6b plots the homeownership rate among households by their liquidity preference. To extract transfers through illiquid housing you must own and so almost all children who prefer sales costs are homeowners. Figure 1.6c plots parent wealth by the child's liquidity preference. To extract transfers, your parents must be sufficiently wealthy, and so households who prefer illiquidity have wealthier parents. Finally, Figure 1.6d plots the child's wealth by their liquidity preference. We see that households who prefer illiquidity are initially wealthier, but this relation flips at age 33. The relationship flips because households only benefit from their housing being subject to sales cost if they are homeowners, requiring some wealth. Then, to keep benefiting, they must be liquidity-constrained (homeowners with low wealth) to

Figure 1.6: Liquidity Preference over Age



Notes: These figures break down the sample of households by whether they prefer illiquidity based on the experiment described in the text.

induce transfers.

1.7 Conclusion

In this paper, I investigate the role of inter-vivos transfers from parents on their children's housing decisions. I build and estimate a rich over-lapping generations life-cycle model with altruistic parents and housing. Through a counterfactual experiment without altruism (the standard life-cycle model) I find that transfers account for 15 percentage points (31%) of the homeownership rate. I show that policies intended to increase homeownership amplify the importance of parental wealth on housing outcomes. Finally, I study the role of housing illiquidity and parental transfers. I show that some households with wealthy parents prefer housing to be illiquid and that this results is not sensitive to preference parameters, and holds in both in the estimated quantitative model and in a stylized two-period model.

The first contribution of this paper is to study and quantify the role of parent inter-vivos transfers on the homeownership rate. Transfers increase homeownership through four distinct mechanisms: i) transfers decrease savings, decreasing ownership, ii) transfers relax borrowing constraints, increasing ownership, iii) transfers reduce the probability of costly downsizing, increasing ownership, and iv) households with wealthy parents invest more in illiquid housing, increasing ownership. My paper thus provides to a better understanding of the determinants of homeownership. More broadly speaking, my paper contributes to a growing literature that studies the role of family economics in shaping macroeconomic outcomes (e.g., Doepke and Tertilt (2016); Daruich (2018)).

The second contribution of the paper is to include a second illiquid asset into models of altruistic transfers. In models with altruistic parents, transfers flow to borrowing-constrained households since they have a large marginal utility of wealth (Boar, 2018; Barczyk and Kredler, 2018). With a single asset, this implies that households who receive transfers are poor. In the data, around 20% of all households are 'wealthy hand-to-mouth' and have positive wealth but no liquid wealth (Kaplan and Violante, 2014; Attanasio et al., 2020). My paper bridges these two strands of the literature. First, I show that some households with wealthy parents choose to be liquidity-constrained to receive larger transfers. Second, I show that transfers flow to both borrowing-constrained and liquidity-constrained households.

I made several simplifying assumptions to keep the model tractable. Incorporating richer housing dynamics would allow one to study other interesting questions, such as the extent to which transfers support price increases. Transfers are important for ownership and so increase housing demand. This increased demand increases house prices, thus increasing the wealth of parents who own, possibly spurring larger transfers. An interesting extension of my theoretical work would be to formalize and study the notion that illiquidity may reduce the commitment problem in the family. Another extension is to introduce richer heterogeneity in the income process. In ongoing work, inspired by Ashman and Neumuller (2020) and Aliprantis et al. (2020), I use the model to quantify the contribution of parental transfers to the black-white homeownership gap.

2 STOCK MARKET PARTICIPATION AND EXIT: THE ROLE OF HOMEOWNERSHIP

Abstract

This chapter argues that a large part of the stock market participation puzzle is driven by high stock market exit rates among participants: In the US, 20% of households who have stock hold no stocks two years later. Using survey data I show that stock market exit frequently coincides with renting households becoming first-time owners. After estimating a life-cycle model of portfolio choice with housing and per-period participation costs, I show that it quantitatively matches the US participation rate, homeownership rate, and entry/exit in stock markets over the entire life-cycle. The introduction of housing increases the exit rate among young new homeowners and reduces the participation rate among middle-aged and retired households by decreasing liquid wealth. Housing reduces the unexplained participation gap between the model and the data by 71%, compared to a model without housing.

2.1 Introduction

Only half of US households hold any stocks or mutual funds at any given time. Among current stock market participants, 20% exit the stock market and hold no stocks two years later. At the same time, the majority of US households own their primary residence.[1] Given the high equity premium, the low stock market participation rate challenges both economic theory and retirement policy that relies on households' private savings. In this paper, I ask whether homeownership and the frictions associated with housing can explain both the low stock market rate and the high exit rate among participants.

[1] Author's calculation from the Panel Study of Income Dynamics, see section 2.2 for details.

I first document the high exit rate from stock markets among US households. At any age, the two-year exit rate is between 15-40%, while the entry rate ranges from 8-16%. This novel fact underscores that the low participation rate is driven by both low entry rates and high exit rates. Second, I show that homeownership is associated with non-participation. All else equal, the stock market participation rate of owners is six percentage points lower than that of renters. Third, the participation dynamics differ by house tenure: the exit rate is substantially higher among renters, and becoming a homeowner increases the probability of exit by 16 percentage points, all else equal. These facts suggest that a life-cycle model of stock market participation should take into account the joint participation-ownership dynamics.

Motivated by these stylized facts, I extend the workhorse life-cycle portfolio choice model in Cocco et al. (2005). The extended model adds a per-period participation cost and house-tenure decisions to a realistic life-cycle model and can jointly account for the participation rate, homeownership rate, conditional portfolio weight on stocks, and net worth over the entire life cycle. To do so, the model requires low participation costs ($124 per year, in 1995 dollars) and a moderate constant relative risk aversion parameter ($\gamma = 4.518$). My model also nests Fagereng et al. (2017) who study limited stock market participation in Norway but omit housing. To understand the contribution of housing to the participation puzzle, I also estimate the model without housing. Housing drives down participation mainly by decreasing homeowners' liquid wealth. Owners prefer to build home equity to move away from the mortgage borrowing constraint before investing in stocks. Secondly, since renters aspire to become homeowners, they have short investment time horizons, which decrease the attractiveness of the stock market and drive down their participation rates. As in the data, the model shows that renters who become homeowners often liquidate their stock holdings to finance a down payment.

To test the validity of the model, I perform three exercises. First, the model matches the entry and exit rates into the stock market over the life cycle, even though this moment is not targeted in the estimation. Second, the model generates lower participation rates among renters than homeowners, a key feature of the data. Third, Chetty et al. (2017) obtain causal estimates of the effects of home equity and mortgage debt on the portfolio weights of US households. Using the same empirical models on the model-simulated panel provides estimates that are similar, showing that the model not only matches aggregate moments but also the causal effects of housing on portfolio choices in the US.

To understand the interplay between homeownership, financial frictions, and stock market participation, I perform a policy experiment where the down payment increases. An increase in the down payment delays homeownership. By delaying homeownership, the participation rate of renters goes up, as they hold more liquid wealth. At the same time, this means that the fraction of middle-aged households with low liquid increases, decreasing the participation rate of middle-aged households. Finally, I study the relative importance of the three ex-ante sources of risk (income, house prices, and stock returns) households face in the model and find that income risk/inequality is the main source of wealth dispersion. Still, the calculation shows that house price risk at age 60 causes the 20th percentile of the wealth distribution to have 2/3 lower net worth than the 80th percentile.

2.1.1 Relation to the Existing Literature

The main contributions of this paper is to demonstrate

1. That high exit rates among participating households is an important driver behind limited stock market participation.
2. That house tenure changes are associated with stock market exit.
3. That a model with rent/own choice and participation decisions can explain the stock market participation rate and the high exit rate.

I provide a general literature review before discussing the two papers that are closest to mine.

There is a large body of literature on the life-cycle profiles of portfolio choices in models with realistic income processes (e.g., Cocco et al. (2005); Chang et al. (2018); Wachter and Yogo (2010)). This literature generally focuses on the portfolio weights and ignores the participation decision. One strand of this literature, owing back to Vissing-Jørgensen (2002) focuses specifically on limited stock market participation (Cocco (2005); Calvet et al. (2007); Athreya et al. (2017); Catherine (2019)), who respectively use a one-time fixed cost, investor mistakes, costly human capital investment or correlations between stock returns and income as mechanisms to explain non-participation. Cocco (2005) and Yao and Zhang (2005) study portfolio choices in the presence of housing, but each paper omits either extensive margin, house tenure or the participation decision, respectively. My paper contributes to our understanding of the stock market participation puzzle by showing that a satisfying theory of limited stock market participation should also explain the high exit rate and that illiquid housing does so.[2]

Some empirical papers have cast doubt on the theoretical findings from life-cycle models with housing and stock market portfolio decisions, but Chetty et al. (2017) reconciles theory with evidence and finds that home equity or property values have large effects on portfolio weights and participation decisions. Further, Beaubrun-Diant and Maury (2016) in an empirical paper explicitly consider the joint tenure-participation decisions of US households and find that the two decisions are interdependent. My paper contributes by showing that housing is important for participation decisions and, in particular, for stock market exit.

Fagereng et al. (2017) use high-quality Norwegian administrative data to document a dual re-balancing away from stocks around retirement: households first decrease portfolio weights as they age, and then gradually exit the stock market. After extending the workhorse model by Cocco et al. (2005) to include a per-period participation cost and stock market tail events, Fagereng et al. (2017) show that the estimated model can match the dual adjustment. This age-dependent interaction between a participation cost and tail events is novel and occurs because older households are more reliant on financial assets, and thus stock market crashes are more costly, and they hold lower portfolio shares than younger households. However, the model

[2]Briggs et al. (2020) use Swedish register data and show that households do not immediately enter the stock market even when winning large lotteries. This is hard to explain solely with reasonable one-time fixed costs or per-period costs. In line with my model, they find that the treatment effects on participation is smaller among renters.

cannot generate sufficiently limited stock market participation, with over 90% of middle-aged households participating versus the 55% participating in the data. My paper contributes by showing that the addition of owner-occupied housing into this framework can jointly explain the low participation rate over the entire life cycle, portfolio weights, and the high exit rate.

While Fagereng et al. (2017) omits housing, Vestman (2019) focuses on the large difference in the participation rate among renters and homeowners. Using Swedish data, he argues that housing seems relatively unimportant in explaining the participation decision among Swedish households but finds evidence for unobserved household fixed effects. He then builds a model where households face a one-time participation cost and a house tenure decision. To match a peak participation rate of 75%, he uses preference heterogeneity, where one type (which tends to own) is more patient, has lower risk aversion, and faces lower participation costs than the other type (which tends to rent). This preference heterogeneity can match the participation gap between renters and owners, a non-trivial achievement since renters have more to gain from participation. Vestman's work is the first to study the house tenure decision together with the entry decision. However, the calibrated model counter-factually predicts 100% participation among retirees and overpredicts participation at all ages above 35. Moreover, a model without per-period participation costs cannot generate exit from stock markets.

Compared to these two papers, this paper contains several innovations. First, I take the model to US data, where institutional differences make private savings more important for consumption after retirement. Second, the combination of housing and per-period cost allows the model to qualitatively and quantitatively match the participation rate and other moments over the life-cycle. I show that per-period costs combined with tail-events can lower participation rates among renters. The mechanism behind this result is similar to the dual adjustment in Fagereng et al. (2017): renters need sufficient financial wealth for a down payment and are less likely to participate in the stock market than owners, all else equal. I compliment the work in Vestman (2019) by highlighting another mechanism (tail events and per-period costs together with borrowing constraints) that induces a participation gap between owners and renters. Further, homeowners with low home equity and low liquid wealth ('home poor') prefer to build home equity to stock investment, decreasing participation even among the middle-aged.

2.2 Data

The Panel Study of Income Dynamics (PSID) is a longitudinal household survey compiled by the University of Michigan since 1968. Since the PSID follows individuals and households over time, we can study household participation and portfolio decisions preceding, during, and after house tenure changes. From 1999 detailed wealth information has been collected bi-yearly. The largest drawback of the PSID is that the household's financial portfolio allocations are poorly measured.

To complement the PSID and obtain more accurate portfolio information I also use the Survey of Consumer Finances (SCF). The SCF is a cross-sectional survey of US households and is conducted every three years by the Federal Reserve Board. The main advantage of the SCF is that it includes more detailed balance sheet information so that we can construct more accurate portfolio weights. The SCF's main drawback is that it consists of repeated cross-sections instead of following individuals over time.

Throughout this paper, the sample includes only households aged 25 to 84. To define household age, education, and gender, I use the household head. In the PSID households from the Survey of Economic Opportunity and Latino Samples are excluded to obtain a representative sample of households. As both the PSID and the SCF are well-known data sets, I omit a detailed description of them, but refer to Gianetti and Wang (2016) for a discussion of measuring participation in the PSID and Athreya et al. (2017) for similar introduction to the SCF.

2.2.1 Estimation of Life-Cycle Profiles

When calibrating and estimating life-cycle models, one must take a stand on whether one should control for time effects or cohort effects since age, birth year, and calendar year are perfectly collinear (Ameriks and Zeldes, 2004). There is no consensus in the literature on which approach to use. The resulting patterns are, in general, largely similar but with larger deviations for older households. Since house prices and stock returns have large year-to-year fluctuations with similar effects across age, I control for time effects and assume that cohort effects are zero.

To construct the age-profiles, I bin age into five year intervals from $[25, 29]$, $[30, 34]$, $\ldots$, $[80, 84]$ to reduce small-sample noise. I use household weights normalized within years to equalize the weight on each year. I drop households that belong to the top 1% and bottom 1% of the wealth distribution within each age group.[3] For all life-cycle statistics in this paper, I use weighted linear regression with a full set of age and year fixed effects. I then find the predicted value for each age and year and find the average predicted value across all years in the sample.

2.2.2 Life-Cycle Participation, Ownership and Exit

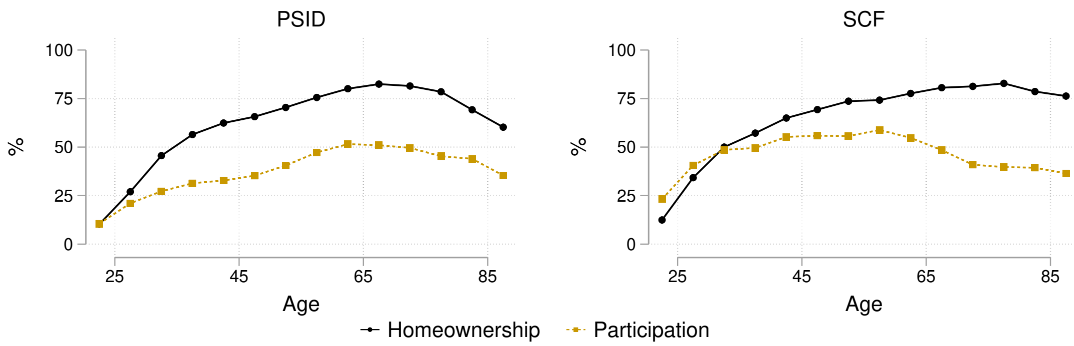
I now turn to study how the participation and homeownership rates evolve over the life cycle in the PSID and the SCF. The left panel of Figure 2.1 uses the PSID and reveals limited stock market participation at all ages. It starts at 10% among the youngest households, increases gradually to 55% at age 65 before it decreases slightly during retirement. Moreover, homeownership increases quickly from 15% among the young to 70% for households aged 45, with a peak at 80% at age 67 before households start to liquidate housing in retirement. The right panel plots the same data from the SCF. Broadly speaking, the patterns are the same, although the participation rate in the SCF is higher for younger households.

2.2.3 Entry and Exit Over the Life-Cycle

To better understand what drives the low participation rate in stock markets, I now turn to participation dynamics among US households using data from the PSID (we cannot observe dynamics in the SCF since it is a cross-section). Figure 2.2, left panel, plots the entry and exit rates from stocks over the life cycle, controlling for time

[3] As is well known, this class of models cannot easily match the upper tail of the wealth distribution.

Figure 2.1: Life Cycle Participation and Homeownership



effects. We can see that the exit rate is 35% at age 25, and then gradually decreases towards retirement age, at which point the exit rate starts to increase. Similarly, we see that the entry rate largely displays the opposite pattern, starting at 8% at age 25, gradually increasing until retirement age, and then weakly decreasing. The second panel plots the entry and exit into homeownership. We can see that middle-aged owners rarely become renters (exit) and that the entry rate in homeownership is relatively stable at 10-15% before retirement. Once households retire, we see that the entry rate to ownership drops while the exit rate increases. The largest difference in dynamics between homeownership and stock market participation is the high exit rate among stock owners.

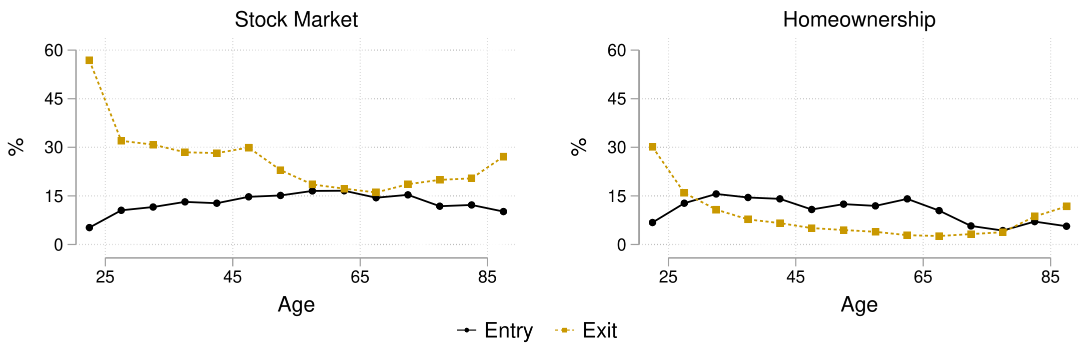
2.2.4 Regressions: Determinants of Stock Market Participation

Which variables predict stock market participation? Participation is related to homeownership using the following linear empirical model:

$$Participation_{it} = \beta \times Homeowner_{it} + \gamma X_{it} + \varepsilon_{it}, \tag{2.1}$$

where participation is measured as holding any amount of stocks in liquid accounts or IRA's or the alternative measure which excludes stock in IRA's. This specification

Figure 2.2: Life-Cycle Entry and Exit from Stock and Housing in the PSID



Notes: These figures plots the exit and entry rates in stocks and homeownership. The exit rate is defined as the fraction of households who own stocks (primary residence) in year t and do not in $t+2$, and are observed in both periods, and vice versa for the exit rates.

mirrors the one used in Gianetti and Wang (2016), and who also use the PSID. The main set of controls include logged income and logged wealth, marriage status, education, lagged participation, logged age, and logged family size, in accordance with the existing literature (e.g., Guiso et al. (2008); Gianetti and Wang (2016)). In some specifications, I include individual-level fixed effects. Some variables are logged for ease of interpretation and to lessen the impact of outliers. The results are reported in Table 2.1. As Gianetti and Wang (2016) I use a linear probability model due to a large number of fixed effects and for ease of interpretation.

The first two columns regress participation (in any account), while columns 3-4 ignores participation in retirement accounts. Columns 2 and 4 include household fixed effects to control for unobserved heterogeneity, such as risk aversion. From column 2, we see that being a homeowner is associated with a 5.6 percentage point decrease in participation probability, indicating a strong substitution between stocks and housing. The effect is somewhat lower when ignoring stocks in retirement accounts. Other coefficients have the expected signs, with income and wealth increasing participation: a 10% increase in wealth increases the probability of participation by 5.0 percentage points when controlling for fixed effects. Controlling for fixed effects has minor impacts on the other control variables, except for the effect of lagged participation.

Table 2.1: Determinants of Stock Market Participation

	(1) Participation	(2) Participation	(3) Participation (w/o IRA)	(4) Participation (w/o IRA)
Homeowner=1	-0.057***	-0.056***	-0.044***	-0.023***
	(0.004)	(0.006)	(0.003)	(0.005)
Log(Age)	-0.028***	0.171***	-0.010**	0.132**
	(0.004)	(0.043)	(0.004)	(0.049)
Married=1	0.027***	0.041***	0.009**	0.008
	(0.004)	(0.008)	(0.003)	(0.008)
Log(Family Size)	-0.044***	-0.013**	-0.025***	-0.005
	(0.003)	(0.005)	(0.002)	(0.005)
Log(Income)	0.033***	0.013***	0.014***	0.008***
	(0.002)	(0.002)	(0.001)	(0.002)
Log(Wealth)	0.055***	0.050***	0.032***	0.022***
	(0.001)	(0.001)	(0.001)	(0.001)
College=1	0.108***		0.078***	
	(0.004)		(0.004)	
Lagged Part.	0.432***	0.023***		
	(0.005)	(0.006)		
Lagged Part. (w/o IRA)			0.479***	-0.001
			(0.007)	(0.008)
Observations	74984	74984	58563	58563
Individual FE	N	Y	N	Y
Year and State FE	Y	Y	Y	Y
Within R^2	0.020	0.055	0.003	0.025

Notes: This table presents the relationship between household characteristics and stock market participation. Standard Errors in parentheses. Clustered at the family level. * $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$.

This suggests that participation in one period does not lead to participation in later periods by itself but that it is a combination of individual-specific characteristics and other financial observable variables that drive a household's participation decision.

2.2.5 Regressions: Determinants of Stock Market Exit

Why is the exit rate so high? I report results from four different regressions, reported in Table 2.2. The empirical model is the same as in equation (2.1) but with stock market exit as the dependent variable. The sample is thus limited to households who participated in $t-2$. We see that after controlling for other variables, homeowners are 4.3 percentage points more likely to exit stock markets. The impact of wealth is higher on exit than on participation: A 10% decrease in wealth increases the probability of exit by 8.3 percentage points, while it decreases the probability of participation by 'only' 5.5 percentage points. Marriage, family size, and income are only weakly related to the exit rate. Why is homeownership associated with stock market exit? Since the two first specifications include individual fixed effects, the coefficient on homeownership must be interpreted with care. The estimate reflects the effect of homeownership only among households for whom we observe house tenure changes (renter $\rightarrow$ owner and owner $\rightarrow$ renter).

To decompose the effect of homeownership, I limit the sample to households who were participating and renting in $t-2$. The results are reported in specifications (3) and (4) of Table 2.2. I use the same control variables but now measure the relationship between exit and becoming a homeowner. New homeowners have a 12-16 percentage points higher exit rate, relative to a mean exit rate of 21%. The relationship is higher when considering exit from non-retirement accounts, possibly as a result of their more liquid nature.[4] The effect of wealth is the same as when using the full participant sample. The effect of age, marriage status, family size, and income are all statistically non-significant.

[4]While retirement accounts are less liquid, they often have rules allowing a withdrawal in times of hardship or special circumstances. For example, first-time homeowners can withdraw penalty-free from an IRA to cover a down payment.

Table 2.2: The Determinants of Stock Market Exit

	Full Sample		Renters in $t-2$	
	(1)	(2)	(3)	(4)
	Exit	Exit (w/o IRA)	Exit	Exit (w/o IRA)
Homeowner=1	0.043**	0.030		
	(0.015)	(0.024)		
New Homeowner=1			0.124***	0.160***
			(0.029)	(0.045)
Employed=1	0.029**	0.038*		
	(0.010)	(0.017)		
Married=1	-0.047*	-0.009	0.001	-0.101
	(0.020)	(0.031)	(0.053)	(0.072)
Log(Age)	0.698***	0.986***	0.139	0.403
	(0.130)	(0.224)	(0.415)	(0.636)
Log(Family Size)	0.028*	0.023	0.083	0.154*
	(0.014)	(0.024)	(0.049)	(0.072)
Log(Income)	-0.017**	-0.013	-0.024	0.022
	(0.006)	(0.010)	(0.018)	(0.023)
Log(Wealth)	-0.083***	-0.077***	-0.074***	-0.064***
	(0.004)	(0.006)	(0.008)	(0.012)
Observations	20103	10485	3559	1751
Within R^2	0.076	0.089	0.145	0.211

Notes: This table present the relationship between household characteristics and exit from stock markets in a linear probability model. To be in the sample households must have owned stocks in year $t-2$. Standard errors in parentheses. Clustered at the family level. * $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$.

Overall, the evidence in this section has three main implications. First, it suggests that the high exit rate partially explains the low participation rate. Second, I find that homeownership is a substitute for stock market participation. Third, homeownership is associated with stock market exit once other variables are held constant. These three facts taken combined suggest that a model with an endogenous house tenure decision combined with an endogenous entry/exit in stock markets may account for low stock market participation rates over the life cycle.

2.3 A Model of Participation and Homeownership

The previous sections establish novel facts about the life-cycle exit and participation decisions of US households. Existing models can account for the hump-shaped participation rate, but not for the joint patterns of homeownership, stock market participation, and entry/exit in stock markets. In this section, I present a life-cycle model that explains these patterns. Before laying out the environment, technology, and preferences, I first provide a birds-eye of the model and describe the main two mechanisms through which housing reduces participation and increases exit.

To facilitate comparisons with the literature, I build on Fagereng et al. (2017), which in turn extends the workhorse model of Cocco et al. (2005). Relative to Fagereng et al. (2017), I add a housing market where households can choose to rent or own. The no-borrowing condition is also relaxed to allow for collateralized borrowing (mortgages). As in Fagereng et al. (2017), tail events and per-period participation account for the decreasing participation rate and portfolio weights among older households. Two main mechanisms improve the model's predictions.

First, housing decreases participation among younger and middle-aged households by tying up wealth in an illiquid asset. This effect is strengthened by the illiquidity of housing (through transaction costs): If a household recently bought a house, they have little liquid wealth. If they receive a bad income shock or a bad stock return shock, they may not be able to repay the mortgage payment in the next period and must downsize. This will also help generate more exit: Some wealthy households who own housing will receive bad income or stock return shocks, so that wealth drifts down. At some point, they become liquidity constrained and so exit the stock market. Without housing, this only happens if households drift towards zero wealth, a very rare event both empirically and in the model.

Second, As noted in Vestman (2019), renters will, all else equal, have more to gain by participation in stock markets. However, tail events reduce the renters' willingness to participate. Intuitively they face the trade-off of investing in stock markets to gain the equity premium to afford the down payment a little sooner. However, if a tail event materializes the dream of homeownership will be delayed when the intended downpayment was substantially invested in stocks.

2.3.1 Households and Utility

Households enter the economy at age 25 and retire at age T^r. The probability of death between age a and $a+1$ is π_a, but households die with certainty at age 100. Households have time-separable preferences with discount factor β over consumption c_a and housing h_a, and the utility function is assumed to have a constant relative risk aversion form with a Cobb-Douglas aggregator:

$$U(c_a, h_a, \mathbf{o}) = \frac{\left(c_a^{\eta}(\chi_o h_a)^{(1-\eta)}\right)^{1-\gamma}}{1-\gamma}, \tag{2.2}$$

where the utility function is allowed to depend on house tenure through the parameter χ_o that equals unity if the household is renting and χ_1 if the household owns. The parameter γ measures risk aversion and η relates to the budget share of consumption expenditure. Households who do not survive between age a and $a+1$ derive warm glow utility from accidental bequest. A household that dies with x_{a+1} in networth receives $v(x_{a+1})$ utils, where

$$v(x_{1+1}) = \psi \frac{(\max\{x_{a+1}, 0\})^{1-\gamma}}{1-\gamma}. \tag{2.3}$$

The max operator is introduced for two reasons. First, in the US, households can die with negative net debt, but that debt is not passed on to heirs. Second, with housing risk as introduced later, households can end up underwater on the mortgage (market value less than their debt), and with negative net worth. However, the CRRA utility function is defined only for strictly positive numbers.[5].

2.3.2 Market Structure and Stochastic Processes

Financial Markets

There are two financial assets, a risk-free one-year bond b_a and risky stocks s_a. The bond earns a constant interest rate r_f if positive, but debt (mortgage) has a mortgage premium of r^m. Borrowing is only available to those who own or buy owner-occupied housing, and the maximum mortgage is limited by the downpayment requirement d

$$b_{a+1} \geq -(1-d)p_a h_{a+1}, \tag{2.4}$$

where $p_a h_{a+1}$ denotes the market value of the house.

The risky asset has uncertain returns, defined as the sum of the risk-free rate, the risk premium r_p and a financial shock ε_t^s. The shock follows a normal distribution augmented with a small probability p_{tail} of stock market crashes:

$$r_t = r^f + r^p + \varepsilon_t^s, \text{ with } \varepsilon_t^s \sim \begin{cases} r_{tail} & \text{with probability } p_{tail}, \\ \mathcal{N}(0, \sigma_s^2) & \text{with probability } 1 - p_{tail}. \end{cases} \tag{2.5}$$

Households who participate in stock markets ($s_a > 0$) must pay per-period participation cost q.

House Market

In the model house prices are linear in house quality h, and follow a stochastic process with drift μ and housing market uncertainty ε^h, as well as stock market correlation $\theta_h^s \varepsilon^s$:

$$R_{t+1}^h \equiv \frac{p_{t+1}}{p_t} = \exp(\mu + \varepsilon_{t+1}^h + \theta_h^s \varepsilon_{t+1}^s), \quad \sigma_t \sim \mathcal{N}(0, \sigma_h^2), \tag{2.6}$$

[5] I actually therefore use $\max\{x_{a+1}, \epsilon\}$ where ε is a small number when solving the model numerically

where p_a is the house price per square meter. The parameter θ_h^s pins down the correlation between the stock market and housing market. Further, the rental price is assumed to be a constant fraction f of the market value. To ease computations the rental market consists of a single unit of quality h_{rent}, and the owner-occupied markets has two sizes, h_{small}, h_{large}. House transactions are settled immediately, so a household that enters a period as a renter can immediately become an owner, and vice-versa.

Buying owner-occupied housing entails a purchase and moving cost m that is proportional to the market value of the house.

Income

Income $w_{i,a}$ of individuals i at age a consists of one idiosyncratic transitory shock ε_i, an idiosyncratic persistent shock v_i, a deterministic life-cycle component f_a as well as the aggregate shocks:

$$\log(w_{i,a}) = f_a + v_{i,a} + \varepsilon_{i,a} + \theta_w^h \varepsilon_a^h, + \theta_w^s \varepsilon_a^s \quad a < T^R, \varepsilon_{i,a} \sim \mathcal{N}(0, \sigma_\varepsilon^2), \tag{2.7}$$

where the θ's pin down the correlation between income and house prices and stock returns. The persistent component $v_{i,a}$ follows a first-order autoregressive (AR(1)) process with normal innovations:

$$v_{i,a} = v_{i,a-1} + \nu_{i,a}, \quad \nu_{i,a} \sim \mathcal{N}(0, \sigma_\nu^2). \tag{2.8}$$

Retired households face no labor income risk. To capture social security and pension benefits retired households receive a fraction ϕ of their wage in the last period of working life:

$$w_{i,a} = \phi w_{i,T^r} \ \forall \ a \geq T^r.$$

Going forward, the subscript i is omitted unless necessary.

Welfare System

Since house prices are growing at rate μ and subject to log-normal shocks, the house price is unbounded above. At the same time income is stationary, and so for very high price realizations some households may unable to afford a place to live. I therefore assume that the government runs a welfare system that guarantees that the minimum after-tax income w is 5% larger than the market price of rental housing.If no such assumption is placed, the model must include either a reflecting barrier for house prices or explicitly model homelessness.

2.3.3 Borrowing Constraints and Law of Motion

The model is best understood from the household's budget constraints and the law of motion for wealth. Households have two sources of wealth: Financial wealth from stocks or bonds and owner-occupied real estate. Let x_a denote a household's wealth at age a.

Evolution of Cash-on-Hand

If the household chose to rent at the beginning of the period, the realized net worth in the next period is given by realized gains on bonds and stocks:

$$x_{a+1} = s_{a+1}(1 + r_{a+1}) + b_{a+1}(1 + r^f). \tag{2.9}$$

Homeowners' future wealth depends additionally on the next period market value of the house, net of deprecation:

$$x_{a+1} = s_{a+1}(1 + r_{a+1}) + b_{a+1}(1 + r^f) + p_{a+1}h_{a+1}(1 - \delta). \tag{2.10}$$

Budget Constraints

In each period, the households choose how to spend their disposable wealth $x_a + w_a$ on consumption c, bonds b, stocks s and housing services h. If a household decides to rent it pays the rental price fph, as well as adjustment costs on housing

$$c_a + (s_{a+1} + \mathbf{1_s} q) + b_{a+1} + fp_a h_a + adj(h_a, h_{a+1}) = x_a + w_a \tag{2.11}$$

where we use $\mathbf{1_s}$ to denote an indicator functions that equals one households participate in stock markets ($\mathbf{1_s} \equiv \mathbf{1}_{s_{a+1}>0}$).

Households that choose to own a house in the current period pay the market price of the house, as well as adjustment costs

$$c_a + \mathbf{1}(s_{a+1} + q) + b_{a+1} + p_a h_a + adj(h_a, h_{a+1}) = x_a + w_a. \tag{2.12}$$

Since house prices are stochastic, we see that house price risk manifests differently for renters and owners. Renters face expenditure uncertainty while owners face wealth uncertainty.

2.3.4 Recursive Formulation

All households have several choices: consumption c, portfolio choices between bonds b, stocks s, and housing h, as well as the discrete ownership and participation decisions. Due to the discrete choices, the decision problems separates into two parts: First, households choose whether to rent, buy a house or if they already own to stay. Second, households choose whether to participate in the stock market. Conditional on these discrete choices, they choose optimal consumption, savings, and portfolio weights. The discrete nature of the problem lends itself to solving the decision problem in parts, conditional on choosing to buy B, rent R, or staying S in the house.

Since house transactions are immediate a homeowner who sells his house with wealth x_a is identical to a renter with wealth x_a. Denote a renter's value function by $V_a^R(x_a, v_a, p_a)$, the value function of households who buys a new house $V_a^B(x_a, v_a, p_a)$, and the value function of owners who stay by $V_a^S(x_a, v_a, p_a, h_a)$. For the rest of the paper I omit the age subscript on variables, and use primes to denote the $a+1$ subscript. A household of that owns at age a then chooses optimally between these tree alternatives:

$$V_a(x, v, p, h) = \max_{R,B,S}\{V_a^R, V_a^B, V_a^S\}. \tag{2.13}$$

A renter faces only the choices between renting and buying. It is worth mentioning that if one omits housing, for example, by setting $h = 0$, that the model collapses exactly to the one in Fagereng et al. (2017), and thus also nests Cocco et al. (2005). See appendix B.2.2 for more.

Stayers' Decision Problem

I now present the decision problem of a stayer. The decision problem of renters and buyers are in appendix B.2.1. A household who enters the period with wealth x, has persistent human capital v, observes house prices p and owns a house of size h chooses consumption c, levels of stock investment s' and the net bond position b'. If he holds a positive amounts of stocks he pays the participation cost q:

$$\begin{aligned} V_a^S(x, v, p, h) &= \max_{c,b',s'} \{u(c, h) + \beta \mathbb{E}_a[\pi_a V_{a+1}(x', v', p', h) + (1 - \pi_a)(x')]\} \\ x + w &= c + \mathbf{1}(s' + q) + b' + ph \\ x' &= s'(1 + r') + b'(1 + r^f) + hp'(1 - \delta) \\ &\{c, s'\} \in [0, \infty)^2, b' \geq -(1 - d)ph \\ &\text{Processes for } w, r, p \text{ (eq. 2.7,2.5,2.6)} \end{aligned} \tag{2.14}$$

2.3.5 Simulation

To take the model to the data, I simulate a large panel of households using the decision rules from the model outlined above. I now discuss how the simulated panel is constructed.

Initial Conditions

When simulating households, we need to simulate households' initial wealth x, human capital v, price level p, and homeownership. I draw human capital from the stationary distribution implied by the process in equation (2.8). I assume that the initial house price can take three values. I find the benchmark price by excluding house values below the first and above the top percentiles or with 20 or more rooms. I then run a regression of house values on the number of rooms with year fixed-effects and without a constant. The estimated slope is \$36,000, which I use as the initial benchmark price per room. Next, I run the same regression on a sample of 'coastal-urban states' (CA, NY, WA, MA) and another on the central Mid-West (WI, IO, MN, MI, IN, OH), which yields prices of \$49,000 and \$29,000 respectively. 70% of the economies use the initial national price while the remaining 30% are equally divided into the other two initial prices. For initial wealth and homeownership, I draw non-parametrically from the data. Let $\upsilon(x, h)$ denote the discretized PDF of net-worth and homeownership. All households who are owners are assumed to own a small house, and net worth is censored below by $-\$15,0000$. I then group households who are 25 into 20 quantiles of wealth and whether they own or rent. The distribution is plotted in Figure B.1b. Within each wealth bin, I use the mean wealth as a value for households drawn to be in that bin.

'Aggregate' Risk

There are three sources of risk in the model: idiosyncratic income risk, aggregate stock returns, and aggregate house price fluctuations. To understand each channel's relative importance, I follow the simulation procedure in Dahlquist et al. (2018). First, I simulate the income shock realizations for 1250 individuals $\{v_{i,a}, \varepsilon_{ia,}\}_{a=25}^{T^r}$. I then simulate 16 realizations of stock returns $\{r_{j,a}\}_{a=25}^{100}$ and 40 house prices sequences $\{p_{k,a}\}_{a=25}^{100}$, which generates 640 different 'economies' $(j \times k)$. I then simulate the behavior of these 1250 individuals in the 640 economies for a simulated panel with 800,000 individual×economy realizations. As the simulated outcomes are sensitive to aggregate outcomes, it is important to simulate multiple economies to avoid spurious results.

2.4 Estimation

The model is estimated in two steps. In the first step I estimate prices and stochastic processes directly from the data or set them to the standard parameter values in the literature. In the second step I estimate the preference parameters, probability of stock market tail events and the participation cost by simulated method of moments (SMM).

2.4.1 Externally Calibrated Parameter Values

Table 2.3 lists all exogenously calibrated parameters along with their sources.

Return Processes

I take the parameters that govern the stock market returns from Cocco et al. (2005), and so the risk-free rate $r^f = 0.02$, the equity premium $r^p = 0.04$, and the standard deviation of stocks $\sigma_s = 0.157$. To find the mortgage premium I calculate the average spread between the average interest rate on 30-year fixed rate mortgages and 10-year treasury bills between 1971 and 2018, which yields $r^m = 0.0169$. Finally, I set the return in case of tail events to be $r_{tail} = -0.5$.[6] The probability of tail events is estimated jointly with the preference parameters.

Correlations of Shocks

To calibrate the correlation between house prices, stock returns and wage shocks I use historical data: the seasonally adjusted monthly S&P/Case-Shiller House Price Index, monthly Wilshire 5000 Total Market Full Cap Index and yearly median weekly real earnings, respectively. To create yearly indexes I take the average value within each year. I then find the year-on-year percentage change of each index and calculate the correlation. This yields correlations of 0.017 between house prices and wages ($p = 0.93, N = 31$), 0.215 between house prices and the stock market

[6]Fagereng et al. (2017) estimate $p_{tail} = -0.485$ in Norway, but it is not clear how one estimates the typical return of rare events.

Table 2.3: Model Parameter Values

Parameter		Value	Source
Financial markets			
Risk free rate	r^f	0.02	Cocco et al. (2005)
Equity premium	r^p	0.04	Cocco et al. (2005)
Stock return std. deviation	σ_s	0.157	Cocco et al. (2005)
Tail event return	r_{tail}	-0.5	n/a
Mortgage premium	r^m	0.0169	Own calculation (sec. 2.4.1)
Correlation income & stocks	θ_w^s	0.0	Own calculation (sec. 2.4.1)
Correlation income & prices	θ_w^h	0.0	Own calculation (sec. 2.4.1)
Correlation stocks & prices	θ_h^s	0.12	Own calculation (sec. 2.4.1)
Labor Market			
Auto-correlation	ρ	0.95	Cooper and Zhu (2016), (sec. 2.4.1)
Transitory shocks std. dev.	σ_ε^2	0.08	Cooper and Zhu (2016), (sec. 2.4.1)
Persistent shocks std. dev.	σ_ν^2	0.018	Cooper and Zhu (2016), (sec. 2.4.1)
Start of retirement	T^R	69	PSID, section 2.4.1
Replacement ratio	ϕ_{ret}	0.758	PSID, section 2.4.1
Deterministic wage profile	f_a	fig. B.1a	PSID, section 2.4.1
Housing Market			
House price drift	μ	0.015	Cocco (2005) (sec 2.4.1)
House price std. deviation	σ_h	0.093	Cocco (2005) (sec 2.4.1)
House price depreciation	δ	0.025	Harding et al. (2007)
Minimum down payment	d	0.15	Cocco (2005)
Transaction cost	mc	0.08	Cocco (2005)
Rent-to-house value	f	0.05	Davis et al. (2008)
Rental size	h_{rent}	4	PSID (sec 2.4.1)
Owner-occupied sizes	h_{small}, h_{large}	(5,8)	PSID (sec 2.4.1)
Simulation & Other			
Survival rates	π_a	fn.	2004 SSA Life Table
Wealth-Ownership joint distr.	n/a	fig B.1b	PSID, (sec 2.3.5)

Notes: The table lists the parameter values for the correlation parameter. These parameters gives a correlation of 0.0, 0.22 and 0.0 between stock market and labor market shocks, stock market and housing shocks, and housing and labor market shocks.

($p = 0.24, N = 31$) and 0.003 between wages and stocks ($p = 0.81, N = 38$). Since all correlations are low and not statistically significant I set $\theta_h^s = \theta_w^h = \theta_w^s = 0$.

Income Process

To find the retirement age T^r I count disabled households as retired, but omit households who retire before they turn 51. I then find that the average age at which households became permanently retired is 69, that is where no subsequent spells of labor market participation is observed. To find the retirement income shifter ϕ_{ret} I take the average income of a household in the two preceding waves before retirement and divide by the average income in the three succeeding waves. The average ratio is 75.8% omitting the 1st and 99th percentiles.

Next, I find the common deterministic life-cycle component of income f_a by taking the sample of households aged 25-67 who are employed, looking for jobs, temporarily sick, or disabled and run OLS on log earnings with a full set of age and year dummies. I then find the average log earnings at each age equally weighting the years. I then fit a fifth-order polynomial to the resulting (non-logged) predicted earnings. The results are reported in Figure B.1a.

I take the parameters governing the stochastic component of labor income from the literature. Many papers (e.g. Cocco et al. (2005),Cooper and Zhu (2016)) estimate and solve the model for different education groups. However, in this paper I solve the model for the general population, ignoring heterogeneity in education. This is done for two reasons. First, for the purposes of this paper it is necessary to observe both stock market entry and exit, as well as transitions in homeownership. These are infrequent events, and so the sample is too small if limiting the sample to only use on education group. Second, the introduction of housing increases the computational burden significantly, and omitting heterogeneity in education keeps the problem tractable. I therefore set the persistence $\rho = 0.95$, variance of persistent shocks $\sigma_\nu^2 = 0.018$ and the variance of the transitory shock $\sigma_\varepsilon^2 = 0.08$. These parameter values lies squarely in the range considered in the literature (Carroll and Samwick, 1997; Cocco et al., 2005; Cooper and Zhu, 2016; De Nardi et al., 2019)

House Prices

I base the parameters governing the house price growth from Cocco (2005). He sets average price growth to be 1% and its standard deviation to be 0.062. To capture the development of house prices since 2000 I increase both the drift and standard deviation by 50%, to $\mu = 0.015, \sigma_h = 0.093$. I take depreciation $\delta = 0.025$ as estimated in Harding et al. (2007). Finally, I take the rental cost f to be 5% (Davis et al., 2008). Further, the median rental unit has 4 rooms. Finally I set the transaction cost mc and minimum downpayment d to be 8% and 15%, respectively, as in Cocco (2005). In section B.5.1, I study the impact of different minimum downpayment requirements. The PSID records the number of rooms (excluding bathrooms) in both owner-occupied and rental housing. The 25th percentile of owner-occupied housing has 5 rooms while the 75th percentile has 8.

Remaining Parameters

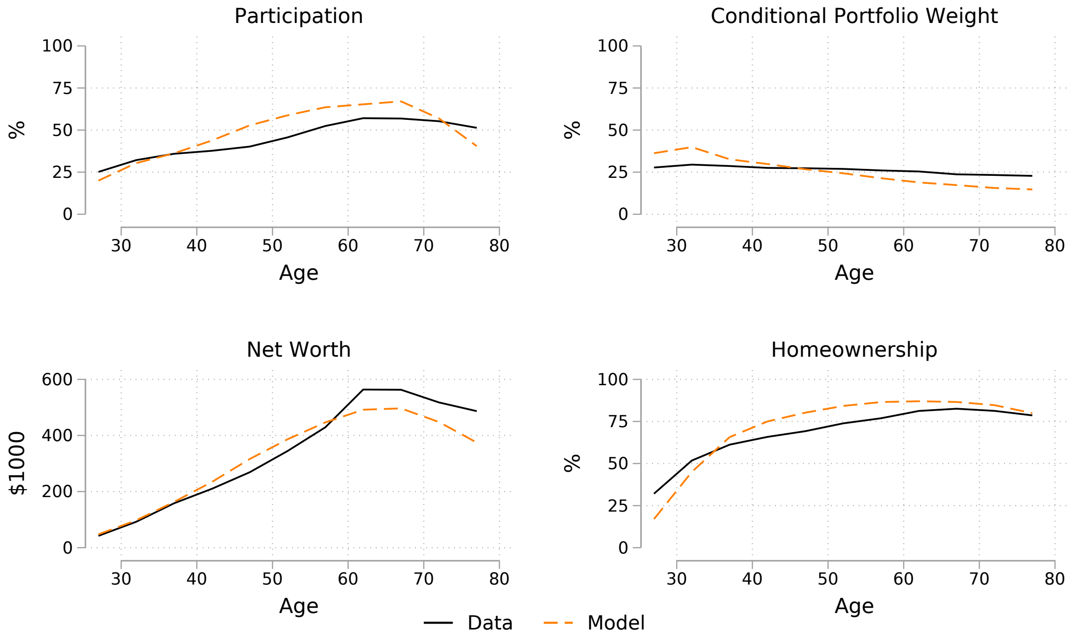
I take the conditional survival probabilities from the 2004 Social Security Administration Life Table. For the simulations a crucial component is the initial distribution of wealth, ownership and productivity. I set the initial distribution of productivity v to be the stationary distribution of v. I estimate the joint distribution of initial wealth x_{25} and homeownership h_{25} non-parametrically from the data.

2.4.2 Internal Estimation

I perform a structural estimation of the preference parameters of the model: risk aversion γ, discount factor β, participation cost q, housing expenditure share η, ownership preference χ_1, bequest parameters ψ_0, ψ_1 and the subjective probability of tail events p_{tail} by the Simulated Method of Moments (SMM). Denote the parameter vector by $\omega \in \mathbb{R}^8$. Given a candidate parameter vector ω, I solve the model and obtain simulated moments $m(\omega)$ and compare them to the the empirical moments m. I search for a vector $\hat{\omega}$ that minimizes the weighted deviation:

$$\hat{\omega} = \arg\min_{\omega}\{[m(\omega) - m]'W[m(\omega) - m]\}, \tag{2.15}$$

Figure 2.3: Estimation With Housing- Targeted Life Cycle Moments



Notes: These figures plots the targeted life-cycle moments in the simulated ($m(\hat{\omega})$, dashed orange line) and empirical (m, solid black line) data. The estimation procedure minimizes the weighted squared distance between the lines.

where W denotes the weight matrix, chosen to be $1/m$ on the diagonal and zeros elsewhere, to normalize each moment. Details on the estimation procedure are in appendix B.3.3. The estimation targets the participation rate, homeownership rate, conditional portfolio weight on stocks and net worth over the life cycle, for households aged 25-79. A discussion of the estimation of the life cycle profiles is in appendix 2.2.1. I use the SCF to estimate the life cycle profile of portfolio weights among participants since the PSID does not include information on stock holdings within IRAs, see section 2.2 for more. The estimation is over-identified, with 6 parameters and 44 moments: four life-cycle moments in 11 age-bins ([25,29],[30,34],...,[75,79]).

Estimation Results

Table 2.4 reports the estimated parameters and the most informative moments for each parameter, while Figure 2.3 plots the simulated and true data moments ($m(\hat{\omega})$ and m). The plots reveal that the model largely fits the data quantitatively. We can see that the model fits the participation rate well. The model underpredicts portfolio weights for households over the age of 45 due to the large estimated risk aversion and high probability of tail events. The model matches wealth accumulation up to age 55 but generates a too large decline in weath after retirement. The model abstracts from several aspects of retirement and models it as an exogenous change at age T^R. Finally, the model qualitatively matches the homeownership rate but overpredicts among middle-aged households. The parameter values for risk aversion and discount factor ensure that virtually all households save substantial amounts to fund consumption in retirement, and so most households cross the endogenous rent/own wealth threshold.

Table 2.4: Estimation Results

	Parameter	Housing	No Housing	Identifying Moments
q	Participation cost	0.124	0.441	Participation
β	Discount Factor	0.937	0.907	Net Worth, Participation
γ	Risk Aversion	4.518	4.111	Portfolio W., Net Worth
p_{tail}	Tail Events	0.041	0.044	Portfolio W., Participation
χ_1	Owner Preference	1.16	–	Homeownership
ψ	Bequest Motive	706.57	171.74	Net Worth (old households)
	# of Moments	44	33	
	Obj. Function	119.23	187.03	
	Part. Error	17.62	60.50	

Notes: Identifying moments are listed in approximate order of importance.

The model struggles to explain behavior among middle-aged households. Since stock market participation is largely driven by wealth, and the participation cost is constant across the life-cycle, the model must trade of increasing participation among the young by increasing β and decreasing the participation cost q or decrease participation among the middle-aged by decreasing β or increasing q. The only other mechanism is housing: since 'house-poor' homeowners are unlikely to participate in the stock market, the estimation increases the homeownership rate among the middle-aged to decrease their participation. The result is that more middle-aged households have low home equity and prioritize building more home equity before participating in the stock market.

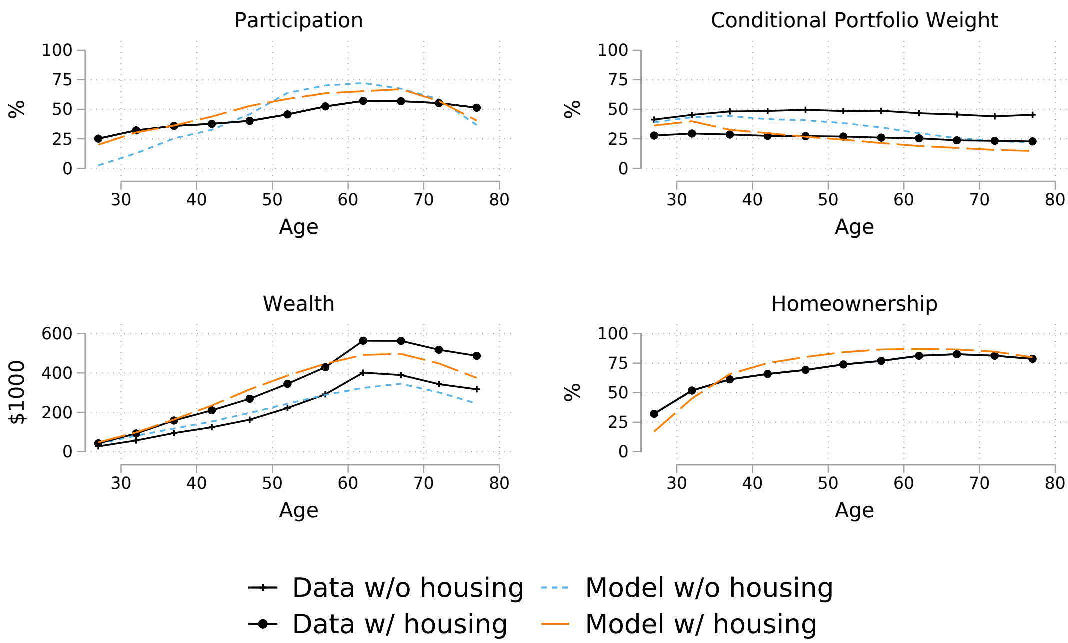
Finally, Table 2.4 lists the point estimates and the main identifying moments. The third column also reports the parameter estimates from a model without housing (see section 2.4.3). The participation cost is estimated to be 0.124, which can be interpreted as $124 in 1995 dollars. The model estimates a discount factor of 0.937, a risk aversion of 4.52, a probability of tail events of 4.1%, which all are lower than the estimates in Fagereng et al. (2017) but comparable to those in Catherine (2019). The ownership preference premium is quite low 1.16 relative to other life-cycle papers (e.g., Corbae and Quintin, 2015; Chang, 2020). Two model mechanisms drive down the estimated preference shifter: First, the largest rental unit is the small house size, so wealthy houses who want to equate the marginal benefits and costs of consumption and housing must be homeowners once they are sufficiently wealthy. Second, with stochastic prices and constant rental price ratios, renting is risky, and becoming a homeowner provides insurance against expenditure shocks.

2.4.3 Model Improvement with Housing

While the estimated model does well at matching the observed life-cycle outcomes, it is instructive to see what happens when housing is omitted. I redefine net worth to financial wealth to keep the model consistent with the data.[7] The portfolio weight is similarly redefined to stocks over financial wealth instead of over net worth. In addition, I remove the minimum income floor as in Fagereng et al. (2017). Since this model omits housing, the parameters χ_1 and η are redundant. The estimation thus mirrors the estimation in Fagereng et al. (2017) in all aspects, except that the

[7] When estimating the life-cycle moments, I follow the procedure described in 2.2.1, but I recoded financial wealth to missing for households in the top/bottom 1% of financial wealth, before dropping households in the top/bottom 1%.

Figure 2.4: Estimation Without Housing - Targeted Life Cycle Moments



Notes: These figures plots the targeted life-cycle moments in the simulated data in the model with and without housing, as well as the empirical moments.

estimation targets US data. Figure 2.4 plots the estimated life-cycle patterns, and Table 2.4 lists the estimated coefficients.

Comparing the estimated outcomes, it is clear that the model with housing matches the participation rate significantly better, even though it targets an additional moment. The peak participation rate is too high without housing, while the participation rates for young and old households are too low. The model without housing is able to largely match net worth, but still with too strong withdrawal after retirement. Both models are largely able to match the data for middle-aged households, but the largest improvement for the model without housing is among younger households. This is intuitive: The transition from renting to owning happens for young and middle-aged households. Further, the model and results in Fagereng et al. (2017) show that the model without housing can qualitatively match the dual adjustment of old households (exit and increased portfolio weights among participants). The housing market in this paper omits several important factors for older and retired households, such as reverse mortgages and increased depreciation, which could improve the model's ability to match data among older households.

Finally, from Table 2.4, we see that the participation cost increases to 0.441 from 0.124 while the discount factor decreases to 0.907 from 0.937. At the same time, risk aversion falls slightly to 4.111, and the probability of tail events increases to 4.4% from 4.1%. The main takeaways are: First, a model with housing can quantitatively match the participation rate over the life cycle with a low participation cost ($124), relative to a model without housing. Second, the sum of the squared deviation between the model and empirical participation rates decreases by 71% from 60.5 to 17.62 when housing is included. Third, the model fit, as calculated by the sum of squared percentage deviations, decreases by 40% by including housing, even though it only introduces one new estimated parameter for 11 new moments (homeownership over the life-cycle).

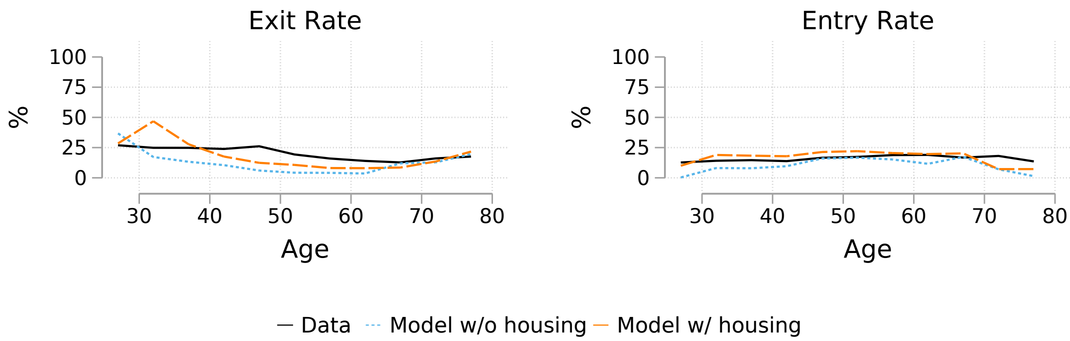
2.5 Non-Targeted Moments

I now turn to discuss the models' performance on matching non-targeted moments to highlight the robustness of the model.

2.5.1 Stock Market Entry and Exit

This paper proposes a new channel (entry and exit) to explain limited stock market participation. Figure 2.5 plots the simulated and true two-year entry/exit rates over the life-cycle. The model with housing does remarkably well at matching the qualitative and quantitative patterns with hump-shaped entry and u-shaped exit. In the model, almost all renters who become owners sell their stocks, leading to a too high simulated exit rate initially. However, without housing, we see that the model generates too little exit in middle age. The only reason households exit without housing is that their wealth declines below the participation threshold due to a

Figure 2.5: Entry and Exit from Stock Markets - Data and Simulation



Notes: These figures plot the two-year entry/exit rates in stock markets in the data (solid line) and the model (dashed line).

sequence of bad income or stock returns. However, at middle-age, the threshold is low, and most households have accumulated significant savings, and there is virtually no exit without housing. I study the role of the minimum downpayment level in Appendix B.5.1. I show that entry is increasing in downpayments (i.e., the highest entry rate is obtained when households must pay for the house without borrowing) and that exit is decreasing.

2.5.2 Micro-Level Behavior

The model matches aggregate behavior well. I now use the simulated panel to estimate the causal effects of property values on the participation decision to verify that the individual-level simulated behavior matches the data. Chetty et al. (2017) (Section D) estimate

$$\Delta part_i = \alpha + \beta_1 \Delta PropertyValue_i + \beta_2 \Delta TotalWealth_i + \gamma \Delta X_{it} + \Delta \varepsilon_i, \quad (2.16)$$

where $\Delta x_i \equiv x_{i,t+1} - x_{i,t-1}$ for an individual who purchased a house in period t. The purpose of this regression is to control for selection while answering: "Do households who buy more expensive houses reduce their stock holdings by a larger amount from

Table 2.5: Replicating Chetty et al. (2017)

ΔParticipation	Chetty et al (2017)	Model Simulations
Δ Property Value	-12.14	-24.92
($\times$ \$100K)	(2.56)	(1.2)
Δ Total Wealth	6.10	7.3
($\times$ \$100K)	(0.96)	(1.58)
Observations	6912	60207

Notes: Standard errors in parentheses. The results for specifications 1 is from column 5 in Table VI in Chetty et al. (2017). All specifications use a two-stage least squares estimator where the state price index instruments for the property value. The set of control variables is the same as in Chetty et al. (2017) except that the simulated model has no year fixed effects, and use the persistent human capital shock v as a proxy for education.

the year before to the year after home purchase?". To deal with the endogeneity in the size of a house one purchases, they instrument for property values using state house price indices. When I estimate equation (2.11) on the simulated panel, I follow their procedure as close as possible. For more details on their estimation I refer to section C in Chetty et al. (2017), while a detailed discussion of my replication using simulated data is in Appendix B.4.1 and Table B.2 compares the estimation samples.

Table 2.5 include the result in Table 5 from Chetty et al. (2017) on participation, as well as the same regression in the model. Chetty et al. find that an increase in the property value of $100,000 in 1990 dollars, keeping home equity and mortgage debt constant, decreases the probability of participation by 12 percentage points. The same increase in total wealth increases the portfolio weight by 5.88 percentage points. Overall, the estimates from the simulated panel are reported in Column (2) of Table 2.5 and match the effects found in Chetty et al. (2017) well. From these overall results, I conclude that the model not only matches average life-cycle moments well but also captures on an individual level the impacts of property values and total wealth on US households' portfolio decisions.

2.6 Conclusion

This paper improves our understanding of the causes of the low stock market participation rate over the entire life cycle in the US. New salient empirical results highlight the high exit rate (about 20%) from stock markets as a reason for the low participation rate among young and middle-aged households and the relative importance of homeownership in driving exit decisions. Based on the empirical results, it develops a quantitative life-cycle portfolio choice model that can match the four main components of households' portfolios over the life-cycle: the participation rate, homeownership rate, conditional portfolio weight, and net worth. To do so, the model requires a low participation cost and a high risk aversion parameter relative to a model without housing.

Adding housing to the benchmark models (e.g., Fagereng et al., 2017; Cocco, 2005) improves the model fit for participation over the entire life cycle. The main mechanisms are that liquidity constrained ('home poor' or 'wealthy hand-to-mouth') homeowners delay stock investment to build sufficient home equity. A model with a one-time cost and housing (e.g. Vestman (2019); Cocco (2005)) eventually predicts 100% participation among middle-aged and/or retirees. This paper shows that a model with housing and per-period costs can match the participation rate over the entire life-cycle. The combination of per-period costs and house-tenure allows the model to not only match targeted moments but it also qualitatively matches the entry and exit rates over the life cycle. Additional to matching targeted and non-targeted life-cycle moments, regressions on the simulated households recover the causal impacts of home equity and property values found in Chetty et al. (2017).

3 RISK-TAKING, FAMILY RESOURCES, AND A FULL VIEW OF THE PORTFOLIO (CO-AUTHORED WITH ANNIKA BACHER AND JOEL MCMURRY)

Abstract

We empirically document the association between parental wealth and the risk-taking behavior of their adult children in the United States. We hypothesize that parental wealth increases risk tolerance of the child household, as wealthy, altruistic parents may provide partial insurance against losses, decreasing the downside to risk in asset, housing, and labor markets. Survey data on US households confirm this hypothesis. We first show that household risk-taking in individual assets is increasing in parental wealth. However, risk in one choice may be hedged against with other assets or expectations about future labor income. Therefore, we use the volatility of next-period wealth normalized by current wealth as our preferred measure of risk-taking, since this measure jointly accounts for multiple sources of risk. We derive the measure from a standard budget equation in a model of labor and portfolio choices with incomplete markets, with a clear mapping from theory to data. Overall risk-taking is increasing in parental wealth.

3.1 Introduction

In this project, we study how parental wealth affects the risk-taking behavior of their adult children along three dimensions: labor market risk, asset market participation, and housing choices. We hypothesize that parental wealth increases households' risk tolerance as it provides partial insurance to losses, decreasing the downside to risk. Understanding the degree to which family resources shift risk tolerance is important for two reasons. First, given equity premia and gains to diversification, households that take more risk will accumulate more wealth in expectation. Additional risk-taking induced by family insurance may therefore amplify both cross-sectional wealth inequality and the persistence of wealth across generations (Benhabib et al., 2011; Fagereng et al., 2020, 2021). Second, the existence of family insurance drives a wedge between observed measures of risk exposure and the true distribution of returns that households actually face. Therefore, ignoring private forms of insurance might distort welfare analysis and the optimal design of public insurance due to a misspecification error that may be quantitatively important.

Moreover, several recent studies have documented that a key feature of wealth dispersion is heterogeneity in the rate of return on wealth (that returns are increasing in wealth) (e.g., Benhabib et al., 2017; Xavier, 2021), and that this heterogeneity is driven by portfolio composition and not differences in returns (Xavier, 2021; Nekoei and Seim, 2019). Thus, determining the sources of wealth inequality requires an understanding of why households hold different portfolios. In this paper, we argue that heterogeneity in parental wealth may be driving part of these differences in portfolio composition. The fact that parental wealth is associated with riskier (and higher-return) portfolios means that cross-sectional inequality is tightly connected to inter-generational inequality in a way that is separate from hypothesized mechanisms such as inter-generational credit constraints or the correlation in genetic endowments between parents and children.

Studying the association between risk-taking and parental wealth requires data in which both parents and children are observed. The Panel Study of Income Dynamics (PSID) is such a genealogical dataset, and thus the PSID forms the basis for our analyses. We begin by documenting that households with wealthier parents choose riskier occupations measured by income volatility, are more likely to participate in risky asset markets, and invest a larger share of their overall wealth in housing. In addition, households with wealthier parents are more leveraged and more likely to own a private business. However, risk exposure in one dimension may be offset by a less risky choice along another dimension. Therefore, we construct a measure of aggregate risk exposure that summarizes a household's overall portfolio and accounts for the covariance structure between returns across different assets. We derive our risk measure from the households budget constraint, and it is the standard deviation of next-period wealth including income, normalized by current wealth. We find that this measure of risk-taking in the "full" portfolio is increasing as a function of parental wealth, controlling for the own wealth of the child household. Moreover, the positive association between parental wealth and risk-taking remains after we control for a wide set of household and parental controls known to be related to risk-taking, such as income, age, education. For example, among households in the bottom own-wealth quartile, increasing parental wealth from the bottom to the top wealth quartile is associated with an increase in risk-taking by 13%, after controlling for other characteristics.

Next, we provide suggestive evidence that parental wealth encourages risk-taking because it provides partial insurance to losses (we call this the "*insurance channel*"). So far, the literature has focused on the competing roles of immutable genetic endowments (nature) and the environment induced by parental characteristics and choices (nurture) to explain the positive correlation between child and parent outcomes (e.g. Fagereng et al., 2021).[1] As conceptualized by the literature, both of these hypotheses generate the same prediction concerning the sign of the association between parental wealth and child savings. The "nature" hypothesis asserts that parents and children make similar savings decisions because they share genetic characteristics that induce them to save. In contrast, the "nurture" hypothesis posits that children of wealthy parents accumulate wealth because they learn savings and investing habits from their parents. Crucially, both of these hypotheses lead to the prediction that child saving should be *increasing* in parental wealth. In contrast, our proposed "insurance" channel predicts the opposite: a child's marginal valuation of wealth should decrease in parental wealth, as family insurance is a substitute for self-insurance. Therefore, children of wealth parents should save *less*. We show the data are indeed consistent with the insurance channel: household savings are decreasing in both parental wealth and parental savings, after controlling for own wealth.

[1] This literature mainly studies similarities in risk-taking behavior between parents and children and not between parental wealth and children's risk choices. However, because of risk premia, more risk-taking by parents results (ceteris paribus) in larger wealth levels. See Section 3.1.1 for a more detailed discussion of the literature.

3.1.1 Related Literature

Our paper lies in the intersection of three strands of the economics and finance literature, namely those concerned with return heterogeneity, wealth inequality, and family economics.

Our paper relates most closely to those studying the role of family background on economic outcomes. Our central contribution is to empirically document that households with wealthier parents take on more risk. The existing literature has focused on the role of intra-household heterogeneity in marriage, divorce, and the number of children on portfolio choice (e.g., Love (2010); Bogan and Fernandez (2017)). Another large literature has focused on the effect of family wealth and parental background on children's human capital in the presence of borrowing constraints (e.g., Caucutt and Lochner (2020); Lee et al. (2020)). In contrast to these papers, we provide evidence that contemporaneous characteristics of parents are associated with portfolio choices that shift outcomes in adulthood. In this vein, a related paper is Brandsaas (2021) which studies the effect of parental wealth on the housing decisions of children.[2] Finally, some papers look at parent's responses to children's outcome. For example, Boar (2021) documents that parents accumulate savings to insure their children against income risk, supporting our assumed mechanism.

Our paper also contributes to the broader literature on the inter-generational persistence of wealth. Charles and Hurst (2003) document, using the same data as we do, that the inter-generational correlation of wealth in the US is 0.37, and find that lifetime income and asset ownership explains two-thirds of the correlation. Our paper complements their work by documenting one channel through which households with wealthy parents receive higher returns and income: increasing risk-taking, which – in general – increases expected returns. Fagereng et al. (2020) focus on heterogeneity in returns in Norway, and find that both wealth and the returns to wealth are persistent over generations, but do not study income, the propensity to own assets, or the

[2]Many papers have documented that parental transfers increase the propensity to buy housing by relaxing borrowing constraints (e.g., Blickle and Brown (2019)) or that entrepreneurs rely on financing from family and friends (e.g., Lee and Persson (2016)). In this paper, we also consider assets with fewer financing frictions such as stocks and study total risk-taking.

portfolio weight on various assets. We contribute by documenting that one driver of the inter-generational persistence in the return to wealth is that households with wealthier parents hold more of their wealth in high-risk, high-return assets. Finally, a recent literature uses high-quality Scandinavian data to study the persistence of wealth across generations (e.g., Boserup et al. (2016); Black et al. (2020); Fagereng et al. (2021)), but this literature does not focus on risk-taking or return heterogeneity.

Many different factors can explain the empirical fact that child and parent outcomes are positively correlated, and a large number of theories have been proposed in the literature. An extensive literature uses twin studies to disentangle genetic and environmental determinants (e.g., Black et al. (2020); Fagereng et al. (2021), frequently finding that environmental factors remain important when controlling for genetic endowments. On the other hand, Barth et al. (2020) find that a significant driver of the gene-wealth gradient is financial decision-making, even after controlling for income. Another related literature documents that children tend to invest similarly to their parents (e.g., Knüpfer et al. (2017); Chiteji and Stafford (1999); Black et al. (2017)) and learn from them (e.g., Hvide and Oyer (2018)). We complement these findings by showing that American households with wealthier parents take on more risk in their portfolio and labor market choices, and we propose a new channel that explains why this is so: access to parental resources decreases the downside to risky investments, tilting the portfolio of households towards high-risk assets.

The remainder of this paper is structured as follows. In Section 3.2, we explain how we measure risk in labor and assets markets. Section 3.3 describes our data and presents descriptive statistics of the linked parent-child sample that we analyze. Section 3.4 shows that risk-taking along individual dimensions is increasing in parental risk whereas Section 3.5 documents that parental wealth also encourages overall risk-taking. Finally, Section 3.6 discusses possible underlying mechanisms whereas Section 3.7 concludes.

3.2 Methodology: Measures of Risk and Family Resources

In this section, we discuss how we measure income risk, how we measure risk in various assets, and give a short introduction to models of parental wealth as insurance.

3.2.1 Measuring Income and Occupational Risk

The second moment of earnings within an occupation, and its relation to the first, has been studied since at least Kuznets and Friedman (1939) who documented a positive association between the mean and variance of income for professional workers. Other studies have confirmed this finding (e.g., Cubas and Silos (2017)). A related branch of literature has been concerned with estimation of the dynamics of earnings, including how best to specify the covariance structure of processes generating individual income over time (see Lillard and Willis (1978); MaCurdy (1982); Abowd and Card (1989); Meghir and Pistaferri (2004)). However, establishing a link between labor market risk and second moments of earnings requires theoretical structure that specifies the information set to which agents have access. Observed conditional variances in earnings might truly reflect randomness that is unknowable to those agents generating the data, but it may also be the case that variation is induced by heterogeneity unobserved by the econometrician. A more subtle point is that a proper conception of labor market risk requires more than simple uncertainty. Here we think of labor market risk as a function of forces external to the decision-maker. That is, holding an agent's decisions fixed, what are the unforecastable components of earnings? This sort of uncertainty fundamental to the "job" is distinct from uncertainty about actions the agent might take in the future. An example of this latter type of uncertainty is future taste shocks for leisure. A worker might be uncertain about her valuation of leisure in the future, inducing a distribution of future earnings due to her future optimal choices. However, the component of this future earnings distribution due to her future labor supply choices should not be thought of as risk: if she could commit to future labor supply, this component of "risk" would disappear.

Our conception of labor market risk is consistent with studies that specify an exogenous wage equation (see for example Guvenen and Smith (2014); Altonji et al. (2013); Low et al. (2010); Moffitt and Gottschalk (2002)).[3] To our knowledge, the study that most closely matches our conception of risk and studies occupation-specific risk is Dillon (2018). That paper specifies a wage equation in which the stochastic components of wages includes occupation-specific aggregate shocks and both idiosyncratic permanent and transitory shocks, both with occupation-specific variances. As our measure of occupation risk, we use the sum of the variances of these three shocks. Table 3.1 summarizes the results.

In our analysis we categorize occupations into three groups according to the sum of shock variances. We define high-risk occupations as those with a sum of variance of 0.27 or higher, and low risk those below 0.23. While arbitrary, this ensures that the number of households in each risk category is comparable.

3.2.2 Measuring Asset and Liability Return Risk

We now describe our general strategy for calculating the risk associated with items on both sides of the household balance sheet. For the remainder of the text, we will use assets to refer to both liabilities and assets. To map our risk measure (discussed in section 3.5.1) to the data, we need to know the entire variance-covariance matrix of returns on all assets. The return on an asset comprises two terms, the income stream (e.g., the interest rate on deposits or dividends on stocks) and capital gains (e.g., price appreciation on owner-occupied housing or stocks). We estimate the matrix since, to our knowledge, no estimates exist that cover all the assets we consider in the US.

For financial assets such as stocks or interest-bearing assets, we follow the standard method and use historical yearly returns (including dividends when applicable) to find the expected rate of return and volatility. For other assets, such as privately

[3]Boar (2021) (forthcoming) is a recent paper that studies parental responses to the labor market risk of their children. The author takes a non-parametric approach and conceptualizes risk as the standard error of the forecast errors of lifetime income. Although this measure is appropriate for understanding how parents respond to the dynamics of child earnings, it also incorporates changes in earnings due to unforecastable worker labor supply and occupation-switching choices. Therefore, it is not a measure of pure occupation risk.

Table 3.1: Occupational Risk Ranking

Occupation	Sum Shock Variances
Agriculture	0.57
Finance	0.31
Legal	0.28
Construction	0.27
Entertainment	0.27
Health	0.27
Maintenance	0.26
Community	0.25
Management	0.24
Transportation	0.24
Sales	0.24
Sciences	0.23
Protection	0.21
Mechanics	0.21
Education	0.21
Manufacturing	0.20
Office Support	0.20
Computers	0.18
Engineering	0.17

Source: Authors' calculation based on Dillon (2018)

owned businesses and housing, we only calculate returns from capital gains based on national indexes. For housing, dividends (e.g., the difference between market rent and ownership costs) do not enter our risk measure. For private businesses, we follow Xavier (2021) and use the aggregate value of private businesses to calculate capital gains. In our framework, we capture the dividend of private business by household income. We list and discuss the data we have used in detail in Appendix C.1.

We estimate net returns on the main asset classes observed in our household-level data. To find the net returns, we use the Wilshire 5000 Index (stocks), S&P 500 Case-Shiller house price index (owner-occupied housing), 3-month treasury bill rate (safe assets), average 30-year fixed rate mortgage rate (mortgages), average credit card interest rate charged by commercial banks (credit card debt), and proprietor's equity in non-corporate businesses (farms & business). We then compute the mean and variance of each asset and the correlation matrix from historical data from FRED. Table 3.2 displays the calculated expected returns and volatility, while Table 3.3 displays the correlation matrix

Table 3.2: Expected Returns and Standard Deviations of Assets

Asset	Expected Return	Standard Deviation of Return
Safe	4.21	3.08
Credit Card	13.8	1.44
Stocks	11.7	13.6
Housing	3.97	5.25
Mortgage	7.80	3.28
Private Business	5.92	6.17

Notes: This table display the average return and the standard deviation of the return, for various assets. Variable definitions in main text.

Table 3.3: Correlation Between Assets

	Safe	Credit Card	Stocks	Housing	Mortgage	Business
Safe	1.00					
Credit Card	0.71^{***}	1.00				
Stocks	0.09	0.24	1.00			
Housing	0.09	0.02	0.24	1.00		
Mortgage	0.95^{***}	0.58^{**}	0.07	-0.03	1.00	
Business	0.16	0.01	0.32^{*}	0.77^{***}	-0.02	1.00

Notes: This table displays the historic correlation coefficients between the yearly net returns between different assets in the US. * $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

3.3 Data Description

Our analysis relies on the Panel Study of Income Dynamics (PSID), a free publicly available longitudinal household survey compiled since 1968. The study follows both the original families and children moving out of their parent's households ('splitoffs'). Detailed information on financial wealth and portfolio choices are available for every other year starting in 1999. Importantly for our purposes, the data allows us to link adult children with their parents to obtain children-parent pairs while observing parental wealth and income and the child's portfolio allocations. We use data from the 1984 wave to the 2017 wave of the PSID.

While most of the existing literature on return heterogeneity and inter-generational persistence uses Scandinavian high-quality register data, we believe American survey data has other benefits. First, we can observe financial transfers, in-kind transfers, and whether households think they can rely on family for assistance. Second, a weaker social safety net may strengthen our insurance channel. Third, and perhaps most importantly, it allows us to share our code and data for replications. Fourth, we know relatively little about return heterogeneity in the US.

3.3.1 Sample Selection

We limit our sample to households that have at least one parent with observed wealth. We limit the sample to households of age between 25 and 55 to focus on those of working age, allowing us to abstract away from education and retirement decisions. Next, in addition to the Survey Research Center (core sample), we include the immigrant subsample to obtain a representative sample from 1997. We also include the Survey of Economic Opportunity ('poverty sample') to better capture the role of parental resources among poorer households. We drop the Latino sub-sample as it was collected only between 1990 to 1995. We treat each parent-child link as a unique observation so that a parent linked with two children are all household characteristics such as age, race, or education, refer to those of the head. We only use survey waves where detailed wealth information was collected (every fifth year from 1968 and every other since 1999).

We define a 'family' as one child-parent combination. Thus, one parent with two kids is observed twice as a parent. A parent may be observed with his/her parent, so a parent may simultaneously be observed as a child and parent. When both the father and mother are observed, we use the father as the parent. In total, we have 8443 unique individuals and 5076 unique parents. The average household is observed in 4 waves, and no household is observed in more than 12 waves. We deflate all nominal variables by the CPI-Urban deflator with 2009 as a base year.

3.3.2 Descriptive Statistics

We now provide a brief description of the final estimation sample and the sample broken down by parental wealth. Table 3.4 lists the means, medians, standard deviations, and the number of observations for various variables. The average household in our sample is 37.8 years old with an average wealth of $170,089$ and an annual average income of $69,203. 48% are homeowners, 20% own stocks directly, 47% finished high school but did not graduate college while 30% have a college degree, 38% are married, and 76% are white. There is substantial wealth inequality in our sample, and the median wealth is only 13% of the average.

We also list some detailed information about the household portfolios, conditional on holding a non-zero amount in the asset. We see that the (conditional) average amount is high, $142,304 but with a median of $18,000. The average home value is $219,266, and the average home equity is $104,217. The average farm or business value is large, at $430,795 among only 482 households. While the PSID does not include detailed information about retirement benefits, we see that roughly 15% of households report owning IRA's or annuities, valued at $84,239. 34% of households belong to safe occupations, 31% to medium, 18% to risky, and 17% to other.

Finally, Table C.2 replicates the same table without limiting the sample to households without observed parents. By dropping households without observed parental wealth, the sample is reduced by 53%, and the average age increases from 37 to 40. We can also see that the estimation sample is a little poorer, less likely to own various assets, or highly educated. However, the differences are relatively minor.

Table 3.4: Summary Statistics of Estimation Sample

	Mean	Median	SD	N
Overview				
Age	37.60	37.00	8.63	32962
Wealth	170,089.15	23,053.95	975,299.39	32962
Income	69,203.17	50,229.28	101,686.47	32962
Home owner (%)	0.48	0.00	0.50	32962
Stock owner (%)	0.20	0.00	0.40	32962
High-School (%)	0.47	0.00	0.50	32962
College (%)	0.30	0.00	0.46	32962
Married (%)	0.38	0.00	0.48	32962
White (%)	0.76	1.00	0.42	32962
SRC sample	0.84	1.00	0.36	32962
Immigrant Sample	0.04	0.00	0.19	32962
SEO Sample	0.12	0.00	0.32	32962
Portfolio Composition				
Stocks	142,304.00	18,000.00	1220801.24	5044
IRAs & Annuities	84,239.44	26,257.02	185,245.69	5058
Safe Assets	19,854.46	4,394.19	101,216.29	22706
Home Value	219,266.84	157,542.13	216,289.71	14311
Home Equity	104,217.18	57,894.96	166,322.98	14349
Farm & Business Equity	363,717.01	54,927.33	1720511.64	2376
Real Estate Equity	161,204.23	54,309.27	442,722.18	2683
Other Equity	7,608.52	-4,342.12	303,909.69	13740
Occupation				
Safe (%)	0.34	0.00	0.47	27700
Medium (%)	0.31	0.00	0.46	27700
Risky (%)	0.18	0.00	0.38	27700
Other (%)	0.17	0.00	0.38	27700

Notes: Weighted by family weights. All variables under portfolio composition are conditional on holding non-zero of the asset, but includes negative values. For these rows N reports the number of non-zero, non-missing observations. *Source:* PSID 1984-2017.

Next, Table 3.5 reports the average of the same variables by the wealth quartile of the parent. We see the intergenerational correlation in wealth and income, with children with parents in the top 25% having 6.7 times the wealth and 2.3 times the income of those with parents in the bottom 25%. There is a strong positive correlation between parental wealth and the other demographic variables: homeownership (2.1), stock ownership (4.5), college (3.8), marriage (1.6), and white (1.6). The average wealth of parents in the bottom 25% is only $546 but $1,547,111 for those in the top 25%. The average income of parents in the bottom 25% is $31,261 and $123,783 for those in the top 25%. Even though we calculate age-independent wealth quartiles, we see that age is only slightly increasing in wealth: the rightest parents are three years older on average, and their kids are 1.5 years older, and so the observed patterns are unlikely to be driven by age.

The table next reports the portfolio composition, and we see that dollars invested in an asset are increasing in parental wealth. For example, children of the wealthiest 25% of parents invest 2.5 times more in stocks, conditional on owning stocks. The same is true for all of the assets: Conditional on owning an asset, the children of the richest have more dollars invested than children of the poorest 25%. However, some of the cells have few observations. We also see that households with richer parents are more likely to work in risky occupations. Interestingly, there is no clear pattern in the share of households working in safe occupations, but the share of households in medium and unclassified sectors is decreasing in parental wealth.

3.4 Parental Wealth and Separate Gradients in Choices

In this section, we study the relation between parental wealth and individual risk measures of asset market participation, housing choices as well as occupational risk, while controlling for own wealth. In Section 3.5, we look at combined risk-taking and also control for other variables such as age, income, and wealth.

Table 3.5: Summary Statistics of Estimation Sample by Parental Wealth Quartiles

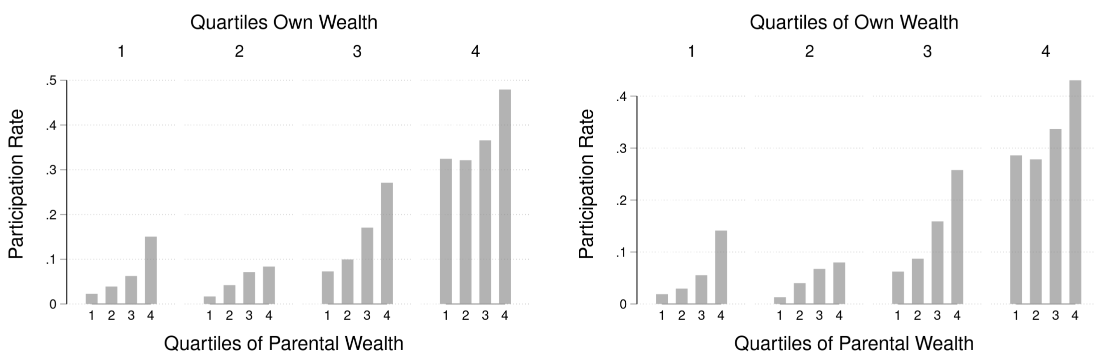
	1 Mean	2 Mean	3 Mean	4 Mean
Overview				
Age	36.69	37.46	37.98	38.25
Wealth	58,318.90	87,707.67	146,148.96	388,220.74
Income	44,805.07	55,138.71	74,702.69	102,173.40
Home owner (%)	0.29	0.45	0.57	0.60
Stock owner (%)	0.08	0.13	0.24	0.36
High-School (%)	0.53	0.54	0.46	0.35
College (%)	0.14	0.19	0.34	0.53
Married (%)	0.28	0.36	0.42	0.44
White (%)	0.53	0.70	0.89	0.94
Parental Variables				
Wealth	546.04	87,035.52	277,688.83	1547117.85
Income	31,261.26	50,812.34	70,115.52	123,783.61
Age	64.14	65.29	66.72	67.62
Portfolio Composition				
Stocks	93,927.23	62,054.90	64,388.52	234,848.28
IRAs & Annuities	86,482.10	58,727.46	71,397.85	100,165.15
Safe Assets	12,331.93	10,238.57	20,230.09	32,102.08
Home Value	155,225.51	142,664.75	207,467.86	318,712.89
Home Equity	67,859.32	58,056.19	94,079.14	165,852.94
Farm & Business Equity	173,941.82	348,241.15	178,801.99	537,754.33
Real Estate Equity	116,613.16	104,621.02	136,035.69	224,695.17
Other Equity	-1,829.61	2,563.96	7,172.04	20,005.61
Occupation				
Safe (%)	0.31	0.37	0.38	0.31
Medium (%)	0.28	0.29	0.31	0.35
Risky (%)	0.12	0.15	0.20	0.24
Other (%)	0.28	0.19	0.11	0.11

Notes: Weighted by family weights. All variables under portfolio composition are conditional on holding non-zero of the asset, but includes negative values. For these rows N reports the number of non-zero, non-missing observations. Parental wealth quartiles are age indenpendent. *Source:* PSID 1984-2017.

3.4.1 Asset Market Participation

A commonly used measure of financial risk is whether or not households hold risky assets in their portfolio. We define risky assets as direct stock holdings, indirect holdings (such as mutual funds) as well as owning an IRA/annuity. Figure 3.1a shows the stock market participation rate as a function of parental wealth. After controlling for their wealth, we find that the fraction of households who hold risky assets in their portfolio is strictly increasing in parental wealth, in line with our hypothesis. We can only observe whether households own assets in IRA's/annuities and not how much, or even whether any, is in stocks. Therefore, in Figure 3.1b, we show that the likelihood of asset market participation is also increasing in parental wealth when abstracting from any stocks holdings through retirement accounts.[4]

Figure 3.1: Stock Market Participation Rate by Parental Wealth



(a) All Risky Financial Assets

(b) Risky Financial Assets excluding IRAs

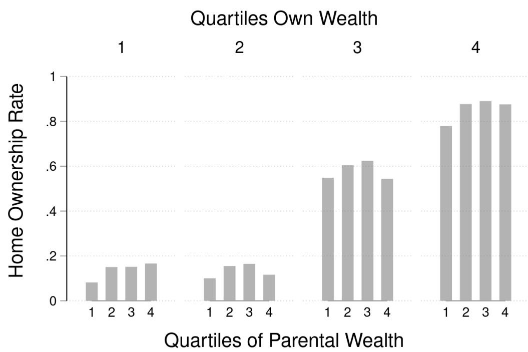
3.4.2 Housing Choices

Housing wealth constitutes the largest fraction of an average household portfolio and is therefore crucial when thinking about exposure to financial risk. In particular, because of its illiquid nature, it typically cannot be used for consumption smoothing

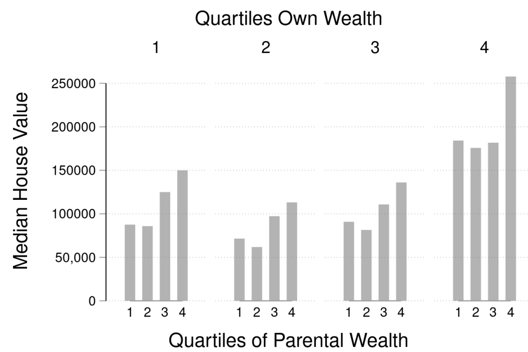
[4]We can only observe the amount of wealth invested in stocks through liquid accounts (e.g., ignoring IRA's) which gives a limited view of the equity risk households choose to bear. We plot the share of wealth invested in stocks in Figure C.1.

purposes. Moreover, most housing investments are financed through mortgages. Thus, we expect households with richer parents to invest more in housing (as a share of their overall wealth) and to take out larger mortgages in relation to their home value. The idea is that in case of a negative income shock, parents can transfer resources to their children to either smooth their consumption or to not get behind with mortgage payments. Indeed, Figure 3.2 confirms that house values and home equity are increasing in parental wealth, conditional on own wealth.

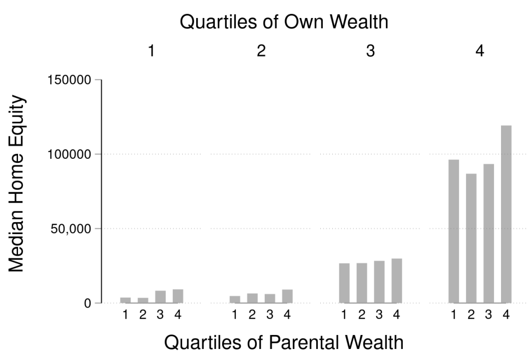
Figure 3.2: Housing by Parental Wealth



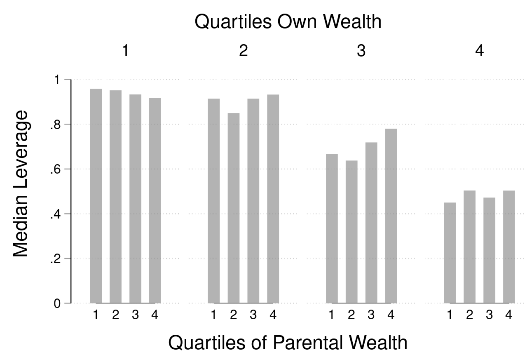
(a) Homeownership Rate



(b) Home Value

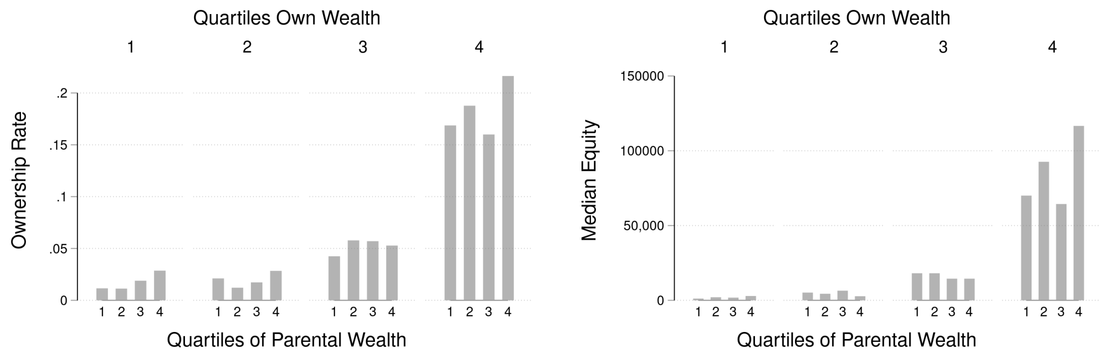


(c) Home Equity



(d) Home Leverage

Figure 3.3: Farm and Business Ownership and Equity



(a) Ownership (b) Home Equity ($)

3.4.3 Farm and Business

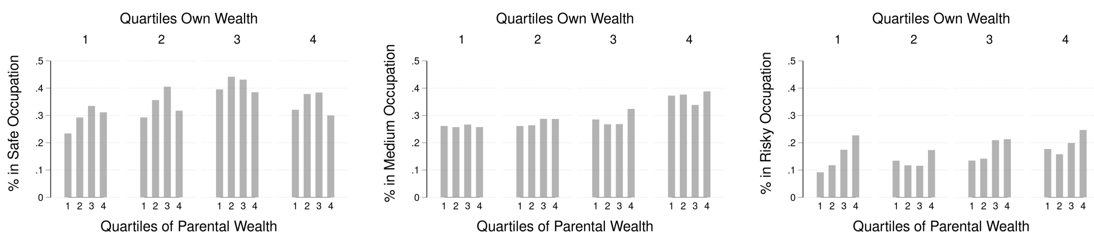
The final large asset that we observe in the PSID is farm and business ownership. However, only 7% of households how this asset. However, conditional on owning it the asset is often large, and we know that entrepreneurs and business owners are important for the fat tail of the US wealth distribution. Figure 3.3 plots the ownership and median equity (conditional on owning) by own and parental wealth quartiles. Business ownership is monotonically increasing in both own and parental wealth. Figure 3.3b plots the median equity among business owners. Poor households who own businesses have very little equity, but median equity is increasing in parental wealth among the top 25%.

3.4.4 Occupational Choice

This section studies whether households with access to larger parental resources take more risk in the labor market. We follow Dillon (2018) and define labor market risk to be the sectoral volatility across occupations. Next, as described in Section 3.2.1, we then classify all occupations into "*safe*", "*normal*" and "*risky*" and hypothesize that individuals with relatively wealthier parents are more likely to work in *risky* occupations, conditional on their own wealth. Similarly, we expect them to have a lower likelihood of working in a *safe* occupation. Figure 3.4 displays our results.

We find that the likelihood of working in a *risky* occupation is indeed increasing in parental wealth whereas the fraction of individuals who work in *normal* occupation does not display a steep gradient in parental wealth in either direction. In contrast, the pattern for working in a *safe* by parental wealth is less clear: Whereas the probability of working in such an occupation is decreasing in parental resources for relatively wealthy households, it is increasing in parental wealth for relatively asset-poor households.

Figure 3.4: Occupational Choice



(a) % in *safe* occ. (b) % in *normal* occ. (c) % in *risky* occ.

One potential concern with our occupational classification might be that *risky* occupations differ from *safe* occupations along further dimensions than their riskiness which could make them more attractive to individuals with richer parents. For example, if *risky* occupations require more education, they may be more attractive when parents can pay for tuition fees during college. Therefore, in Appendix C.2 we show that our results are robust to further splitting the sample into low vs. high educated households (Figure C.3) as well as when conditioning on household income as opposed to household wealth (Figure C.2).

3.5 Parental Wealth and the Full Portfolio

So far, we have considered multiple risk channels individually. However, households may hedge their overall risk exposure across different dimensions. For example, from portfolio choice theory we know that a household that makes more risk in one asset may lower the portfolio weight on other risky assets. Moreover, Chang et al. (2021)

show that Norwegian household respond to increased labor market risk by reducing portfolio weights on stocks. In this section, we derive our preferred risk measure, robust from these re-balancing through assets or occupations, from the household budget constraint.

3.5.1 Theoretical Derivation

Let $\mathcal{J} = \{1, \dots, j, \dots, J\}$ denote all assets (including liabilities) in the household's portfolio with respective return $r_{j,t}$ in period t and $y_{s,t}$ the labor income of sector s in period t, which yields the following standard law of motion for next-period disposable household wealth x_{t+1}:

$$x_{t+1} = y_{s,t+1} + \underbrace{(x_t - c_t)}_{\text{savings}} \sum_j \alpha_j (1 + r_{j,t+1}), \tag{3.1}$$

where c_t is consumption and α_j denotes the portfolio share for the respective asset. That is, $\alpha_j < 0$ for all liabilities, $\alpha_j > 0$ for each asset and it has to hold that $\sum \alpha_j = 1$. We omit individual-level subscript for ease of exposition. The variance of (3.1) can then be expressed as:

$$\begin{aligned} Var(x_{t+1}) =& Var\left(y_{s,t+1}\right) + Var\left((x_t - c_t)\sum_j \alpha_j(1 + r_{j,t+1})\right) + \\ & \sum_j Cov\left[y_{s,t+1}, (x_t - c_t)\alpha_j(1 + r_{j,t+1})\right] + \\ & \sum_{j \neq k} Cov\left[(x_t - c_t)\alpha_j(1 + r_{j,t+1}), (x_t - c_t)\alpha_k(1 + r_{k,t+1})\right] \end{aligned} \tag{3.2}$$

We abstract from labor income due to data limitations and assume that $y_{s,t+1} = 0 \,\forall\, s, t$ which allows us to re-write Equation (3.2) as:

$$Var(x_{t+1}) = \sum_j ((x_t - c_t)\alpha_j)^2 \sigma_{r_j}^2 + 2(x_t - c_t)^2 \sum_{j \neq k} \alpha_j \alpha_k Cov(r_j, r_k), \tag{3.3}$$

where $\sigma^2_{r_j}$ denotes the variance in the return of asset (or debt) category j. One benefit of ignoring labor income when we calculate the volatility of wealth is that it aids comparisons with the literature on return heterogeneity which largely ignores income. To compute Equation (3.3), we use the estimated variances (Section 3.2.2) of each asset and their respective covariances.

Finally, we define the normalized risk measure for household i in year t as follows:

$$\mathcal{R}_{i,t} = \frac{Var(x_{i,t+1})}{x^2_{i,t}}. \tag{3.4}$$

Without normalizing the risk measure we could not compare the level of risk between households with different net worth.

3.5.2 Empirical Implementation

We now discuss in some detail how construct map the data to our risk measure $\mathcal{R}_{i,t}$. First, we replace missing values of an asset with zeros (e.g., IRA's/Annuities which are only observed separately since 1999 or home values for all renters). For some assets, such as private business and farms, we only observe the equity (net value) up to 2011. To keep the definitions consistent over years, we calculate and use net value of these assets also after 2011. Since consumer loans, such as mortgages and credit card debt, is predominantly fixed interest rate we set the volatility of these liabilities to zero.

Net worth $x_{i,t}$ is defined as the sum of four gross assets: stocks, IRA's/annuities, safe assets, and owner-occupied primary housing, and additionally the sum of two net (equity) assets: other real estate, farm and business.[5] We assume that IRA's/annuities are invested 50% in stocks and 50% in safe assets. Next, we divide the sample by wealth and parental wealth quartiles, after keeping only households with strictly positive net worth (so that portfolio weights are well defined). We define the portfolio weights as dollars in each asset over net worth. Households with portfolio weights

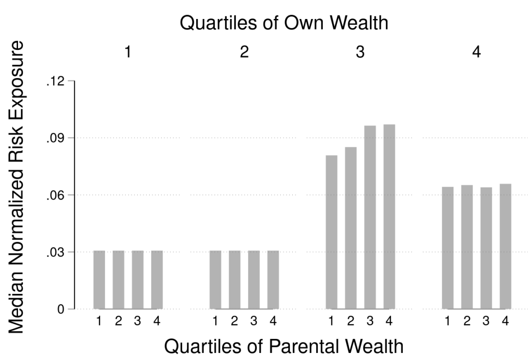
[5]We do not observe amounts in IRA's/annuities in 1984, 1989, and 1994. In those years we replace 7042 observations with 0.

above or below 7 are dropped.[6]

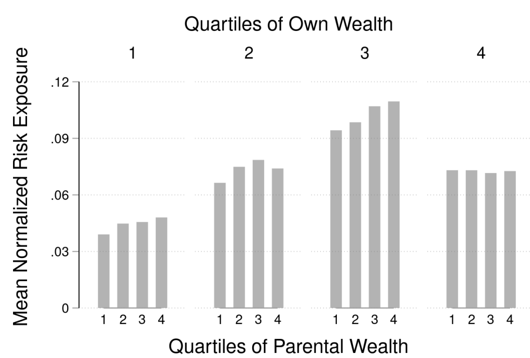
3.5.3 Results Without Controls

Figure 3.5 shows both the mean and median of the estimated normalized risk measure $\mathcal{R}$ as defined in equation 3.4 by parental wealth, conditional on own wealth. Since the median household in each cell only holds the safe asset among the poorest 50%, the median risk measure is flat. once we go to households above median wealth, we see that the risk measure is increasing in parental wealth. Households belonging to the third quartile have relatively high risk measures as they are levered homeowners. We plot the mean risk measure in Figure 3.5b, and we see that the parental wealth gradient is generally positive. Moreover, as predicted by our theory, there is no parental wealth gradient among the wealthiest households.

Figure 3.5: Normalized Risk Measure



(a) Median



(b) Mean

3.5.4 Results With Controls

At these point we have established a clear pattern. Households with wealthier parents take more risk in individual assets, in occupational choices, in a combined risk measure.

[6]This dropping rule prohibits 5, 1, 1, and 1259, observations due to extreme weights on safe assets, stocks, farm/business, and housing. These extreme allocations happen among first-time homebuyers with very low home equity but very expensive homes.

However, we know that parental wealth is correlated with a many other economic outcomes, such as education, income, race, and marriage. We thus now turn to linear regressions.

We proceed as follows. First, we limit the sample to all households in a given wealth quartile. We then run pooled ordinary least squares regressions where we control for log household income, race dummies, occupational risk dummies, education of the head (high-school, college), marriage dummy, age, age-squared, as well as parental age, parental age-squared, parental log household income, and parental wealth quartile dummies.[7] The main coefficients of interest are the ones on each parental wealth quartiles.

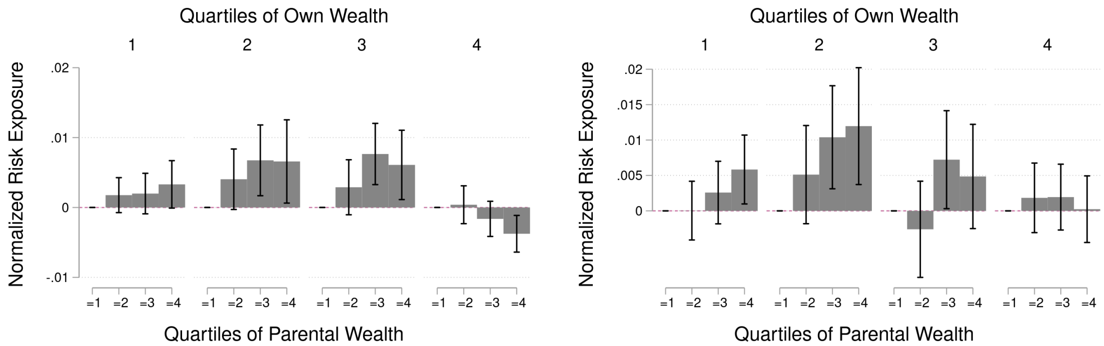
Figure 3.6 plots the estimated coefficient coefficient and 90% confidence intervals for the parental wealth quartile. When we look at the full sample we see that the risk measure is increasing in parental wealth for households in the bottom three quartiles. For example, for a household in the second wealth quartile, increasing parental wealth from the bottom to the top quartile is associated with a 0.005 increase in the risk measure (mean level 0.07). Next, we see that the effect of parental wealth is smaller the richer the household is, relative to the mean risk level in the quartile.

Finally, we limit the sample to those with married parents, similar to selection criteria in Attanasio et al. (2018).[8]. We then see that the association between parental wealth and risk-taking is increased among households in the bottom two wealth quartiles. There is still no significant association between parental wealth and children's risk-taking.

[7]We report results from random effects and fixed effects models in appendix C.3. The estimates are similar, but less precise, under the assumption of random effects. All results are insignificant with household fixed effects. One downside of fixed effects in our setting is that parental wealth is very persistent overtime, so there is very little within-household variation in parental wealth, and very few parent's move across wealth quartiles.

[8]Dropping households with single parents selects a very different sample. For example, the sample is younger (less likely that one parent have perished), have more siblings on average, and parents have higher wealth and income on average. Unlike Attanasio et al. (2018) we also include parents who have remarried new spouses

Figure 3.6: Conditional Effect of Parental Wealth on the Normalized Risk Measure



(a) Full Sample

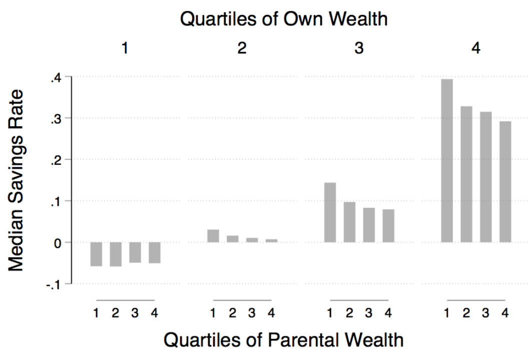
(b) Married Parents

3.6 Discussion of Underlying Mechanisms

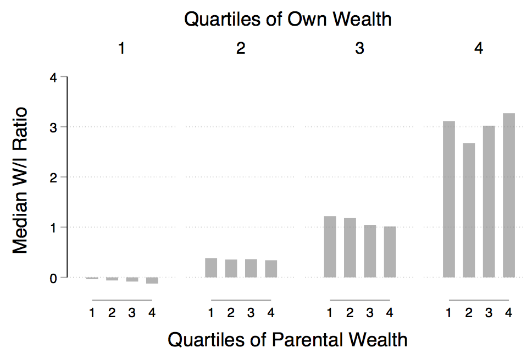
After having established an empirical link between parental wealth and the risk-taking behavior of their adult children, we now turn to discuss potential channels that drive the observed correlation. So far, the literature has focused on the role of nurture and nature to explain intergenerational transmission of investment behavior. Thereby, nature describes similarities in genetics within families that make them for example particularly risk-averse. In contrast, nature refers to parents acting as role-models for their children. In both cases, as well as in our proposed *insurance channel*, if parents invest more risky (what on average will result in higher returns and hence, larger wealth), their children will be more likely to do so as well. Thus, we cannot conclude from the empirical correlations reported in section 3.4 that parental wealth encourages risk-taking by decreasing the downside to that risk.

However, the savings behavior of individuals as a function of parental wealth operates in the opposite direction for the *insurance channel* than for the nature vs. nature mechanism. On the one hand, if children and parents have the same inherent taste for investment choices (nature) or if children learn from their parents (nurture), we would expect the savings rate of children to be increasing in the parent's savings rate. On the other hand, economic theory predicts (precautionary) savings to be decreasing in insurance possibilities, thus we would expect the savings rate of children to be decreasing in their parent's savings rate. To test this intergenerational correlation of savings pattern, we work with two definitions of savings: the wealth-to-income ratio and a constructed savings rate s defined as $s = \frac{wealth - L2.wealth}{2 * inc}$. In line with our proposed *insurance channel*, we find both measures to be decreasing in parental wealth as well as in parental wealth-to-income ratio (Figure 3.7 and 3.8, respectively).

Figure 3.7: Savings by Parental Wealth

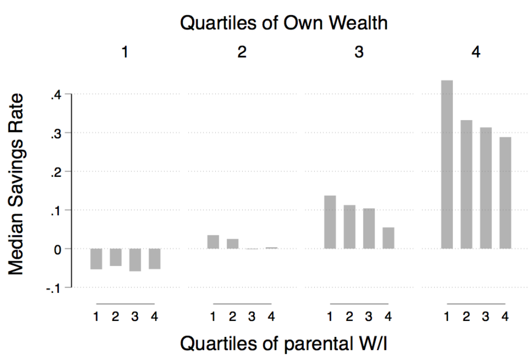


(a) Savings Rate

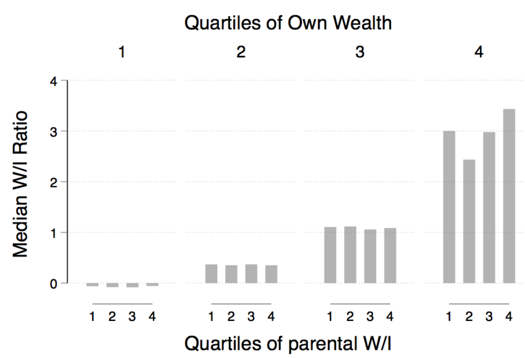


(b) Wealth-to-Income Ratio

Figure 3.8: Savings by Parental Wealth-to-Income Ratio



(a) Savings Rate



(b) Wealth-to-Income Ratio

3.7 Conclusion

Using genealogical American survey data, we document a positive association between household risk-taking and parental wealth. The gradient in risk-taking with respect to parental wealth exists for individual decisions as well as for a measure of overall risk exposure that takes into account the covariance between different assets.

These results have important implications for our understanding of wealth inequality within and across generations. Our finding that children with wealthy parents hold riskier portfolios provides one possible mechanism for the empirical finding that returns, through portfolio choices, are increasing in wealth, since wealth is positively correlated across generations. While we do not rule out other mechanisms, we view the evidence as consistent with an insurance channel in which parental wealth acts as insurance against downside risk, allowing households to take on more risk and generate the compensating higher return. The association between parental wealth and risk-taking is strongest between poor households with wealthy parents, consistent with our proposed mechanism. The empirical association between parental wealth and portfolio choice helps explain cross-sectional inequality (via return heterogeneity) and the inter-generational persistence of wealth (via the correlation between parental wealth and asset returns). Moreover, it suggests a tight connection between the two.

The results above suggest several avenues for future work. An obvious, yet difficult, next step is to carry out similar analyses with higher-quality data. While the PSID allows us to observe parental wealth and children's portfolio decisions, the information on asset holdings is limited (e.g., we cannot observe the portfolio weight on stocks in retirement accounts), limiting our ability to capture the entire household portfolio and increasing noise in our estimation. We also leave causal estimates for future work. In addition, the small sample size in the PSID makes inference difficult and limits the possibility of subgroup analysis. Further theoretical work that can generate testable predictions regarding the precise way in which parents may insure their children would also likely be fruitful.

A APPENDIX: ILLIQUID HOMEOWNERSHIP AND THE BANK OF MOM AND DAD

A.1 Data Appendix

A.1.1 Variable Definitions (PSID)

Table A.1 lists the most important variable definitions from the 2015 PSID wave.

Table A.1: Variable Definitions in the PSID

Variable	PSID code	Description	Note
Transfer Related			
Whthr Rcved Transfer	ER67962	2/5years, gift/inherit $10,000+	Changing def.
Transfer given	RT13V125	Loans/gifts to child in 2012	2013 prnt/chld file
Transfer Amount	RT13V125	Amount given in 2012	2013 prnt/chld file
Other			
Behind on Mortgage	ER66062	Behind on mortgage payments	
Income	ER65349	Total Household Income	
Employment Status	ER66164	Working, Unemployed etc	
House Value	ER60031	Reported Market Value	
Dollars Rent	ER66090	Monthly Rent	
Family Weight	ER71570	Weight of family (household) unit	

Notes: This lists the main variables I use from the PSID and their name in the PSID codebook

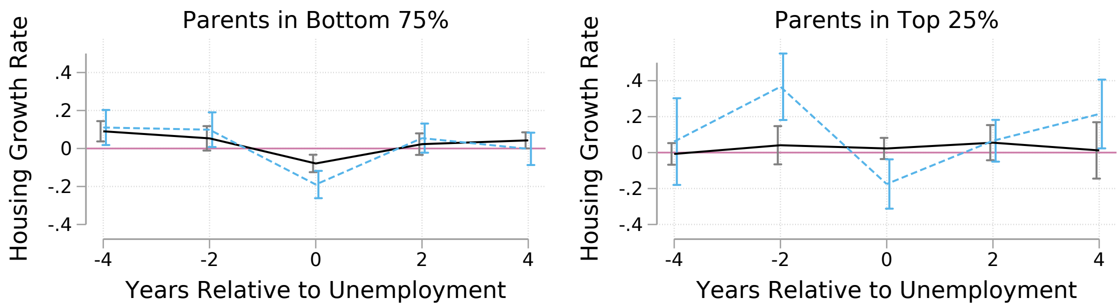
A.1.2 Event Study Details

In the end, the sample consists of 2,200 households with non-missing log growth rates of housing consumption from 974 unique households. Means and standard errors are constructed using family weights.

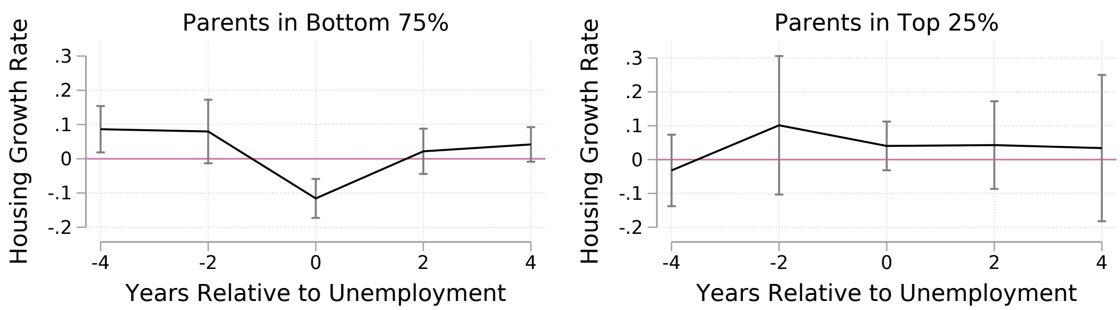
In Figure A.1, I also report the results where I do the exercise separately for renters and owners and only code households switching from renting to owning or vice versa as missing. We see the same pattern as in the main exercise, but the results are insignificant at the 5% level for owners.

Figure A.1: Event Study: Housing Consumption at Unemployment by Parental Wealth

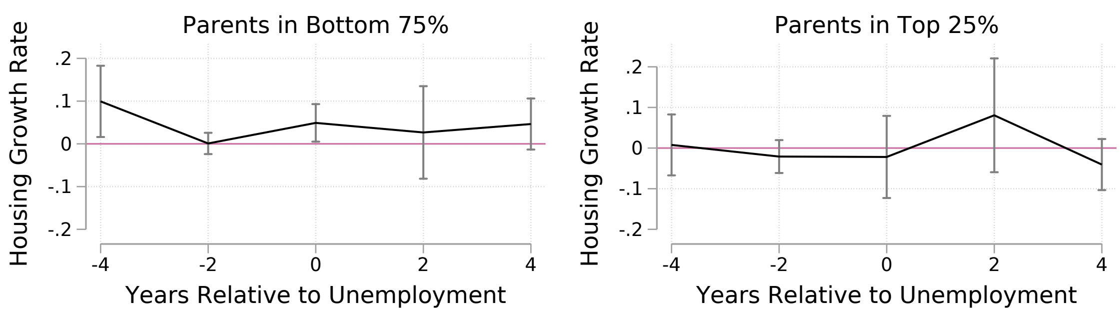
(a) Renters and Owners: Housing and Food Consumption



(b) Renters

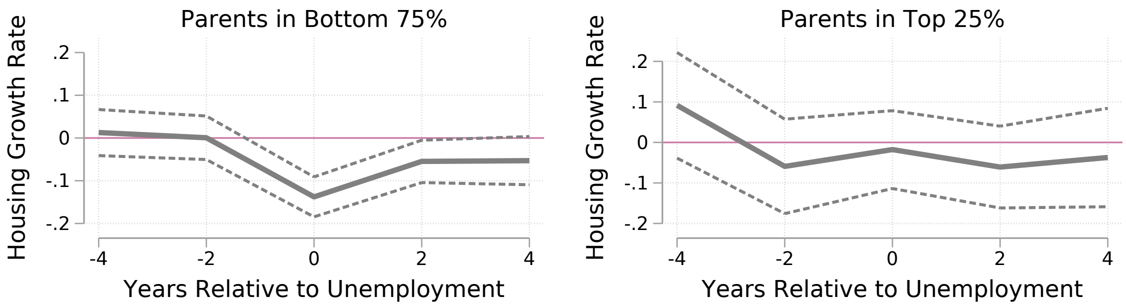


(c) Owners



Notes: Solid lines are the means and bars denote the 95% confidence interval. Sample consists of households aged 20-65 with exactly one unemployment spell, and without changes in head and/or spouse in the four years before and after unemployment.

Figure A.2: Event Study: Housing Consumption at Unemployment by Parental Wealth With Controls



Notes: Solid lines denote means and dashed lines denote the 95% confidence interval. Sample consists of households aged 25-45 with exactly one unemployment spell and without changes in head and/or spouse in the four years before and after unemployment. Controls variables include wealth and income quantiles, as well as dummies for age, year, state, marriage, race, and education.

Event Study Controlling for Household Characteristics

The main event study does not control for household characteristics for three reasons. First, this replicates the analysis in Chetty and Szeidl (2007). Second, this makes it straightforward to replicate the event study in the model. Third, for ease of interpretation. I now show that the results are robust to including household controls.

I use the same estimation samples and variable definitions. I then run linear regressions where I interact years relative to unemployment with a dummy for having wealthy parents at unemployment. The set of controls include dummies for children's wealth and income quintiles, a full set of age, year, and state dummies, and dummy variables for college, high-school, and marriage. The regressions are weighted by family weights and plotted in figure A.2. The main result is that households with wealthier parents do not significantly decrease housing consumption at unemployment. However, the hypothesis that the effect of unemployment is the same for both groups is rejected at the 95% confidence interval but not at the 90%.

A.2 Quantitative Model Details

A.2.1 Calculation of Transfer Moments

The 2013 wave of the PSID includes a more detailed transfer module that I use to calculate transfer moments.[1] However, this question only includes information regarding transfers in 2012. Among matched child-parent pairs in the 2013 PSID, where children are aged 25-44, 24% report a transfer from parents from kids with an average value (conditional on transfers) of \$3,900 in 2012. I biennialize by increasing the annual transfer rate by 1.5 and the transfer size by 1.33.[2]

A.2.2 Complete set of Decision Problems

Decision Problem Conditional on Choosing to Rent

The household problem, conditional on choosing to rent, has the following differences from the problem conditional on choosing to own: i) the choice of housing itself, ii) households pay rent qph instead of the market value ph, iii) households bring no housing wealth to next period, and iv) the borrowing constraint becomes a no-borrowing constrant. The kid's problem becomes

$$
\begin{aligned}
V_k(\mathbf{s}_k) = \max_{c_k, b'_k, h'_k = h_r} \; & u(c_k, h'_k) + \beta \mathbb{E}\left[V_k(\mathbf{s}'_k)\right] \\
\text{s.t.} \quad & b'_k = x_k + t_p + w_k - c_k - qph'_k - adj(h_k, h'_k) \\
& x'_k = b'_k(1 + r(b'_k)) \\
& b_k \geq 0.0,
\end{aligned}
$$

and the parent's problem is changed in the same way.

[1]Another alternative would be use a question related to transfers and inheritances over \$10,000. While this question is available every year it is limited to transfers over \$10,000 and includes inheritance.

[2]This assumption is valid when half of transferring households (12% of the sample) would not transfer in 2013, that half of transferring households (12% of the sample) would transfer the same amount in 2013, and that 12% of the total sample would transfer \$3,900 only in 2013. This yields a two-year transfer rate of 36% and a two-year transfer size of \$5,200.

Decision Problems at Age 53 and 83

When the kid is 53 the following changes: i) the continuation value is given by the parent's value function, ii) the expectation is over initial wealth of the new kids wealth and productivity instead of the 'old' kid's productivity and iii) his next period wealth includes bequests. For a kid aged 53, conditional on choosing to rent, the problem becomes:

$$\begin{aligned}
V_k(\mathbf{s}_k; a_k = 53) = \max_{c_k, b'_k, h'_k = h_r} \; & u(c_k, h'_k) + \beta \mathbb{E}_{x_{k,25}, v_{k,25}} \left[V_p(\mathbf{s}'_{p,25}; a_k = 25) \right] \\
\text{s.t.} \quad & b'_k = x_k + t_p + w_k - c_k - \kappa p h'_k - adj(h_k, h'_k) \\
& x'_{p,25} = b'_{k,53}(1 + r(b'_k)) + x'_{p,53} \\
& b_k \geq 0.0,
\end{aligned}$$

where $k, 53$ and $p, 53$ denotes the variables associated with old kid (new parent) and the old parent (dead parent). The dying parent's problem has the following changes: i) the continuation value is given by the new parent's value function $\eta V_p(\mathbf{s}'_p; a_k = 25)$, ii) the expectation is over initial wealth of the new kids wealth and productivity instead of the 'old' kid's productivity and iii) the new parent's next period wealth includes bequests, and is otherwise changed in the same way as the kids.

A.2.3 Decision Problems with Commitment

The decision problem with commitment changes significantly from the no-commitment formulation. The main change is that a single planner maximizes utility, placing weight θ on the child's utility. To illustrate, I show the decision problem of the planner, conditional on both households entering as renters and renting in the current period:

$$V_f(\mathbf{s}_f) = \max_{c_k, c_p, h'_k = h'_p = h_r, b'_f} (1-\theta)u(c_p, h'_p) + [(1-\theta)\eta + \theta]\, u(c_k, h'_k) + \beta \mathbb{E} V_f(\mathbf{s}'_f),$$

$$\text{s.t. } b'_f = x_f + w_k + w_p - c_k - c_p - qp(h'_k + h'_p),$$

$$x'_f = b'_f(1 + r(b'_f)),$$

$$b'_f \geq 0, c_k \geq 0, c_p \geq 0.$$

When the kid is aged 53, and it's the final period for the current period, the continuation value changes. The family planner discounts the expected future (namely initial conditions of the kid), and places weight $(\theta + (1-\theta)\eta)\beta$ on the future. I assume that the Pareto weight is held constant throughout the dynasty.

A.3 Robustness Exercises

A.3.1 Parental Income Risk

In the benchmark model, households face no income risk after age 55. I now show that the results are robust to this assumption. To do so, I perform the following modifications. First, the labor income of parents is now assumed to be the product of a transitory productivity shock:

$$w_{i,a} = l_a \nu_{i,a} \; \forall a \in \{55, 57, \ldots, 83\}.$$

The process is calibrated as follows. First, I keep households aged 55-85. I subtract healthcare expenditures from household income as healthcare expenditure risk is a significant risk for older households (Hubbard et al., 1995). Next, I divide the sample into year-age specific income tertiles, find the median income within each age, and average over years to find the parent productivity shifter $\nu_{i,a}$. The results, fitted to a cubic trend, are plotted in Figure A.3a. The shock is transitory, and the PDF $\Pi(\nu)$ takes the value 1/3 for any outcome.

The results are reported in Table A.2. We see that the introduction of income risk for the old has small effects and leaves the main findings intact. Mainly, it increases the wealth of parents by $20,000. Second, we see that income risk slightly decreases young households' homeownership rates with altruism. Nonetheless, parental transfers still account for 13pp (28%), down from 15pp (31%), when parents face transitory income risk.

A.3.2 Aggregate Price Risk

In the benchmark model house prices are certain. I now show that the results are robust to introducing price risk in the manner of Corbae and Quintin (2015). This introduces a new state variable z that denotes the aggregate price level, and the house price is either low, normal, or high depending on the value of z. The transition matrix for z follows

$$\Pi(z'|z) = \begin{bmatrix} 0.90 & 0.10 & 0.00 \\ 0.02 & 0.96 & 0.02 \\ 0.00 & 0.25 & 0.75 \end{bmatrix}. \tag{A.1}$$

The aggregate house prices are set to be $(p_l, p_n, p_h) = (0.7, 1.0, 1.3)p_{bench}$, where p_{bench} is set to be the estimated value from Table 1.4. I then solve the model with price uncertainty, but simulate the economy when house prices are at the normal level.

The results are reported in Table A.2. We see that the introductino of aggregate price uncertainty increases savings for both young and old households, with and without altruism. It also induces households to buy housing slightly later, with lower LTV's and higher wealth at purchase. However, the main quantitative finding remains: Parental transfers now account for 15pp (31%) of the homeownership rate. I also perform robustness checks where I allow for transitory idiosyncratic dividend/return shocks as in Chang (2020) for homeowners, and find that this source of transitory return risk in housing is quantitative unimportant. The results are available upon request.

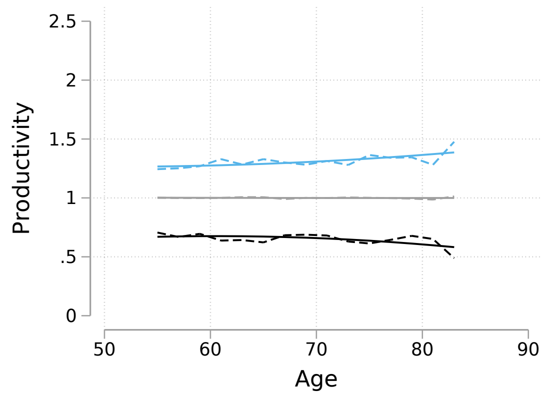
Table A.2: Results Robust to Old-Age Risk and Uncertain House Prices

		Benchmark		Old Risk		Price Risk	
Moment	Data	$\eta > 0$	$\eta = 0$	$\eta > 0$	$\eta = 0$	$\eta > 0$	$\eta = 0$
Targeted Moments							
Median Wealth (25-44)	23.54	23.65	42.10	22.75	42.36	33.68	55.74
Median Wealth (55-74)	206.67	206.86	208.64	222.66	227.48	212.77	221.08
Owner (25-44)	0.49	0.48	0.33	0.46	0.33	0.47	0.32
Rent / Income (25-44)	0.23	0.21	0.20	0.21	0.20	0.21	0.20
Age First Own (25-44)	32.53	32.85	37.52	32.89	36.94	32.50	36.86
LTV at Purchase (25-44)	0.67	0.65	0.46	0.65	0.46	0.58	0.44
Parent Transfers (55-74)	0.36	0.45	0.00	0.44	0.00	0.44	0.00
Transfers Around Purchase (25-44)	0.39	0.36	0.00	0.39	0.00	0.26	0.00
Non-Targeted Moments							
Hand to Mouth (25-44)		0.42	0.23	0.40	0.23	0.40	0.21
Wealth at Purchase (25-44)	33.36	45.69	74.29	47.73	74.70	57.51	79.96
Owner (25-73)		0.60	0.55	0.59	0.55	0.58	0.55
Parent Wealth Gradient (med)	2.53	2.53	1.26	2.13	1.19	2.65	1.21

		Benchmark		Old Risk		Price Risk	
Moment	Data	$\eta > 0$	$\eta = 0$	$\eta > 0$	$\eta = 0$	$\eta > 0$	$\eta = 0$
Targeted Moments							
Median Wealth (25-44)	23.54	23.65	42.10	22.75	42.36	33.68	55.74
Median Wealth (55-74)	206.67	206.86	208.64	222.66	227.48	212.77	221.08
Owner (25-44)	0.49	0.48	0.33	0.46	0.33	0.47	0.32
Rent / Income (25-44)	0.23	0.21	0.20	0.21	0.20	0.21	0.20
Age First Own (25-44)	32.53	32.85	37.52	32.89	36.94	32.50	36.86
LTV at Purchase (25-44)	0.67	0.65	0.46	0.65	0.46	0.58	0.44
Parent Transfers (55-74)	0.36	0.45	0.00	0.44	0.00	0.44	0.00
Transfers Around Purchase (25-44)	0.39	0.36	0.00	0.39	0.00	0.26	0.00
Non-Targeted Moments							
Hand to Mouth (25-44)		0.42	0.23	0.40	0.23	0.40	0.21
Wealth at Purchase (25-44)	33.36	45.69	74.29	47.73	74.70	57.51	79.96
Owner (25-73)		0.60	0.55	0.59	0.55	0.58	0.55
Parent Wealth Gradient (med)	2.53	2.53	1.26	2.13	1.19	2.65	1.21

Figure A.3: Calibration of Robustness Exercises

(a) Income Productivity $\nu_{i,a}$



Notes: Dashed lines are the empirical age-medians and solid lines are fitted second order polynomials that are used in the model calibration. The lines denote the value of $\nu_{i,a}$ in the first tertile (black), middle (gray), and top (blue) by age.

A.4 Numerical Solution Algorithm

A.4.1 Numerical Details

I now briefly discuss some details in the numerical solution of the model.

Solving Decisions Problems: Due to the non-convex nature of the decision problems, occasionally binding constraints and discrete nature of housing I use grid search as a slow, but robust approximate solution algorithm. For a detailed discussion of these issues see Chu (2020) and Barczyk and Kredler (2020). The value and policy functions are linearly interpolated in kid and parent wealth/savings, conditional on the discrete choices.

Interpolation Details: The policy function for consumption and savings are non-continuous in wealth which makes interpolation unattractive. However, the policy functions, conditional on choosing a specific house quality are smoother, and do not display large jumps in the quantitative model. When I interpolate the policy functions of the parent when solving the kid's problem, and vice versa, I therefore do the following. I first find the interpolated policies for each housing choice, and then find the probability that the parent/child makes this choice. The probability is the interpolated policy discrete choice function, which is binary $\{0, 1\}$, while the interpolated policy (with flat extrapolation) is continuous between $[0, 1]$.

Next, one must be careful with the interpolated policy functions around the borrowing constraints. If the interpolated consumption choice of the kid c_k leads to a net bond position b_k that violates the borrowing constraint I set b_k equal to the constraint and reduce c_k to make it hold.

Reflecting Boundary: If the accidental bequest is large and the young household is saving, then it is likely that the young household will escape any grid one enforces in the numerical calculation. For that reason the top grid point is assumed to reflecting. This is never chosen by households, but since the decision problems are non-convex and solved using discrete grid search these points must also be evaluated.

Simulation of Households: I simulate N=10,000 dynasties. The initial states of each dynasty (initial kid and initial old) $(x_p, h_p, x_k, v_k, h_k, a_k = 25)$ is drawn from a five-dimensional joint uniform distribution. I then simulate all dynasties for 5 generations, since the distribution, as measured by average homeownership, wealth, and, productivity levels stabilizes after four generations. I discard observations from the first four kids and parents in each dynasty.

Computational Packages: The program is written in Julia v1.5.0. I rely on the `interpolations.jl` v0.12.10 package for numerical interpolation routines and `Optim.jl` v0.22.0 for the Nelder-Mead algorithm used in the structural estimation.

A.5 Estimation

A.5.1 Heuristic Identification

I now provide a brief argument for why at least one moment is informative for each parameter. We know that wealth accumulation is strongly affected by the discount factor β. The transfer rate identifies the strength of altruism η since higher altruism increases transfers. The age of first purchase decreases when the preference shifter χ for owning increases. With lower mortgage rates, households are willing to take on higher loans, and so the LTV ratio at purchase identifies the mortgage premium r_m^k. When minimum owner-occupied house sizes increase, households have higher income and wealth before they buy, so the average rent-to-income ratio decreases. Finally, the house price is pinned down by the homeownership rate, as higher prices delay ownership. The model is highly non-linear, and all parameters influence at least one moment. See Section A.5.3 for graphical plots.

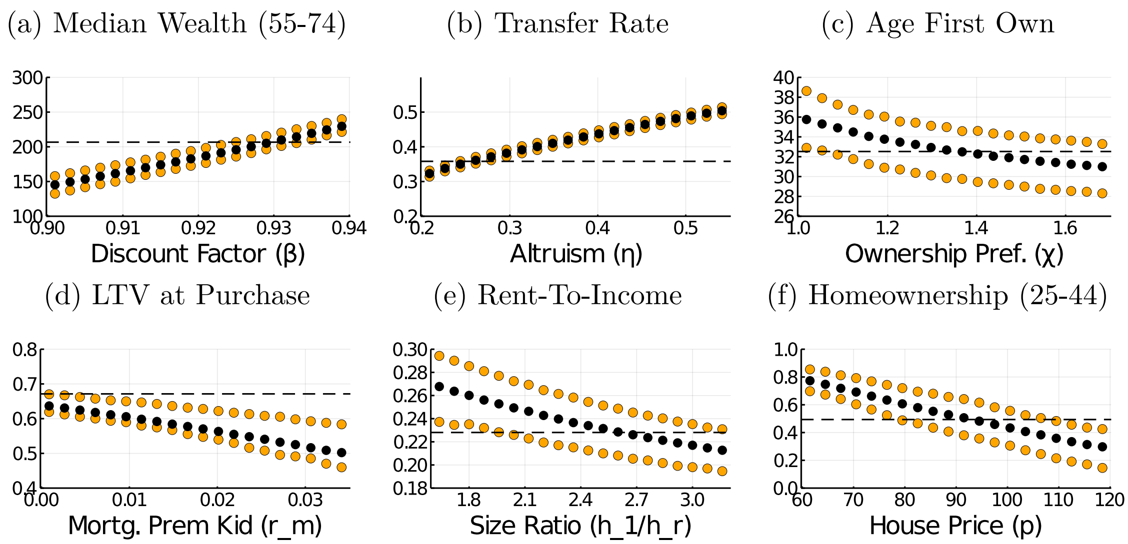
A.5.2 Estimation Algorithm

There are $P = 6$ parameters that are estimated internally. Define a P-dimensional hypercube of uniform distributions. Then I draw $N_s = 40,000$ quasi-random candidate parameter vectors from this hypercube generated by Sobol sequencing. I solve the decision problems, find the stationary distribution, and find the $M = 8$ moments for each candidate parameter vector. After solving the model under the N_s candidate vectors, I find the one that minimizes the distance (equation 1.13). I use this as the starting point for a local optimization, using a Nelder-Mead algorithm. This final step improves the model fit slightly, and the objective function decreases from 0.033 to 0.029.

A.5.3 Identification

The global optimization procedure lends itself to verifying identification. After solving the model for N_s parameter vectors and finding the simulated moments, one can do the following procedure for all moments and parameters. First, pick a parameter, say β, and divide it into 20 quantiles. Within each quantile of β, I find the 25th, 50th, and 75th percentiles for a moment, say the transfer rate. The remaining $P - 1$ parameters are uniformly distributed within each quantile of β. We can then show how the transfer rate depends on β, by plotting the percentiles within each quantile of β. One can think of this procedure as taking the (numerical) partial derivative of the transfer rate with respect to β, keeping the distribution of other parameters constant. We can then repeat this process for every parameter and every moment.

Figure A.4: Identification of Parameters



Notes: Dashed line is the moment's empirical value. Yellow and black dots denote the 25th, 50th, and 75th percentile of the empirical moment for each quantile of the parameter, keeping the distribution of other parameters constant.

A moment is informative for a parameter if, as we move across quantiles keeping the distribution of other parameters constant, the moment percentiles move. The steeper the slope, the more informative the moment is for the parameter. A parameter is relatively more important when the distance between the 25th- and 75th-moment percentiles is smaller.

Figure A.4 shows that each parameter affects at least one moment. For example, we can see that median wealth at age 55-74 is strongly affected by the discount factor β in Figure A.4a. In Figure A.4b, we see that the transfer rate is very informative about the altruism intensity parameter η. We can see that ownership preference shifter χ is pinned down by the age of first-time homeowners. However, other moments also have a significant impact on this moment. For example, house prices are also important: everybody would own if housing were free, or few would own when prices are high. The remaining figures are interpreted in similar ways.

Finally, the main objective of this paper is to study the role of altruism on housing demand, and it turns out that the altruism parameter η affects all moments (Figure

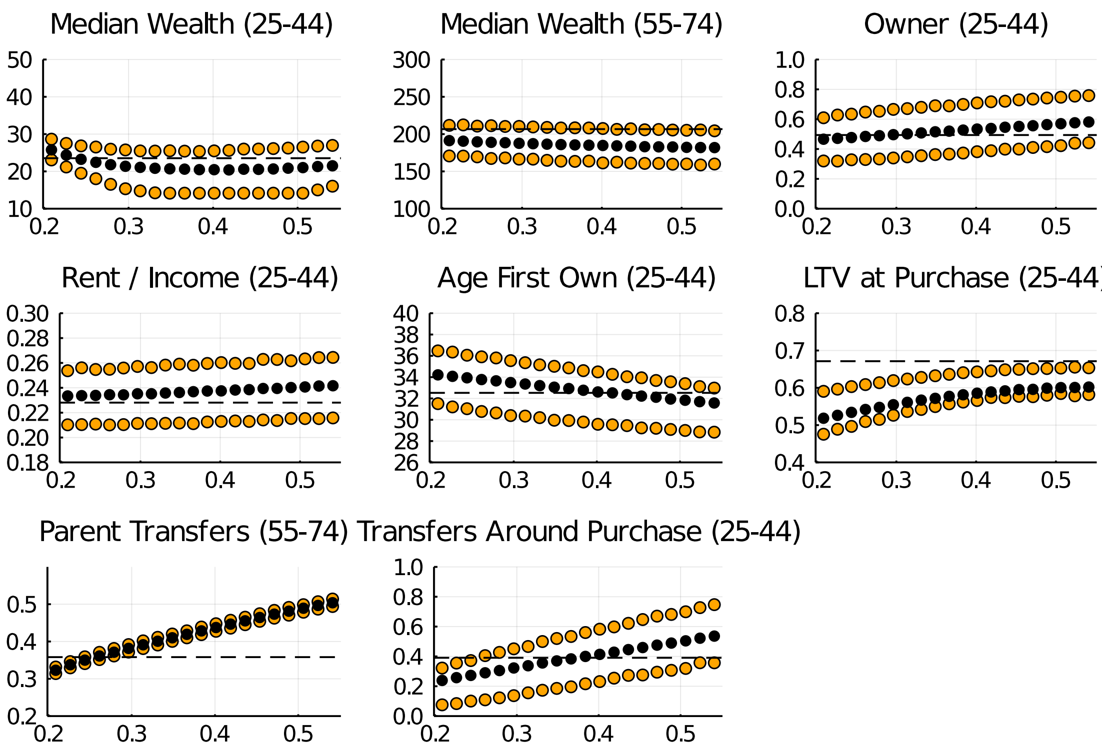
A.5). First, median wealth is initially strongly decreasing altruism as households decrease savings to receive more transfers. Altruism also slightly decreases the wealth of older households: households save less when young and parents give more resources to the kid. Homeownership rates are also increasing in altruism: altruism decreases the downsides and increases the benefits of homeownership. Altruism slightly increases the rent-to-income ratio, but this is driven by selection into homeownership. With higher altruism, the age at which households first own is strongly decreasing: households are willing to buy housing sooner, and they receive larger transfers that push them into owning. We also see that the LTV at purchase is strongly increasing in altruism: Households are willing to take on more leverage. Finally, both the overall transfer rate and the transfers around home purchases are also increasing in transfers. However, altruism does not uniquely pin down transfers around purchase since this moment is also affected by other parameters that affect the decision to buy or rent. I include identification plots for all estimated parameters in the online appendix

A.5.4 Mapping Lee et al. (2020) to the Model

Lee et al. (2020) run regressions using the PSID that find the effect of receiving transfers on the probability of purchase. The sample is limited to households between the ages 25-44, who are not owners in $t-2$ but are observed in t. All control variables are those observed in year $t-2$ except the transfer indicator. Some control variables (race, regional characteristics, year, marital status, parent's education) do not exist in the model. I follow the specification as closely as possible by controlling for child age (in five-year bins), wealth and income (in logs) for child and parent and parent's housing status. I include dummies for the current productivity level of the child to control for 'education'.

A.6 Supplementary Figures and Tables

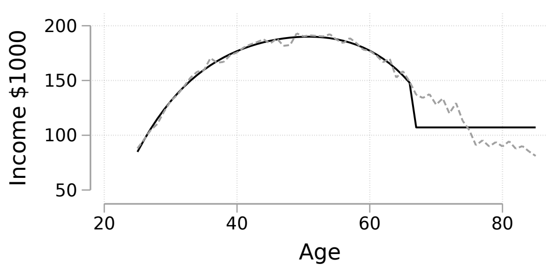
Figure A.5: Identification of Altruism η



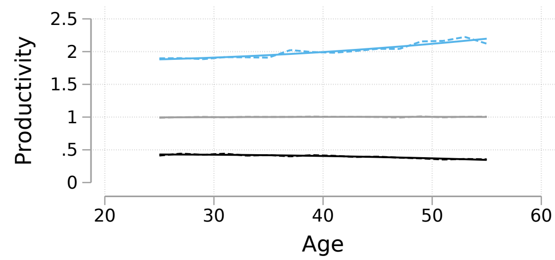
Notes: Dashed line is the moment's empirical value. Yellow and black dots denote the 25th, 50th, and 75th percentile of the empirical moment for each quantile of the parameter, keeping the distribution of other parameters constant. The x-axis denotes values of η and the y-axis the moment.

Figure A.6: Calibrated Income Process

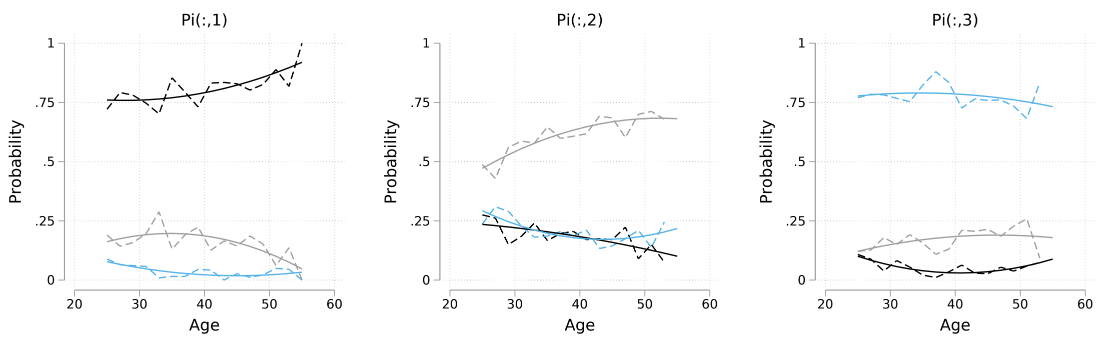
(a) Deterministic Income Profile y_a



(b) Productivity Shifter $y_{i,a}$

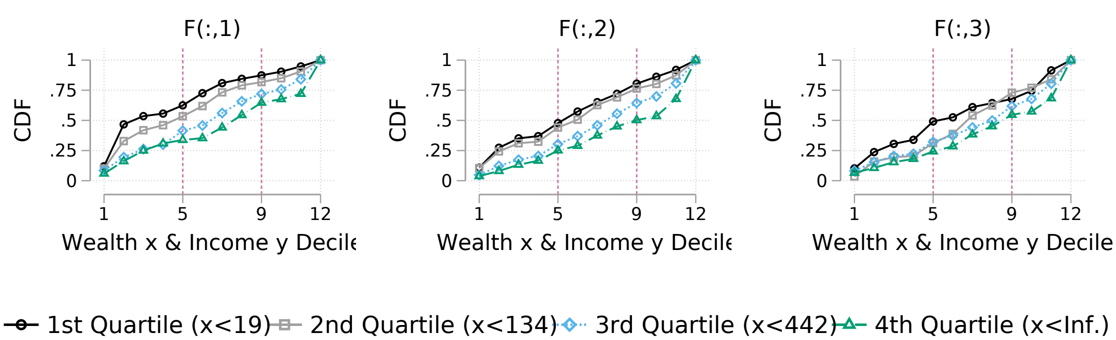


(c) Age-State Dependent Transition Probabilities $\Pi(y_{i,a+2}|y_{i,a})$



Notes: Dashed lines are the empirical age-means and solid lines are fitted third order polynomials that are used in the model calibration. The bottom row plots the probability of moving to the bottom tertile (black), middle (gray), and top (blue) income tertiles by the income tertile the kid is currently in, by age.

(d) Initial Distribution $F(x_{53}, y_{53})$ by wealth x_{53} and productivity y_{53}



Notes: The vertial lines denote the first, second, and third income shifters for the kids. Within each interval each point denotes a wealth quartile.

Table A.3: Effects of Risk and Borrowing Constraints on Homeownership

	Benchmark		No LTV		Liquid Housing		No Income Risk	
Moment	Altr	No Altr	Altr	No Altr	Altr	No Altr	Altr	No Altr
Targeted Moments								
Median Wealth (25-44)	23.47	42.13	12.09	39.71	17.50	39.18	29.03	29.03
Median Wealth (55-74)	206.78	208.20	182.58	202.51	194.68	194.02	194.03	179.64
Owner (25-44)	0.48	0.33	0.55	0.51	0.51	0.45	0.62	0.61
Rent / Income (25-44)	0.21	0.20	0.22	0.18	0.23	0.22	0.13	0.13
Age First Own (25-44)	32.89	37.52	32.60	32.19	31.04	33.28	32.53	32.73
LTV at Purchase (25-44)	0.66	0.46	0.71	0.65	0.70	0.63	0.74	0.74
Parent Transfers (55-74)	0.45	0.00	0.44	0.00	0.42	0.00	0.33	0.00
Transfers Around Purchase (25-44)	0.37	0.00	0.48	0.00	0.43	0.00	0.22	0.00
Non-Targeted Moments								
Parent Wealth Gradient (med)	2.49	1.25	4.26	0.79	1.62	1.44	1.03	1.03
Owner (25-73)	0.60	0.55	0.68	0.73	0.65	0.67	0.85	0.85
Wealth at Purchase (25-44)	46.85	74.31	41.51	52.11	40.47	48.31	43.08	40.84
Mortgage (25-44)	123.93	60.25	146.85	125.28	126.81	90.93	186.84	186.70

Notes: Results using the *bench*mark model (Table 1.5), with a higher LTV of 1.0 instead of 0.8, liquid housing ($m_s = m_b = 0$), and with income certainty ($v_{i,a} = 1.0$). All other parameters and prices are constant. To avoid numerical issues with extrapolation when the LTV is set to be 1.0, the numerical algorithm sets $LTV = 1.0 + \varepsilon$.

Table A.4: Descriptive Statistics (Median), Households Aged 20-44

Demographics	All		Single		Married		Renter		Owner	
Receiver	No	Yes	No	Yes	No	Yes	No	Yes	No	Yes
Transfer	0.00	1.53	0.00	1.02	0.00	2.03	0.00	1.53	0.00	1.22
Wealth	10.17	15.26	3.05	6.10	34.59	47.82	1.63	4.07	65.25	81.39
Wealth Parent	96.86	339.31	64.10	289.97	140.41	404.94	37.64	265.55	222.82	503.63
Income	56.51	56.64	35.06	35.82	84.55	81.90	36.51	40.70	91.60	81.50
College	0.00	1.00	0.00	0.00	0.00	1.00	0.00	0.00	0.00	1.00
White	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Owner	0.00	0.00	0.00	0.00	1.00	1.00	0.00	0.00	1.00	1.00
Owner t-2	0.00	0.00	0.00	0.00	1.00	1.00	0.00	0.00	1.00	1.00
Age	33.00	32.00	32.00	29.00	36.00	35.00	31.00	30.00	37.00	36.00
Observations	2404	656	1094	304	1310	352	1453	400	951	256
Age	20-24		25-29		30-34		35-39		40-44	
Receiver	No	Yes	No	Yes	No	Yes	No	Yes	No	Yes
Transfer	0.00	1.22	0.00	1.53	0.00	2.03	0.00	1.53	0.00	1.02
Wealth	4.60	6.00	5.09	19.33	12.31	31.24	22.38	23.91	44.16	53.92
Wealth Parent	43.79	279.79	81.39	351.01	100.73	396.80	127.18	336.77	145.70	404.94
Income	37.64	39.79	49.14	55.96	61.59	71.98	78.85	70.30	87.60	69.59
College	0.00	1.00	0.00	1.00	0.00	1.00	0.00	0.00	0.00	0.00
White	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Owner	0.00	0.00	0.00	0.00	0.00	0.00	1.00	1.00	1.00	1.00
Owner t-2	0.00	0.00	0.00	0.00	0.00	0.00	1.00	1.00	1.00	1.00
Age	26.00	26.00	30.00	30.00	34.00	34.00	38.00	39.00	43.00	43.00
Observations	572	195	566	163	562	127	384	99	320	72
Wealth Quintile	Quintile 1		Quintile 2		Quintile 3		Quintile 4		Quintile 5	
Receiver	No	Yes	No	Yes	No	Yes	No	Yes	No	Yes
Transfer	0.00	1.02	0.00	1.22	0.00	1.02	0.00	1.53	0.00	1.53
Wealth	-31.95	-30.52	0.00	-0.51	7.62	7.83	36.76	37.64	186.19	185.17
Wealth Parent	67.66	234.01	18.62	138.88	46.75	234.11	155.67	422.23	345.93	719.32
Income	49.55	38.95	26.17	30.52	39.68	38.15	69.72	65.22	114.47	100.73
College	0.00	1.00	0.00	0.00	0.00	0.00	0.00	1.00	1.00	1.00
White	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Owner	0.00	0.00	0.00	0.00	0.00	0.00	1.00	0.00	1.00	1.00
Owner t-2	0.00	0.00	0.00	0.00	0.00	0.00	1.00	0.00	1.00	1.00
Age	32.00	30.00	32.00	32.00	32.00	29.00	33.00	32.00	38.00	34.00
Observations	459	148	478	91	518	121	471	137	478	159

Notes: Data from the PSID Transfer, Individual, and Family modules. Weighted using family weights. Wealth, transfer and income is measured in 1000s of 2016 US dollars.

A.7 Two-Period Model of Altruism and Housing

This section develops and solves a stylized two-period model with children ("kid") and parents. The child and parent interact without commitment and non-cooperatively. The model highlights that housing adjustment costs, which make housing illiquid, increases parental transfers. Poor children with wealthy parents, if given the choice, would prefer adjustment costs on their housing expenditures. Finally, I introduce a commitment technology and show that adjustment costs have ambiguous effects on total welfare.

A.7.1 Model Environment

The model simplifies the two-period model in Altonji et al. (1997) by ignoring income uncertainty and extends it by including illiquid housing in a similar vein to Chetty and Szeidl (2007).

Population: There are two households, kids k and parents p. Both are alive at the same time and live for two periods.

Preferences: Kid's preferences are defined over first- and second-period consumption of goods c and housing services h, and are assumed to be time-separable and without discounting:

$$u(c_k, h_k) + u(c_k', h_k'). \tag{A.2}$$

The parent household derives utility over their own goods consumption in both periods but do not consume housing services. They also value their kid's utility weighted by the altruism parameter $\eta > 0$

$$\mu(c_p) + \mu(c_p') + \eta\left[u(c_k, h_k) + u(c_k', h_k')\right], \tag{A.3}$$

where $\mu(c_p)$ maps parent's consumption into utils. Finally, I assume that the kid's utility function satisfies the following conditions:[3]

[3]These assumptions allow for a wide class of utility functions including constant elasticity of substitution (when the elasticity of substitution is weakly less than 1) and separable power utility with a risk aversion of good consumption higher than 1. Note that assumption A2 in combination

A1: Limits for both goods: The first derivative of u approaches i) zero at infinity in both arguments (i.e., $\lim_{c\to\infty} u(c,h) = \lim_{h\to\infty} u(c,h) = 0$), and ii) children never prefer to have 0 goods consumption (i.e., $\lim_{c\to 0} u(c,h) = \inf_{c',h'}(c',h') \, \forall \, h$)

A2: The marginal utility of consumption is non-decreasing in housing consumption ($u_{ch} \geq 0$)

Endowment: Both households are endowed with an initial level of financial wealth x_k, x_p. Households have no income.

Financial Assets: Households can save in an interest-free bond ('pillow technology'). There is no borrowing.

Consumption and Housing: Both households consume non-negative amounts of goods c in both periods, while kids can consume any non-negative amount of housing services h. Goods and housing both have a unit cost of unity. Housing is illiquid: the kid can adjust his housing choice in the second period h'_k, but doing so entails adjustment costs $\kappa \geq 0$ proportional to the quantity of housing chosen in the first period h_k.

Transfers: In both periods the parent can transfer a non-negative amount $t_p, t'_p \in \mathbb{R}^2_+$ to the child.

No Commitment and Non-Cooperative: Households cannot commit and act non-cooperatively.

Timing: Each period is divided into two stages. In the first stage, the parent chooses his goods consumption and transfers. The kid then receives the transfer and chooses his consumption allocation. Both households die at the end of period two.

A.7.2 Solving the Game

I solve the game by backwards induction. The model cannot be solved in closed form, but the solution is unique. I solve the model numerically, and report results using Cobb-Douglas preferences with a risk aversion parameter $\gamma = 1.2$, a housing-expenditure share χ of 0.4, and a altruism parameter η of 0.3.

with A1 precludes cases where goods and housing are perfect substitutes. Chetty and Szeidl (2007) contains a detailed discussion of the role of these assumption.

Final Period: Kid

I now show how adjustment costs induce kinks in the kid's marginal value of wealth. In the final period, his disposable wealth is $x'_k + t'_p$, which he allocates between housing and consumption.[4] The kid's problem can be broken down by whether he adjusts his consumption of housing ('moves') or not. If the kid does not move, they spend all their disposable wealth net of housing on consumption :

$$V^0_{k'}(x'_k + t'_p, h_k) = u(x'_k + t'_p - h_k, h_k). \tag{A.4}$$

If the kid moves, he can equate the marginal benefits of consumption and housing:

$$V^m_{k'}(x'_k + t'_p, h_k) = \max_{h'_k \geq 0} u(x'_k + t'_p - h'_k - \kappa h_k, h'_k). \tag{A.5}$$

Both value functions are differentiable in both arguments. Kids are only willing to pay the adjustment cost κ when the non-move allocation is far from the optimal within-period allocation:

$$V'_k(x'_k + t'_p, h_k) = \max \left\{ V^m_{k'}(x'_k + t'_p, h_k), V^0_{k'}(x'_k + t'_p, h_k) \right\}. \tag{A.6}$$

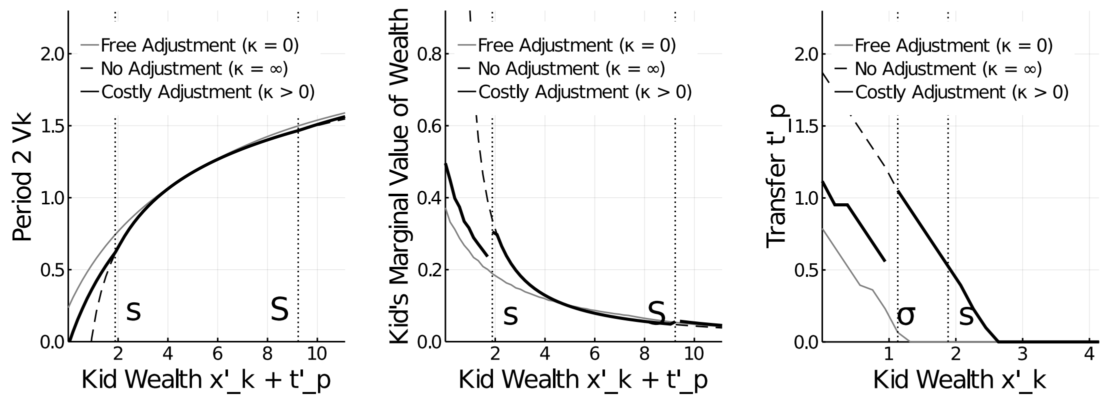
Under assumptions A1 and A2 households follow a strategy where they move only when disposable wealth is outside of two thresholds s, S. The intuition for the thresholds is straightforward. If the kid enters the period with a large house, he must reduce good consumption dramatically to remain in the house. As wealth x'_k increases to $x'_k + t'_p = s$, it becomes optimal to suffer some misallocation but save the adjustment cost and consume more. As wealth rises above S, it becomes optimal pay the adjustment cost to move to a better house. A similar mechanism creates the upper limit of the no-move region S.[5]

[4]The solution to the second-period problem of the kid is very similar to the one in Chetty and Szeidl (2007). In this section I discuss pertinent effects of adjustment costs on the strategic transfer game between parents and kids.

[5]While not the main focus of this paper, it is worth noting the link adjustment costs have with the literature on low-liquidity households with large marginal propensities to consume, such as the 'wealthy hand-to-mouth' in Kaplan and Violante (2014). Household with a large house h_k can only

Figure A.7: Adjustment Costs and Second Period Outcomes

(a) Period 2 Value Function (b) Period 2 Slope in Wealth (c) Period 2 transfer t'_p



Notes: Vertical lines denoted s, S indicate the thresholds for staying in the current sized house, while σ denotes the level of wealth the kid must bring into the period to stay in his house, taking into accounts the gifts he then receives.

The no-move region (s, S) creates kinks in the kid's value functions. Outside of (s, S) the slope of the value function is given by the envelope theorem applied to $V^m_{k'}(\cdot)$, where households optimally balance housing and consumption. Within (s, S) the child stays in the house, and the slope is given by the envelope theorem applied to $V^0_{k'}(\cdot)$. Once $x'_k + t'_p > s$ households do not equate marginal benefits of housing and consumption, and so the slope is steeper as it moves us closer to within-period optimality. The value function is plotted in Figure A.7a, which also shows the cases with free adjustment and infinite adjustment costs. The slope (Figure A.7b) jumps up when wealth crosses either threshold from the left. Inside (s, S) the slope is initially higher than without costs but becomes lower at the point where not-moving would be optimal without adjustment costs. As we will see in the parent's problem, the optimal transfer is closely related to the kid's marginal value of wealth.

consume $x'_k + t'_p$. Any change in disposable wealth (for example through transfer or income shocks) maps one-to-one into consumption unless the change is sufficiently large to make the household willing to pay the adjustment cost.

Final Period: Parent

I now show how the adjustment costs affect the parent's transfer behavior in the final period. The parent must decide how much to transfer to his kid and consumes the rest. His states are his own wealth, his kid's wealth, and the kid's housing state. The parent's problem is

$$V_{p'}(x'_p, x'_k, h_k) = \max_{t'_p \geq 0} \left\{ \mu(x'_p - t'_p) + \eta V'_{k'}(x'_k + t'_p, h_k) \right\}, \tag{A.7}$$

where I have inserted $V_{k'}(x'_k + t'_p, h_k)$ for $u\left(c'^*_k(x'_k + t'_p, h_k), h'^*_k(x'_k + t'_p, h_k)\right)$. From the previous section we have established that V'_k is only differentiable when there are no adjustment costs ($\kappa = 0$) or there is no adjustment at all ($\kappa = \infty$), so the optimization problem is generally not twice differentiable.

Transfers are pinned down by the slope of the kid's value function when the value function is differentiable:

$$u'(x'_p - t'_p) = \eta V'_{k'}(x'_k + t'_p, h_k) + \lambda, \tag{A.8}$$

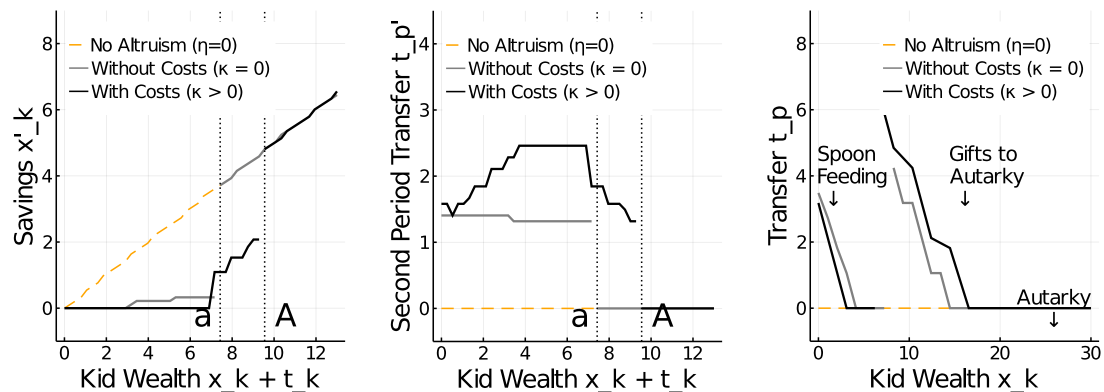
where λ is the multiplier on the non-negativity of the transfer constraint. From (A.8) we see that transfers are weakly decreasing in kid's wealth when the problem is smooth.

Since the kid's marginal utility jumps at the kinks (Figure A.7b), the second-period transfer policy t'_p also jumps. Figure A.7c plots the policy for some (x'_p, h_k). Transfers jump at a level $x'_k = \sigma$ where the transfer changes the kid's extensive choice on moving.[6] Just below σ, the parent does not give enough to keep the kid in his house. At σ, the gift jumps to a level that is at least big enough to keep the kid in his house. Transfers are non-decreasing in kid's second period wealth with illiquid housing: Moving from $x'_k = \sigma - \epsilon$ to $x'_k = \sigma + \varepsilon$ ensures the kid will obtain a much larger transfer.

[6]Note that $x'_k + \sigma$ will generally be larger than s, as in the figure.

Figure A.8: The Effect of First-Period Choices

(a) Period 1 Expenses $c_k + h_k$ (b) Period 2 Transfer $t'_p()$ (c) Transfer $t_p(x_p, \bar{x}_k)$



Notes: The vertical dashed lines indicate the threshold for where the kid behaves as if in autarky, without adjustment costs (a) and with adjustment costs (A). The x-axis varies cash-on-hand $x_k + t_p$, and the parent's first-period savings choice x'_p is held constant.

First Period: Kid

I now show that adjustment costs increase the kid's incentive to undersave by spending more on illiquid housing. The kid's states in the first period are disposable wealth and the parent's savings decision. He takes into account how his choices will affect the second-period transfer:[7]

$$V_k(x_k + t_p, x'_p) = \max_{x'_k \geq 0, h_k \geq 0} u(x_k + t_p - x'_k - h_k, h_k) + V_{k'}(x'_k + t'^*_p(x'_p, x'_k, h_k), h_k).$$

Figure A.8a plots the kids savings $x'_k(x'_p, x_k + t_k)$ for some level of parental wealth. Without altruism (autarky) the kid smooths perfectly since households do not discount the future, and savings are interest-free. With altruism households initially save nothing, increasing consumption today and receiving larger transfers in the second

[7]The problem is solved numerically due to the non-differentiability of second-period objects. Namely, there are three problems i) adjustment costs induce kinks in V_k (Figure A.7a), ii) the transfer policy is non-continuous in x'_k (Figure A.7c) when $0 < \kappa < \infty$ and iii) the transfer policy function has a kink where the non-negativity condition on transfers binds (Figure A.7c).

period. At some point, it is better to forego second-period transfers and smooth inter-temporally. With adjustment costs, the jump to autarky is delayed from a to A. The explanation is found in Figure A.8b which shows the second period transfer $t'_p(x'_p, x'_p, h_k)$ that the kid knows he will receive. With altruism but without costs, the second-period transfer is initially flat in cash-on-hand since the kid starts the second period in the same state: x'_p is already chosen by the parent and the kid doesn't save $x'_k = 0$.[8] With adjustment costs, the second-period transfer increases in cash-on-hand as the kid enters the second period with a larger house. While the kid still enters with zero wealth ($x'_k = 0$), he also has a larger house, so the parent gives larger transfers moving the kid towards intra-temporal optimality between housing and goods.[9] The two remaining policy functions c_k and h_k are plotted in the appendix, in Figure A.10.

First Period: Parent

The second-period adjustment costs also affect the parent's first-period problem by increasing the value of pushing kids to behave as if in autarky. The parent must decide how much to save and allocate spending on consumption and transfers. The parent considers how his transfer t_p increases the kid's cash-on-hand and that the savings decision x'_p informs the kid about the second-period transfers

$$\begin{aligned} V_p(x_p, x_k) = \max_{x'_p \geq 0, t_p \geq 0} \Big\{ & \mu(x_p - t_p - x'_p) + \eta u(c^*_k(x'_p, x_k + t_p), h^*_k(x'_p, x_k + t_p)) + \\ & V'_{p'}(x'_p, x'^*_k(x'_p, x_k + t_p), h^*_k(x'_p, x_k + t_p)) \Big\} . \end{aligned} \tag{A.9}$$

The first-period savings choice of the kid $x'_k(x'_p, x_k + t_p)$ provides intuition about the parent's incentives. First, if the kid is close to behaving as in autarky, a large enough gift pushes the kid into autarky and eliminates the kid's strategic motives. Second, if

[8] The first-period housing choice is irrelevant in the second period without adjustment costs.

[9] In fact, the increases in gifts are so large that kids prefer an economy with adjustment costs to an economy without (Figure A.11a). First, somewhat wealthy kids prefer to have adjustment costs since this increases the second-period transfer. Second, altruism has no impact once the kid jumps to autarky. Appendix A.7.6 shows that this result is not sensitive to parameters as long as assumptions A1 and A2 hold. Interestingly, this result is true and economically significant in the estimated quantitative model (Section 1.6.2).

the kid is poor while the parent is wealthy, the kid will consume less than the parent would choose for him without transfers. The parent can then effectively dictate the kid's consumption (spoon-feeding).[10] Figure A.8c plots the parent's transfer decision and the effect of adjustment costs on these two transfer motives. When the kid is poor, the parent transfers to increase consumption in the current period, but the kid does not save. Then, there is a region without transfers before the parent's transfer policy jumps up to push the kid into autarky. As kid wealth increases, transfers go to zero, and kids behave as in autarky.

A.7.3 What if Kids and Parents Could Commit?

This paper assumes, in line with the empirical results, that households cannot commit. What happens if one assumes the existence of a commitment technology?

When kids and parents can commit, they join forces and solve a family planner problem where each household receives a Pareto weight at formation. The planner pools initial wealth $x_f = x_k + x_p$, and allocates consumption to achieve intra- and inter-temporal optimality. Let θ denote the Pareto weight on the kid's utility function and $V_c(x_f;\theta)$ denote the family planners value function:

$$\begin{aligned} V_c(x_f;\theta) = \max_{c_k, c_k', c_p, c_p', h_k, h_k'} & \Big\{(1-\theta)(\mu(c_p)+\mu(c_p'))+ \\ & [\theta+(1-\theta)\eta](u(c_k,h_k)+u(c_k',h_k'))\Big\}, \\ \text{subject to } x_f' &= x_f - c_k - h_k - c_p', \\ 0 &= x_f' - c_k' - h_k' - c_p' - \mathbf{1}_{\{h_k' \neq h_k\}}\kappa h_k, \\ x_f' &\geq 0. \end{aligned} \tag{A.10}$$

The optimal allocations of consumption and housing for initial family wealth x_f depends on the kid's Pareto weight θ. We can define the kid's indirect utility from

[10] Spoon-feeding is the main focus in Altonji et al. (1997), while Chu (2020) shows that the correct solution to the model includes a second transfer motive (gifts to autarky). Finally, Barczyk and Kredler (2020) derive the parameters that generate the different transfer motives.

the commitment problem as

$$V_k^c(x_f;\theta) = u(c_k^c, h_k^c) + u(c_k'^c, h_k'^c), \tag{A.11}$$

where superscript c denotes the optimal allocation with commitment. The parent's indirect utility is similarly defined. It follows that the kid would only accept to join the family planner problem if his utility increases by doing so, that is if and only if $V_k^c(x_f, \theta) \geq V_k(x_k + t_p(x_k, x_p), x_p)$. There exists at least one $\theta \in [0, 1]$ such that both households would be willing to commit for any initial endowment of kid and parent wealth since any feasible allocation without commitment is feasible with commitment.

Finally, the planner's solution is unaffected by the adjustment costs: The planner will, when $\kappa = 0$ always smooth consumption and housing perfectly since $\beta = \frac{1}{1+r}$ and there is no uncertainty. The same allocation is feasible with costs, and so the adjustment costs have no impact on the planners choice under these assumptions on discount factors, interest rates, and uncertainty.

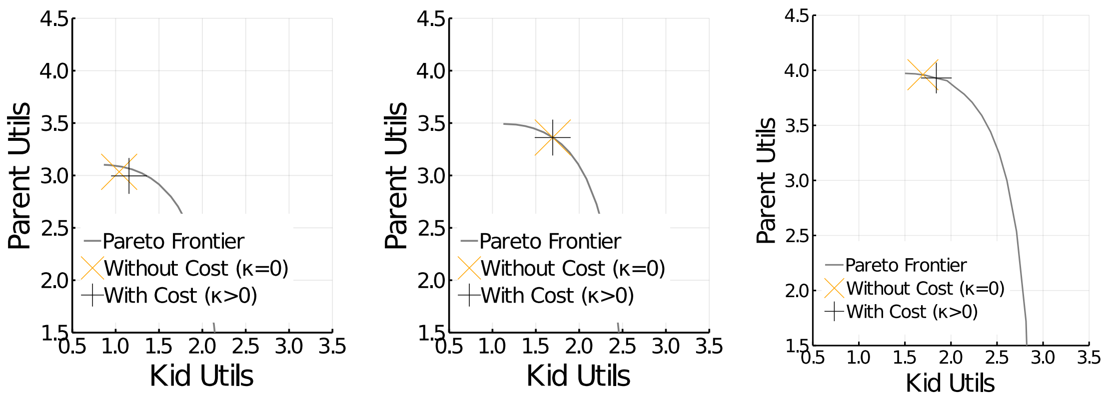
Is Illiquid Housing Welfare Improving?

I now turn to study whether illiquid housing improves welfare. For an initial allocation x_p, x_k we can trace out the frontier of discounted life-time utility for kids and parents in V_k, V_p space by varying the Pareto weight on the kid. For each initial allocation we can also find the kid and parent life-time utilities in the same space with and without adjustment costs. Figure A.9 plots the Pareto frontier and the no-commitment allocations with and without adjustment costs for a variety of initial allocations.

Figure A.9a shows what happens when the kid is poor while the parent is moderately wealthy. The introduction of costs reduces parent's welfare and increases kid's welfare (by increasing the first-period gift). Next, I increase kid's wealth (Figure A.9b), and the kid behaves as if in autarky. Thus both no-commitment allocations are identical and on the frontier. Figure A.9c plots the results when I also increase parental wealth and households no longer behave as if in autarky. Both no-commitment allocations are on the frontier, but the kid prefers adjustment costs since they increase gifts. These results for some initial allocations indicate that

Figure A.9: Illiquid Housing Improves Kid's Welfare

(a) $x_k = 2, x_p = 9$ (b) $x_k = 5, x_p = 9$ (c) $x_k = 5, x_p = 13$



Notes: All models solved under the same parameters. Each subplot plots the utility of the child and parent: under commitment (Pareto Frontier), with liquid housing (yellow x) and illiquid housing (black +), under various initial wealth allocations. The child weakly prefers illiquid housing at the expense of his parent.

adjustment costs make kids weakly better off and parents weakly worse off.[11] I revisit this question in the estimated quantitative model (Section 1.6.2) and find that (18%) of 25-year old kids prefer their own housing to have adjustment costs, even with uninsurable income risk.

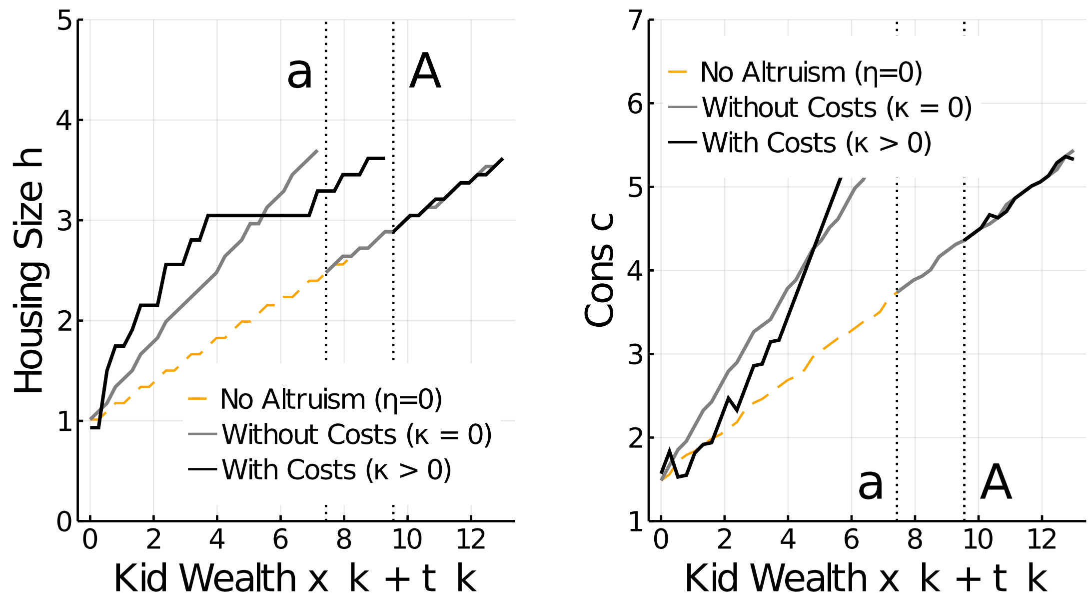
Taking the Commitment Allocations to the Data

By assuming a commitment technology, we lose several objects necessary to bring the model to the data. First, we cannot observe the timing of transfers (but we can back out lifetime net-transfers). Second, wealth allocations within the family are indeterminate. A minimum standard of a model that quantifies the contribution of parent transfers to their children's homeownership decisions must be consistent predictions on transfers. Second, it must match the wealth levels and relative wealth

[11] In Appendix A.7.6 I show that these results are not sensitive to parameter values and that the results hold for any initial allocation that implies transfers in period one or period two. Additionally, adjustment costs never improve parents welfare.

Figure A.10: First Period Kid Choices

(a) Period 1 Housing h_k (b) Period 1 Consumption c_k



Notes: The vertical dashed lines indicate the threshold for where the kid behaves as in autarky, taking into account the first-period gifts without, for the case without adjustment costs(a) and with adjustment costs (A).

within the family. However, a model with commitment cannot speak to these issues.

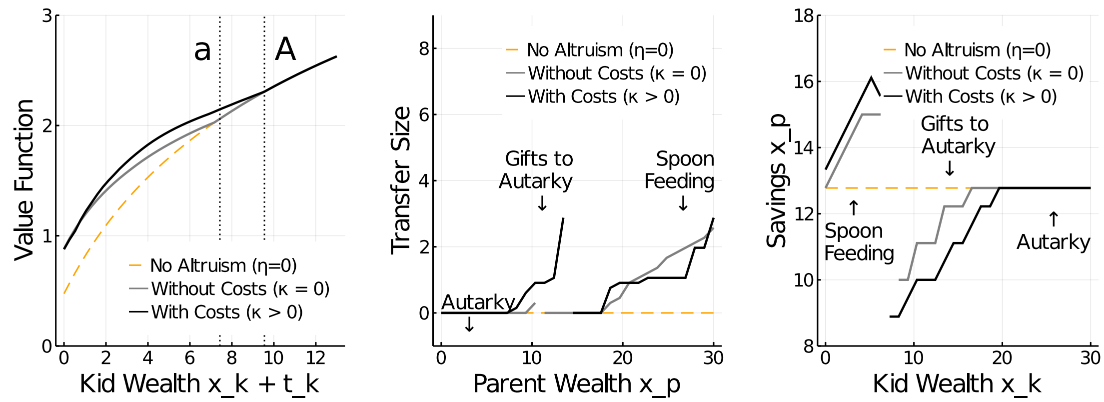
A.7.4 Additional Details for the Two-Period Model

A.7.5 Full Set of Policy Rules without Commitment

In the first-period problem we saw that the gifts the kid expects to receive can be increasing in cash-on-hand. Figure A.11a shows the effect of this pattern on the value functions for the kid in the first period. We can see that poor kids with wealthy parents strictly prefer altruism, but as they jump to autarky they are indifferent. However, we see that adjustment costs increase kid's welfare in the second-stage of the first-period.

Figure A.11: First Period Parent Choices

(a) Period 1 Value Fun. $V_k()$ (b) Transfer $t_p(\bar{x}_p, x_k)$ (c) Savings $x_p(\bar{x}_p, x_k)$



Notes: These figures show how the three different regimes are induced by changes in parental and kid wealth. During spoon-feeding the parent transfers to the kid, but the kid receives a transfer also in the second period. During gifts to autarky, the parent gives enough to make the kid behave as if there was no altruism. During autarky, both households behave as if there was no altruism.

Figure A.8c showed how adjustment costs decrease spoon-feeding but increase gifts to autarky. The same pattern holds when a kid's wealth is held constant while varying parental wealth, Figure A.11b. With adjustment costs, spoon-feeding transfers are generally smaller since the kid buys larger houses to receive a larger transfer in the second period. At the same time, the gifts-to-autarky are generally larger, as the benefits of pushing the kid into self-sufficiency is larger. Finally, Figure A.11c plots the savings policy, and we see that adjustment costs also have a non-monotone effect on parent's savings.

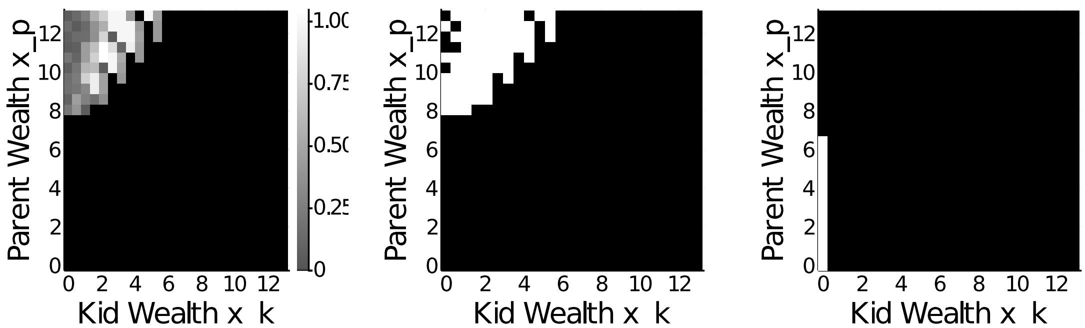
A.7.6 Further Details on Welfare Improves of Adjustment Costs

When do Kids Prefer Adjustment Costs?

It turns out that at any initial allocation, lifetime transfers are weakly larger with adjustment costs, as shown in figure A.12a. Interestingly, this is true also for regions

Figure A.12: Effect of Adjustment Costs on Life-Time Transfers and Utility

(a) Life-Time Transfers (b) Kids Prefer Costs (c) Parents Prefer Costs



Notes: The intensity of the life-time transfer A.12a denotes how much larger the transfer is with adjustment costs. Solid black denotes areas where the transfers are identical. In figures A.12b,A.12c black denotes where the household is indifferent and white where it strictly prefers adjustment costs.

that generate spoon-feeding transfers (Figure A.8c) where transfers are smaller in period 1. While spoon-feeding transfers are smaller with costs, the second-period transfers are larger, leading to increased lifetime transfers. However, we see that the kids who benefit the most from adjustment costs receive larger gifts-to-autarky.

Which kids strictly prefer adjustment costs? First, in initial allocations where there are no transfers (black areas of Figure A.12a), kids behave as if in autarky. Since there is no uncertainty and $\beta = \frac{1}{1+r} = 1$ households smooth perfectly across time, and the choices are identical for all $\kappa \geq 0$. The only area where kids may strictly prefer costs is when transfers happen with or without adjustment costs. Figure A.12b shows that almost all kids that do receive transfers prefer the world with costs.

Which parents prefer adjustment costs? No parents strictly prefer adjustment costs: In the region where there are no transfers, they are indifferent. When transfers flow in at least one period, transfers are weakly higher with costs, and so parents are worse off with adjustment costs as plotted in Figure A.12c.

Are the Results Robust to Parameter Values?

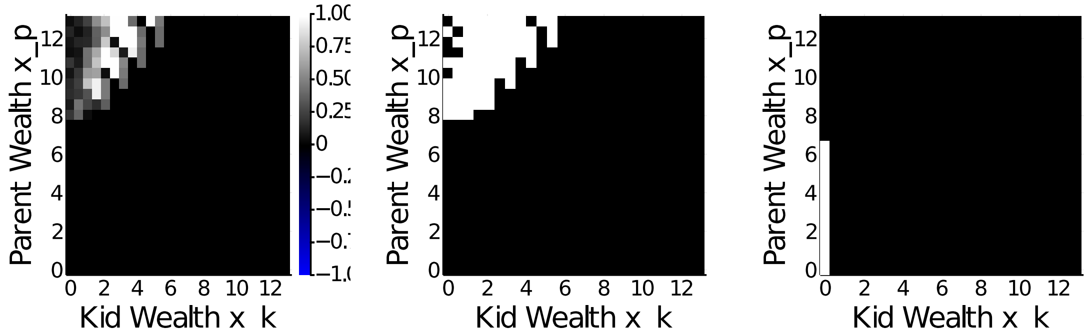
Figure A.13 repeats the exercise from the previous section under different parameter values of risk aversion γ, altruism η, and expenditure share on housing ξ. The patterns remain qualitatively similar. The fact that the plots are not entirely smooth is unsurprising. Households' policies have numerous kinks, jumps, and non-convexities. Additionally, the solution is a numerical approximation.

The first panel A.13a plots the results under the benchmark parameterization. The second panel plots the results with higher risk aversion γ A.13e. An increase in risk aversion also increases the desire to smooth, and so parents transfer more to their kids (eq. A.8), which increases the region where kids prefer adjustment costs. Next, panel A.13f plots the result with higher altruism η. As transfers increase, the region where kids prefer costs grows. Finally, I increase the expenditure share on housing ξ. As households spend more on housing, a larger fraction of expenditures entails adjustment costs, and so the area where kids prefer adjustment costs increase. No parameter combinations make the parent prefer adjustment costs.

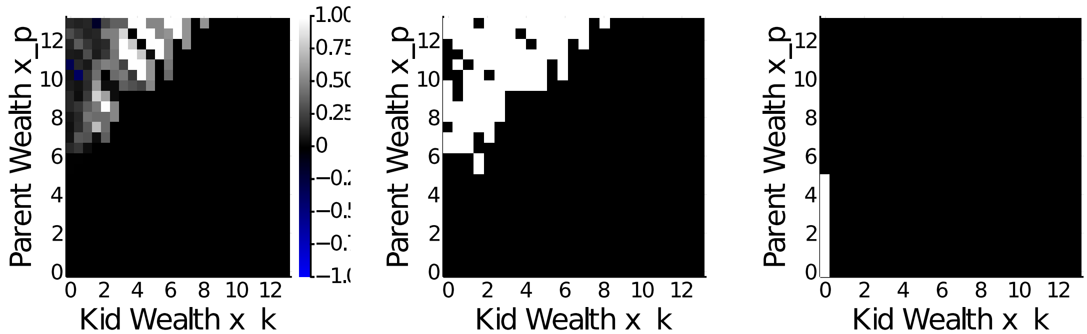
Figure A.13: Stylized Model: Sensitivity Parameter Values

(a) Benchmark: $\gamma = 1.2, \eta = 0.5, \xi = 0.4$

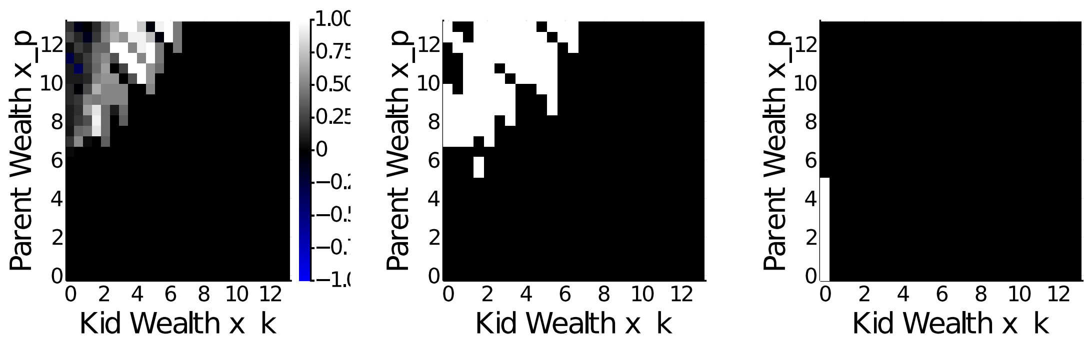
(b) Life-Time Transfers (c) Kids Prefer Costs (d) Parents Prefer Costs



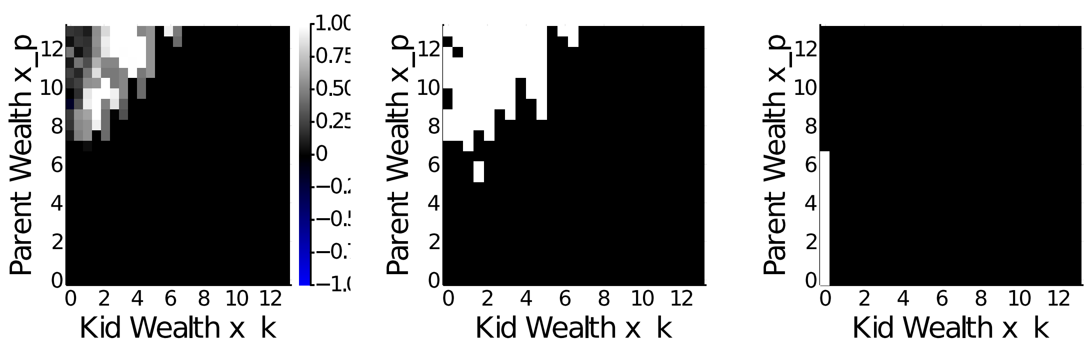
(e) Higer Risk Aversion $\boldsymbol{\gamma = 1.5}, \eta = 0.5, \xi = 0.4$



(f) Lower Altruism $\gamma = 1.2, \boldsymbol{\eta = 0.6}, \xi = 0.4$



(g) Lower Weight on Housing $\gamma = 1.2, \eta = 0.5, \boldsymbol{\xi = 0.5}$

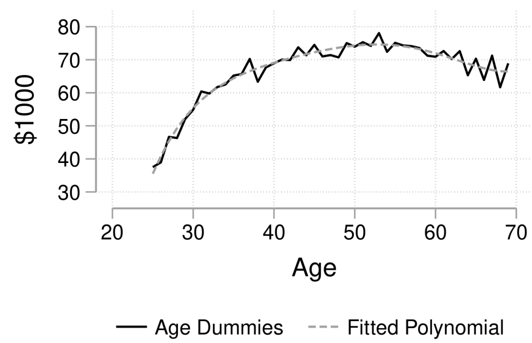


B APPENDIX: STOCK MARKET PARTICIPATION AND EXIT: THE ROLE OF HOMEOWNERSHIP

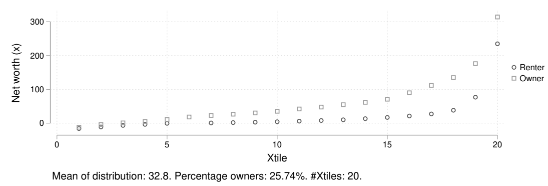
B.1 Supplementary Figures and Tables

Figure B.1: Life Cycle Participation, Homeownership, Entry and Exit

(a) Joint Wealth and Ownership Distribution



(b) Joint Wealth and Ownership Distribution



B.2 More Model Details

B.2.1 Renters' and Buyers' Decision Problems

The renter's decision problem

Below I fully describe the decision problem facing an agent who doesn't own a house at the beginning of the period. The renter chooses optimal consumption, rental size, (positive) bond holdings and if he chooses to pay the fixed cost q, also how much to

Table B.1: Summary Statistics by Ownership in the PSID

	PSID		SCF	
	Renters	Homeowners	Renters	Homeowners
	mean	*mean*	*mean*	*mean*
Financial Portfolio				
Stock Participation	0.21	0.52	0.26	0.60
Exit	0.34	0.19	.	.
Entry	0.10	0.23	.	.
Weight on Stocks	.	.	0.06	0.12
Cond. Weight on Stocks	.	.	0.49	0.25
Financial Portfolio (w/o IRA)				
Stock Participation	0.12	0.32	0.15	0.30
Exit	0.40	0.29	.	.
Entry	0.05	0.12	.	.
Weight on Stocks	0.04	0.07	0.02	0.04
Cond. Weight on Stocks	0.14	0.16	0.31	0.15
Economic variables				
Income (thousands)	46.05	99.42	44.23	118.57
Wealth (thousands)	57.72	540.33	82.59	816.21
Stocks (thousands)	10.18	84.43	2.41	18.36
House Value (thousands)	0.00	244.60	−0.00	279.48
Home Equity (thousands)	0.18	156.31	−0.00	186.36
Other				
High School	0.55	0.52	0.56	0.51
College	0.23	0.33	0.20	0.34
Married	0.26	0.67	0.39	0.69
White	0.82	0.92	0.56	0.79
Age	43.69	54.39	42.42	53.61
Family Size	1.97	2.55	.	.

Notes: Author's own calculation from the PSID, waves 1984-2015. All observation are equally weighted. Exit and entry is relative to the previous observation, i.e. a five year gap for waves 84, 89, 94, 99 and two year gap thereafter.

save in stocks:

$$\begin{aligned} V_a^R(x,v,p) = \max_{c,b',s',h} \{u(c,h) + \beta_a \mathbb{E}_a[V_{a+1}(x',v',p',0)]\} \\ x + w = c + \mathbf{1}(s'+q) + b' + fph \\ x' = s'(1+r') + b'(1+r^f) \\ \{c, b', s'\} \in [0,\infty)^3, h \in \{small, large\} \\ \text{Processes for } w, r, p \text{ (eq. 2.7,2.5,2.6)} \end{aligned} \tag{B.1}$$

The buyer's decision problem

Compared to renters and stayers, buyers decide on how big of a house to own, don't pay rent, can borrow in the bond but also pay moving costs.

$$\begin{aligned} V_a^B(x,v,p) = \max_{c,b',s',h'} \{u(c,h') + \beta_a \mathbb{E}_a[V_{a+1}(x',v',p',h')]\} \\ x + w = c + \mathbf{1}(s'+q) + b' + ph'(1+mc) \\ x' = s'(1+r_{a+1}) + b'(1+r^f) + hp'(1-\delta) \\ \{c, s'\} \in [0,\infty)^2, b' \geq -(1-d)ph', h' \in \{small, large\} \\ \text{Processes for } w, r, p \text{ (eq. 2.7,2.5,2.6)} \end{aligned} \tag{B.2}$$

B.2.2 Nesting models without housing

Nesting Fagereng, Gottlieb and Guiso (2017)

The model extends Fagereng et al. (2017) by including housing. To obtain their model one only must limit the economy to not include housing, i.e. setting $h \in \mathcal{H} = \{0\}$. Under this assumptions the house price p is redundant, as is the discrete choice between renting, staying and buying a new house. The household decision problem is then simplified into

$$\begin{aligned} V_a^{FGG}(x,v) &= \max_{c,b',s'} \{u(c) + \beta_a \mathbb{E}_a[V_{a+1}(x',v')]\} \\ x + w &= c + \mathbf{1}(s' + q) + b' \\ x' &= s'(1+r') + b'(1+r^f) \\ \{c, b', s'\} &\in [0,\infty)^3 \\ &\text{Processes for } w, r \text{ (eq. 2.7,2.5)} \end{aligned} \tag{B.3}$$

Nesting Cocco, Gomes and Maenhout (2005)

To nest Cocco et al. (2005) only two further assumption is required; that the fixed cost is zero ($q = 0$) and the probability of a tail event is equal to zero ($p_{tail} = 0$). This removes one discrete choice (whether to participate), and mechanically implies 100% stock market participation.

$$\begin{aligned} V_a^{CGM}(x,v) &= \max_{c,b',s'} \{u(c) + \beta_a \mathbb{E}_a[V_{a+1}(x',v')]\} \\ x + w &= c + s' + b' \\ x' &= s'(1+r') + b'(1+r^f) \\ \{c, b', s'\} &\in [0,\infty)^3 \\ &\text{Processes for } w, r \text{ with } p_{tail} = 0 \text{ (eq. 2.7,2.5)} \end{aligned} \tag{B.4}$$

B.3 Numerical Details

B.3.1 Solution Algorithm

The problem is solved backwards, by first solving the value function of a retiree at age T, when death is certain. In the final period households liquidate all wealth for goods consumption and hold no housing wealth. This process is repeated backwards, until age $a = 25$. All stochastic elements are discretized following Rouwenhorst (1995). The persistent income shock v follows a three-state Markov chain process, and the transitory income shock is discretized to three states. The house price shock ε^h is discretized to five states. The stock market return shock is discretized to have six states (five normal returns and the tail return). The net worth x and price p grids are both unevenly spaced, with higher density for lower values. For values of x and p not on the grids I use linear interpolation.

B.3.2 Details on Moment Construction

I use the following procedure to estimate all the four life-cycle moments. I first group households into 5-year bins from 25-29 to 80-84. Next I drop all households who are in the top or bottom percentile of wealth within each age group. I then reweigh all sample weights to have constant sum of weights across years. I then run weighted linear regressions of the moment on the age dummies and year dummies. I then predict the value of the moment for each $age \times year$, and then find the average over years to obtain the life-cycle profile. When calculating the simulated moments there are no year effects so I simply find the average within each age group.

B.3.3 Structural Estimation

The estimation procedure is similar to the one in Daruich (2018):

1. Outside Estimation: I first set parameters that pin down the stochastic processes and prices outside the model. These parameters are either estimated directly from the data or set to standard values in the literature. These parameters are listed in Table 2.3.

2. Global Search: As there is no reason to think that the objective function will have a single local minimum, I use a global optimization procedure. First, I draw 10,000 parameter vectors ω from a six-dimensional hypercube (one dimension for each parameter) using a quasi-random low-discrepancy Sobol sequence. I then calculate the objective function for each parameter vector. The hope is that the parameter vector that minimizes the objective function approximates the global minimum.

3. I then perform a local search using a standard downhill simplex (Nelder-Mead), using as an initial guess the optimizer identified in the previous step. The convergence criteria is set to be that the percentage change between the objective function evaluated at the worst and best parameter vector in the simplex is less than 0.1%.

B.4 Details on Post Estimation Procedures

B.4.1 Sample Construction for Chetty et al (2017)

I now describe in detail how I prepare the simulated sample in order to replicate the empirical participation regression in Chetty et al. (2017). Parantheses denote the value or method used in Chetty et al. (2017). I define an indicator function for when households buys a house (renting to owning as well as owning to a new owned house). I then renormalize all dollar variables to be in $100,000. I then keep all observations the year before, during and after a house transaction. The participation indicator is multiplied by 100 to make it into a percentage. I keep all households aged 25-79. I then run IV regressions of the participation decision on property values (instrumented by the house price at the time of purchase), gross wealth , and a full set of indicators for age, productivity v ('education') and economy ('state'), equation (2.16).

B.4.2 Comparing Samples

Table B.2 compares the descriptive statistics of the estimation sample in Chetty et al. (2017) and the simulated panel. Arguably the two samples are relatively close, but the model sample is somewhat wealthier and invests more heavily in stocks.

Table B.2: Sample Comparison to Chetty et al. (2017)

	Chetty et al (2017)			Model Simulations		
	Mean	Median	Std. Dev.	Mean	Median	Std. Dev.
Age	43.53	40.00	13.70	44.21	42.00	13.11
Income	53.13	42.98	46.86	56.63	52.47	22.28
Property Value	133.87	109.83	96.23	156.66	141.94	52.74
Mortgage	79.24	70.75	62.07	30.96	34.48	23.36
Gross Wealth	139.89	70.87	200.63	175.67	131.16	118.04
Liquid Wealth	35.46	5.57	98.33	25.77	0.00	62.24
Home Equity	54.99	31.38	73.04	125.70	106.23	64.76
Participation Rate	36.31	0.00	48.09	17.52	0.00	38.01
Portfolio Weight	22.52	0.00	35.27	43.01	39.15	36.25
Observations	6912	6912	6912	59363		

Notes: The descriptive statistics in the first two columsn are taken from Table IIb in Chetty et al. (2017, p.1184). All variables in thousands 1990 US Dollars. Gross wealth in the simulation is defined as net worth plus mortgage ($x + abs(b) \times \mathbf{1}_{\{b<0\}}$) while liquid wealth is stocks plus bonds ($s + b \times \mathbf{1}_{\{b>0\}}$). The portfolio weight is defined as stocks over liquid wealth.

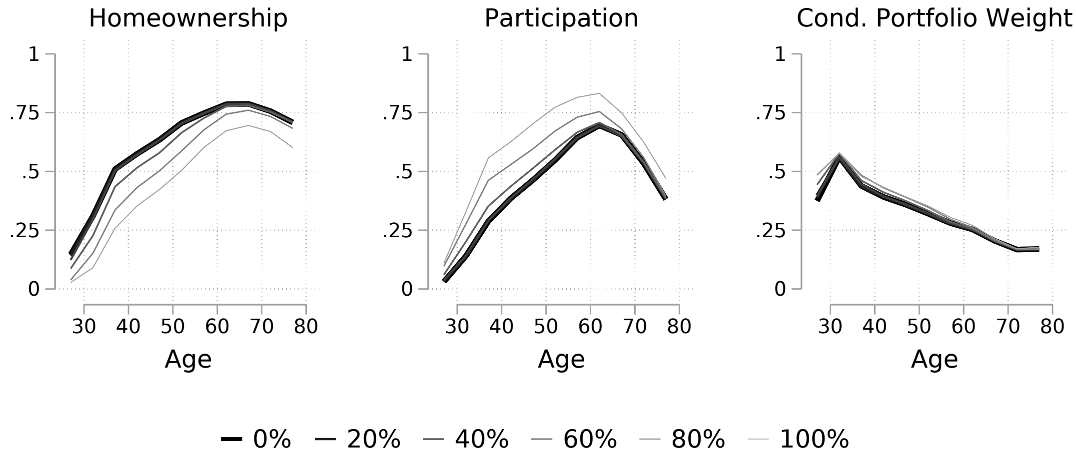
B.5 Robustness Exercises

B.5.1 Changing the Down Payment Requirement

For young households who want to become homeowners, a key constraint is the down payment constraint. One of the main mechanisms in this model is that down payments generate non-monotone participation decisions in wealth. To shed light on how the down payment affect households' portfolio decisions, I solve and simulate the model under minimum down payment requirements ranging from 0-100% using the estimated parameters. The simulated homeownership, participation, and conditional portfolio weights are plotted in Figure B.2. Since the model has no market clearing or price adjustment and so any price effects and equilibrium effects that could arise from a change in the down payment are ignored.

Homeownership is decreasing in the down payment, and higher requirements progressively delay homeownership. However, the participation rate among the young is increasing in tightening borrowing constraints. The reason is two-fold. First, the participation among renters is increasing since a) their investment time horizon is

Figure B.2: Effects of the Minimum Down Payment

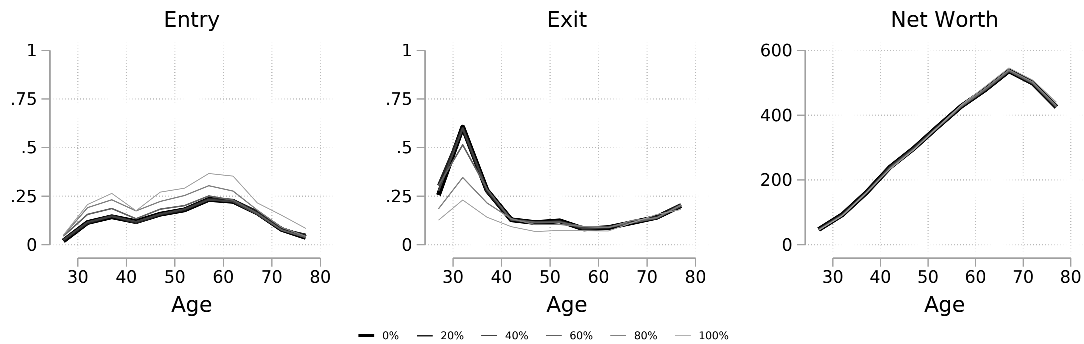


Notes: These figures plot the effect of increasing the size of the minimum downpayment. Darker, thicker lines have lower minimum downpayment (d) requirements.

longer, and b) they have more wealth and savings. Second, homeowners are also more likely to participate since they now have lower leverage and debt, which allows them to participate in the stock market sooner. The conditional portfolio weight responds little to changes in the down payment. However, we see that with higher down payments, we have higher participation, which effectively means that the mean participant has lower wealth, which increases the average portfolio weight.

Finally, Figure B.3 also plots the effects for the entry and exit rates as well as net-worth. Higher downpayments increase the entry rate over the entire life-cycle because of later entry to ownership for young and middle-aged and that downsizing now increases liquid wealth more for older households. The exit rate is lower only for younger households, indicating that renters now stay in the market for longer, and less new owners exit the stock market. Net worth is not affected by downpayments when prices are constant, so these effects are driven purely by the effects of the borrowing constraint on the portfolio choices.

Figure B.3: Effects of the Minimum Down Payment on Entry/Exit

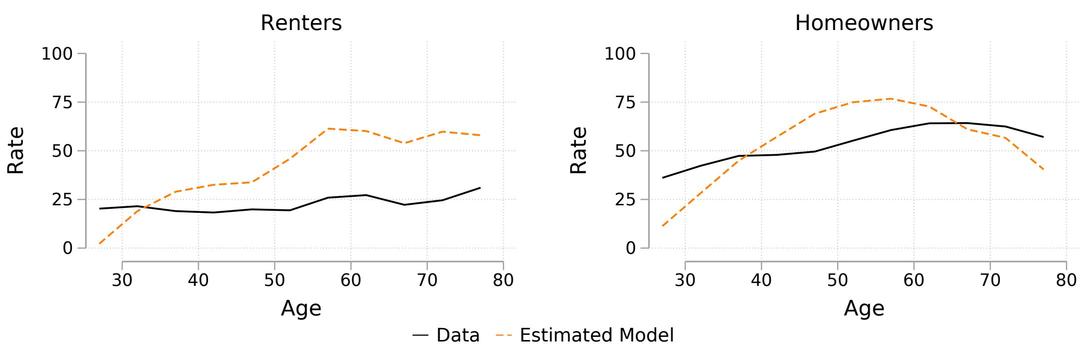


Notes: These figures plot the effect of increasing the size of the minimum downpayment. Darker, thicker lines have lower minimum downpayment (d) requirements.

B.5.2 Participation Rates by House Tenure

A major contribution in Vestman (2019) is to build a model that can rationalize the participation gap between renters and participants. In Vestman's model, the main mechanism is preference heterogeneity (higher risk-aversion, lower discount factors, and higher participation costs) between a renter and owner type. I plot the participation rates by house tenure in Figure B.4. We see that the model generally does worse at predicting the participation rate among renters than owner. However, the model correctly predicts the main feature of the data: that homeowners have higher participation rates than owners.

Figure B.4: Participation By Homeownership - Data and Simulation



C APPENDIX: RISK-TAKING, FAMILY RESOURCES, AND A FULL VIEW OF THE PORTFOLIO

C.1 Supplementary Data Information

Table C.1: Data Sources for Return Processes

Variable	Source	Code
Stocks	FRED	WILL5000IND
Safe	FRED	DTB3
Home	FRED	CSUSHPISA
Mortgage	FRED	MORTGAGE30US
Credit Card	FRED	TERMCBCCALLNS
Private Bus & Farms	FRED	NNBPEBA027N
CPI	FRED	CPILFESL

Notes: The table lists the Federal Reserve Economic Data (FRED) codes that we use for each return process.

C.1.1 Summary Statistics Before Dropping Households Without Observed Parents

C.2 Supplementary Figures

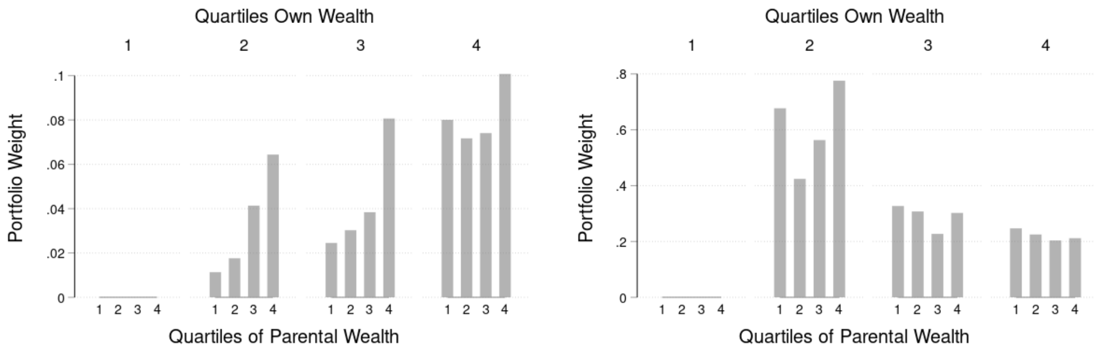
C.3 Alternative Regression Specifications

In this section we plot results from alternative regression specificatoins from those used in the main text.

Table C.2: Summary Statistics of Full Sample

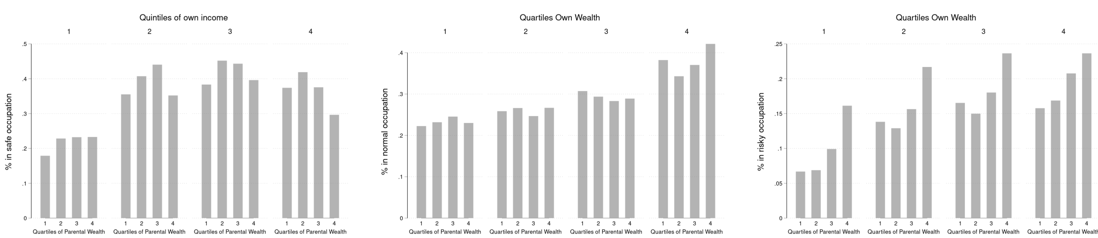
	Mean	Median	SD	N
Overview				
Age	40.01	40.00	8.87	70693
Wealth	198,406.38	39,000.00	890,382.09	70695
Income	76,280.75	57,240.31	104,912.32	70695
Home owner (%)	0.56	1.00	0.50	70695
Stock owner (%)	0.21	0.00	0.40	70695
High-School (%)	0.46	0.00	0.50	70695
College (%)	0.27	0.00	0.44	70695
Married (%)	0.54	1.00	0.50	70695
White (%)	0.74	1.00	0.44	70695
SRC sample	0.81	1.00	0.39	70695
Immigrant Sample	0.08	0.00	0.27	70695
SEO Sample	0.11	0.00	0.31	70695
Portfolio Composition				
Stocks	123,171.24	21,710.61	886,591.81	11257
IRAs & Annuities	86,170.61	28,612.67	181,232.53	11407
Safe Assets	21,553.00	4,768.78	85,152.05	50172
Home Value	219,228.61	159,320.77	221,847.63	36550
Home Equity	107,888.30	62,081.94	169,496.42	36761
Farm & Business Equity	383,542.60	76,898.26	1481965.80	6021
Real Estate Equity	192,764.77	60,580.86	664,283.49	7285
Other Equity	8,420.85	-4,130.34	263,498.20	31009
Occupation				
Safe (%)	0.34	0.00	0.47	35963
Medium (%)	0.30	0.00	0.46	35963
Risky (%)	0.17	0.00	0.38	35963
Other (%)	0.18	0.00	0.39	35963

Figure C.1: Stock Market Portfolio Weight by Parental Wealth



(a) All Risky Financial Assets (b) Risky Financial Assets excluding IRAs

Figure C.2: Occupational Choice as a function of household income



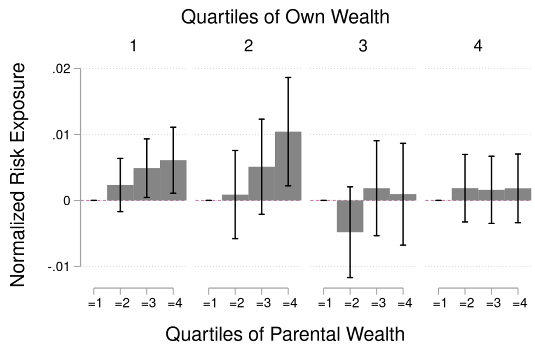
(a) % in *safe* occ. (b) % in *normal* occ. (c) % in *risky* occ.

Figure C.3: Occupational Choice by Education

(a) % in *safe* occ. (b) % in *normal* occ. (c) % in *risky* occ.

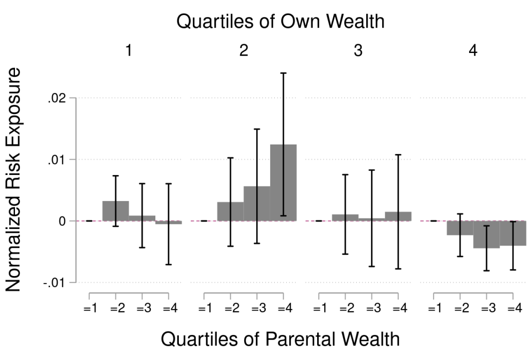
Figure C.4: Random Effects: Conditional Effect of Parental Wealth on the Normalized Risk Measure

(a) Full Sample

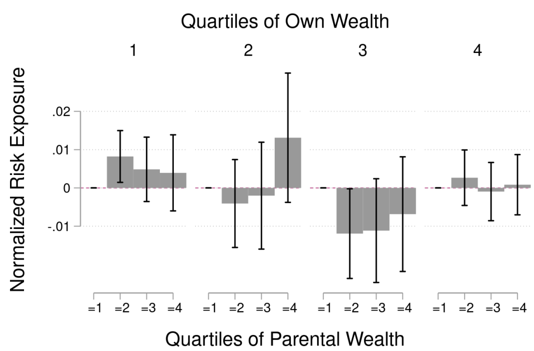


(b) Married Parents

Figure C.5: Fixed Effects: Conditional Effect of Parental Wealth on the Normalized Risk Measure



(a) Full Sample



(b) Married Parents

REFERENCES

Aastveit, Knut, Bruno Albuquerque, and Andre Kallak Anundsen. 2020. Changing Supply Elasticities and Regional Housing Booms. *Bank of England Working Paper* (844).

Abowd, John M, and David Card. 1989. On the Covariance Structure of Earnings and Hours Changes. *Econometrica* 57(2):411–445.

Aliprantis, Dionissi, Daniel Carroll, and Eric R. Young. 2020. The Dynamics of the Racial Wealth Gap. *SSRN Electronic Journal* 1–33.

Altonji, Joseph G, Fumio Hayashi, and Laurence J Kotlikoff. 1997. Parental Altruism and Inter Vivos Transfers: Theory and Evidence. *Journal of Political Economy* 105(6).

Altonji, Joseph G, Anthony A Smith, and Ivan Vidangos. 2013. Modeling Earnings Dynamics. *Econometrica* 81(4):1395–1454.

Ameriks, John, and Stephen P Zeldes. 2004. How Do Household Portfolio Shares Vary With Age?

Ashman, Hero, and Seth Neumuller. 2020. Can income differences explain the racial wealth gap? A quantitative analysis. *Review of Economic Dynamics* 35:220–239.

Athreya, Kartik, Felicia Ionescu, and Urvi Neelakantan. 2017. Stock Market Participation: The Role of Human Capital. *Federal Reserve Bank of Richmond Working Paper* 15(07):1–57.

Attanasio, Orazio, Agnes Kovacs, and Patrick Moran. 2020. Temptation and Commitment: Understanding Hand-to-Mouth Behavior. *NBER Working Paper Series* (27944).

Attanasio, Orazio, Costas Meghir, and Corina Mommaerts. 2018. Insurance in Extended Family Networks. *SSRN Electronic Journal*.

Barczyk, Daniel, Sean Fahle, and Matthias Kredler. 2020. Save, Spend or Give? A Model of Housing, Family Insurance, and Savings in Old Age. *Working Paper*.

Barczyk, Daniel, and Matthias Kredler. 2014. Altruistically Motivated Transfers Under Uncertainty. *Quantitative Economics* 5:705–749.

———. 2018. Evaluating Long-Term-Care Policy Options, Taking the Family Seriously*. *The Review of Economic Studies* 85(2):766–809.

———. 2020. Blast from the past : The altruism model is richer than you think. *Working Paper* 0–45.

Barro, Robert J. 1974. Are government bonds net wealth? *Journal of Political Economy* 82(6):1095–1117.

Barth, Daniel, Nicholas W. Papageorge, and Kevin Thom. 2020. Genetic Endowments and Wealth Inequality. *Journal of Political Economy* 128(4):1474–1522.

Beaubrun-Diant, Kevin E., and Tristan-Pierre Maury. 2016. Home tenure, stock market participation, and composition of the household portfolio. *Journal of Housing Economics* 32:1–17.

Benhabib, Jess, Alberto Bisin, and Mi Luo. 2017. Earnings Inequality and Other Determinants of Wealth Inequality. *American Economic Review: Papers & Proceedings* 107(5):593–597.

Benhabib, Jess, Alberto Bisin, and Shenghao Zhu. 2011. The Distribution of Wealth and Fiscal Policy in Economies With Finitely Lived Agents. *Econometrica* 79(1): 123–157.

Black, Sandra E, Paul J Devereux, Petter Lundborg, and Kaveh Majlesi. 2017. On the Origins of Risk-Taking in Financial Markets. *The Journal of Finance* 72(5): 2229–2278.

———. 2020. Poor Little Rich Kids? The Role of Nature versus Nurture in Wealth and Other Economic Outcomes and Behaviours. *The Review of Economic Studies* 87(4):1683–1725.

Blickle, Kristian, and Martin Brown. 2019. Borrowing Constraints, Home Ownership and Housing Choice: Evidence from Intra-Family Wealth Transfers. *Journal of Money, Credit and Banking* 51(2-3):539–580.

Boar, Corina. 2018. Dynastic Precautionary Savings. *Working Paper* 1–82.

———. 2021. Dynastic Precautionary Savings. *The Review of Economic Studies*.

Boar, Corina, Denis Gorea, and Virgiliu Midrigan. 2020. Liquidity Constraints in the U.S. Housing Market. *Working Paper* (May).

Bogan, Vicki L, and Jose M Fernandez. 2017. How children with mental disabilities affect household investment decisions. *American Economic Review: Papers & Proceedings* 107(5):536–40.

Bond, Shaun A., and Michael D. Eriksen. 2020. The role of parents on the home ownership experience of their children: Evidence from the health and retirement study. *Real Estate Economics* 1540–6229.12332.

Boserup, Simon H, Wojciech Kopczuk, and Claus T Kreiner. 2016. The role of bequests in shaping wealth inequality: evidence from danish wealth records. *American Economic Review: Papers & Proceedings* 106(5):656–61.

Brandsaas, Eirik Eylands. 2021. Illiquid homeownership and the bank of mom and dad. *Working Paper*.

Briggs, Joseph, David Cesarini, Erik Lindqvist, and Robert Östling. 2020. Windfall gains and stock market participation. *Journal of Financial Economics*.

Calvet, Laurent E., John Y. Campbell, and Paolo Sodini. 2007. Down or Out: Assessing the Welfare Costs of Household Investment Mistakes. *Journal of Political Economy* 115(5):707–747.

Carroll, Christopher D., and Andrew A. Samwick. 1997. The nature of precautionary wealth. *Journal of Monetary Economics* 40(1):41–71.

Catherine, Sylvain. 2019. Countercyclical Income Risk and Portfolio Choices over the Life-Cycle. *Working Paper*.

Caucutt, Elizabeth M, and Lance Lochner. 2020. Early and late human capital investments, borrowing constraints, and the family. *Journal of Political Economy* 128(3):1065–1147.

Chang, Minsu. 2020. A House Without a Ring: The Role of Changing Marital Transitions for Housing Decisions. *Working Paper*.

Chang, Yongsung, Jay H. Hong, and Marios Karabarbounis. 2018. Labor Market Uncertainty and Portfolio Choice Puzzles. *American Economic Journal: Macroeconomics* 10(2):222–62.

Chang, Yongsung, Jay H. Hong, Marios Karabarbounis, Yicheng Wang, and Tao Zhang. 2021. Income volatility and portfolio choices. *Review of Economic Dynamics*.

Charles, Kerwin Kofi, and Erik Hurst. 2002. The transition to home ownership and the black-white wealth gap.

Charles, Kerwin Kofi, and Erik Hurst. 2003. The Correlation of Wealth across Generations. *Journal of Political Economy* 111(6):1155–1182.

Chatterjee, Satyajit, and Burcu Eyigungor. 2015. A quantitative analysis of the U.S. housing and mortgage markets and the foreclosure crisis. *Review of Economic Dynamics* 18(2):165–184.

Chetty, R., and A. Szeidl. 2007. Consumption Commitments and Risk Preferences. *The Quarterly Journal of Economics* 122(2):831–877.

Chetty, Raj, László Sándor, and Adam Szeidl. 2017. The Effect of Housing on Portfolio Choice. *The Journal of Finance* 72(3):1171–1212.

Chiteji, Ngina S., and Frank P. Stafford. 1999. Portfolio choices of parents and their children as young adults: Asset accumulation by African-American families. *American Economic Review* 89(2):377–380.

Chu, Yu-chi. 2020. Testing Parental Altruism : A Full Solution to a Dynamic Model of Altruistic Transfers. *Working Paper*.

Cocco, João F. 2005. Portfolio Choice in the Presence of Housing. *Review of Financial Studies* 18(2):535–567.

Cocco, João F., Francisco J. Gomes, and Pascal J. Maenhout. 2005. Consumption and portfolio choice over the life cycle. *Review of Financial Studies* 18(2):491–533.

Cooper, Russell, and Guozhong Zhu. 2016. Household finance over the life-cycle: What does education contribute? *Review of Economic Dynamics* 20:63–89.

Corbae, Dean, and Erwan Quintin. 2015. Leverage and the Foreclosure Crisis. *Journal of Political Economy* 123(1):1–65.

Cubas, German, and Pedro Silos. 2017. Career choice and the risk premium in the labor market. *Review of Economic Dynamics* 26:1–18.

Dahlquist, Magnus, Ofer Setty, and Roine Vestman. 2018. On the Asset Allocation of a Default Pension Fund. *The Journal of Finance* Forthcomin.

Daruich, Diego. 2018. The Macroeconomic Consequences of Early Childhood Development Policies. *Working Paper*.

Davis, Morris A., Andreas Lehnert, and Robert F. Martin. 2008. The Rent-Price Ratio for the Aggregate Stock of Owner-Occupied Housing. *Review of Income and Wealth* 54(2):279–284.

De Nardi, Mariacristina, Giulio Fella, and Gonzalo Paz-Pardo. 2019. Nonlinear Household Earnings Dynamics, Self-Insurance, and Welfare. *Journal of the European Economic Association*.

Dillon, Eleanor W. 2018. Risk and return trade-offs in lifetime earnings. *Journal of Labor Economics* 36(4):981–1021.

Doepke, M., and M. Tertilt. 2016. Families in Macroeconomics. *Handbook of Macroeconomics* 2:1789–1891.

Engelhardt, Gary V., and Christopher J. Mayer. 1998. Intergenerational Transfers, Borrowing Constraints, and Saving Behavior: Evidence from the Housing Market. *Journal of Urban Economics* 44(1):135–157.

Fagereng, Andreas, Charles Gottlieb, and Luigi Guiso. 2017. Asset Market Participation and Portfolio Choice over the Life-Cycle. *The Journal of Finance* 72(2): 705–750.

Fagereng, Andreas, Luigi Guiso, Davide Malacrino, and Luigi Pistaferri. 2020. Heterogeneity and persistence in returns to wealth. *Econometrica* 88(1):115–170. https://onlinelibrary.wiley.com/doi/pdf/10.3982/ECTA14835.

Fagereng, Andreas, Magne Mogstad, and Marte Ronning. 2021. Why Do Wealthy Parents Have Wealthy Children? *Journal of Political Economy* 129(3).

Favilukis, Jack, and Stijn Van Nieuwerburgh. 2017. Out-of-Town Home Buyers and City Welfare. *SSRN Electronic Journal*.

Fisher, Jonas D. M., and Martin Gervais. 2011. Why Has Home Ownership Fallen Among the Young. *International Economic Review* 52(3):883–912.

Gianetti, Mariassunta, and Tracy Yue Wang. 2016. Corporate Scandals and Household Stock Market Participation. *The Journal of Finance* 71(6):2591–2636.

Goodman, Laurie S., and Christopher Mayer. 2018. Homeownership and the American Dream. *Journal of Economic Perspectives* 32(1):31–58.

Greenwald, Daniel, and Adam M. Guren. 2020. Do Credit Conditions Move House Prices? *SSRN Electronic Journal*.

Guiso, Luigi, and Tullio Jappelli. 2002. Private Transfers, Borrowing Constraints, and Timing of Homeownership. *Journal of Money, Credit, and Banking* 34(2): 315–339.

Guiso, Luigi, Paola Sapienza, and Luigi Zingales. 2008. Trusting the Stock Market. *The Journal of Finance* 63(6):2557–2600.

Guvenen, Fatih, and Anthony A. Smith. 2014. Inferring Labor Income Risk and Partial Insurance From Economic Choices. *Econometrica* 82(6):2085–2129.

Harding, John P., Stuart S. Rosenthal, and C.F. Sirmans. 2007. Depreciation of housing capital, maintenance, and house price inflation: Estimates from a repeat sales model. *Journal of Urban Economics* 61(2):193–217.

Hatchondo, Juan Carlos, Leonardo Martinez, and Juan M Sánchez. 2015. Mortgage defaults. *Journal of Monetary Economics* 76:173–190.

Hubbard, Robert G, Jonathan Skinner, and Stephen P Zeldes. 1995. Precautionary Saving and Social Insurance. *Journal of Political Economy* 103(21):360–399.

Hvide, Hans, and Paul Oyer. 2018. Dinner Table Human Capital and Entrepreneurship. *NBER Working Paper Series* 24198.

Justiniano, Alejandro, Giorgio E. Primiceri, and Andrea Tambalotti. 2019. Credit Supply and the Housing Boom. *Journal of Political Economy* 127(3):1317–1350.

Kaplan, Greg, Kurt Mitman, and Giovanni L. Violante. 2020. The Housing Boom and Bust: Model Meets Evidence. *Journal Of Political Economy*.

Kaplan, Greg, and Giovanni L. Violante. 2014. A Model of the Consumption Response to Fiscal Stimulus Payments. *Econometrica* 82(4):1199–1239.

Khorunzhina, Natalia, and Robert Miller. 2019. American Dream Delayed: Shifting Determinants of Homeownership. *Working Paper*.

Knüpfer, Samuli, Elias Henrikki Rantapuska, and Matti Sarvimäki. 2017. Why does portfolio choice correlate across generations. *Bank of Finland Research Discussion Paper* 25.

Kuznets, Simon, and Milton Friedman. 1939. *Incomes from independent professional practice, 1929-1936*. Cambridge, MA: National Bureau of Economic Research.

Lee, Hyojung, Dowell Myers, Gary Painter, Johanna Thunell, and Julie Zissimopoulos. 2020. The role of parental financial assistance in the transition to homeownership by young adults. *Journal of Housing Economics* 47.

Lee, Samuel, and Petra Persson. 2016. Financing from Family and Friends. *Review of Financial Studies* 29(9):2341–2386.

Lee, Sang Yoon, and Ananth Seshadri. 2019. On the Intergenerational Transmission of Economic Status. *Journal of Political Economy* 127(2):855–921.

Lillard, Lee A., and Robert J. Willis. 1978. Dynamic aspects of earning mobility. *Econometrica* 46(5):985–1012.

Love, David A. 2010. The effects of marital status and children on savings and portfolio choice. *The Review of Financial Studies* 23(1):385–432.

Low, Hamish, Costas Meghir, and Luigi Pistaferri. 2010. Wage risk and employment risk over the life cycle. *American Economic Review* 100(4):1432–1467.

Mabille, Pierre. 2020. The Missing Home Buyers : Regional Heterogeneity and Credit Contractions. *Working Paper*.

MaCurdy, Thomas E. 1982. The use of time series processes to model the error structure of earnings in a longitudinal data analysis. *Journal of Econometrics* 18(1): 83–114.

McGee, Rory. 2019. Old Age Savings and House Price Shocks. *Working Paper*.

Meghir, Costas, and Luigi Pistaferri. 2004. Income variance dynamics and heterogeneity. *Econometrica* 72(1):1–32.

Moffitt, Robert A., and Peter Gottschalk. 2002. Trends in the transitory variance of earnings in the united states. *The Economic Journal* 112(478):C68–C73.

Mommaerts, Corina. 2016. Long-Term Care Insurance and the Family. *Working Paper*.

Nekoei, Arash, and David Seim. 2019. How Do Inheritances Shape Wealth Inequality? Theory and Evidence from Sweden. *Ssrn* 1–126.

Paz-Pardo, Gonzalo. 2019. Homeownership and Portfolio Choice over the Generations. *Working Paper* 1–87.

Rouwenhorst, K.G. 1995. Asset Pricing Implications of Equilibrium Business Cycle Models. In *Frontiers of business cycle research*, ed. T.F. Cooley, 294–330. Princeton: Princeton University Press.

Sanchez, Manuel, and Felix Wellschmied. 2020. Modeling life-cycle earnings risk with positive and negative shocks. *Review of Economic Dynamics*.

Shapiro, Thomas M. 2004. *The Hidden Cost of Being African American: How Wealth Perpetuates Inequality*. 1st ed. New York: Oxford University Press.

Shore, Stephen H., and Todd Sinai. 2010. Commitment, risk, and consumption: Do birds of a feather have bigger nests? *Review of Economics and Statistics* 92(2): 408–424.

Vestman, Roine. 2019. Limited Stock Market Participation Among Renters and Homeowners. *The Review of Financial Studies* 32(4):1494–1535.

Vissing-Jørgensen, Annette. 2002. Towards an Explanation of Household Portfolio Choice Heterogeneity: Nonfinancial Income and Participation Cost Structures. *NBER Working Paper Series* 8884.

Wachter, Jessica A., and Motohiro Yogo. 2010. Why Do Household Portfolio Shares Rise in Wealth? *Review of Financial Studies* 23(11):3929–3965.

Xavier, Ines. 2021. Wealth inequality in the us: the role ofheterogeneous returns. *Working Paper*.

Yang, Fang. 2009. Consumption over the life cycle: How different is housing? *Review of Economic Dynamics* 12:423–443.

Yao, Rui, and Harold H. Zhang. 2005. Optimal Consumption and Portfolio Choices with Risky Housing and Borrowing Constraints. *Review of Financial Studies* 18(1): 197–239.