Homeownership as Life Cycle Goldmine: Evidence from Macrohistory*

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Abstract

Should a household buy a home? Using data from 16 developed countries spanning 1870 to 2020, this study provides a resounding affirmative answer. Contrary to popular expert advice, homeownership enhances life cycle wealth by up to 9% and welfare by up to 23%, compared to all-equity investment strategy. Homeownership reduces wealth portfolio risk and improves wealth equality, though it comes at the cost of lower working-life wealth and curtailed financial asset holdings. Gains are heterogeneous: Low-income (high-income) households gain more in wealth (welfare), and home purchase during periods of moderately low interest rates and high housing prices maximizes these benefits.

Keywords: Asset Allocation, Homeownership, Life Cycle Investments, Welfare

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> "The average personal investor sits on a nontraded, highly leveraged, illiquid asset chock full of idiosyncratic risk—the owner-occupied home. That government policy heavily encourages such a disastrous investment, under the fallacy that homes 'build wealth' (better than stocks), is obviously partly to blame. People in many other countries rent houses, and the first thing a consumer financial protection effort should do is to discourage such investment."
>
> — Cochrane (2022), Portfolios for Long-Term Investors, *Review of Finance*, 26(1):1–42.

1 Introduction

Homeownership is central to American households' portfolio allocation. 66% of American households are homeowners, and 80% of American home buyers are willing to finance their homeownership.[1] In the public belief, real estate has been ranked in the first place since 2013 as the best long-run investment, overtaking stocks, bonds, and savings.[2] Housing is also the most important wealth storage for American households, especially for the bottom 50% households in wealth distribution (Diwan et al., 2021).

Despite its popularity among the public, housing as an investment instrument has long been criticized by the experts. Choi (2022) documents that 14 out of 50 most popular personal finance books *explicitly* state that housing is not a great investment, and Cochrane (2022) describes investments in housing as "disastrous" investments and advises against them. Additionally, Campbell (2006) argues that the illiquid nature of homeownership as an asset could lead to sacrifices in household consumption. Meanwhile, the U.S. homeownership growth has lagged behind the other countries, and many Americans have started questioning whether the homeownership should remian part of the "American Dream" (Goodman and Mayer, 2018).

In light of these conflicting views, understanding the life cycle economic implications of homeownership is crucial, especially during the current housing supply shortage in the U.S., which continues to suppress the homeownership. Should a household purchase a home from a long-run perspective? This

[1] See https://fred.stlouisfed.org/series/RSAHORUSQ156S and https://www.nar.realtor/research-and-statistics/research-reports/highlights-from-the-profile-of-home-buyers-and-sellers.

[2] See https://news.gallup.com/poll/645107/stocks-gold-down-americans-best-investment-ratings.aspx for Gallup's quarterly updated survey.

paper provides an affirmative answer to the question and challenges the negative view on the potential of homeownership in wealth creation and welfare enhancement.

We utilize the Jordà-Schularick-Taylor Macrohistory Database (hereafter, Macrohistory Database) from Jordà et al. (2019) and employ the method of Anarkulova et al. (2023) and Politis and Romano (1994). Specifically, we apply a stationary block bootstrap simulation to the historical data based on a life cycle model, which incorporates labor income risk, risky returns from different asset classes, and longevity risk. We draw our conclusion based on the life cycle performance of investment strategies across four key aspects: Wealth accumulation, welfare gains and losses, downside risks, and wealth equality.

Our evaluation of life cycle investment strategies begins with constructing a single household's life cycle economic environment using stationary block bootstrap sampling. Then, we backtest the exogenously defined strategies with the same simulated household life cycle. *Each* strategy with access to homeownership has a corresponding benchmark strategy where the household rents for life and invests only in financial assets, i.e., stocks.[3] We compare different strategies with access to homeownership against their own benchmark strategies. We repeat the process for 1,000,000 times for each comparison to draw a generalizable conclusion.

A household in our setup starts with a couple of life cycle investors who earn independent labor income during their working life. For the strategies with access to homeownership (hereafter, homeowner strategy), a household (hereafter, homeowner) rents a home first. During the renting life, the homeowner pays for the rent with labor income, saves 10% labor income to financial assets, and consumes the remaining labor income. The homeowner purchases a home when a down payment criterion and an additional purchase threshold are satisfied.[4] We examine various strategies where households enter the housing market with differing wealth and leverage levels. After the home purchase, the homeowner financing for the home pays for the mortgage using labor income, invests 10% of the remaining labor income in financial assets, and consumes the rest.

[3]Note that we have a different benchmark strategy for each homeowner strategy because each homeowner strategy imposes different exogenously defined home purchase rules and that we match the total investments and the consumptions during the working life between homeowners and renters for head-to-head comparisons.

[4]We search through the home purchase strategies characterized by the down payment and the additional purchase threshold, since the down payment and the liquidity constraints are two important factors in households' decision making of home purchase (Campbell, 2006; Fuster and Zafar, 2016). The additional purchase threshold imitates the liquidity choice and technically delays the home purchase. It helps households cover necessary expenditures in consumption and home purchase.

In the benchmark strategies (all-equity strategies), a household (hereafter, renter) pays for the rent with labor income, saves 10% labor income to financial assets, and consumes the remainder. We match the homeowner's working-life consumption with its respective renter's. In other words, although the renter is set to rent for life and does not purchase a home when it is qualified, i.e., its savings in financial assets satisfy a down payment criterion and an additional purchase threshold, the renter would change its investment in financial assets such that the renter's sum of rent payment and its investment in financial assets matches to the corresponding homeowner's sum of mortgage payment, along with other fees, and the homeowner's investment in financial assets. This match allows us to mirror the working-life investments and the working-life consumptions between the homeowner strategies and their benchmark strategies, enabling clear attribution of homeownership's economic effects.[5]

A homeowner after home purchase will liquidate the home (or take reverse mortgage against the home equity if retired) when the mortgage payment or the minimum consumption becomes unaffordable due to income risk, longevity risk, or exhaustion of liquid wealth.[6] In the event of consumption disaster, i.e., when a household cannot afford the minimum consumption, the household receives a Supplemental Security Income (SSI) according to the Social Security Administration's (SSA) minimum dollar value consumption in 2024. A household retires at age 65. During the retirement years, the household receives social security income and withdraws 4% of its wealth evaluated each year. The withdrawal amount has to be greater than or equal to 4% of the household's wealth at retirement (age 65). Retired homeowners can also take reverse mortgage and borrow against home equity to level up their consumptions.

Our bootstrap simulation enjoys the important advantage of keeping the long-run multivariate time-series autocorrelation inherent in the data while avoiding optimization complexity. Based on the 150-year data across 16 developed countries of more than 1,800 annual data points, our simulations draw observations from millions of candidate possibilities and evaluate household performance with a life cycle model. Together, our method and the long-run perspective allow us to circumvent drawing

[5]In particular, this setup ensures that the observed economic effects of homeownership are not driven by its role as an investment commitment vehicle. For example, Venti and Wise (1998) document that one of the reasons for wealth dispersion in the population is the choice of savings in early life. Without mirroring the working-life consumptions and thus the working-life investments, renters can have lower total investments relative to homeowners in the event when the price-to-rent ratio is high.

[6]Households can directly consume liquid wealth, including labor income, rent income, and financial assets and 4% withdrawal after retirement.

long-run conclusions from short-run panel data in a cross-sectional analysis. The flexibility of simulation also allows us to impose a comprehensive set of decision rules that closely imitates the decision making of households in real life.

Considering portfolio allocation in stocks, long-term government bonds, and savings, our results suggest that a homeowner in life cycle generally would enjoy economic gains in both wealth and welfare at death. For brevity, we only report the economic benefits of homeowner strategies against their corresponding all-equity strategies. Our choice to focus on this comparison is motivated by the literature. Based on the conclusions from Anarkulova et al. (2023), the simple all-equity strategy, which invests solely in the stock market, is among the best strategies for wealth accumulation (preservation) compared with other investment strategies, including the popular target date funds (TDF) and the balanced portfolio allocation between stocks and bonds. Therefore, the simple all-equity strategy is an appropriate benchmark for comparison.[7] Meanwhile, the literature emphasizes the need for a comparison between the performance of investments in homeownership and investments in stocks (Cochrane, 2022).

Benchmarking against the corresponding renters, a homeowner can experience a gain in wealth accumulation at death of up to 9.6%. This is achieved if the homeowner opts to purchase a home with 20% down payment and a purchase threshold requiring the homeowner to save an additional 50% of the home value in excess of the down payment. We also observe universal welfare increases across the homeowner strategies in the retirement years by as high as 23%. Our main results are based on the global data sets. For robustness and generalizability to specific local regions, we also report life cycle performance of the homeowner strategies with the data from the U.S., the U.K., and Europe. Our conclusion from the region level data stays the same.

Besides the gains in wealth and welfare, homeownership also significantly reduces the downside risk of wealth portfolio measured as maximum drawdown, which highlights the potential of wealth preservation by introducing homeownership to households' wealth portfolios. The effect is sizable before and after retirement.

[7] Anarkulova et al. (2023) show that the all-domestic equity strategy provides high wealth accumulation at a ruin probability comparable to the ruin probability of the TDFs and that the equity strategy with international diversification significantly reduces the ruin probability while maintaining the wealth accumulation effect. In unreported results, we examine other potential benchmark strategies including financial assets like bonds and treasury bills, those benchmark strategies significantly underperform the all-equity strategy.

With our analysis of different home purchase criteria, we observe substantial heterogeneity in the economic effects of homeownership. First, leverage and purchase thresholds exert a complex, non-uniform influence on life cycle wealth. In particular, we extend the literature's understanding of housing's influence on low-income homeowners. Not only do these homeowners exhibit a higher marginal propensity to consume out of home equity, contributing to greater volatility in consumption, but their home equity also tends to generate lower wealth gains compared to wealthier households (Mian et al., 2013). The favorable wealth effect primarily benefits wealthy homeowners—those with additional liquid assets. For instance, with a 20% down payment, homeowners who meet a 50% extra purchase threshold gain over 9% in wealth by the time of death, whereas those with a 10% purchase threshold see an average wealth increase of less than 1.5 percentage points.

From another perspective, homeowners generally benefit in wealth from delaying home purchases and accumulating more financial assets. Our findings may also help explain why the portfolio share of risky assets increases with wealth (Wachter and Yogo, 2010). Specifically, greater financial asset holdings, combined with home purchases, enhance households' overall wealth portfolios.

Second, homeownership enhances welfare universally in our simulations. However, the welfare gains are most pronounced with moderate leverage level. Both the down payment and the purchase threshold alternate the welfare gains non-monotonically. For example, in comparison to cash purchase with 10% purchase threshold, the home purchase with 40% down payment and 10% purchase threshold realizes an additional welfare gain of more than 5%. The maximum gains in welfare is achieved through 50% down payment and 10% purchase threshold. Broadly consistent with our conclusion from wealth gains, enhancements in welfare primarily accrue to relatively wealthier but not the wealthiest households that can afford higher down payment or delay the purchase by saving up more financial assets.

[Insert Figure 1 Here]

Figure 1 illustrates wealth and welfare profiles across households following two homeowner strategies versus renters with 10% down payment. For example, Panels (a) and (b) show total and financial wealth trajectories for households with purchase thresholds of 10%. Homeowners surpass renters in total wealth later in life, with earlier crossovers observed under the 50% purchase threshold strategy.

Panels (e) and (f) demonstrate accumulated consumption welfare, highlighting homeowners' persistent welfare advantage over renters. Initially reduced financial wealth (Panel b, d) recovers over time.

To identify the realized gains among households implementing homeowner strategies who are actually able to afford a home purchase (hereafter, actual homeowners), we repeat our life cycle analysis against the benchmark renters, excluding households in homeowner strategies that ultimately are not able to purchase a home. At death, actual homeowners enjoy wealth and welfare gains of up to over 100% relative to renters. Note that the renters are households with the exact same life cycles, differing only in their life cycle investment strategy. Therefore, our results indicate that simply by altering the investment choice, households can achieve significantly different life cycle wealth and welfare outcomes, providing a resounding affirmative answer to our research question. We visualize actual homeowners' gains in heatmap presented in Figure 2.

[Insert Figure 2 Here]

Homeownership's benefits are not limited to the increases in wealth and welfare. Having access to homownership also demonstrates important positive social impact (Bhamra and Uppal, 2019). Our simulations show that the reduction of wealth inequality at retirement in an economy because of the access to homeownership can be as high as close to 15%, relative to the corresponding benchmark economy adopting the all-equity strategy.

Homeownership preserves wealth, enhances welfare, protects households from the downside risks of their wealth portfolios, and mitigates wealth inequality. Given these significant benefits, we explore the underlying sources that generate them. First, we calculate the wealth change at retirement for the entire wealth portfolio and the financial asset holdings. Our results uncover that households obtain the wealth and welfare gains through an intertemporal transition between working years and retirement life. Homeowners generally encounter wealth loss in the working life potentially due to the reduction in financial asset holdings, consistent with the prior literature (Becker and Shabani, 2010; Cocco et al., 2005; Vestman, 2019; Yao and Zhang, 2004). However, we observe that financial asset holdings gradually recover over the course of retirement. At death, the reduction in financial asset holdings is negligible among wealthy homeowners who delayed the home purchase by taking on high purchase threshold but remains modest for other homeowners (e.g., 2—7% reductiion decreased from 30—40%).

Second, we investigate the sources of welfare gains. Contrary to the common belief that homeownreship suppresses consumption, further analysis in our life cycle model reveal that the welfare enhancement is significantly driven by the increase in retirement consumption with primary contribution from bequest motive.

Next, we study the heterogeneity in the economic effects within the group of homeowners of the common down payment level. We are particularly interested in two interactions: 1. the relationship between labor income and economic gains, and 2. the relationship between timing of the home purchase and economic gains. We have two main findings. First, among the homeowners who purchase their homes with 10% down payment and an additional purchase threshold of 10% home value, labor income is a deciding factor of wealth effect. Contrary to the general conclusions from our prior analysis across the strategies, homeownership's economic effects reverse in the simulations of highly leveraged homeowners. Within the group of highly leveraged homeowners, wealth effect of homeownership decreases as the labor income increases, while the welfare effect of homeownership increases as the labor income increases. Second, timing home price relative to labor income (HPI) and the interest rate can also alternate homeownership's economic effects. Lifetime welfare increases in HPI. More interestingly, our results highlight that the wealth at death can be maximized among the highly leveraged homeowners if they purchase their homes when the HPI is at the top decile and when the interest rate is moderately low (in the second decile). We interpret the results of the price level as a disciplining effect, since high home price suppresses working-year consumption, requires higher commitment in home equity through mortgage payments, and reduces the wealth portfolio volatility relative to financial asset holdings. Our results suggest that the 24% lifetime wealth gain and the 48% welfare gain from moderately low interest rates are structural, i.e., purchasing a home when the interest rate is moderately low is the optimal interest timing for homeownership over the life cycle. Such time periods may be associated with stable long-run economic outlook.

With the gains in wealth and welfare through single-home ownership, we investigate the effect of a second home with the same simulation setup benchmarking to the single-home purchase strategy of 10% down payment and 10% additional purchase threshold. A second-home owner purchases (liquidates) the home following the same setup of the single-home owners. Instead of paying for mortgage only, the second-home owner receives rent from a renter. Our results show sizable increase in wealth

at death through further reduction in wealth during the working years and also additional reduction in financial asset holdings, while the overall welfare at death does not change. We also summarize household age profile in figure 1.

The paper proceeds as follows. We discuss the motivation of this study and its relation with the literature in Section 2. Section 3 introduces our main data and presents summary statistics of the returns. Section 4 discusses the stationary bootstrap simulation method, the life cycle design, and the utility function. Section 5 examines the outcomes of the simulations with different life cycle investment strategies. We also report the comparison in the performance between the single-home ownership and the second-home ownership. We conclude the study in section 6.

2 Related Literature

This study primarily contributes to the household finance literature focusing on life cycle investments (Anarkulova et al., 2023; Choi, 2022; Dahlquist et al., 2018; Duarte et al., 2022). We respond to the literature's demand in understanding the long-run investment benefits of homeownership, offer essential advice to the life cycle investors, and challenge the the negative view on homeownership (Campbell, 2006; Cochrane, 2022).

Specifically, homeownership is crucial. For example, Gan (2010) and Mian et al. (2013) show that housing wealth and home mortgage significantly influence household consumption. Pelizzon and Weber (2008) find that housing wealth determines whether the household portfolio is efficient. There are two strands of research in the study of homeownership as an investment instrument. From the long-run perspective, the studies based on time series pay much attention to the price trend. For example, Shiller (2015) shows that there is no continuous uptrend in real home prices in the U.S. from 1980 to 2020. Eicholtz (1997) also documents with 350-year data that local house prices can grow as slow as 0.14% biennially. In the recent review articles, Choi (2022) also summarizes negative overall suggestions from the popular personal finance books on housing investments, while Cochrane (2022) calls the investment in homeownership "disastrous" investment.

Despite the time series underperformance over the long run, the studies relying on time series do not fully account for the complexity of homeownership from the angle of household decision making. It is important to note that a household typically adopts a specific strategy to purchase a home and owns

it for a period significantly shorter than the long-run horizon analyzed in time series studies. Therefore, making household finance interpretations directly out of the time series studies can be misleading.

From the household perspective, studies utilizing panel data better characterize households' home purchase decision making. For example, Herbert et al. (2014, 2016) compare homeowners and renters using data from the Panel Study of Income Dynamics (PSID) spanning 1999 to 2013. While the results are helpful for understanding homeownership, the short panel data imposes substantial limitations on the interpretation. An important concern over such comparison is the generalizability of the conclusion outside of the time period, the country, and the observed life cycles.

This study is mainly motivated by the limitations faced by the two stands of studies. Specifically, we follow Anarkulova et al. (2023) and Politis and Romano (1994), and we adopt a block bootstrap simulation method with the life cycle model from Guvenen et al. (2021). We set up our simulation using the Macrohistory Database that covers 16 countries over 150 years (Jordà et al., 2019). Because our setting is based on a life cycle model, we bypass the loss of the realistic economic setup and closely model household behaviors over the life cycle. Since we rely on the global data over a super long run, we avoid the concerns on short panel data for the limitation on the interpretation and also respond to the call for evaluation of long-run investment strategies (Choi, 2022; Cochrane, 2022). Our approach maintains long-term multivariate time series autocorrelation, eludes optimization challenges, and offers clear economic intuition on the benefits of homeownership.

From this point of view, our study is the closest to the trendy research in household investments, such as the studies by Anarkulova et al. (2023) and Duarte et al. (2022), in the application of simulation methods to examine household investments. Many of the current studies focus on the evaluation of retirement investment strategies, such as TDFs. However, a paucity of studies has investigated the investments in homeownership with a life cycle setup for its important wealth and welfare influence from a long-run perspective (Guren et al., 2020). Our study precisely fits in this gap. We focus on the question of homeownership in a realistic setup, incorporating household investment strategies with mortgage. Benchmarking against an optimal life cycle strategy from Anarkulova et al. (2023), we add to the literature the evidence showing that homeownership is economically beneficial to the household and that it reduces the downside risk of the wealth portfolio. We document that, with or without a mortgage, purchasing a home universally increases households' lifetime welfare. Although we find

that homeownership reduces wealth inequality in general, our results also highlights the uneven wealth influence from housing due to wealth, labor income, and the timing of purchase.

3 Data

Our main data source is the Macrohistory Database by Jordà et al. (2019). The database includes novel historical housing market data from (Knoll et al., 2017), enabling us to study life cycle portfolio allocation involving the housing market from a long-run perspective.[8]

Specifically, the Macrohistory Database provides macroeconomic indices, including 10-year government bond return, consumer price index, exchange rate from local currency to US dollar, housing capital appreciation, housing rent return, labor wage, long-term interest rate, short-term interest rate, stock market return, stock dividend return, and treasury bill rate. The data spans from 1870 to 2020 across 18 developed countries, covering Australia, Belgium, Canada, Switzerland, Germany, Denmark, Spain, Finland, France, the UK, Ireland, Italy, Japan, Netherlands, Norway, Portugal, Sweden, and the US. Although the database does not start all at the same time across indices, assets, and countries, the time series are continuous once they begin. Our choice of data is consistent with the literature focusing on the long-run macroeconomic series (Krishnamurthy and Muir, 2025; Muir, 2017). Because the data availability is limited for Canada and Ireland, we exclude them from our simulations.

3.1 Overview of Returns: Housing as A Better Bond-Like Asset

[Insert Table 1 Here]

To provide a first look at the housing investment, we focus on the portfolio performance without detailed life cycle setup and provide a simple performance summary of the three portfolio strategies through stationary block bootstrap simulation: all-equity, 50% stock + 50% house, and 50% stock + 50%

[8] In general, Jordà et al. (2019) estimate bill returns with money market rates or deposit rates of banks when treasury bills are not available. They consider a large sample of 10-year bonds that are likely to be held by the representative household. The stock market returns are collected from multiple sources, including economic and financial history journals, yearbooks, stock exchanges, newspapers, and company reports. The house prices from Knoll et al. (2017) are based on the work of Knoll (2017), who collected the house prices from more than 60 different sources. Other macroeconomic data are primarily from journal publications, central banks, national statistics bureaus, institutions such as the International Monetary Fund, and statistics publications. See Jordà et al. (2019) and Knoll (2017) for details.

bond. We simulate 75 years and 1,000,000 households. The initial wealth is 1. Figure 3 shows the mean and standard deviation of log wealth over time for the three strategies. The all-equity strategy has both highest mean and standard deviation, while the 50% stock + 50% bonds strategy has both lowest mean and standard deviation. The housing investment strategy has a mean between the all-equity and the 50% stock + 50% bond strategy, and a standard deviation quite close to the 50% stock + 50% bond strategy. The result indicates that the housing is a better bond-like asset.

[Insert Figure 3 Here]

4 Life Cycle Model Simulation

4.1 Simulation Overview

Through the analysis of households' life cycles, we assess different life cycle investment strategies involving homeownership and financial assets. We consider a discrete-time life cycle model that accounts for households navigating changing economic environments. We follow Guvenen et al. (2021) for the labor income before retirement to capture various income risks, and households receive a social security income after retirement.

To maintain the long-run multivariate time-series autocorrelation of different markets in the economic environment, we implement a stationary block bootstrap approach (Anarkulova et al., 2023; Politis and Romano, 1994). For each household in our simulations, we repetitively draw economic environment observations in blocks until we cover the entire life cycle of the household. Each block is a realization of the economic environment of several consecutive years from the same country. The length of each block follows a geometric distribution with a mean of $T_s = 10$ years. The flexibility offered by the simulation allows us to impose a comprehensive set of decision rules that mimic real-world household choices. With the simulated household life cycles, we analyze the life cycle investment strategies characterized by homeownership access and home purchase strategies. Each home purchase strategy is characterized by a unique combination of down payment and additional purchase threshold.

To evaluate the economic performance of strategies with homeownership access, we compare each such strategy with its corresponding benchmark strategy. The benchmark strategy mirrors the

working-life consumption of the homeownership strategy but invests exclusively in the stock market index and rents throughout the life cycle. We repeat the process for 1,000,000 times to draw a generalizable conclusion. Our choice of benchmark is motivated by literature. Anarkulova et al. (2023) conduct a comprehensive search for the best investment strategies for life cycle investors covering stocks, bonds, bills, and different retirement investment funds. They show that the all-equity strategy is among the best-performing strategies in wealth accumulation and risk-return trade-off.

[Insert Table 2 Here]

First, we consider the strategies with single-home ownership, where the household can at most purchase one home. We refer to the households in strategies with homeownership access (homeowner strategies) as "homeowners" and those of corresponding benchmark strategies (all-equity strategies or renter strategies) as "renters". Note that homeowners have access to the housing market but do not necessarily own homes. We refer to homeowners actually owning homes *actual* homeowners. Next, to offer broad insights into the economic effects of homeownership, we also consider the second-home ownership in our simulations. In this situation, we compare the second-home ownership strategies with the single-home ones.

4.2 The Economy

For generalizability of our conclusions, we primarily focus on simulations using global data. Specifically, in our main results, we simulate households using historical market data spanning 150 years across multiple countries to mitigate concerns about "lucky" market (Anarkulova et al., 2022). The household strategies are designed to reflect the behavior of U.S. households. Additionally, for robustness, we report the performance of simulations based solely on regional data, such as U.S. historical data. We introduce our economic setup below.

Households A household is born as a couple of life cycle investors. To simplify the consideration of longevity risk, we consider households of a male and a female. Note that the income process and the longevity are simulated at the individual level. [9] In each period (denoted by t) during the working life, a

[9]We follow the U.S. Social Security Administration (SSA) to define an individual's longevity risk according to the age of the individual. See the actuarial life table with death probabilities here: https://www.ssa.gov/oact/STATS/table4c6.html.

household (denoted by i) earns labor income and makes decisions regarding consumption, investments in stocks, and housing. A household will retire at age 65. In the retirement years, the household receives retirement income and consumes wealth portfolio. Each individual starts at age 25 ($t = 0$) and lives for at most $T = 75$ years until age 100. A household ceases to exist when both of the individuals pass away.

Regardless of access to homeownership or the strategies adopted, all households begin their life cycles as renters. During this renting phase, each household saves 10% of its labor income and consumes the remainder. Consumption generates welfare gains, while wealth at death contributes to household welfare through the bequest motive. Households in homeowner strategies enters the housing market once they meet the qualifications for home purchase.

Markets We consider a financial market with stocks, a housing market with housing capital, and a credit market with a 30-year fixed-rate mortgage (FRM) and a fixed-rate lump sum reverse mortgage (FRRM). Households can participate in these markets and are provided with individual prices including the stock return r^s_{it}, the bond return r^b_{it}, the housing capital return r^h_{it}, the rental yield r^c_{it}, the mortgage rate r^m_{it}, and the reverse mortgage rate r^{rm}_{it}. The joint distribution of the returns, House-price-to-income ratio (HPI) r^{hpi}_{it} and inflation rate r^d_{it} is given by:

$$\{(r^s_{it}, r^b_{it}, r^h_{it}, r^c_{it}, r^{hpi}_{it}, r^d_{it})\}_{t=1}^{T} \sim \tilde{F}, \tag{1}$$

$$r^m_{it} = r^b_{it} + \text{mortgage spread}, \tag{2}$$

$$r^{rm}_{it} = r^b_{it} + \text{reverse mortgage spread}, \tag{3}$$

where $\tilde{F}$ denotes the distribution from the simulation.

We use the HPI and labor income to determine each household's home value at purchase. The holding period return of the housing capital is then determined by the housing capital return r^h_{it}. Homeowners must pay a per-period maintenance cost $c_m H_{it}$, where H_{it} is the house value and c_m is the maintenance cost rate, and will receive the rental yield $r^c_{it} H^v_{it}$ if they have a second vacant home for lease with a housing capital H^v_{it}. We set maintenance costs (property tax, fees to Homeowner Association or HOA, home insurance, and regular maintenance and repair, etc.) to 2.5% of the home value in our simulations. Note that we do not impose any tax from holding stocks. In real life, even with

common retirement saving accounts, households have to pay the deferred tax when they take out their savings. If homeownership positively influences life cycle wealth accumulation, the exclusion of tax from stock holdings would make the economic size downward biased.

On the other hand, renters must pay the rental cost $r_{it}^c P_{it}^h$, where P_{it}^h is the price of one unit of housing capital. Additionally, we introduce transaction costs for the housing market. Households must pay c_h of the house value when purchasing or selling a home. We set the transaction costs (legal fees, broker commission, loan origination fees, etc.) to 3% of the home value in our simulations.

Labor Income We assume that a couple within a household has independent labor income. The labor income Y_{it} of each individual during the working life follows Guvenen et al. (2021) to incorporate individual heterogeneity, permanent and transitory shocks, and unemployment shocks:

$$Y_{it} = (1-\gamma_{it}) e^{g(t)+\alpha_i+\beta_i t+z_{it}+\varepsilon_{it}}, \tag{4}$$

$$\text{where } z_{it} = \lambda_z z_{it-1} + \nu_{it}, z_0 \sim N(0, \sigma_{z_0}^2) \tag{5}$$

$$\nu_{it} \sim \begin{cases} N(\mu_{\nu 1}, \sigma_{\nu 1}^2) & \text{with probability } p_\nu, \\ N(\mu_{\nu 2}, \sigma_{\nu 2}^2) & \text{with probability } 1-p_\nu. \end{cases} \tag{6}$$

$$\varepsilon_{it} \sim \begin{cases} N(\mu_{\epsilon 1}, \sigma_{\varepsilon 1}^2) & \text{with probability } p_\varepsilon, \\ N(\mu_{\epsilon 2}, \sigma_{\varepsilon 2}^2) & \text{with probability } 1-p_\varepsilon. \end{cases} \tag{7}$$

$$\gamma_{it} \sim \begin{cases} 0 & \text{with probability } 1-p_v(t, z_{it}), \\ \min(1, \exp(\lambda_\gamma)) & \text{with probability } p_v(t, z_{it}). \end{cases} \tag{8}$$

$$p_v(t, z_{it}) = \frac{1}{1+\exp(-\xi_{it})}, \quad \xi_{it} = a_\xi + b_\xi t + c_\xi z_{it} + d_\xi t z_{it}. \tag{9}$$

In the above income process, γ_{it} is the unemployment duration. t is the normalized age ($t = (\text{age} - 24)/10$). $g(t)$ is a quadratic function of t ($g(t) = a_0 + a_1 t + a_2 t^2$), which captures the labor income common to all individuals. (α_i, β_{it}) determine ex-ante earnings heterogeneity of the level and the growth and is drawn from a bivariate normal distribution with zero mean and estimated covariance matrix from Guvenen et al. (2021). z_{it} is the persistent shock to individual earnings following a normal distribution with zero means, and ν_{it} is the innovation to the persistent shock drawn from the mixture

of two normal distributions. ε_{it} is the transitory shock to the labor income also drawn from the mixture of two normal distributions. p_v characterizes the probability of unemployment.

Supplemental Security Income We also consider supplemental security income as a part of the income process. The Supplemental Security Income (SSI) in our model is only available for renters who cannot afford the minimum consumption level with all available resources, and will supplement the household's income to exactly meet the minimum consumption level. The minimum consumption level in 2024 is \$11316 for an individual, and an additional \$5664 will be added for a spouse. If a homeowner cannot afford the minimum consumption level with all available resources, the household must liquidate its home or default on its home mortgage, after which the household becomes a renter.

Retirement Income Retirees in our economy have two main income sources: Social Security Income (SS) and withdrawal from the liquid wealth. The SS is assumed to be exogenous and deterministic, specified as a constant fraction λ of the labor income in the last working period,

$$Y_{it} = \lambda Y_{iR-1}, \quad t \geq R, \tag{10}$$

where the retirement period $R = 40$, corresponding to the retirement age 65.

Aside from SS, households withdraw from their wealth portfolio to cover their retirement consumption. Specifically, the households follow the popular 4% rule and withdraw 4% of their wealth evaluated annually. When their current 4% wealth is below the 4% wealth in the year when they retire, the households will take reverse mortgage, sell their home, and exhaust their economic resources to cover their consumption, after which they will live on minimum consumption provided by the SSI.

Reverse Mortgage To fully capture the effect of housing investment, we introduce the reverse mortgage (ERM) in our model, which allows the household to borrow against the home equity after retirement. We only consider a lump sum FRRM, which means that the household receives a lump sum payment at the origination period of ERM, and the balance of ERM increases with a fixed rate. ERM will not require any repayment until termination when the household dies, sells the home, or no longer lives in the home as their primary residence. The household can choose to repay the ERM with the house

equity at termination, and the remaining balance beyond the home value will be insured. Therefore, ERM is costly, and we follow the real market to set an initial and annual costs for ERM.

In addition, ERM constrains how much households can borrow against their home equity. We follow the Reverse Mortgage for Seniors (HECM) program of Federal Housing Administration (FHA) to set the percentage of home value that households can borrow, i.e., the principal limit factor (PLF).[10] The PLF is jointly determined by the age of the youngest borrower and the interest rate, which is the bond rate in our model.[11]

Wealth Portfolio The wealth portfolio return R^p_{it} is given by:

$$r^p_{it} = \alpha_{it} r^s_{it} + (1 - \alpha_{it}) r^b_{it}, \tag{11}$$

where α_{it} is the stock share in the portfolio. Therefore, the terminal real wealth (W_{it}) of household i at period t is:

$$W_{it+1} = (1 + r^p_{it}) \left(\frac{W_{it}}{1 + r^d_{it}} + Y_{it,1} + Y_{it,2} - C_{it} + \varphi_{it} - \phi_{it} \right), \tag{12}$$

where $Y_{it,1}$ is the labor income from the household head, $Y_{it,2}$ is the labor income from the spouse if applicable, φ_{it} is other cash inflows including rental income (if there is a second home), payments from mortgage and reverse mortgage, and SSI, and ϕ_{it} is the life cost including mortgage payments, housing maintenance for owners or rental payments for renters, and transaction costs.

Welfare A household i value of a strategy π_j ($V_{it}(\pi_j)$) consists of the CRRA utility flow from consumption C_{it} and a bequest motive, with a relative risk aversion coefficient δ and bequest parameters (a_q, b_q):

$$V_{it}(\pi_j) = \sum_t^T \frac{\left(C_{it}(\pi_j)/\sqrt{N_{it}}\right)^{1-\delta}}{1-\delta} + a_q \frac{(W_{it}(\pi_j) + b_q)^{1-\delta}}{1-\delta}, \tag{13}$$

[10] See the precomputed PLF tables: https://www.hud.gov/program_offices/housing/sfh/hecm/.

[11] In our simulations, individuals in a household have the same age.

where N_{it} is the number of alive household members and W_{it} is the terminal wealth for household i at period t. A strategy π_j includes the rule of consumption, investment in liquid assets, and housing capital, which will be detailed in the following section. We consider the inflation risk in our model, and all the variables are in real terms of 2024 U.S. dollars.

4.3 Strategies

Households all start from zero wealth and make life cycle investment decisions at each period. Specifically, we construct strategies as the following four parts.

Consumption and Financial Investment Before retirement, households save 10% of net labor income (labor income minus costs) and consume the rest. We follow the popular 4%-rule and assume that retirees consume the greater of either 4% of their financial wealth at the time of retirement or 4% of their current financial wealth (Bengen, 1994; Choi, 2022). Households invest all financial wealth in stocks. The saving rules and the consumption rules are consistent with Anarkulova et al. (2023).

Home Purchase The home purchase rules are set to imitate the real world. We assume that a household would purchase a home when the following two conditions are simultaneously satisfied: 1. the household's financial wealth reaches a certain threshold and 2. the household has enough labor income to afford the mortgage. We consider different combinations of down payment (10%, 20%, 30%, 40%, 50%, and 100% of the home value), purchase thresholds (10%, 20%, 30%, 40%, and 50% of the home value), and the popular Payment-to-Income (PTI) ratio of at most 1/3. The PIT rule requires the household spends at most 1/3 of its labor income on the mortgage payment. For strategies considering access to a second home, if the household decides to purchase a second home, we require the household to fully pay off its current mortgage before leveraging up for the second home.

Reverse Mortgage Senior households will earn less labor income and have a higher chance of financial distress. We consider the reverse mortgage as a way to unlock the housing capital and maintain the consumption level. We assume that a household will take a reverse mortgage when it expects to be unable to afford the current consumption level in next three years. Households are only available to take reverse mortgage after retirement and will not repay the reverse mortgage unless they have to

liquidate the home. We assume households will only take reverse mortgage on the first home, since the ERM market generally requires the primary residence to be the collateral. We also assume that households will borrow the maximum amount of reverse mortgage according to the PLF constraints.

Liquidation Due to the illiquidity of the housing investment, households may face financial difficulties and have to liquidate their homes. We consider two liquidation rules. A household will liquidate its home 1. when the current loan-to-value (LTV) ratio is above 1.5 or 2. when its total liquid wealth (financial wealth from the last period plus labor income in the current period) cannot afford the minimum consumption level. If the household owns a second home, it will liquidate any home with a LTV above 1.5. When in financial difficulties, the household can liquidate one home first and become a single-home owner. If it is still necessary, the household will liquidate the other home to make sure the consumption need is satisfied.

Households may liquidate their homes by either selling or defaulting on their mortgage. We assume that households will choose to sell their homes if the profit and loss (P&L) from the sale is positive; otherwise, they will default on the mortgage. Defaulting will negatively impact the household's credit history, preventing them from obtaining a mortgage in the future.

4.4 Benchmark Strategy

In our analysis of the simulated households, we force the renters to exactly replicate the consumption of the homeowners in working life. This can be achieved since we evaluate the strategies over the same simulated household life cycles. In other words, after a simulated household becomes qualified for home purchase, the sum of the corresponding renter's rental payment and investment in financial assets matches to the sum of the homeowner's mortgage payment and investment in financial assets. This setup allows us to perform head-to-head comparisons in the economic effects and avoid viewing homeownership as a commitment vehicle of long-run investments. In particular, for example, in the situation where the rent payment on average is lower than the mortgage payment, homeownership can potentially become an investment commitment vehicle. This induces difficulty in the attribution of economic effects. We cannot conclusively determine whether the economic gains from homeownership stem from the investment strategy itself or from the increased amount of capital that households

invest over their life cycle. Through the replication of consumption, we avoid this concern.

4.5 Parameterization

We follow De Nardi et al. (2010) and Anarkulova et al. (2023) to specify risk aversion coefficient $\delta = 3.84$, bequest intensity $a_q = 2,360$, and bequest curvature parameter $b_q = \$490,000$ in 2024 U.S. dollars. The labor income is specified as in Guvenen et al. (2021), summarized in Table 3, and scaled to match the level of average log earnings in 2024 dollars. We specify the mortgage spread to be 1.85% and the reverse mortgage spread (including an annual fee) to be 3.35%, estimated by the average spread over the U.S. monthly historical data from 201601:202405. In addition, Jordà et al. (2019) only provide wage index and housing price index normalized to be 100 in 1990. Thus, we rescale the HPI to match 4.14 in 1990 from the U.S. data.

[Insert Table 3 Here]

5 Results

In this section, we evaluate the simulation outcomes for households implementing different life cycle strategies. Our simulations explore a grid of homeowners' purchase thresholds and down payment options, comparing the performance of these strategies with their respective all-equity (rent-for-life households') strategies. We focus on the stock market indices as the financial assets accessible to households because of the documented merits of stocks over the other assets, including bonds, bills, and other common retirement investment strategies such as Target Date Funds (TDF) (Anarkulova et al., 2023).

Specifically, our simulations cover combinations between down payment of 10%, 20%, 30%, 40%, 50%, and 100% of the home value at the time of purchase and extra purchase thresholds of 10%, 20%, 30%, 40%, and 50% of the home value at the time of purchase. For example, with a 20% down payment and a 30% extra purchase threshold, a household will only purchase a home when its financial assets' value reaches 50% (=20%+30%) of the home value. The situations of 100% down payment represent cash purchase in our simulations.

We examine the wealth effect through lifetime wealth accumulated until death and the welfare changes according to equation 13. To ensure the comparison is head-to-head, we match the two groups—homeowner strategies and benchmark renter strategies—on working-year consumption and thus the allocation of economic resources between financial assets and housing. This match is based on the same simulated household life cycle. In other words, if there is any positive economic effect due to homeownership, it is not driven by homeownership's commitment vehicle effect. Because homeowners and renters of the corresponding strategies share the matched working-life consumptions, we only calculate utility changes for the retirement life.

In section 5.1, we report the life cycle economic effects of homeownership in wealth accumulation and welfare enhancement. We also highlight the wealth preservation effect of homeownership and homeownership's influence on wealth inequality. Section 5.4 discusses the attribution of the economic gains from homeownership. We analyze the intertemporal transition and the contribution to welfare enhancement from consumption and bequest. We provide granular insights of the economic effects in section 5.5. Until 5.5, we only allow homeowners to purchase at most one home. Since the economic effects are primarily positive for the single-home ownership, we report an additional set of results investigating the economic effects of owning a second home in section 5.6.

5.1 Economic Gains

Table 4 reports the life cycle economic gains in wealth and welfare attributable to single-home ownership. The wealth effect is examined with households' mean wealth at death. First, we calculate the mean wealth for each homeowner strategy. Second, we calculate the mean wealth for the corresponding benchmark all-equity strategy. Next, for each homeowner strategy, we calculate the net percentage ratio between the mean wealth of owning a home and the mean wealth of all-equity strategy. Finally, we calculate the percentage changes, i.e., wealth gains and losses, for all homeowner strategies against their benchmark all-equity strategies. Specifically, we define wealth change as

$$\Delta \bar{W}_{\tau,j} = \frac{\bar{W}_{\tau,j}}{\bar{W}_{\tau,equity}} - 1, \tag{14}$$

where $\bar{W}_{\tau,j}$ is the mean dollar-value wealth of homeowner strategy j at households' life cycle time $\tau \in \{\text{retirement, death}\}$ and $\bar{W}_{\tau,equity}$ is the mean dollar-value wealth of all-equity strategy at the corresponding life cycle time τ. Note that the means are calculated across the household i's in our simulations.

Panel A in Table 4 shows the change of wealth accumulation attributable to adding the homeownership into households' investment opportunity set. Despite the historical underperformance of the real estate market relative to the stock market and the prevailing skepticism among experts regarding housing as an investment, most investment strategies with access to the housing market demonstrate significant improvements in life cycle wealth by the end of the household's life (Eicholtz, 1997; Shiller, 2015). On average, for instance, a homeowner can achieve a 9.6% increase in wealth accumulation by making a 20% down payment for the home purchase under a 50% purchase threshold. This threshold requires the household to delay its home purchase until it accumulates financial assets equivalent to 50% of the home's value.

The wealth effect seems limited in the situations where the household purchases home with small holdings in financial assets. In the case of home purchase with 10% purchase threshold, we observe near-zero wealth gains. In other words, our results emphasize that the wealth gains are likely to accrue primarily to wealthier households capable of delaying home purchases by saving a larger portion of their labor income in financial assets. This higher purchase threshold, however, may prevent the actual homeowners from transitioning into a wealthy hand-to-mouth existence (Kaplan et al., 2014).

[Insert Table 4 Here]

Following Anarkulova et al. (2023) and Duarte et al. (2022), we adopt the utility function as described in equation 13. Households gain utility from consumption and bequest motive. To further assess the life cycle investment strategies, we compare the welfare level of the homeowner strategies against the their corresponding all-equity strategies. Our arrangement of the welfare evaluation is designed to understand (1) whether homeownership can increase welfare and (2) the contribution from consumption and bequest motive to the welfare change. To measure the welfare change, we define the equivalent wealth V of a utility level U as :

$$V = ((1-\delta)U)^{1/(1-\delta)}. \tag{15}$$

We compute the change in equivalent wealth for comparison:

$$\Delta \bar{V}_{\tau,j} = \frac{\bar{V}_{\tau,j}}{\bar{V}_{\tau,equity}} - 1, \tag{16}$$

where $\bar{V}_{\tau,j}$ is the mean equivalent wealth of homeowner strategy j at households' life cycle time $\tau \in$ {before retirement, after retirement, lifetime (at death)} and $\bar{V}_{\tau,equity}$ is the mean equivalent wealth of all-equity strategy at the corresponding life cycle time τ. Note that the means are calculated across the household i's in our simulations.

We report homeowners' welfare gains by the end of their life cycles relative to renters' in Panel B of Table 4. Since we enforce a head-to-head comparison and match working-year consumptions between homeowners and their benchmark renters, the welfare evaluation is focused on the retirement life until death. Consistent with our wealth evaluation, the welfare changes due to the access to homeownership are universally positive. The highest increase in welfare is from the strategies of moderate level of down payments, which emphasizes the effect of the "right" level of home mortgage leverage. In addition to the evaluation of welfare at death, we also trace the welfare to consumption and bequest motive. We discuss the details in 5.4.

In Panel C to Panel G of Table 4, we repeat our analysis but focus on specific regions. Our analysis confirms the generalizable conclusions we learn from the global data. Moderate leverage levels and extra financial assets uniformly deliver the best wealth gains across the U.S., the U.K., and the Europe. Of the three regions, the U.S. households enjoy the highest wealth gains of up to over 10% throughout the life cycle, while access to homeownership leads to the lowest wealth gain in the U.K. for households purchasing homes with 10% down payment and 10% purchase threshold. The regional results also show wealth enhancement consistent to our main results. Highest welfare gains still come from moderate leverage levels. If households purchase homes with low leverage, then the welfare improvement will increase with the purchase threshold, i.e., households will benefit from delaying their home purchase and increasing their holdings of financial assets.

Our analysis in Table 4 compares homeowner strategies with their corresponding renter strategies. The results demonstrate that homeowner strategies, on average, yield superior outcomes relative to renter strategies. Building on these findings, we next investigate the optimal homeowner strategy among households that purchased homes in the homeowner economies. In Table 5, we present the life

cycle gains of actual homeowners compared to their corresponding benchmark renters. Two key findings emerge from this analysis. First, actual homeowners derive substantial benefits from homeowner strategies, achieving wealth gains and welfare improvements at death exceeding 100%. Second, consistent with our conclusions at the strategy level, the largest gains are associated with purchase strategies characterized by low purchase thresholds. Delaying home purchase is shown to substantially diminish the benefits in terms of both wealth accumulation and welfare enhancement.

[Insert Table 5 Here]

5.2 Downside Risk

We adopt maximum drawdown as a main metric to evaluate the downside risk of life cycle wealth portfolio. Consistent with our prior analysis, We compare the wealth portfolios of homeowners—who invest in financial assets and have the access to purchase homes—with the wealth portfolios of renters adhering to a benchmark all-equity strategy. To assess the impact of homeownership on wealth preservation, we calculate the changes in maximum drawdowns as the differences between the maximum drawdowns of homeowners' wealth portfolios and those of renters' wealth portfolios. In Table 6, we report the changes by the end of the life cycle, during the working life, and after the retirement.

Our results indicate that the maximum drawdown generally decreases when homeownership is allowed. The magnitude is sizable: Around 10%-13% over the life cycle. The reduction in downside risk is more pronounced for home purchase through moderate leverage. Although higher purchase thresholds result in increased holdings of financial assets, they are associated with greater improvements in the downside risk protection of wealth portfolios. Moreover, the magnitude of these improvements in downside risk mitigation may exhibit opposing trends before and after retirement. For example, as the purchase threshold increases, households buying homes with a 10% down payment experience greater downside risk protection before retirement but reduced downside risk protection after retirement. Together, Table 4 and Table 6 provide robust evidence that access to homeownership enhances households' economic benefits and strengthens the preservation of wealth.

[Insert Table 6 Here]

5.3 Wealth Inequality

Since homeownership protects the households from the downside risk and a portfolio with 50% stocks and 50% housing leads to lower wealth portfolio volatility (see Section 3), we hypothesize that one of the social consequences of access to homeownership can be the improvement of wealth inequality. To examine whether this is the case, we regard individual life cycle strategies as separate economies and adopt Gini Index as the tool to measure the economies' wealth inequality. Then, we analyze whether there exists any improvement among the homeowner strategies relative to all-equity investments. Specifically, we compare different strategies' wealth inequality at retirement. The comparison of wealth inequality at retirement is more appropriate in this case as households face longevity risks and their life expectancy can lead to ambiguities in the interpretation of wealth inequality at death. We define the Gini index as:

$$G_j = \frac{\sum_{m_i=1}^{n} \sum_{m_j=1}^{n} \left| y_{m_i} - y_{m_j} \right|}{2n \sum_{m_i=1}^{n} y_{m_j}}, \tag{17}$$

where n is the total population, 1,000,000 in each of the investment strategies, y_{m_j} is the wealth at retirement of household m_j implementing life cycle investment strategy j. As with the other comparisons, we focus on assessing whether the wealth inequality of households with access to homeownership is reduced compared with the wealth inequality of all-equity households. Table 7 reports the percentage changes in wealth inequality.

[Insert Table 7 Here]

We observe an universal improvement in wealth inequality at retirement across all the purchase strategies. For high leverage home purchase, we document that wealth inequality is mostly improved with low extra purchase threshold, since lower extra purchase threshold leads to less allocation to financial assets. The highest wealth inequality reduction of over 15% compared with all-equity strategy is observed in the cases of cash purchase and purchase using 50% down payment. Our results indicate that the best wealth inequality improvement can be found through the search of the optimal combination of down payment level and purchase threshold. The wealth inequality problem has been long-standing in the U.S. since the late 1970s (Wolff, 1992). Our findings highlight the importance for the society to expand the access to homeownership. As what Bhamra and Uppal (2019) documents,

"financial markets are not a mere sideshow to the real economy". Homeownership supplies to the homeowners not only the housing functionality. It enhances households' wealth and welfare, besides which it significantly reduces wealth inequality.

5.4 Performance Attribution

So far, we document substantial economic gains due to the access to homeownership. What are the costs that the households have to pay to enjoy the economic benefits? What contributes to the improvement of life cycle welfare? To answer these questions, we examine the changes in pre-retirement wealth, financial asset holdings, and the welfare changes in consumption and bequest motive.

First, we investigate the changes in wealth at retirement and the wealth shifts in financial assets. Table 8 reports our findings. We repeat the wealth accumulation calculation as in equation 11 for households in their retirement years and calculate the worth of their holdings in financial asset. Panel A in Table 8 indicates that the wealth accumulation of homeowner strategies is significantly slower than the all-equity strategies before the homeowners retire. The reduction in wealth accumulation before retirement is more severe among the homeowners who purchase home early and take high leverage. The reduction in wealth accumulation before retirement is significantly lower among the homeowners who purchase their homes with cash. This finding highlights the intertemporal transition of wealth, i.e., the wealth gains at death is potentially caused by the wealth loss during the working years. The wealth loss during the working years is the most pronounced among the low income households that cannot purchase their homes without high leverage, which explains the observation in Table 4.

Our findings in Panel B and C of Table 8 indicate that there is a consistent decrease in financial assets upon retirement, which is expected. Prior to purchasing a home, financial assets, such as stocks, serve as the primary form of wealth storage in our economy. As households prepare to buy a home, they tend to sell off their stocks. This mechanical substitution effect aligns with existing literature (Becker and Shabani, 2010; Cocco et al., 2005; Vestman, 2019; Yao and Zhang, 2004). However, our results offer novel insights into the relationship between substitution and the purchasing decision. Although financial asset holdings universally decrease across the homeowner strategies relative to their corresponding all-equity strategies at about the same level, the overall lifetime reduction in financial asset holdings is significantly lower than that before the retirement. Across the strategies, most homeowners catch

up in their financial asset holdings after they retire relative to the renters. Homeowners that are able to save up 50% extra financial assets before home purchase eventually erase the difference in financial asset holdings by the end of their life cycles relative to the renters. This is mechanically decided by the life cycle investment strategies, since we follow the literature and adopt the 4% rule of post-retirement withdrawal from wealth (Anarkulova et al., 2023). As the withdrawal only applies to the financial assets, the benchmark renters would thus consume more during the retirement life relative to the homeowners, which effectively reduces wealth accumulation in financial assets.

[Insert Table 8 Here]

Next, where do the welfare gains come from? We analyze the welfare gains of the homeowner strategies during the life cycle from the two sources as outlined in equation 13: Consumption and bequest motive. We investigate the welfare changes attributable to these sources separately. Since homeownership is a type of illiquid asset along with both the upfront down payment and the commitment to the long-lasting mortgage payments, the literature highlight the consumption reduction (Campbell, 2006; Choi, 2022; Kaplan et al., 2014). In contrast to the literature, our results in Table 9 show that the primary source of welfare enhancement is bequest motive, while the consumption also makes significant contributions to welfare improvement.

[Insert Table 9 Here]

5.5 Within-Strategy Heterogeneity

Table 4 illustrates the heterogeneity across the investment strategies characterized by leverage. Households wealthy enough to save up more financial assets enjoy the most of the wealth gains. Such finding implies strong heterogeneous influence of household profile on wealth accumulation. To precisely describe the heterogeneity across the household profiles, we focus on the life cycle investment strategy that allows the home purchase with 10% down payment and 10% additional purchase threshold and investigate the influence of labor income, home purchase price, and interest environment within the same life cycle investment strategy.

We report our results in Table 10. For brevity, we report wealth change at retirement, wealth change at death, and total welfare change by household profile. The benchmark strategy is the all-equity strategy with 10% down payment and 10% additional purchase threshold. Panel A in Table 10 shows that

labor income can alternate gains in wealth accumulation and welfare. Low labor income households benefit more in wealth accumulation from homeownership, while high labor income households benefit more in welfare enhancement from homeownership.

Panel B in Table 10 reports the results by household timing of purchase in house price to labor income (HPI) ratios. When housing price is high relative to labor income, households would consume less during the retirement life which enhances the wealth at death. The benefit from consumption smoothing also increases post-retirement welfare.

In our simulations, a household would face interest risk if it finances through mortgage for the home purchase. The mortgage rate is defined by a base interest rate and a interest spread as defined in equation 3. In Panel C of Table 10, we report our analysis of economic effects from homeownership by households' interest timing. We document that the economic benefits of homeownership are primarily concentrated around the home purchase time when the interest rate is moderately low. That is when the 10-year government bond return is about 2.85% to 3.34% on average in the world or about 2.39% to 2.81% in the U.S. During those periods, the mortgage rate in our setup ranges from 4.7% to 5.2% on average in the world and from 4.2% to 4.7% in the U.S. If a household enters the housing market during those periods, the household can accumulate 24% more lifetime wealth relative to its renter strategy. The welfare enhancement associated with the wealth gain is a shocking 48% increase. In summary, our results emphasizes the household profiles' influence on the economic effects from homeownership. In short, timing the housing market can be helpful for wealth gain and welfare enhancement. For the same strategy, low income household benefit the most in wealth accumulation while the high income household benefit the most in welfare improvement.

5.6 Second-Home Economic Effects

5.6.1 Second-Home Wealth Effect

Overall, our assessment of homeownership highlights its benefits. An important question arises: Do the benefits extend to a second home? In this section, we repeat our analysis but focus on the comparison between the single-home strategies, where households have access to purchase only one home, and the second-home strategies, where households have access to purchase two homes in a sequential order. For brevity, in this section, we consider the single-home strategy with 10% down

payment and 10% extra purchase threshold as the benchmark, and we report the results of purchase thresholds of 10%, 20%, and 30% for the second-home purchase.

Panel A (C) in Table 11 reports the wealth change at retirement (death) for second-home owners relative to single-home owners. Consistent with out single-home ownership findings, adding access to a second home shows generally additional negative impacts in wealth at retirement. For instance, with a 10% down payment and a 10% extra purchase threshold, there is a -5.74% wealth loss. However, we observe significantly increased wealth gains at death across the purchase strategies for the second-home ownership. With a 10% down payment and a 10% extra purchase threshold, households on average accumulate 8% more wealth at death. To the opposite of our findings in singe-home ownership, the wealth effect of the second home primarily accrue to the households that purchase the second home early without much additional financial assets, i.e., low purchase threshold. Combined with our observations in Panel A and Panel C, our results further highlight the intertermporal transition in wealth gains from the working life to the retirement life. Panel B (D) reports the primarily negative changes in financial asset holdings due to the introduction of access to the second-home ownership. In other words, the second-home ownership continues to lower households' investments in liquid assets. In unreported results, we verify the economic insights by fixing the second-home strategies to 10% down payment and 10% purchase threshold and examining the first-home strategies. Our conclusion stays completely the same.

[Insert Table 11 Here]

5.6.2 Second-Home Welfare Effect

We report the welfare assessment of the second-home ownership in Table 12. As with our wealth effect assessment, we analyze the welfare change of the second-home ownership strategies against the single-home ownership strategy with 10% down payment and 10% extra purchase threshold.

[Insert Table 12 Here]

Panel A in Table 12 examines the welfare change at death between the households with only access to the single-home ownership and the households having the option to access the second-home ownership. The results show that owning a second home typically does not lead to any change in the welfare over life cycle. Panel B and C uncovers the intertemporal transition in welfare behind the zero over-

all welfare influence. In particular, households with access to second-home ownership enjoys slightly higher working-life welfare relative to the benchmark single-home strategy, potentially due to the additional rent income. In exchange, the households face sizable welfare reduction after retirement. Such welfare loss can be as high as 9%. This is expected. Owning two homes, would substantially suppress the holdings in financial assets and reduce the consumption level in retirement life as depicted in figure 1. We also report the attribution of welfare change in Panel D and Panel E in Table 12. Bequest motive becomes the only positive contributor to second-home owners' welfare, while consumption reduces the life cycle welfare of second-home owners.

6 Conclusions

Contrary to popular expert advice that housing is a "disastrous" investment, this study shows that homeownership is beneficial for life cycle investors. Using stationary block bootstrap simulations, we estimate that homeownership increases households' life cycle wealth by up to 9% compared to renters adopting an all-equity strategy. Moreover, we observe universal welfare improvements among homeowners across household profiles, with an average life cycle welfare increase of up to 23% relative to all-equity investors.

The benefits are the most pronounced for households employing moderate leverage or holding extra financial assets. Among those households that adopt homeowner strategies and purchase homes, early home buyers achieve the largest gains in wealth and welfare by the end of their life cycles. These households experience wealth and welfare increases exceeding 100%.

Homeownership also enhances wealth preservation, as evidenced by lower maximum drawdowns of homeowners' wealth portfolios. Additionally, it significantly reduces wealth inequality: Households with access to homeownership exhibit 12—15% lower wealth inequality compared to renters. Within groups following the same life cycle investment strategy, the economic benefits of homeownership are further influenced by household profiles and the timing of home purchases.

However, homeowner strategies come with trade-offs during working life, including reduced wealth and lower holdings of financial assets. Unlike prior literature, our results show that the substantial welfare gains of households adopting homeowner strategies are driven significantly by increased consumption relative to benchmark renters, though bequest motive contributes more.

Purchasing a second home further boosts wealth but does not yield additional welfare gains. Delaying the purchase of a second home significantly diminishes the wealth benefits.

References

Anarkulova, A., Cederburg, S., and O'Doherty, M. S. (2023). Beyond the status quo: A critical assessment of lifecycle investment advice. *Available at SSRN*.

Anarkulova, A., Cederburg, S., and O'Doherty, M. S. (2022). Stocks for the long run? evidence from a broad sample of developed markets. *Journal of Financial Economics*, 143(1):409–433.

Becker, T. A. and Shabani, R. (2010). Outstanding debt and the household portfolio. *Review of Financial Studies*, 23(7):2900–2934.

Bengen, W. P. (1994). Determining withdrawal rates using historical data. *Journal of Financial Planning*, 7(4):171–180.

Bhamra, H. S. and Uppal, R. (2019). Does household finance matter? small financial errors with large social costs. *American Economic Review*, 109(3):1116–54.

Campbell, J. Y. (2006). Household finance. *Journal of Finance*, 61(4):1553–1604.

Choi, J. J. (2022). Popular personal financial advice versus the professors. *Journal of Economic Perspectives*, 36(1):167–192.

Cocco, J. F., Gomes, F. J., and Maenhout, P. J. (2005). Consumption and portfolio choice over the life cycle. *Review of Financial Studies*, 18(1):491–533.

Cochrane, J. H. (2022). Portfolios for long-term investors. *Review of Finance*, 26(1):1–42.

Dahlquist, M., Setty, O., and Vestman, R. (2018). On the asset allocation of a default pension fund. *Journal of Finance*, 73(4):1893–1936.

De Nardi, M., French, E., and Jones, J. B. (2010). Why do the elderly save? *Journal of Political Economy*, 118(1):39–75.

Diwan, R., Duzhak, E. A., and Mertens, T. M. (2021). Effects of asset valuations on u.s. wealth distribution. *Federal Researve Bank of San Francisco Economic Letter*.

Duarte, V., Fonseca, J., Goodman, A., and Parker, J. A. (2022). Simple allocation rules and optimal portoflio choice over the lifecycle. *Working paper, University of Illinois*.

Eicholtz, P. M. (1997). A long run house price index: The herengracht index, 1628-1973. *Real Estate Economics*, 25(2):175–192.

Fuster, A. and Zafar, B. (2016). To buy or not to buy: Consumer constraints in the housing market. *American Economic Review*, 106(5):636–40.

Gan, J. (2010). Housing wealth and consumption growth: Evidence from a large panel of households. *Review of Financial Studies*, 23(6):2229–2267.

Goodman, L. S. and Mayer, C. (2018). Homeownership and the american dream. *Journal of Economic Perspectives*, 32(1).

Guren, A. M., McKay, A., Nakamura, E., and Steinsson, J. (2020). Housing wealth effects: The long view. *Review of Economic Studies*, 88(2):669–707.

Guvenen, F., Karahan, F., Ozkan, S., and Song, J. (2021). What do data on millions of us workers reveal about lifecycle earnings dynamics? *Econometrica*, 89(5):2303–2339.

Herbert, C. E., McCue, D. T., and Sanchez-Moyano, R. (2014). Is homeownership still an effective means of building wealth for low-income and minority households. *Homeownership built to last: Balancing access, affordability, and risk after the housing crisis*, pages 50–98.

Herbert, C. E., McCue, D. T., and Sanchez-Moyano, R. (2016). Update on homeownership wealth trajectories through the housing boom and bust. *Working Paper of Joint Center for Housing Studies of Harvard University*.

Jordà, O., Knoll, K., Kuvshinov, D., Schularick, M., and Taylor, A. M. (2019). The rate of return on everything, 1870–2015. *Quarterly Journal of Economics*, 134(3):1225–1298.

Kaplan, G., Violante, G., and Weidner, J. (2014). The wealthy hand-to-mouth. *Working Paper, National Bureau of Economic Research*.

Knoll, K. (2017). Our home in days gone by: Housing markets in advanced economies in historical perspective. *Working Paper, Free University of Berlin*.

Knoll, K., Schularick, M., and Steger, T. (2017). No price like home: Global house prices, 1870-2012. *American Economic Review*, 107(2).

Krishnamurthy, A. and Muir, T. (2025). How credit cycles across a financial crisis. *Journal of Finance*.

Mian, A., Rao, K., and Sufi, A. (2013). Household balance sheets, consumption and the economic slump. *Quarterly Journal of Economics*, 128(4):1687–1726.

Muir, T. (2017). Financial crises and risk premia. *Quarterly Journal of Economics*, 132(2):765–809.

Pelizzon, L. and Weber, G. (2008). Are household portfolios efficient? an analysis conditional on housing. *Journal of Financial and Quantitative Analysis*, 43(2):401–431.

Politis, D. N. and Romano, J. P. (1994). The stationary bootstrap,. *Journal of American Statistical Association*, 89(1):1303–1313.

Shiller, R. J. (2015). *Irrational Exuberance: Revised and Expanded Third Edition*. Princeton University Press.

Venti, S. F. and Wise, D. A. (1998). The cause of wealth dispersion at retirement: Choice or chance? *American Economic Review*, 88(2):185–191.

Vestman, R. (2019). Limited stock market participation among renters and homeowners. *Review of Financial Studies*, 32(4):1494–1535.

Wachter, J. A. and Yogo, M. (2010). Why do household portfolio shares rise in wealth? *Review of Financial Studies*, 23(11):3929–3965.

Wolff, E. N. (1992). Changing inequality of wealth. *American Economic Review*, 82(2):552–558.

Yao, R. and Zhang, H. H. (2004). Optimal consumption and portfolio choices with risky housing and borrowing constraints. *Review of Financial Studies*, 18(1):197–239.

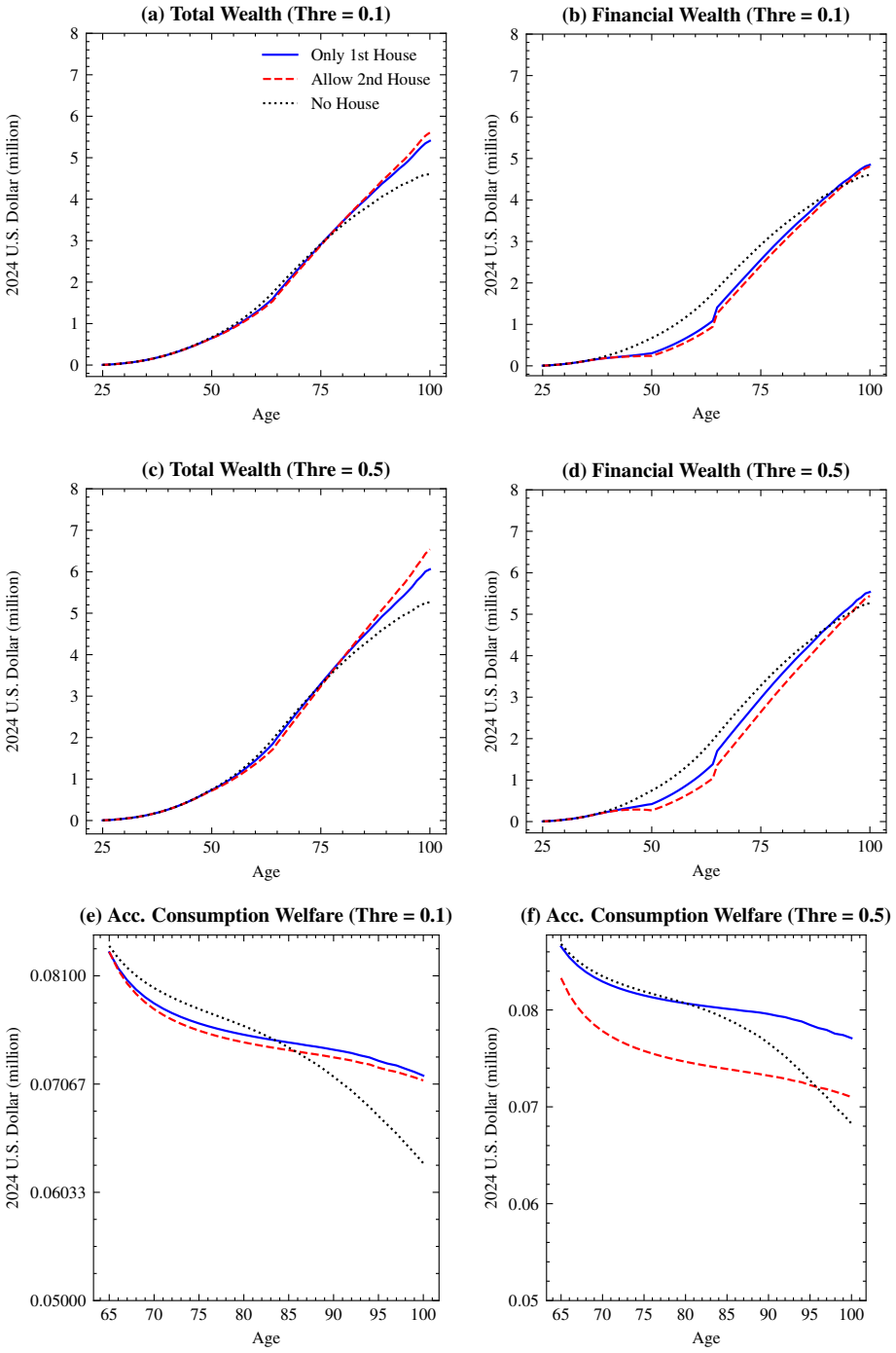


Figure 1: Household Age Profile over the Life Cycle

This figure presents the household age profile in wealth and consumption, comparing homeowners and renters. Wealth is plotted in millions of 2024 U.S. dollars. The analysis focuses on homeowner strategies where households purchase homes with a 10% down payment upon reaching additional wealth thresholds of either 10% or 50% of the home value. Results show that homeowners surpass renters in lifetime wealth, especially second homeowners, with earlier crossover at 50% threshold. Although homeownership reduces financial asset holdings initially, these holdings recover over time. At death, homeowners also experience higher consumption levels than renters.

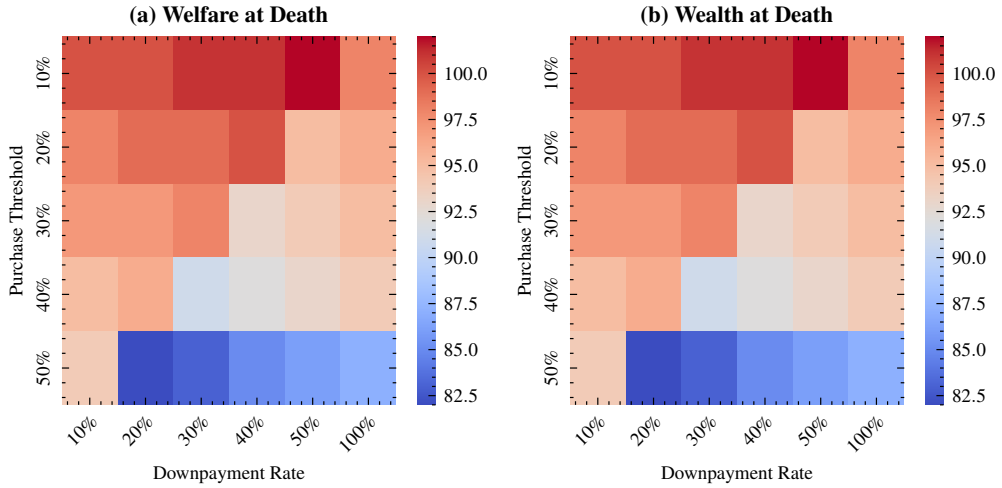


Figure 2: Optimal Life Cycle Homeownership Strategy

This figure reports the life cycle gains in welfare and wealth among actual homeowners who purchased homes in economies permitting single homeownership. The scales represent percentage increases compared to renters adopting all-equity strategies. Taking a retrospective perspective, we measure life cycle gains across combinations of purchasing thresholds, i.e., the money set aside as a percentage of the home price and the down payment as a percentage of the home price. The figure reveals that down payment levels have a nonlinear influence on life cycle gains. In general, for those who bought homes, down payments around 50% with low purchase thresholds (e.g., 10%) enhance life cycle gains from homeownership. These gains can exceed 100% for both welfare and wealth.

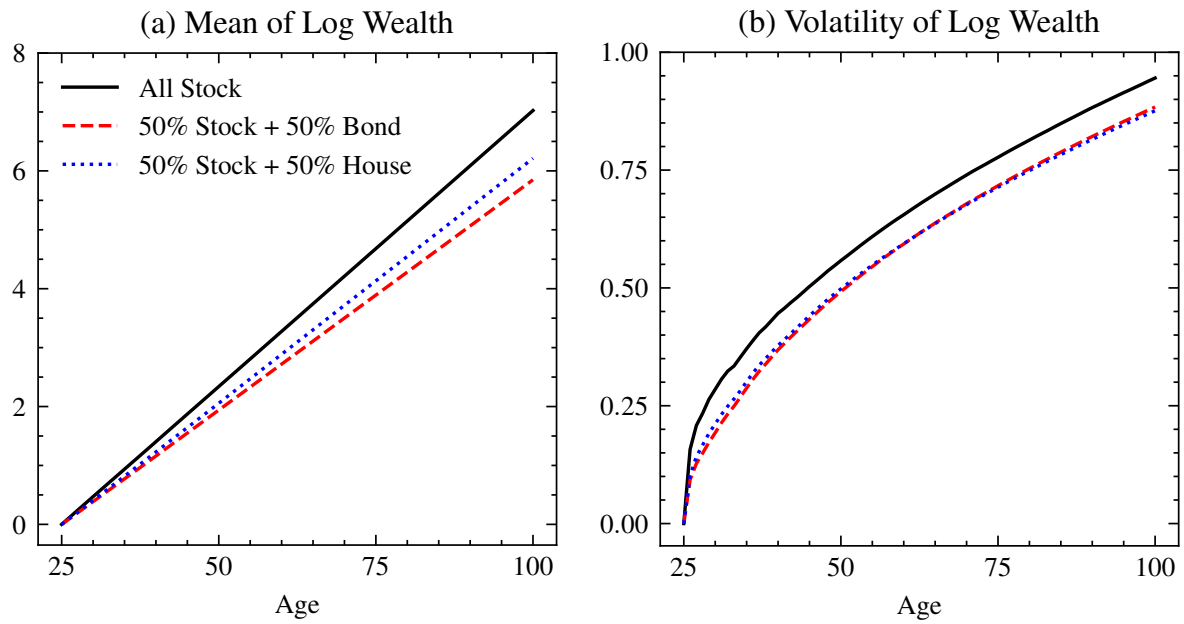


Figure 3: Mean and Standard Deviation of Log Wealth Over the Life Cycle

This figure presents the summary statistics of wealth in age profiles from 1,000,000 stationary bootstrap simulations with three life cycle investment strategies: (1) all-equity investment strategy, (2) 50% stock and 50% bond balanced investment strategy, and (3) 50% stock and 50% housing investment strategy. We plot the log-scale wealth accumulation and the wealth portfolio volatility of the log-scale wealth. The initial wealth is 1. The figure shows that the average wealth accumulation of the 50% stock and 50% housing investment strategy is faster than that of the balanced investment strategy while the volatilities of the two strategies are at the same level.

Table 1: Summary Statistics

This table reports the summary statistics of nominal returns across the countries spanning 1870 to 2020 from the Macrohistory Database.

	Mean	Std. Dev.	10%	25%	50%	75%	90%
Stock Return	0.1124	0.1770	-0.0960	0.0236	0.1068	0.1966	0.3640
House Return	0.0729	0.1533	-0.0129	0.0253	0.0529	0.1017	0.1487

Table 2: Simulation Steps

Step	Procedure
1.	Simulate the labor income process and life spans of 1,000,000 households. Households are born at age 25, retire at age 65, and face longevity risk with a maximum life span of 100 years.
2.	For each household, simulate the economic environment over its life cycle by sampling blocks of years from the Macrohistory Database. Each block consists of a random number of years from a geometric distribution with a mean of 10 years. If there is any surplus years in the last draw, we keep the first years that complete the life cycle.
3.	With the simulated households and the economic environments, we adopt different life cycle investment strategies characterized by access to homeownership and evaluate these strategies' economic performance. The evaluation of each home purchase strategy is based on a comparison with the corresponding benchmark renters' strategy: a strategy that mirrors the working life consumption and total investment and that allows no investment in homeownership, i.e., a household would rent for life.

Table 3: Labor Income Parameterization

This table presents the parameter specification for the labor income process in our life cycle simulations as characterized in equation 13. The parameters of the labor income process are estimated using real values with the year 2010 as the base year. The output labor income is then adjusted to 2024 U.S. dollars using the consumer price index (CPI).

Description	**Parameter value**
Deterministic part ($g(t)$)	$a_0 = 2.581,\ a_1 = 0.812,\ a_3 = -0.185$
Ex ante part (α, β)	$\sigma_\alpha = 0.3,\ \sigma_\beta = 0.196,\ \rho_{\alpha\beta} = 0.768$
Persistent shock (z_{it})	$\lambda_\nu = 0.959,\ p_\nu = 0.407,\ \sigma_{z_0} = 0.714,\ \mu_\nu = (-0.085, 0.058),\ \sigma_\nu = (0.364, 0.069)$
Transitory shock(ϵ_{it})	$p_\epsilon = 0.13,\ \mu_\epsilon = (0.271, -0.040),\ \sigma_\epsilon = (0.285, 0.037)$
Nonemployment part (γ_{it})	$\lambda_\gamma = 0.01\%,\ a_\xi = -3.036,\ b_\xi = -0.917,\ c_\xi = -5.397,\ d_\xi = -4.442$

Table 4: Life Cycle Gains

This table reports the mean household wealth change and welfare change of the homeowners relative to the renters from the stationary bootstrap simulations. We evaluate the difference in utility between the homeowners and the renters following equation 15. Since the simulations match pre-retirement consumption of homeowners to pre-retirement consumption of the corresponding benchmark renters, we compare only the post-retirement welfare. In the life cycle simulations, homeowners earn labor income during the working years and invest in financial assets (stocks). They purchase their homes when the value of their financial assets reaches a certain percentage of the home value. The percentage is jointly decided by the down payment ratio and an extra purchase threshold, i.e., a homeowner household will decide to purchase a home once the financial assets' value is higher than the sum of the down payment and the extra purchase threshold. The renters, however, only invest their income in financial assets (stocks). We report the mean wealth change of the homeowners relative to the all-equity-strategy renters because the literature documents that the simple all-equity strategy is the best life cycle investment strategy relative to other more popular strategies, such as TDFs. Panel A reports the lifetime wealth change evaluated at death, and panel B reports the lifetime welfare change evaluated at death. Panel C—G report the regional level results from simulations restricted to the US, the UK, and other European countries' data. Specifically, the European results are from the simulations restricted to data from Belgium, Denmark, Finland, France, Germany, Ireland, Italy, Netherlands, Norway, Portugal, Sweden, and Switzerland. A positive percentage indicates a gain from homeownership. Column "Down Payment" indicates the down payment ratio as a percentage of home value. Column "Threshold" indicates the extra purchase threshold on top of the down payment requirement as a percentage of home value. The wealth (welfare) change is calculated as the ratio of accumulative wealth (welfare) in the life cycle between homeowners and renters minus one.

Panel A: Wealth Gains at Death (%)

	Down Payment					
Threshold	10.0%	20.0%	30.0%	40.0%	50.0%	100.0%
10%	0.27	1.23	2.12	2.91	3.54	1.31
20%	2.31	3.16	3.83	4.28	2.53	3.45
30%	4.17	4.65	5.00	3.82	4.60	5.07
40%	5.41	5.60	5.07	5.58	5.90	6.10
50%	6.23	9.58	9.40	9.18	8.96	8.74

Panel B: Welfare Gains at Death (%)

	Down Payment					
Threshold	10.0%	20.0%	30.0%	40.0%	50.0%	100.0%
10%	17.89	19.59	21.43	22.56	23.36	16.95
20%	19.23	20.92	22.09	22.88	16.31	18.70
30%	20.43	21.48	22.01	15.89	18.24	19.81
40%	20.72	21.39	15.55	17.82	19.21	20.19
50%	20.71	15.21	16.94	18.18	18.99	19.47

Table 4: Life Cycle Gains (Continues)

Panel C: US Wealth Gains at Death (%)						
	Down Payment					
Threshold	10.0%	20.0%	30.0%	40.0%	50.0%	100.0%
10%	0.02	1.07	2.05	2.89	3.51	1.21
20%	2.29	3.2	3.86	4.31	2.59	3.56
30%	4.26	4.73	5.10	4.06	4.77	5.24
40%	5.61	5.75	5.29	5.80	6.17	6.31
50%	6.35	10.13	9.87	9.59	9.29	9.03
Panel D: US Welfare Gains at Death (%)						
	Down Payment					
Threshold	10.0%	20.0%	30.0%	40.0%	50.0%	100.0%
10%	13.87	16.27	18.26	19.87	21.21	13.58
20%	16.20	18.38	20.00	20.98	13.31	16.17
30%	18.27	19.72	20.31	13.59	16.20	18.11
40%	19.15	19.95	13.59	16.15	17.70	18.86
50%	19.6	14.83	16.70	17.99	18.74	19.28
Panel E: UK Wealth Gains at Death (%)						
	Down Payment					
Threshold	10.0%	20.0%	30.0%	40.0%	50.0%	100.0%
10%	-0.55	0.47	1.35	2.12	2.74	0.46
20%	1.46	2.32	3.00	3.48	1.60	2.54
30%	3.27	3.79	4.14	2.82	3.59	4.16
40%	4.51	4.75	4.01	4.61	4.99	5.21
50%	5.40	8.83	8.66	8.46	8.30	8.08
Panel E: UK Welfare Gains at Death (%)						
	Down Payment					
Threshold	10.0%	20.0%	30.0%	40.0%	50.0%	100.0%
10%	20.23	21.98	23.80	24.94	25.38	18.93
20%	21.23	23.00	23.92	24.41	18.04	20.43
30%	21.90	22.77	23.35	17.29	19.6	20.93
40%	21.96	22.42	16.53	18.69	20.33	21.16
50%	21.68	15.40	17.20	18.46	19.39	20.03
Panel F: Europe Wealth Gains at Death (%)						
	Down Payment					
Threshold	10.0%	20.0%	30.0%	40.0%	50.0%	100.0%
10%	0.01	1.04	1.98	2.72	3.34	1.11
20%	2.15	2.97	3.62	4.11	2.33	3.25
30%	3.96	4.47	4.79	3.61	4.37	4.90
40%	5.22	5.46	4.84	5.39	5.71	5.93
50%	6.02	9.34	9.16	8.96	8.74	8.49
Panel G: Europe Welfare Gains at Death (%)						
	Down Payment					
Threshold	10.0%	20.0%	30.0%	40.0%	50.0%	100.0%
10%	16.53	18.62	20.57	22.02	23.07	15.96
20%	18.35	20.31	21.69	22.26	15.44	18.05
30%	19.98	21.00	21.55	15.32	17.89	19.37
40%	20.33	20.97	15.30	17.45	18.88	19.83
50%	20.41	14.99	16.57	17.73	18.59	19.19

Table 5: Life Cycle Gains from Home Purchases

This table reports the mean household wealth change and welfare change due to *actual* home purchase in the homeowner strategies relative to the renters from the stationary bootstrap simulations. In other words, we focus on the life cycle gains of only a part of the households in homeowner strategies that actually purchased homes. We evaluate the difference in utility between the homeowners and the renters following equation 15. Since the simulations match pre-retirement consumption of homeowners to pre-retirement consumption of the corresponding benchmark renters, we compare only the post-retirement welfare. In the life cycle simulations, homeowners earn labor income during the working years and invest in financial assets (stocks). They purchase their homes when the value of their financial assets reaches a certain percentage of the home value. The percentage is jointly decided by the down payment ratio and an extra purchase threshold, i.e., a homeowner household will decide to purchase a home once the financial assets' value is higher than the sum of the down payment and the extra purchase threshold. The renters, however, only invest their income in financial assets (stocks). We report the mean wealth change caused by home purchase relative to the all-equity-strategy renters because the literature documents that the simple all-equity strategy is the best life cycle investment strategy relative to other more popular strategies, such as TDFs. Panel A reports the lifetime wealth change evaluated at death, and panel B reports the lifetime welfare change evaluated at death. Column "Down Payment" indicates the down payment ratio as a percentage of home value. Column "Threshold" indicates the extra purchase threshold on top of the down payment requirement as a percentage of home value. The wealth (welfare) change is calculated as the ratio of accumulative wealth (welfare) in the life cycle between homeowners and renters minus one.

Panel A: Wealth Gains at Death (%)

	Down Payment					
Threshold	10.0%	20.0%	30.0%	40.0%	50.0%	100.0%
10%	100	100	100	101	101	98
20%	98	99	99	99	96	96
30%	97	97	98	94	95	95
40%	96	96	93	93	94	94
50%	95	87	88	89	89	90

Panel B: Welfare Gains at Death (%)

	Down Payment					
Threshold	10.0%	20.0%	30.0%	40.0%	50.0%	100.0%
10%	100	100	101	101	102	98
20%	98	99	99	100	95	96
30%	97	97	98	93	94	95
40%	95	96	91	92	93	94
50%	94	82	83	85	86	87

Table 6: Maximum Drawdown

This table reports the details of the mean maximum drawdown during the life cycle. In the life cycle simulations, homeowners earn labor income during the working years and invest in financial assets (stocks). They purchase their homes when the value of their financial assets reaches a certain percentage of the home value. The percentage is jointly decided by the down payment ratio, and the extra purchase threshold, i.e., a homeowner household will decide to purchase a home once the financial assets' value is higher than the sum of the down payment and the extra purchase threshold. The renters, however, only invest their income in financial assets (stocks). We report the maximum drawdowns of the homeowners relative to the all-equity-strategy renters since the literature documents that the simple all-equity strategy is the best life cycle investment strategy relative to other more popular strategies, such as TDFs. Panel A (B/C) reports the maximum wealth portfolio drawdown for homeowners during the life cycle (before/after retirement). A positive percentage indicates a reduction in maximum drawdown of wealth portfolio. Column "Down Payment" indicates the down payment ratio as a percentage of home value. Column "Threshold" indicates the extra purchase threshold on top of the down payment requirement as a percentage of home value.

Panel A: Maximum Drawdown Change over the Life Cycle (%)

	Down Payment					
Threshold	10%	20%	30%	40%	50%	100%
10%	11.16	11.02	10.8	10.53	10.23	11.49
20%	11.29	11.00	10.68	10.35	11.88	11.60
30%	11.25	10.89	10.52	12.20	11.83	11.43
40%	11.03	10.64	12.44	12.01	11.57	11.15
50%	10.74	13.01	12.43	11.88	11.39	10.94

Panel B: Maximum Drawdown Change before Retirement (%)

	Down Payment					
Threshold	10%	20%	30%	40%	50%	100%
10%	6.71	6.52	6.3	6.07	5.84	7.14
20%	6.93	6.68	6.42	6.17	7.81	7.55
30%	7.25	6.96	6.67	8.48	8.14	7.79
40%	7.45	7.15	9.05	8.67	8.29	7.92
50%	7.60	11.25	10.77	10.32	9.89	9.50

Panel C: Maximum Drawdown Change after Retirement (%)

	Down Payment					
Threshold	10%	20%	30%	40%	50%	100%
10%	10.10	9.95	9.73	9.44	9.14	10.41
20%	10.18	9.87	9.53	9.19	10.66	10.34
30%	9.97	9.60	9.24	10.83	10.44	10.04
40%	9.63	9.24	10.94	10.50	10.07	9.64
50%	9.22	10.97	10.39	9.84	9.36	8.92

Table 7: Gini Change at Retirement (%)

This table reports Gini index change in wealth portfolio evaluated at retirement as a difference in percent between homeowners' Gini index and renters' Gini index. In the life cycle simulations, homeowners earn labor income during the working years and invest in financial assets (stocks). They purchase their homes when the value of their financial assets reaches a certain percentage of the home value. The percentage is jointly decided by the down payment ratio, and the extra purchase threshold, i.e., a homeowner household will decide to purchase a home once the financial assets' value is higher than the sum of the down payment and the extra purchase threshold. The renters, however, only invest their income in financial assets (stocks). We report the Gini index change of the homeowners relative to the all-equity-strategy renters because the literature documents that the simple all-equity strategy is the best life cycle investment strategy relative to other more popular strategies, such as TDFs. A negative percentage indicates a reduction in the inequality of wealth portfolios across the households. Column "Down Payment" indicates the down payment ratio as a percentage of home value. Column "Threshold" indicates the extra purchase threshold on top of the down payment requirement as a percentage of home value.

	Down Payment					
Threshold	10%	20%	30%	40%	50%	100%
10%	-14.96	-14.27	-13.54	-12.83	-12.16	-15.08
20%	-14.34	-13.62	-12.89	-12.22	-15.03	-14.33
30%	-13.60	-12.88	-12.22	-14.96	-14.23	-13.51
40%	-12.82	-12.20	-14.77	-14.09	-13.42	-12.78
50%	-12.24	-14.86	-14.39	-13.89	-13.39	-12.88

Table 8: Life Cycle Costs

This table reports the mean household wealth change of the homeowners relative to the renters from the stationary bootstrap simulations. In the life cycle simulations, homeowners earn labor income during the working years and invest in financial assets (stocks). They purchase their homes when the value of their financial assets reaches a certain percentage of the home value. The percentage is jointly decided by the down payment ratio and the extra purchase threshold, i.e., a homeowner household will decide to purchase a home once the financial assets' value is higher than the sum of the down payment and the extra purchase threshold. The renters, however, only invest their income in financial assets (stocks). We report the mean wealth change of the homeowners relative to the all-equity-strategy renters because the literature documents that the simple all-equity strategy is the best life cycle investment strategy relative to other more popular strategies, such as TDFs. Panel A reports the wealth change evaluated at retirement, panel B reports the wealth change in financial assets evaluated at retirement, and panel C reports the wealth change in financial assets evaluated at death. A positive (negative) percentage indicates a wealth gain (loss) from homeownership. Column "Down Payment" indicates the down payment ratio as a percentage of home value. Column "Threshold" indicates the extra purchase threshold on top of the down payment requirement as a percentage of home value. The wealth change is calculated as the ratio of wealth in the life cycle between homeowners and renters minus one.

Panel A: Wealth Change at Retirement (%)						
	Down Payment					
Threshold	10.0%	20.0%	30.0%	40.0%	50.0%	100.0%
10%	-19.24	-18.59	-17.56	-16.27	-14.98	-8.39
20%	-17.71	-16.86	-15.74	-14.61	-13.43	-7.55
30%	-16.17	-15.21	-14.20	-13.18	-12.15	-6.87
40%	-14.65	-13.78	-12.90	-11.98	-11.08	-6.24
50%	-13.35	-12.57	-11.79	-10.98	-10.16	-5.69
Panel B: Wealth Change in Financial Assets at Retirement (%)						
	Down Payment					
Threshold	10.0%	20.0%	30.0%	40.0%	50.0%	100.0%
10%	-37.6	-35.71	-33.63	-31.59	-29.78	-38.21
20%	-35.91	-33.66	-31.65	-29.81	-38.42	-35.93
30%	-33.69	-31.65	-29.83	-38.44	-35.93	-33.66
40%	-31.65	-29.85	-38.41	-35.87	-33.63	-31.64
50%	-29.86	-37.81	-35.32	-33.16	-31.26	-29.56
Panel C: Wealth Change in Financial Assets at Death (%)						
	Down Payment					
Threshold	10.0%	20.0%	30.0%	40.0%	50.0%	100.0%
10%	-8.5	-7.42	-6.36	-5.38	-4.56	-7.75
20%	-6.57	-5.52	-4.62	-3.92	-6.78	-5.64
30%	-4.66	-3.91	-3.28	-5.72	-4.66	-3.87
40%	-3.22	-2.70	-4.64	-3.78	-3.11	-2.57
50%	-2.12	-0.30	-0.00	0.23	0.41	0.56

Table 9: Dissection of Welfare Gains

This table reports the dissection of mean lifetime household welfare change of the homeowners relative to the renters. We evaluate the difference in utility between the homeowners and the renters following equation 15. Since the simulations match pre-retirement consumption of homeowners to pre-retirement consumption of the corresponding benchmark renters, we compare only the post-retirement welfare. Both the homeowners and the renters gain utility from consumption and bequest motive. In the life cycle simulations, homeowners earn labor income during the working years and invest in financial assets (stocks). They purchase their homes when the value of their financial assets reaches a certain percentage of the home value. The percentage is jointly decided by the down payment ratio and the extra purchase threshold, i.e., a homeowner household will decide to purchase a home once the financial assets' value is higher than the sum of the down payment and the extra purchase threshold. The renters, however, only invest their income in financial assets (stocks). We report the mean welfare change of the homeowners relative to the all-equity-strategy renters because the literature documents that the simple all-equity strategy is the best life cycle investment strategy relative to other more popular strategies, such as TDFs. Panel A reports the welfare gains from consumption evaluated at death, and panel B reports the welfare gains from bequest evaluated at death. Column "Down Payment" indicates the down payment ratio as a percentage of home value. Column "Threshold" indicates the extra purchase threshold on top of the down payment requirement as a percentage of home value.

Panel A: Welfare Change over Consumption at Death (%)

	Down Payment					
Threshold	10.0%	20.0%	30.0%	40.0%	50.0%	100.0%
10%	17.76	19.45	21.29	22.42	23.22	16.82
20%	19.10	20.78	21.95	22.74	16.17	18.56
30%	20.29	21.34	21.87	15.76	18.10	19.67
40%	20.58	21.25	15.42	17.69	19.07	20.05
50%	20.57	15.09	16.82	18.05	18.87	19.35

Panel B: Welfare Change over Bequest at Death (%)

	Down Payment					
Threshold	10.0%	20.0%	30.0%	40.0%	50.0%	100.0%
10%	54.38	56.9	58.62	59.25	59.28	56.73
20%	59.21	60.37	60.73	60.18	59.04	61.24
30%	62.04	61.77	61.25	60.95	62.71	63.12
40%	62.71	61.93	62.71	63.96	64.01	63.42
50%	62.60	66.81	66.08	65.01	63.90	62.43

Table 10: Heterogeneity

This table reports the heterogeneous economic effects of homeownership through examination of homeowners' labor income levels at time of home purchases, purchasing prices, and interest rates at the time of home purchases. We calculate the mean household wealth change of the homeowners relative to the renters from the stationary bootstrap simulations and evaluate the difference in utility between the homeowners and the renters following equation 15. In the life cycle simulations, homeowners earn labor income during the working years and invest in financial assets (stocks). They purchase their homes when the value of their financial assets reaches a certain percentage of the home value. The percentage is jointly decided by the down payment ratio and the extra purchase threshold, i.e., a homeowner household will decide to purchase a home once the financial assets' value is higher than the sum of the down payment and the extra purchase threshold. The renters, however, only invest their income in financial assets (stocks). We report the mean welfare change of the homeowners relative to the all-equity-strategy renters because the literature documents that the simple all-equity strategy is the best life cycle investment strategy relative to other more popular strategies, such as TDFs. Panel A (B/C) reports the heterogeneous influence of homeownership on wealth and welfare due to labor income (housing price/interest rate). The calculation of wealth and welfare is based the group of simulated households conditional on the corresponding percentile brackets. We report the heterogeneity results based on the strategy of 10% down payment and 10% extra purchase threshold.

Panel A: Labor Income (%)							
	Labor Income Percentile Brackets						
	<10%	10%-20%	20%-30%	30%-40%	40%-50%	≥90%	Best Per.
Wealth at Ret	-17.91	-17.91	-17.92	-18.34	-19.31	-18.68	15%
Wealth at Death	4.69	3.92	3.10	2.34	1.50	-1.60	5%
Total Welfare	0.21	9.29	15.37	22.64	28.59	73.33	95%
Panel B: Housing Price (%)							
	Housing Price Percentile Brackets						
	<10%	10%-20%	20%-30%	30%-40%	40%-50%	≥90%	Best Per.
Wealth at Ret	-14.36	-16.2	-17.49	-18.22	-19.43	-20.77	5%
Wealth at Death	-0.91	-0.92	-1.07	-0.68	-0.94	4.95	95%
Total Welfare	4.29	6.00	8.79	11.48	12.55	30.17	95%
Panel C: Interest Rate (%)							
	Interest Rate Percentile Brackets						
	<10%	10%-20%	20%-30%	30%-40%	40%-50%	≥90%	Best Per.
Wealth at Ret	-11.26	10.01	-19.14	-14.56	-19.42	-29.23	15%
Wealth at Death	8.24	24.35	0.03	4.06	-0.32	-10.27	15%
Total Welfare	11.94	47.81	10.35	14.91	13.9	3.5	15%

Table 11: Second-Home Wealth Effect

This table reports the mean household wealth change of the second-home owners relative to the single-home owners from the stationary bootstrap simulations. In the life cycle simulations, homeowners earn labor income during the working years and invest in financial assets (stocks). They purchase their homes when the value of their financial assets reaches a certain percentage of the home value. The percentage is jointly decided by the down payment ratio, and the extra purchase threshold, i.e., a homeowner household will decide to purchase a home once the financial assets' value is higher than the sum of the down payment and the extra purchase threshold. The homeowners purchase the second home following the same decision process. For brevity, the benchmarks are from the single-home owners who purchase their homes with a 10% down payment and 10% extra purchase threshold. Panel A (C) reports the wealth change of owning a second home at retirement (death) relative to owning a single home, and panels B (D) reports the changes in financial asset holdings at retirement (death). A positive (negative) percentage in panels A and B indicates a wealth gain (loss). Column "Down Payment" indicates the down payment ratio as a percentage of the second home value. Column "Threshold" indicates the extra purchase threshold on top of the down payment requirement as a percentage of the second home home value. The wealth change is calculated as the percentage ratio of wealth between the second-home owners and the single-home owners minus one.

Panel A: Wealth Change at Retirement (%)

	Down Payment					
Threshold	10%	20%	30%	40%	50%	100%
10%	-5.74	-4.82	-4.04	-5.83	-4.94	-4.17
20%	-5.92	-5.02	-4.29	-5.92	-5.06	-4.33
30%	-5.85	-5.01	-4.3	-4.77	-4.11	-3.54

Panel B: Wealth Change in Financial Assets at Retirement (%)

	Down Payment					
Threshold	10%	20%	30%	40%	50%	100%
10%	-23.91	-21.45	-19.23	-23.88	-21.31	-19.00
20%	-23.67	-20.99	-18.63	-23.11	-20.43	-18.02
30%	-22.37	-19.66	-17.27	-17.28	-14.99	-13.07

Panel C: Wealth Change at Death (%)

	Down Payment					
Threshold	10%	20%	30%	40%	50%	100%
10%	8.3	7.96	7.61	7.58	7.22	6.79
20%	6.84	6.41	5.95	6.02	5.58	5.13
30%	5.26	4.81	4.36	2.61	2.32	2.07

Panel D: Wealth Change in Financial Assets at Death (%)

	Down Payment					
Threshold	10%	20%	30%	40%	50%	100%
10%	-4.64	-3.99	-3.42	-4.57	-3.91	-3.37
20%	-4.46	-3.82	-3.29	-4.31	-3.7	-3.17
30%	-4.1	-3.53	-3.04	-2.98	-2.56	-2.21

Table 12: Second-Home Welfare Effect

This table reports the mean welfare change of the single-home owners and the second-home owners. We evaluate the difference over the life cycle in utility between the second-home owners and the single-home owners following the utility function described in equation 13. In the life cycle simulations, homeowners earn labor income during the working years and invest in financial assets (stocks). They purchase their homes when the value of their financial assets reaches a certain percentage of the home value. The percentage is jointly decided by the down payment ratio, and the extra purchase threshold, i.e., a homeowner household will decide to purchase a home once the financial assets' value is higher than the sum of the down payment and the extra purchase threshold. The homeowners purchase the second home following the same decision process. For brevity, the benchmarks are from the single-home owners who purchase their homes with a 10% down payment and 10% extra purchase threshold. Panel A reports the welfare change over the life cycle at death of owning a second home relative to owning a single home, panels B and C report the welfare change during working and retirement life, and panel C and D report the welfare change over the bequest motive. A positive (negative) percentage in panels A and B indicates a welfare gain (loss). Column "Down Payment" indicates the down payment ratio as a percentage of the second home value. Column "Threshold" indicates the extra purchase threshold on top of the down payment requirement as a percentage of the second home value. The welfare change is calculated as the percentage ratio of utility between the second-home owners and the single-home owners minus one.

Panel A: Welfare Change at Death (%)

	Down Payment					
Threshold	10%	20%	30%	40%	50%	100%
10%	0.02	0.30	0.48	-0.30	0.04	0.25
20%	-0.65	-0.27	-0.02	-0.98	-0.55	-0.28
30%	-1.26	-0.80	-0.50	-1.64	-1.20	-0.89

Panel B: Welfare Change before Retirement (%)

	Down Payment					
Threshold	10%	20%	30%	40%	50%	100%
10%	2.49	2.29	2.09	2.4	2.18	1.98
20%	2.21	1.98	1.77	1.94	1.73	1.53
30%	1.66	1.46	1.28	0.67	0.57	0.48

Panel C: Welfare Change after Retirement (%)

	Down Payment					
Threshold	10%	20%	30%	40%	50%	100%
10%	-8.62	-6.94	-5.58	-8.76	-6.94	-5.56
20%	-8.69	-6.86	-5.45	-8.44	-6.63	-5.26
30%	-8.11	-6.33	-4.99	-5.49	-4.22	-3.28

Panel D: Welfare Change over Consumption (%)

	Down Payment					
Threshold	10%	20%	30%	40%	50%	100%
10%	0.02	0.29	0.48	-0.31	0.04	0.25
20%	-0.65	-0.27	-0.02	-0.98	-0.56	-0.28
30%	-1.27	-0.81	-0.51	-1.65	-1.21	-0.9

Panel E: Welfare Change over the Bequest Motive (%)

	Down Payment					
Threshold	10%	20%	30%	40%	50%	100%
10%	12.47	11.13	10.02	11.47	10.38	9.34
20%	10.85	9.72	8.6	10.	8.83	7.87
30%	9.21	8.15	7.2	5.66	4.97	4.33