The Composition and Concentration of Wealth: Fiscal and Monetary Policy Implications*

Bulent Guler Burhan Kuruscu Baxter Robinson

July 23, 2025

Abstract

Wealthy households often carry substantial mortgage debt despite having sufficient financial assets to repay it. We argue that this pattern greatly matters for the effectiveness and distributional consequences of fiscal and monetary policies. For this purpose, we develop a life-cycle model of households featuring housing tenure choice (rent versus own), long-term defaultable mortgages, and heterogeneous returns on financial assets, wherein high-return households optimally retain mortgage debt to leverage favorable investment opportunities. The model reproduces key empirical patterns of the composition of wealth and generates a large fraction of hand-to-mouth households, and consequently high marginal propensities to consume (MPCs). We compare the implications of this model with an otherwise identical model but with homogeneous returns, which grossly understates the mortgage debt for the wealthy and the proportion of hand-to-mouth households. For fiscal and monetary policy, the two models have starkly different implications, stemming from the stark differences in their underlying wealth concentrations and compositions.

JEL Codes: D14, D31, E21, E62, G51.

Keywords: Wealth concentration and composition, return heterogeneity, housing, mortgage debt, fiscal policy, monetary policy.

*Guler: Indiana University, bguler@iu.edu; Kuruscu: University of Toronto, burhan.kuruscu@utoronto.ca; Robinson: University of Western Ontario, brobin63@uwo.ca
For generous financial support, Kuruscu thanks the Social Sciences and Humanities Research Council of Canada and Robinson thanks the Stephen A. Jarislowsky Chair in Central Banking. The authors also acknowledge the Indiana University Pervasive Technology Institute and the Digital Research Alliance of Canada for providing computing resources that have contributed to the research results reported within this paper. We thank Alina Bartscher, David Berger, Carlos Garriga, Gaston Navarro, Serdar Ozkan, Jonathan Parker, Roman Sustek, and Gianluca Violante as well as participants at numerous conferences for helpful comments. Previously titled "The Composition and Distribution of Wealth and Aggregate Consumption Dynamics".

1 Introduction

It is well-documented that household wealth is highly unequally distributed in the U.S. The top 10% of households hold approximately 70% of total wealth, while the bottom 50% own just 3%.[1] The composition of wealth also varies markedly across the distribution. While wealthy households hold a smaller share of their portfolios in housing, housing is the primary asset for the majority of households. As a result, although housing remains concentrated, it is less so than overall wealth, with the top 10% owning 33% of the U.S. housing stock. In addition, a substantial fraction of households own almost no liquid financial assets, some own only housing, while others hold neither housing nor liquid financial assets. As noted by Kaplan and Violante (2014), such "hand-to-mouth" households are highly responsive to income changes, making them particularly important for evaluating the effectiveness of stimulus transfers.

A lesser-known fact is that mortgage debt is also unequally distributed across U.S. households. The wealthiest 10% of households owe 23% of aggregate mortgage debt. More strikingly, 52% of these households own sufficient financial assets so that if they sold them, the proceeds would be enough to fully pay off their entire mortgage balance. Since mortgages play a potentially crucial role in monetary policy transmission and remain central to fiscal interventions during downturns, understanding the drivers of the mortgage debt distribution is essential for assessing the effectiveness of both fiscal and monetary policy.

To understand these patterns and illustrate how they matter for the effectiveness and distributional consequences of fiscal and monetary policies, we develop an overlapping generations model of finitely-lived households featuring housing tenure choice (rent versus own), and long-term, fixed-rate and defaultable mortgages. The key ingredient of our benchmark model that allows it to match the wealth concentration and composition, most importantly, the concentration of mortgage debt at the top, is heterogeneity in financial asset returns, which has a permanent and i.i.d. component.[2]

We calibrate the benchmark model to match both aggregate and distributional moments regarding household net worth and housing wealth. The calibrated model reproduces key empirical patterns of the composition of wealth, most importantly, the concentration of mortgage debt at the top, and generates a large fraction of hand-to-mouth households, and consequently high marginal propensities to consume (MPCs).

In the model, while most households earn low returns, a small group of households earn

[1] The authors' calculations are based on data from the 1995 Survey of Consumer Finances (SCF). See also Kuhn and Rios-Rull (2016).

[2] See Campbell, Ramadorai, and Ranish (2019), Bach, Calvet, and Sodini (2020), Fagereng et al. (2020), and Smith, Zidar, and Zwick (2023) for empirical evidence in favor of return heterogeneity.

high returns. Households earning high returns have strong incentives to accumulate financial wealth, resulting in a realistic aggregate wealth-to-income ratio and a realistic degree of wealth inequality. Being wealthy, these households also own larger houses. However, they also choose to carry substantial mortgage debt since they earn higher expected returns on their financial assets than their mortgage interest rates. On the other hand, the return risk and endogenous mortgage pricing prevent these households from becoming excessively leveraged. As a result, the benchmark model generates both a realistic concentration and composition of wealth. Specifically, the model produces a declining share of housing assets as well as loan-to-value ratio of mortgages, but an increasing amount of mortgage debt, over the wealth distribution.

In contrast, households earning low returns accumulate few financial assets. As a result, 26.6% of the population ends up with no financial assets and are labeled as "hand-to-mouth." Among these households, those who own housing are called “wealthy” hand-to-mouth, while those who do not are called “poor” hand-to-mouth, following Kaplan and Violante (2014). Because these households have very high marginal propensities to consume (MPCs), particularly the wealthy hand-to-mouth, the benchmark model generates a high average annual MPC of 36.5%. Thus, return heterogeneity creates a link between wealth inequality and the average MPC, as the liquid financial assets required for consumption smoothing are disproportionately held by the wealthiest households.

We contrast our benchmark economy with a recalibrated homogeneous-returns economy, which is identical to our benchmark except that all households earn the same rate of return on their liquid financial assets, set equal to the average interest rate in the benchmark model. In this alternative model, savings motives are much more evenly distributed across the population, and, naturally, wealth inequality is much lower than in the data. Most strikingly, this model generates no mortgage debt among the wealthiest 20% of households and substantially overestimates the fraction of mortgage debt held in the middle of the wealth distribution, in sharp contrast with the data. Furthermore, it grossly understates the proportion of hand-to-mouth households. Consequently, the average MPC is lower at 21.2%.

We illustrate the importance of matching both the concentration and composition of wealth through four applications. First, we study the determinants of the average MPC in our economy. We examine which features of the model contribute to generating a high average MPC by shutting down these features and recalibrating the model. Moving from a heterogeneous returns economy to a homogeneous returns model reduces the average annual MPC from 36.5% to 21.2%. Thus, return heterogeneity contributes a significant 15.3 percentage points to the average MPC. This contribution arises primarily because return heterogeneity allows the model to match the observed share of hand-to-mouth households.

When we remove mortgage debt from the economy, the average MPC rises to 24.8%, an increase of 3.6 percentage points. Mortgage debt in our model is inherently illiquid, because households have to pay significant refinancing costs. Nevertheless, households use refinancing to smooth out income fluctuations rather than selling their houses, which would entail even larger transaction costs. Thus, removing mortgage debt increases the average MPC, but not dramatically.

Finally, removing illiquid housing reduces the average MPC to 9.4%. In this case, the model simplifies to a standard life-cycle framework with a single asset. Evidently, the significant portion of aggregate household wealth tied up in illiquid housing is not readily available to smooth consumption fluctuations. Consequently, the presence of illiquid housing makes a substantial contribution to the average MPC, accounting for 15.4 percentage points.

Second, we study a mortgage relief policy that delivers a cash transfer to households proportional to their level of mortgage debt. We show that this policy is regressive in our benchmark model with heterogeneous returns, as the largest mortgages are owed by the wealthiest households, as in the data. By contrast, in the homogeneous returns model, the policy appears much more progressive, as the bulk of mortgage debt is counterfactually held by middle-class households.

Third, we compare the effectiveness of universal cash transfers with targeted transfers, specifically, transfers only to homeowners and transfers only to renters (all under the same transfer budget). While both models imply that universal transfers generate a larger average consumption response than transfers targeted to renters, they yield conflicting results for homeowner-targeted transfers. In particular, the heterogeneous returns model implies that targeting homeowners generates the highest consumption response, whereas the homogeneous-returns model suggests it generates the lowest among these policies.

To understand these divergent policy implications, note that two opposing forces drive the differences in average MPC across these policies. On the one hand, for a given budget, targeted transfers result in larger payments per recipient. Since the proportion of a transfer spent on current consumption declines as the transfer size increases, this dampens the aggregate consumption response. On the other hand, targeting subgroups with higher MPCs increase the consumption response. Specifically, targeting homeowners directs more transfers per household to wealthy hand-to-mouth households, who have the highest MPCs out of transfers, while targeting renters channels more transfers to poor hand-to-mouth households, who have moderately high MPCs.

Since the heterogeneous returns model generates a substantial share of wealthy hand-to-mouth households, consistent with empirical data, the second effect dominates, leading to the conclusion that targeting homeowners is the most effective policy for stimulating aggregate consumption. In contrast, the difference in the share of poor hand-to-mouth households between the two models is relatively small. Thus, both models agree on the ranking of universal cash transfers over targeted transfers to renters. Overall, because the heterogeneous returns model more accurately captures the distribution and composition of wealth, its implication, that targeting homeowners can generate a stronger consumption response, is likely the more relevant guide for fiscal policy.

Finally, we examine the effects of a monetary policy shock in the form of an unanticipated reduction in the mortgage interest rate. In both models, the decline in the mortgage interest rate leads to an increase in mortgage debt, the home ownership rate, and aggregate consumption. However, the magnitudes of these increases are much smaller in the heterogeneous returns model compared to the homogeneous returns model.

In both models, the reduction in the mortgage interest rate lowers mortgage payments, proportional to the mortgage balance, for existing borrowers through refinancing and incentivizes households to take on larger mortgage debt. The biggest beneficiaries from refinancing are the wealthy in the heterogeneous returns model, who have low loan-to-value ratios. For them, the mortgage relief constitutes a small fraction of their lifetime wealth. On the other hand, the biggest beneficiaries in the homogeneous-returns model are those in the middle of the wealth distribution, who have high LTV ratios. For these households, the mortgage relief represents a much larger fraction of their lifetime wealth. Thus, even though both models are calibrated to match the aggregate mortgage debt-to-GDP ratio and the potential aggregate mortgage relief is the same, they generate very different responses because the relief ultimately benefits very different segments of the population. These findings highlight that conclusions about the effectiveness of monetary policy critically depend on accurately capturing both the concentration and composition of wealth.

Related Literature

There has been considerable interest in understanding the determinants of wealth inequality. On the theoretical front, starting from the early contributions of Quadrini (2000) and Cagetti and De Nardi (2006), a number of studies have demonstrated that persistent return heterogeneity is crucial for reproducing key features of the wealth distribution that standard models struggle to explain. For instance, Benhabib, Bisin, and Luo (2017); Benhabib and Bisin (2018) highlight its role in generating the Pareto tail of the wealth distribution; Gabaix, Lasry, Lions, and Moll, 2016; Jones and Kim, 2018 explore its implications for the dynamics of wealth inequality; and Guvenen et al. (2023) examine its relevance for understanding the high incidence of self-made billionaires among the ultra-wealthy. However, these studies generally treat wealth as a one-dimensional construct, without examining how its composition varies across the wealth distribution.[3] We contribute to this literature by demonstrating that return heterogeneity drives not only the concentration of wealth but also its composition, an insight that proves crucial for evaluating the effects of fiscal and monetary policy.

On the empirical front, a growing number of studies document large and persistent differences in rates of return across individuals (see, for example, Fagereng, Guiso, Malacrino, and Pistaferri (2020), Bach, Calvet, and Sodini (2020), Campbell, Ramadorai, and Ranish (2019) and Smith et al. (2019)). We provide complementary evidence supporting return heterogeneity using a heterogeneous-agent model of households and data on housing and mortgages from U.S. households.

This paper also contributes to a large literature studying the aggregate consumption response to fiscal stimulus. A great deal of empirical work has been done estimating the average marginal propensity to consume. See for example, Johnson, Parker, and Souleles (2006), Parker et al. (2013), Jappelli and Pistaferri (2014), Jappelli and Pistaferri (2020), Fagereng, Holm, and Natvik (2021), and Lewis, Melcangi, and Pilossoph (2021). The empirical evidence poses a challenge for standard incomplete market models with one asset since, when these models are calibrated to match the level of aggregate wealth in the data, very few households end up being borrowing constrained. Thus, the challenge for the quantitative macroeconomics literature has been to generate a sizable hand-to-mouth consumer base consistent with aggregate wealth accumulation in the data.

Kaplan and Violante (2014) distinguish between "wealthy hand-to-mouth" households who own illiquid assets such as housing but no liquid assets and "poor hand-to-mouth" households who do not have liquid or illiquid assets. They show that a calibrated two-asset model, with a low-return liquid asset and a high-return illiquid asset, can generate the fraction of both poor and wealthy hand-to-mouth households in the data and produce a high average MPC, consistent with the data. While Kaplan and Violante (2014) require a high-return on their illiquid asset and a low-return on their liquid asset, we show how the combination of heterogeneous returns on liquid assets and a utility-flow from housing services can create a large mass of hand-to-mouth households that generate high MPCs in a quantitative macro model.

Other quantitative papers studying the average MPC use behavioral mechanisms (Attanasio, Kovacs, and Moran (2020) and Boutros (2022)). Attanasio, Kovacs, and Moran (2020) argue that the two asset model proposed by Kaplan and Violante (2014)

[3] One exception is Díaz and Luengo-Prado (2010) who document how housing as a fraction of total wealth decreases with the level of wealth and build a model to match this fact.

requires an unreasonably large difference between returns on housing and on liquid assets in order to generate a high fraction of wealthy hand-to-mouth households. Our model, on the other hand, generates a large fraction of wealthy hand-to-mouth households without requiring a higher return on housing relative to the liquid asset return and relying on behavioral mechanisms.

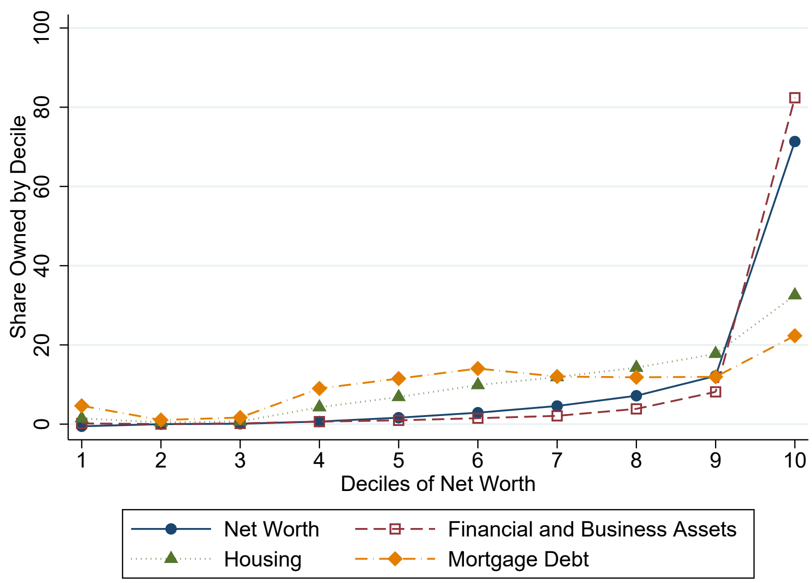
Carroll et al. (2017) study how the distribution of marginal propensities to consume is influenced by discount rate heterogeneity, which also generates some wealth inequality. Aguiar, Bils, and Boar (2024) also study a model of preference heterogeneity, with heterogeneity in both discount rates and the elasticity of inter-temporal substitution and show that it can generate high MPCs. We propose an alternative, and possibly complementary, mechanism: return heterogeneity, that delivers high MPCs. We further provide evidence for this mechanism by comparing its implications for mortgage distribution with observed data.

Finally, Kaplan and Violante (2022) argue that a one-asset model with return heterogeneity can generate a high MPC only with unrealistically low median wealth, a phenomenon they call the "missing middle". However, our benchmark model with both return heterogeneity and illiquid assets not only generates a high average MPC but also does not suffer from the missing middle problem.

Our paper is also broadly related to a literature on the effects of housing and mortgage markets on aggregate economic outcomes. Boar, Gorea, and Midrigan (2022) study liquidity constraints in the U.S. housing market and estimate that the majority of homeowners would value extracting liquidity from their house. Recent work has emphasized the role of mortgage refinancing in the transmission of monetary policy to aggregate outcomes (see Garriga, Kydland, and Šustek (2017), Beraja et al. (2018), Kinnerud (2021), Berger et al. (2021) and Eichenbaum, Rebelo, and Wong (2022)). We contribute to this literature by demonstrating that the effectiveness of monetary policy critically depends on the concentration of mortgage debt.

In the next section we document several facts from the Survey of Consumer Finances about household portfolios that are relevant to our analysis. We then present our life-cycle model in section 3. In section 4, we discuss the calibration of our benchmark model with return heterogeneity and an alternative model with homogeneous returns. We compare the composition and distribution of wealth between the data and these models in section 5. Our main findings about how the aggregate consumption response depends on the composition and distribution of wealth are presented in section 6.1 and we study the policy implications in sections 6.26.3 and 6.4. Finally, we conclude in section 7.

Figure 1: Concentration of Wealth over the Wealth Distribution



The fraction of wealth, financial and business assets, housing assets and mortgage debt by each decile of net worth.

2 Empirical Facts

We start by documenting several facts about the composition and distribution of US household wealth using the Survey of Consumer Finances (SCF). We focus on the year 1995 in order to avoid the instability of housing prices in the subsequent decades. However, these facts remain relatively stable over time, as can been seen in appendix I, which documents the same facts in the other Survey of Consumer Finances waves from 1989-2019.

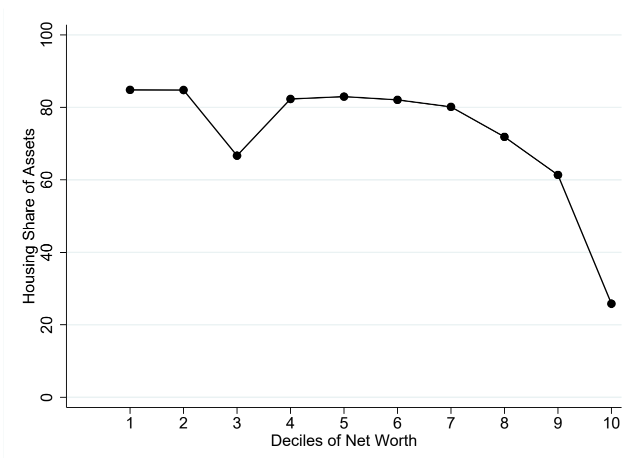
The largest illiquid asset class that most households own is housing. We contrast the ownership of illiquid housing with relatively more liquid financial assets, which we define as the sum of liquid financial assets, certificates of deposit, mutual funds, bonds, the cash value of life insurance, stocks, and other financial assets. We include retirement accounts only for households where the head of the household is older than 65, as early-withdrawal penalties typically make it costly to access before retirement age.[4] Finally, we include the value of private business wealth given their importance in driving the top wealth shares.[5]

2.1 Financial Wealth

Wealth is highly unequally distributed across different US households. Figure 1 shows the distribution of wealth. The top 10% of US households own 70% of aggregate wealth (net worth), with the top 1% owning 39%. Financial and business assets are slightly more unequally distributed than net worth. The wealthiest 10% of US households own 82% of aggregate financial and business assets and the wealthiest 1% own 52%. The bottom 30% of US households own less than 1% of total financial and business assets. The fact that most non-housing wealth is held by the wealthiest households implies that the remaining households hold little wealth other than housing. To the extent that the ownership of financial assets allows individuals to smooth consumption across time, the concentration of financial assets at the top of the wealth distribution has important implications for how households will be able to respond to both idiosyncratic and aggregate shocks.

2.2 Housing

Figure 2: Composition of Assets over the Wealth Distribution



The percentage of housing in total assets by net worth decile.

Housing is relatively more equally distributed compared to these other assets. However, the top 10% of US households still hold a large fraction, 33% of aggregate housing. Figure 2 shows the composition of household assets over the wealth distribution. The share of assets invested in housing declines over the wealth distribution, with some non-monotonicity around zero net worth in the third decile. For the bottom 7 deciles of the wealth distribution, housing constitutes around 80 percent of total assets.

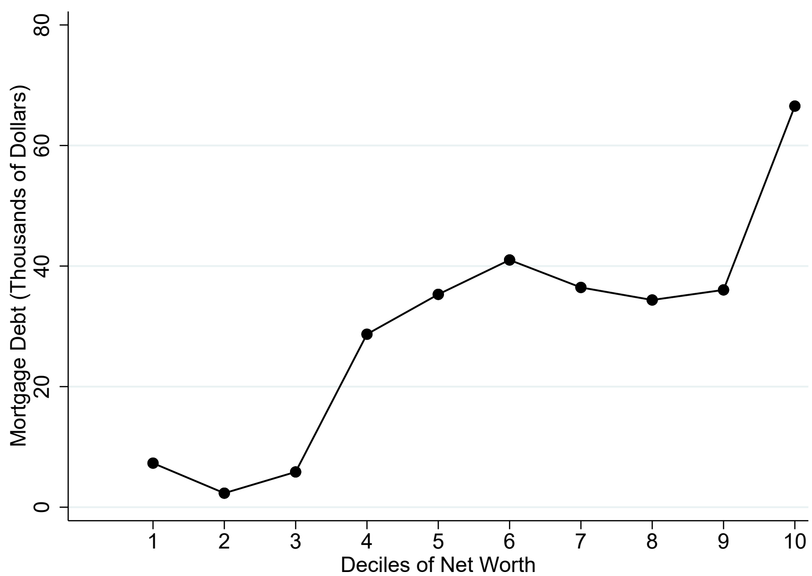
[4]This assumption is consistent with how we will treat retirement accounts in our model, see Section 4.

[5]We exclude from our analysis both vehicles and non-residential real estate. Both of these asset categories are relatively illiquid, but are considerably smaller than the value of residential housing.

Díaz and Luengo-Prado (2010) have documented this fact and provided a quantitative theory to account for it, based on extreme labor income shocks (as in Castañeda, Díaz-Giménez, and Ríos-Rull (2003)) to generate wealth inequality and frictions in the housing market. As we demonstrate in Appendix D, however, this mechanism implies unrealistically low mortgage levels for the very wealthy as in the homogeneous return model that we analyze in the main text.

2.3 Mortgage Debt

Figure 3: Mortgage Debt over the Wealth Distribution

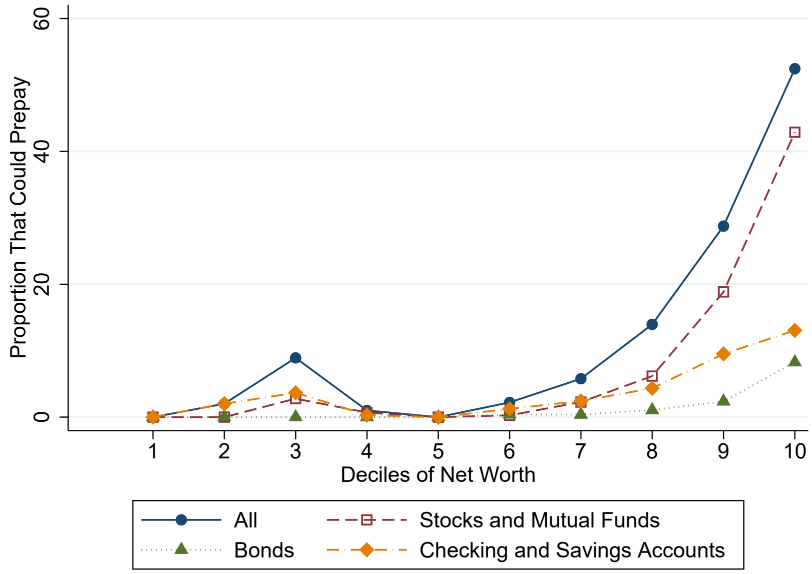


Average mortgage debt by net worth decile.

While financial and housing wealth inequality have been studied extensively in the literature, little has been documented and studied about the inequality in mortgage debt. In the data, wealthy households hold a substantial amount of mortgage debt. As Figure 1 illustrates, the wealthiest 10% of households owe 23% of aggregate mortgage debt. Figure 3 shows the average amount of mortgage debt over the wealth distribution, which is broadly increasing with wealth.

Many of these wealthy households could pay off the entire balance of their mortgage if they sold their financial assets. Figure 4 shows what proportion of mortgage owning households could fully repay their mortgages if they sold various categories of financial assets and used the proceeds to pay off their mortgage debts. Among higher percentiles this is even stronger,

Figure 4: Payable Mortgage Debt over the Wealth Distribution



Proportion that could prepay by net worth decile. A household is classified as able to prepay if the value of their stocks and mutual funds, their bonds, their checking and savings accounts, or all of these assets together exceeds the total amount of outstanding mortgage debt. Private business assets and retirement accounts are not included here.

60% of households among the wealthiest 5% of households could sell their financial assets and fully pay off their mortgage balance. Among the same group, 50% have enough stocks and mutual funds to fully pay off their mortgage balances.[6] The fact that they choose not to is consistent with the idea that they expect to earn higher rates of return on their financial assets than the mortgage interest rates that they pay.

3 Life-cycle Model

In order to study how the composition and distribution of household wealth matter, we build a quantitative overlapping generations life-cycle model with rate of return heterogeneity, idiosyncratic labor income uncertainty, and incomplete markets. We distinguish liquid financial assets from illiquid housing. Housing is illiquid in the sense that households have to pay a transaction cost whenever it is sold. Housing also generates a consumption flow and can be financed by long-term defaultable mortgages. Households in the model choose how much to invest in both liquid financial assets and illiquid housing. The model therefore generates an endogenous distribution of financial assets, housing, and mortgage debt.

[6]Note that these calculations exclude assets held in retirement accounts for households where the head is younger than 65, as liquidating these assets would result in higher tax liabilities.

3.1 Environment

Demographics and Preferences: The economy is populated with a continuum of households indexed by i. Age is indexed by j. Households are born at age 25 ($j = 1$) and start working in the labor market, retire at age 65 ($J_r = 40$), and die with certainty at age 85 ($J = 60$). At each age j, households face a probability of death given by ψ_j.

Households enjoy utility from non-durable consumption goods c and from housing services s. They maximize expected lifetime utility:

$$\mathbb{E}_0 \sum_{j=1}^{J} \beta^{j-1} \Psi_j u(c_{ij}, s_{ij}), \tag{1}$$

where β is the time discount factor and $\Psi_j = \Pi_{k=1}^{j} (1 - \psi_k)$ is the cumulative survival probability until the age of j.

Stochastic Labor Earnings: Working-age households are subject to idiosyncratic income uncertainty: before retirement, log labor income consists of a deterministic component $h(j)$, which only depends on age, and a stochastic component ν_{ij}, which is assumed to follow an AR(1) process. After retirement, the household receives constant social security benefits which only depends on the labor income in the last working period. Thus, a household's income process y_{ij} is given by

$$y_{ij} = \begin{cases} \exp(h(j) + \nu_{ij}), & \text{if } j \leq J_r \\ y_R(\nu_{iJ_r}), & \text{if } j > J_r \end{cases} \tag{2}$$

$$\nu_{ij} = \rho_\nu \nu_{ij-1} + \varepsilon_{ij}, \quad \varepsilon_{ij} \sim i.i.d. \quad N(0, \sigma_\varepsilon^2),$$

where ρ_ν is the persistence of the stochastic component of income and ε is the i.i.d labor income shock which is normally distributed with mean 0 and standard deviation σ_ε.

Financial Assets: All households can save in a liquid, one period asset a_{ij}, which delivers a stochastic return of r_{ij}^a each period. There is no unsecured borrowing, so $a_{ij} \geq 0$. Household returns are determined by a permanent component z_i that is fixed throughout a household's life-cycle and an transitory idiosyncratic shock ϵ_{ij} drawn from an age-independent normal distribution with mean 0 and standard deviation $\sigma_\epsilon (z_i)$ that depends on the permanent component z_i, according to:

$$1 + r_{ij}^a = (1 + z_i)(1 + \epsilon_{ij}).$$

Housing Choices: In every period, a household can choose between renting or owning a house. If they choose to rent they must pay p^r for each unit of housing services they rent. If they choose to buy a house, they can purchase a house of a desired size h at price $p^h h$. A house of size h delivers housing services of h each period it is owned. Houses are illiquid, so that the sale of a house is subject to transaction costs, which are assumed to be λ fraction of the house's value. There is a minimum house size $\underline{h}$ and a maximum house size $\bar{h}$. Following Kaplan, Mitman, and Violante (2020), we assume segmented housing market, and limit the renter's choice of housing services by $s_{ij} \leq \underline{h}$. Each period a house is owned, the owner must pay δh in maintenance costs in order to prevent depreciation.

Mortgage Choices: A homeowner can take out a long-term fixed-rate mortgage loan against their house. Mortgages are issued by risk-neutral competitive financial intermediaries, which can borrow and save at the risk-free rate r_m. To ensure computational tractability, we assume that mortgages are amortized over the maximum lifespan of a household, J. As death is stochastic, all households who die before age J will have the balance of their mortgage paid out of the value of their assets.

When a household decides to obtain a mortgage amount m, they receive an amount $q * m$ of consumption good after paying a fixed cost φ_f and a variable cost φ_v proportional to the originated mortgage balance m. q is the household-specific price of mortgage that will be specified below. Households can refinance their mortgage at any time by paying the same fixed and variable costs as when purchasing a house. Households can also default on mortgages in any period. The foreclosure cost is κ fraction of the value of the house. Upon default the household is free of mortgage debt, but the lender seizes the house and the household loses all the equity in the house. The household also acquires a default flag, which prevents them from buying a new house. Each period, a household with a default flag faces a constant probability (ζ) of that flag being removed, which allows them to purchase a house again.

In principle, a mortgage can be amortized with any interest rate. Differences in amortization rates translate into differences in the price of the mortgage at the origination (q). Following Hatchondo, Martinez, and Sánchez (2015), Kaplan, Mitman, and Violante (2020), and Arslan, Guler, and Kuruscu (2025), we assume that mortgage amortization is calculated using the risk-free rate r_m.[7] Thus, a $j-$year-old household who has a mortgage balance m makes a payment d based on the amortization formula:

$$m = d\left[1 + \frac{1}{(1+r^m)} + \frac{1}{(1+r^m)^2} + ... + \frac{1}{(1+r^m)^{J-j}}\right]. \tag{3}$$

[7] This is equivalent to buying points by paying upfront fees to reduce the mortgage interest rate to the risk-free mortgage interest rate, which is a common practice in the US mortgage market.

Then, the mortgage balance evolves according to

$$m' = (m - d) * (1 + r^m). \tag{4}$$

Mortgage Pricing: The zero-profit condition of financial intermediaries determines the mortgage price a household receives as a function of mortgage amount m'.[8] In order to illustrate the determination of the mortgage price, let a potential home buyers state be $\tilde{\theta} = (\nu, z, j)$, where ν is the labor income shock, z is fixed return component, and j is age. For a household who decides to purchase a house, their choices of house size (h'), the mortgage amount (m'), and savings in the financial asset (a'), all affect the future probability of default. Thus, the mortgage price depends on $\tilde{\theta}$ and these choices, as we denote by $q\left(\tilde{\theta}; h', m', a'\right)$. Then, the household who obtains a mortgage m', receives $q\left(\tilde{\theta}; h', m', a'\right) m'$ amount of cash from the financial intermediary. The mortgage price is determined by equating the cash given to the household to the expected discounted payoff of the mortgage to the financial intermediary.

In order to define the lender's payoff, let $\theta = \left(\tilde{\theta}, \omega, h, m\right)$ be the state of a household after the mortgage origination, where ω is the beginning-of-period cash-on-hand defined as $\omega = (1 + r^a(z))(1 + \epsilon) a + y(j, \nu)$, h is the current house size, and m is the amount of mortgage balance carried over from the previous period. If the household decides to stay in the current house without refinancing, the lender will receive a mortgage payment $d(\theta)$, where $d(\theta)$ is the solution to the amortization schedule specified in equation 3 given m. If the household chooses to refinance the mortgage or sell the house, the lender will receive the outstanding mortgage balance m. If the household defaults on the mortgage, the lender will receive the foreclosure value of the house $(1 - \kappa)p^h h$. Then, the expected discounted value of a mortgage to the bank, after the mortgage payment is made, is given by:

$$\bar{v}^l(\theta) = \frac{1}{1 + r^m} \int_{\theta'} v^l(\theta') \Pi(\theta'|\theta) \tag{5}$$

where

$$v^l(\theta) = \begin{cases} d(\theta) + \bar{v}^l(\theta) & \text{if} \quad \text{Stay} \\ m & \text{if} \quad \text{Refinance or Sell} \\ (1 - \kappa)p^h h & \text{if} \quad \text{Default} \end{cases}$$

Π is the endogenous transition probability of an existing homeowner that governs the state of the household derived from the exogenous changes (income/return shocks and aging) and endogenous decisions of the household.

[8] Arslan, Guler, and Taskin (2015), Chatterjee and Eyigungor (2015), and Guler (2015) use similar models of mortgage pricing.

The mortgage price $q\left(\tilde{\theta}, a', h', m'\right)$ at the time of the origination is then given by

$$q\left(\tilde{\theta}, a', h', m'\right) m' = \frac{1}{1+r^m} \int_{\theta'} v^l(\theta') \widetilde{\Pi}(\theta'|\tilde{\theta}),$$

where $\theta' = \left(\tilde{\theta}', \omega', h', m'\right)$ and $\widetilde{\Pi}(\theta'|\tilde{\theta})$ is the transition probability for the household's state at the time of the origination, driven by exogenous shocks ν and ϵ which along with the choice of a' determine ω'.[9] Then, the household chooses the housing size, the mortgage debt, and the financial asset taking this price schedule as given.

An important property of the pricing function $q\left(\tilde{\theta}, a', h', m'\right)$ is that, holding other variables constant, it is non-increasing with respect to m' since the household's default probability increases as the household becomes more leveraged. In fact, $q\left(\tilde{\theta}, a', h', m'\right)$ steeply declines in m' whenever the default probability rises above zero. Consequently, receiving more cash becomes increasingly difficult as m' increases despite increasing mortgage payments. This functions as if the mortgage interest becomes higher as the household becomes more leveraged, which prevents households from becoming overleveraged.[10] Without this property, households with higher returns on financial assets would want to borrow as much as possible to invest in the higher-yielding financial asset.

A second implication of this property is that default rates are extremely low or zero in the steady state of the model. This is because houses do not experience negative house-price shocks, homeowners choose to have positive equity, and households only default if the transaction cost of selling exceeds their equity.

The dependence of the mortgage price to household leverage relies on the existence of a rental market for housing. Since households who default are excluded from the housing market, they would have no incentive to default regardless of their leverage if the rental market were absent. As a result, the mortgage price would be independent of household leverage and the model would be equivalent to a model where all households can borrow at risk-free rate r_m.

3.2 Recursive Problems of Households

A household begins every period in one of the following housing tenure states: a potential renter without a default flag, a renter with a default flag, or a homeowner, which we denote by $\{R, D, H\}$ respectively. A potential renter without a default flag can choose to rent or to

[9] $\widetilde{\Pi}(\theta'|\tilde{\theta})$ is similar to $\Pi(\theta'|\theta)$ except that in $\widetilde{\Pi}(\theta'|\tilde{\theta})$, the household chooses h' and m' at the time of the origination, while m' is given by equation 4, a' is the solution to the optimization problem specified below, and $h' = h$ in $\Pi(\theta'|\theta)$ for an existing homeowner.

[10] Subject to this endogenous debt pricing, households are able to take out any loan-to-value ratio up to a maximum of 100%.

buy a house. A household with a default flag in their history is excluded from purchasing a house in that period. They regain access to the housing market in the next period with probability ζ. A homeowner can choose to stay in the same house, sell their house, refinance, or default on their mortgage debt if they have any.

3.2.1 Potential Renters without the Default Flag (R)

A potential renter without a default flag can choose to rent or to buy a house. Thus, the beginning of period value of a potential renter without a default flag is given by:

$$V^R(\tilde{\theta},\omega) = \max\left\{V^{Rent}(\tilde{\theta},\omega), V^{Buy}(\tilde{\theta},\omega)\right\},$$

where $V^{Rent}(\tilde{\theta},\omega)$ is the value of renting a house in that period and $V^{Buy}(\tilde{\theta},\omega)$ is the value of buying a house. Now, we define the value of renting, $V^{Rent}(\tilde{\theta},\omega)$, and buying a new house, $V^{Buy}(\tilde{\theta},\omega)$.

The Value of Renting

If a household chooses to rent, they choose the amount of rental housing services (s), the level of consumption (c), and the amount to save in the risky asset (a'). Thus, the value function of such a household is given as:

$$\begin{aligned} V^{Rent}(\tilde{\theta},\omega) &= \max_{c,s,a'} u(c,s) + \beta(1-\psi_j)\mathbb{E}V^R(\tilde{\theta}',\omega') \\ &\text{s.t.} \\ c + a' + p^r s &= \omega. \end{aligned} \tag{6}$$

The expectation $\mathbb{E}$ is taken with respect to ν and ϵ. The cash-on-hand in the next period, ω', is given by:

$$\omega' = (1 + r^a(z))(1 + \epsilon'_z)\, a' + y(j+1,\nu'). \tag{7}$$

The Value of Buying a House

If a household in state $\tilde{\theta}$ decides to purchase a house of size h', obtain a mortgage m', and save a' in the financial asset, they obtain $q\left(\tilde{\theta}; h', m', a'\right) m' - (\varphi_f + \varphi_\nu m')\,\mathbb{I}_{(m'>0)}$ amount of cash (net of fixed and variable mortgage financing costs). Together with the beginning of period cash-on-hand, this gives the household resources to finance the purchase of the house of size h', consumption (c), and savings in the financial asset a'. The household chooses these variables as well as the mortgage debt subject to the current period budget constraint and law of motion for ω' given by equation (7). Then, the value function of the household is given as:

$$V^{Buy}(\tilde{\theta}, \omega) = \max_{c,a',h',m'} u(c, h') + \beta(1 - \psi_j)\mathbb{E}V^H(\theta') \tag{8}$$

$$\text{s.t.}$$

$$c + a' + p^h h' = \omega + q\left(\tilde{\theta}; h', m', a'\right) m' - (\varphi_f + \varphi_\nu m')\, \mathbb{I}_{(m'>0)}.$$

3.2.2 Homeowner (H)

A homeowner can stay in the current house (S), sell the house and become a potential renter without a default flag (R), refinance and change their mortgage balance (F), or default (D). Thus, a homeowner's beginning of period value function is given by:

$$V^H(\theta) = \max\left\{V^S(\theta), V^R(\tilde{\theta}, \omega^R), V^F(\theta), V^D\left(\theta, \omega^D\right)\right\}.$$

$\omega^R = \omega + p^h h(1 - \lambda) - m$ is the cash-on-hand after after paying the transaction cost of selling the house ($\lambda p^h h$) and mortgage balance (m) when the household sell their house. $\omega^D = \omega + \max\left\{0, p^h h(1 - \kappa) - m\right\}$ is the cash-on-hand after default. The transaction cost of liquidating the house is $\kappa p^h h$. The defaulting household receives the any positive proceeds after the house is liquidated and mortgage balance (m) is paid. However, no household will choose to default if they have positive equity in the house after the mortgage balance is paid out, since the transaction cost of selling is smaller than liquidating it $\lambda < \kappa$, making it optimal for them to sell the house rather than defaulting on the mortgage. Thus, negative equity is a necessary condition for default.

Homeowner Staying in Current House (S)

If a homeowner chooses to stay in their home, they make a simple consumption (c) and savings (a') decision after paying the maintenance cost of the house, δh, and mortgage payment, d. The value of staying is given by the solution to the following problem.

$$V^S(\theta) = \max_{c,a'} u(c, h) + \beta(1 - \psi_j)\mathbb{E}V^H(\theta') \tag{9}$$

subject to

$$\begin{aligned} c + a' + d + \delta h &= \omega \\ \omega' &= (1 + r^a(z))(1 + \epsilon_z)a' + y(j + 1, \nu'). \\ m' &= (m - d)(1 + r^m) \end{aligned}$$

where d is defined in equation (3) given m.

Homeowner Refinancing their Mortgage

$$V^F(\theta) = \max_{c,a',m'} u(c,h) + \beta(1-\psi_j)\mathbb{E}V^H(\theta') \tag{10}$$

subject to

$$\begin{aligned} c + a' + m' + \delta h &= \omega + q\left(\theta'_H\right)m' - \left(\varphi_f + \varphi_\nu m'\right)\mathbb{I}_{(m'>0)} \\ \omega' &= \left(1 + r^a\left(z\right)\right)\left(1 + \epsilon_z\right)a' + y(j+1,\nu'). \end{aligned}$$

where $\theta'_H = \left(\tilde{\theta}, \omega', h, m'\right)$. If a homeowner chooses to refinance their mortgage, they choose the level of consumption (c), the new amount of mortgage debt (m') after paying the fixed and variable costs of refinancing $\varphi_f + \varphi_\nu m'$ and the amount to save in the risky asset (a'). Note that the household can either increase or decrease the current mortgage balance through refinancing.

Household with a Default Flag

A household with a default flag cannot access the owner-occupied housing market. They simply choose the rental housing size (s), consumption (c), and savings in the financial asset (a') as follows:

$$V^D(\tilde{\theta}, \omega) = \max_{c,s,a'} u(c,s) + \beta(1-\psi_j)\left[\zeta\mathbb{E}V^R(\tilde{\theta}', \omega') + (1-\zeta)\,\mathbb{E}V^D(\tilde{\theta}', \omega')\right] \tag{11}$$

subject to

$$\begin{aligned} c + a' + p^r s &= \omega \\ \omega' &= \left(1 + r^a\left(z\right)\right)\left(1 + \epsilon_z\right)a' + y(j+1,\nu'). \end{aligned}$$

A household with a default flag returns to the housing market with probability ζ and keeps the default flag with probability $1-\zeta$.

4 Calibration

The U.S. housing market has experienced a significant boom-and-bust cycle since the late 1990s. To isolate the effects of this episode, we calibrate our model to a period when the U.S. housing market was stable. Specifically, we use the 1995 Survey of Consumer Finances to discipline our model. Online appendix I shows that the key patterns we compare the model against are constant over time. For a set of parameters that can be identified outside the model, we rely on values commonly used in the literature. We then internally calibrate the remaining parameters of the model to match certain moments in the data.

4.1 Externally Chosen Parameters

A model period corresponds to one year. Households are born at age 25 ($j = 1$) and may live for 60 years. The stochastic mortality rates $\{\psi_j\}$ are taken from the Center for Disease Control and Prevention. After age 85 ($J = 60$) households die with certainty.

Table 1 summarizes all of the parameters we choose according to commonly defined values in the literature.

Table 1: Externally Chosen Parameters

Transaction cost of selling housing	λ	7.00 %
Depreciation of housing	δ	1.50 %
Price-Rent Ratio	$\frac{p^h}{p^r}$	13.00
House Price	p^h	1.00
Variable mortgage origination cost	φ_v	0.01
Fixed cost of refinancing	φ_f	0.01
Bank loss on foreclosure	κ	0.25
Probability the default flag is removed	ζ	0.14
Coefficient of relative risk aversion	σ	2.00
Dispersion of labour ability	σ_ε	0.16
Persistence of labour ability	ρ_ν	0.96

Preferences

For preferences, we use a CES utility function: $u(c,s) = \frac{\left[(1-\gamma_s)c^{1-\chi}+\gamma_s s^{1-\chi})\right]^{\frac{1-\sigma}{1-\chi}}}{1-\sigma}$ where γ_s measures the relative preference for housing services s, calibrated to match the share of expenditure on housing services. $\frac{1}{\chi}$ measures the elasticity of substitution between housing services and consumption, set to 1.25 as in Kaplan, Mitman, and Violante (2020) and Piazzesi, Schneider, and Tuzel (2007). We then set $\sigma = 2$ as is standard in the literature.

Labor Income Process

In order to capture the life-cycle profile of earnings, we include a life-cycle component of earnings $h(j)$, which is assumed to be a quadratic function in age.[11] From age 25-65, households also face a stochastic labor income process $\nu_{i,j}$ that follows an AR(1) process, which we discretize using the Tauchen method:

[11]Coefficients are chosen to match doubling of income between age 25 and 55, 10% drop in income between age 55 and 65, and average income of 1.

$$\nu_{ij} = \rho_\nu \nu_{i,j-1} + \varepsilon_{ij} \qquad\qquad \varepsilon_{ij} \sim N(0, \sigma_\varepsilon)$$

We choose $\rho_\nu = 0.96$ and $\sigma_\varepsilon = 0.16$, which matches the estimation results in Storesletten, Telmer, and Yaron (2004).

After age 65, we assume households retire and so receive a constant amount of pension income, which is calculated according to the method in Guvenen and Smith (2014). Household labor income in a retirement period is then given by:

$$y_{ij} = g\left(y_{ij=40}\right)$$

where g represents a function of the predicted average lifetime income conditional on the last period's labor income before retirement. Forecasting coefficients are obtained by running an OLS regression of average income on a constant and the last labor income realization before retirement in a simulation.

Retirement Accounts

Retirement accounts are a non-trivial source of financial wealth for many households. However, because they are typically costly to access before retirement, early withdrawals from retirement accounts are rare and account for only a small fraction of retirement pension wealth (Goodman et al. (2021)). As a consequence, retirement account balances are poorly suited to help households smooth out consumption before retirement. In order to keep our model computationally tractable, yet still recognize that the accumulation of financial wealth within retirement accounts is a key channel through which people save for retirement, we borrow an approach for dealing with retirement accounts found in Berger et al. (2018). In the model, we do not keep track of retirement account balances. Instead, when households retire at age 65, they receive a one-time lump-sum payment that represents gaining access to the balances of their retirement accounts. This one-time payment is a multiple of their income at age 65.[12] We set this multiple to 1.02, which corresponds to the ratio of average retirement account balances to average income for households with a head aged 63-67 in the Survey of Consumer Finances.

Housing

We set the depreciation rate of houses, δ, to 1.5%, consistent with estimates provided in Harding, Rosenthal, and Sirmans (2007). The transaction cost of selling a house, λ, is set to 7% capturing realtor fees, sales costs and local taxes, which is consistent with

[12] We assume that households know about this lump-sum payment from birth.

estimates provided in Delcoure, Miller et al. (2002). Following Pennington-Cross (2006), we set the cost of selling a foreclosed house, κ, to 25%. Following the estimates provided by the Consumer Financial Protection Bureau, we set the fixed cost of originating a mortgage, φ_f, to 2% of average labor income, variable cost of mortgage origination, φ_ν, to 1%.[13] We set the house price-to-rent ratio as $p^h/p^r = 13$, which is within the range of estimates used in the literature (Sommer, Sullivan, and Verbrugge (2013)) and normalize the price of owner-occupied housing to $p^h = 1$. Finally, we set the probability of the default flag being removed, ζ, to 14% capture the fact that foreclosure flags are removed from credit history after 7 years.[14]

4.2 Internally Calibrated Parameters

After externally setting some parameters, we need to calibrate nine parameters internally by matching nine data moments. Table 2 summarizes the internally calibrated parameters, and Table 3 summarizes the targeted data moments. The first column in each table reports the data moments, and the second column reports the corresponding moments from our benchmark model.

We also calibrate three other variants of the benchmark model, sequentially eliminating return heterogeneity, long-term mortgage debt, and illiquid housing. These variants allow us to illustrate the relative importance of these factors in the applications below. We group these alternative models under the umbrella of "models with homogeneous return". We will discuss their calibrations below. We start by describing the calibration of the benchmark model with heterogeneous returns.

4.2.1 Calibration of the Benchmark Heterogeneous Returns Model

We calibrate the discount factor β to match an aggregate wealth-to-income ratio of 3.84. Following Kaplan, Mitman, and Violante (2020), we assume that the housing market is fully segmented. Specifically, the rental choice is limited to the interval $[0, \underline{h}]$, while owner-occupied housing is available in the interval $\left[\underline{h}, \overline{h}\right]$. The minimum owner-occupied house size ($\underline{h}$), maximum house size ($\bar{h}$), and the household's preference for housing services (γ_s) jointly govern the housing and rental markets in the economy. These are jointly calibrated to match the proportion of homeowners (0.60), the share of housing expenditure out of total income (0.25), and the housing share of gross assets owned by the wealthiest 10% of households (0.28).

Since the relevance of mortgage debt distribution for policy is a central focus of this paper, we require both the heterogeneous and homogeneous returns models to generate

[13] See Federal Reserve Board (2008)
[14] See Akin (2023)

Table 2: Internally Calibrated Parameters

Parameters	Benchmark: Heterogeneous Returns Model	Models with Homogeneous Return: Homogeneous Return Model	Models with Homogeneous Return: Housing	Models with Homogeneous Return: One-Asset
β	0.91	0.93	0.92	0.95
γ_s	0.49	0.21	0.55	0.21
$\underline{h}$	1.96	2.85	1.88	-
$\bar{h}$	10.52	3.99	2.90	-
r^M (%)	11.05	4.90	-	-
α_z	20.62	-	-	-
$\underline{z}$	-0.01	-	-	-
$\sigma_\epsilon(\bar{z})$	0.25	-	-	-

Table 3: Targeted Moments

Moments	Data Targets	Benchmark: Heterogeneous Returns Model	Models with Homogeneous Return: Homogeneous Return Model	Models with Homogeneous Return: Housing	Models with Homogeneous Return: One-Asset
Wealth to Income	3.84	3.91	3.84	3.84	3.84
Housing Expenditure Share	0.25	0.23	0.25	0.25	0.25
Housing Share of Wealthy 10%	0.28	0.28	0.28	0.28	-
Prop. of Homeowners	0.60	0.59	0.60	0.60	-
Mortgage Debt to Income	0.67	0.68	0.67	-	-
Top 1% Wealth Share	0.39	0.39	-	-	-
Top 10% Wealth Share	0.72	0.64	-	-	-
Top 50% Wealth Share	0.98	0.98	-	-	-

the same level of aggregate mortgage debt. This allows us to isolate and demonstrate the importance of distributional differences. To ensure that each model supports the targeted aggregate mortgage level, we calibrate the risk-free interest rate accordingly. Specifically, the risk-free interest rate (r^m) is chosen to match the ratio of mortgage debt to income ratio of 0.67.

Rates of Return

We assume that the permanent component of returns (z) follows a Pareto distribution with a shape parameter α_z and a scale parameter $\underline{z}$. In order to capture the fact that wealthier households invest in securities that have greater risk, such as stocks, long-term bonds, and private businesses as documented by Fagereng et al. (2020), we assume that the standard deviation of the idiosyncratic shock depends on the fixed component ($\sigma_\epsilon(z_i)$). We implement this by calibrating the standard deviation of the idiosyncratic shock for the highest z-type, assuming that the lowest z-types face no idiosyncratic risk and linearly interpolating in between.[15]

We calibrate the Pareto shape parameter, the Pareto scale parameter and the standard deviation of the i.i.d. return shock to match the share of wealth owned by the wealthiest 1%, 10%, and 50% of households (0.39, 0.72, and 0.98 respectively). In appendix B we compare the distribution of permanent returns to evidence from Norwegian administrative data (Fagereng et al., 2020) and find that the level of dispersion is quantitatively similar.

4.2.2 Calibrations of homogeneous-returns models

In the homogeneous return versions of the model, we target the same data moments, except those regarding the concentration of wealth, and assume that all households earn the same risk-free return on their financial wealth. Consequently, these versions grossly understate the wealth concentration observed in the data. Nevertheless, they serve as useful benchmarks for comparison, as they are similar to models of housing and mortgage markets used in recent work (see, for example, Chatterjee and Eyigungor (2015); Hatchondo, Martinez, and Sánchez (2015); Arslan, Guler, and Taskin (2015); Guler (2015); Kaplan, Mitman, and Violante (2020)). We set the return on the financial asset in these models to the average return obtained from the calibration of the heterogeneous returns model, which is 3.2%.

We present the calibrated parameters in Table 2 and the targeted moments in Table 3 under columns labeled "Models with Homogeneous Return". In the first version of these model labeled as "homogeneous return model", we eliminate the return heterogeneity from our benchmark heterogeneous returns model while keeping the housing and mortgage market structure unaltered. In the second version, named "Housing" model, we remove the ability to borrow using long-term mortgage debt from the homogeneous return model. In this model, all homeowners must pay the full purchase price of their home upon purchase. Finally, we remove owner-occupied illiquid housing, leaving us with the "One-Asset" model in which every household is a renter.

[15] We set the top discrete point equal to the top 0.1 quantile and the bottom discrete point equal to the minimum value of this distribution. We then calculate the cumulative density of each discrete point by using the midpoints. We bunch the bottom two points by taking the average of the bottom two. We calibrate the two parameters of our fixed return distribution to match features of the wealth distribution.

We use Gauss-Hermite quadrature to discretize the i.i.d. shocks (ϵ).

5 Consistency between the Model(s) and the Data

In this section, we compare the performance of the benchmark model with heterogeneous returns to the homogeneous return model in matching the wealth distribution, asset and debt composition observed in the data. Not surprisingly, the benchmark model matches the distribution of wealth better than the homogeneous return model, as the return process is directly calibrated to statistics characterizing the concentration of wealth at the top. However, a stark contrast between the two models emerges in the distribution of mortgage debt. Despite not being a calibration target, the benchmark model successfully replicates this observed concentration, while the homogeneous return model entirely fails to generate any debt among the wealthiest households. We now compare the performance of these models in detail.

5.1 Concentration of Wealth and its Primary Components

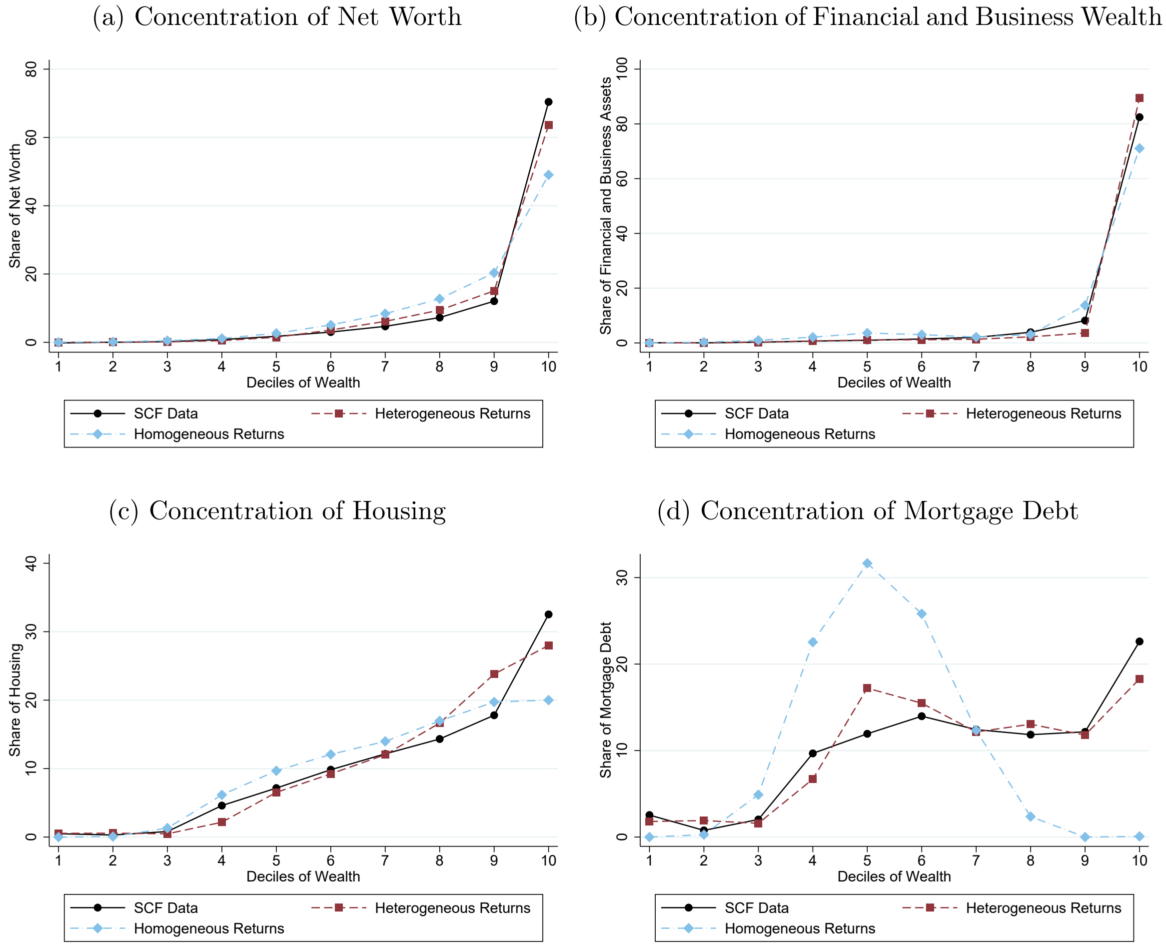
Figure 5 shows the concentration of wealth and its primary components over the wealth distribution. Figure 5a presents the fraction of net worth owned by each decile of the wealth distribution. The top 10% of households own 64% of aggregate wealth in the benchmark model, which is close to the 70% observed in the data. This is not surprising given that the return process is calibrated by targeting the distribution of wealth. By contrast, in the homogeneous returns model, the top 10% own only 49%.

At first glance, it might seem that the homogeneous return model performs reasonably well. However, a closer examination reveals that this model grossly underestimates the fraction of wealth held by the top 1% and overestimates the fraction held by the next 9%, such that the combined fraction held by the top 10% does not appear too far off from the data. We report more detailed concentration statistics in table A.1 in appendix A. In particular, the homogeneous return model generates a top 1% wealth share of only 11%, which is significantly lower than the 39% observed in the data. This implies that households at lower parts of the wealth distribution hold too much wealth given that the model matches the aggregate wealth-to-income ratio. On the other hand, the heterogeneous returns model exactly matches the top 1% wealth share as it is targeted.

Matching the concentration of financial assets across the wealth distribution is vitally important for generating realistic marginal propensities to consume, as we discuss in section 6.1. Figure 5b compares the fraction of aggregate financial and business assets owned by each decile of the wealth distribution in the data to the corresponding fractions in the two models.[16] Financial and business assets are even more concentrated than net worth,

[16] We do not distinguish between business and financial assets in the benchmark heterogeneous returns

Figure 5: Concentration of Wealth and its Primary Components



This figure illustrates the fraction of aggregate wealth, and its primary components, held within each decile of the wealth distribution, and compares the performance of a heterogeneous-return benchmark to that of a homogeneous-return model.

with 82% of these assets owned by the wealthiest 10% of households in the data. The full heterogeneous returns model over-predicts this top share with 90% of these assets owned by the top 10%. The homogeneous returns model, on the other hand, under-predicts the top share with only 71% owned by the top 10%. As a consequence, 9% of these assets are held by households between the 61st and 30th percentiles in the homogeneous return

model due to the model's high dimensionality. While some wealthy households in the data hold illiquid business assets but have few liquid financial assets, in the model they appear to have significant liquid financial assets. This would cause the benchmark model to generate a lower marginal propensity to consume (MPC) than its potential. If we could distinguish between the two assets in the heterogeneous returns model, the model could possibly generate a higher MPC. In the homogeneous returns model, on the other hand, if both an illiquid business asset and a liquid financial asset were to exist simultaneously, households would only save through the liquid financial asset since both assets pay the same return, and thus no illiquid business asset would be owned, making a distinction between the two assets irrelevant.

model, substantially more than the 3% held in the data. In contrast, the benchmark model exactly matches this statistic. The bottom 30% of households own less than 1% of financial and business assets in the data and the benchmark model, but in the homogeneous returns model these households hold around 1%.

Housing is much more equally distributed than financial and business assets as illustrated in Figure 5c. The heterogeneous returns model exactly matches the share of housing owned by the top 10%, which is 33% in the data.[17] By contrast, the homogeneous returns model substantially under predicts the top housing share and also over-predicts how much housing is held by households in the middle of the wealth distribution.

The most striking contrast between the two models appears in the distribution of mortgage debt. As shown in Figure 5d, mortgage debt is less concentrated than housing, yet the top 10% of households still carry 23% of outstanding mortgage balances in the data. The heterogeneous returns model reasonably replicates the distribution of mortgage debt and generates a mortgage debt share of 18% for the top 10% of households. By contrast the homogeneous returns model fails to generate any mortgage debt at the top 20% of the wealth distribution, and significantly overestimates mortgage debt for households in the middle of the wealth distribution. This stark contrast between these two models becomes important when we compare the aggregate and distributional effects of fiscal and monetary policies.

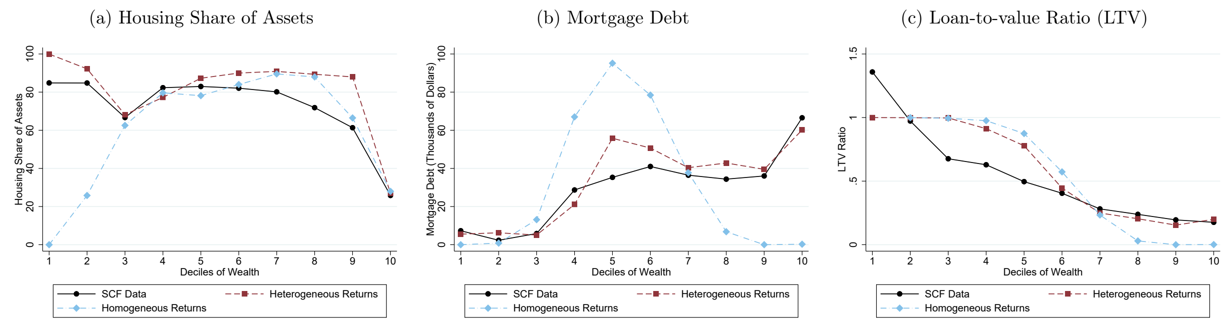
5.2 Composition of Wealth

In this section, we analyze how the composition of household wealth changes over the wealth distribution. Figure 6a shows the share of assets invested in housing. Remember that the housing share of assets of the wealthiest top 10% is a calibration target for both models. As a result, it is not surprising that both models match the decline in the share of wealth invested in housing at the top of the wealth distribution.

Figure 6b shows the level of mortgage debt and Figure 6c shows the loan-to-value (LTV) ratios over the wealth distribution. In the data, the top decile has the largest average amount of mortgage debt. The homogeneous returns model entirely fails to generate this debt, instead having zero mortgage debt at the top of the distribution. This is due to the fact that the calibrated mortgage interest rate is higher than the interest rate on the financial asset. Thus, all homeowners in the homogeneous returns model prefer to fully pay their mortgage debt (subject to refinancing costs) before accumulating any financial assets. Thus, wealthy households typically do not jointly carry mortgage debt and hold financial

[17] Note that one of our calibration targets is the share of their assets the wealthiest 10% of households hold in housing. This is 28% in the data and both models. By contrast, here we report the share of all housing owned by the wealthiest 10% of households.

Figure 6: Housing Share, Mortgage Debt, and Loan-to-value Ratio over the Wealth Distribution



asset. By contrast in the heterogeneous returns model, many wealthy households choose to stay leveraged in order to invest in the financial asset, which may earn a higher rate of return. On the other hand, the rise in the effective mortgage interest rate with default risk discourages these households from becoming fully leveraged. Thus, the heterogeneous returns model jointly matches the increasing amount of mortgage debt and the declining average LTV ratio over the wealth distribution, consistent with the data.

5.3 Wealth-to-Income Ratios

In standard incomplete market models with a single asset, marginal propensities to consume (MPC) are low and similar across households, with the exception of those at their borrowing limit. These constrained households exhibit hand-to-mouth behavior, consuming all income. However, when calibrated to match aggregate wealth, these models yield very few borrowing-constrained households. The core challenge, therefore, lies in developing models that reconcile a substantial hand-to-mouth consumer population with the observed levels of aggregate wealth.

Kaplan and Violante (2022) compare a variety of models calibrated to aggregate wealth-to-income ratios in the context of generating realistic marginal propensities to consume. They find that a one-asset model with rate of return heterogeneity can generate large marginal propensities to consume, but at the expense of creating an insufficient median wealth level, which they call the "missing middle" problem.

Our benchmark model also generates a sizable MPC of 36.5% (see Section 6.1 for more details). However, it does not suffer from the "missing middle" problem highlighted in Kaplan and Violante (2022). To illustrate this point, in Table 4, we report the mean and median values of wealth-to-income ratios from our benchmark model. For comparison, we also report the same statistics from the homogeneous returns model.

Both models are calibrated to match the aggregate wealth-to-income ratio as illustrated

Table 4: Components of Wealth

	Mean			Median		
	$\frac{\text{Wealth}}{\text{Income}}$	$\frac{\text{Fin. Asset}}{\text{Income}}$	$\frac{\text{Housing}}{\text{Income}}$	$\frac{\text{Wealth}}{\text{Income}}$	$\frac{\text{Fin. Asset}}{\text{Income}}$	$\frac{\text{Housing}}{\text{Income}}$
Data	3.84	2.62	1.97	0.86	0.16	1.22
Het. Returns	3.91	2.15	2.52	1.07	0.05	2.16
Homo. Returns	3.84	1.91	2.63	1.41	0.35	3.77

This table shows mean and median wealth-to-income ratios. The means wealth-to-income ratios are calculated as group means, so the total wealth in the economy divided by total income. By contrast, the medians are the median wealth-to-income ratios from the distribution of household level wealth-to-income ratios.

in the first column of Table 4. However, they imply different median wealth-to-income ratios. Most importantly, our benchmark model does not generate a median wealth-to-income ratio that is much lower than it is in the data. In fact, the median wealth-to-income ratio in the benchmark model is 1.07, slightly higher than the data's 0.86. This contrasts with the one-asset heterogeneous returns model analyzed in Kaplan and Violante (2022). On the other hand, the homogeneous returns model generates a median wealth-to-income ratio of 1.41, almost twice the data.

The two models end up with very different ratios of financial wealth and housing wealth-to-income as well. In the data, financial wealth is worth 2.62 times income. Our heterogeneous returns model gets close to this at 2.15, while our homogeneous returns model undershoots it more at only 1.91. Correspondingly, the housing-to-income ratio in the heterogeneous return model is closer to the data (2.52 versus 1.97) than the one in the homogeneous returns model (2.63 versus 1.97).

Finally, the median financial asset-to-income ratio in the benchmark model is 0.05, lower than the observed value of 0.16 in the data. This feature is also present in the two-asset model analyzed in Kaplan and Violante (2022). In contrast, the homogeneous returns model overestimates the financial asset-to-income ratio, yielding 0.35 compared to the empirical value of 0.16.

These results highlight the importance of return heterogeneity in matching both the distribution and composition of wealth. Next, we illustrate why this matters in a series of policy experiments.

Table 5: The Average Marginal Propensity to Consume

	Average MPC	Proportion of Hand-To-Mouth: All	Wealthy	Poor	Average MPC: Hand-To-Mouth Wealthy	Hand-To-Mouth Poor	>0 Liquid Wealth
SCF Data		26.0	9.8	16.2			
Het. Returns	36.5	26.6	17.7	8.9	94.7	33.2	22.9
Models with Homogeneous Returns							
Homo. Returns	21.2	8.4	2.9	5.5	93.7	62.8	16.4
Housing	24.8	12.1	8.4	3.7	92.5	37.6	17.8
One-Asset	9.4	2.0	0.0	2.0	-	55.7	8.5

We calculate the proportion of hand-to-mouth households in the SCF data as the proportion of households with liquid financial assets less than half of their monthly income. Our estimate that 26% of Survey of Consumer Finance households are hand-to-mouth falls firmly within the range of values estimated by Kaplan and Violante (2014). They estimate that between 17.5% and 35% of households in the 2001 wave of the Survey of Consumer Finances are hand-to-mouth households with between 7% and 26% being wealthy hand-to-mouth. These ranges depend on the assumptions about the frequency of the pay-period, whether financial asset includes stocks and bonds, whether illiquid wealth includes vehicles, and whether wealthy hand-to-mouth households are defined as having at least $3,000 in illiquid accounts. Our estimates assume that households are paid monthly, that stocks and bonds are included in financial asset, and that wealthy hand-to-mouth households are defined as homeowners with less than half their monthly income in liquid assets. In the model, we consider households with zero liquid financial assets to be hand-to-mouth.

6 Policy Implications

In this section, we illustrate the importance of accurately capturing both the composition and distribution of wealth. First, we analyze how different model features contribute to the average marginal propensity to consume (MPC), a key statistic for fiscal policy design. Then, we examine the role of return heterogeneity in fiscal and monetary policy analysis by comparing the implications of our benchmark model with those of the homogeneous returns model across a range of policies.

6.1 Determinants of the Average MPC

The economy-wide average marginal propensity to consume (MPC) is an important economic quantity as it is a major determinant of the efficacy of fiscal stimulus as well as monetary policy. During recent recessions, the U.S. government, along with many governments around the world, has sought to stimulate the economy with direct financial transfers to households.[18] Therefore, understanding the consumption responses of these policies is vital for the design of future economic policies.

Empirical research has documented that households spend a significant portion of transfers payments in the quarter that they receive them. While most standard models fail to generate this high MPC, some notable papers have developed frameworks that can (Kaplan and Violante (2014); Carroll (2017); Attanasio, Kovacs, and Moran (2020)). Our benchmark model also generates a sizable annual MPC of 36.5%.

In order to study which features of the benchmark model are responsible for the high MPC, we decompose the importance of return heterogeneity, long-term fixed mortgages and refinancing, and illiquid housing on the average marginal propensity to consume (MPC). We do this by sequentially shutting down each of these channels and recalibrating the model to the remaining relevant moments.[19] We calculate the marginal propensity to consume in all of these models by giving households an unexpected and unfunded $500 tax rebate and comparing their level of consumption in the current period with and without the tax rebate. The ratio of the difference in current aggregate consumption to tax rebate gives the average annual MPC.

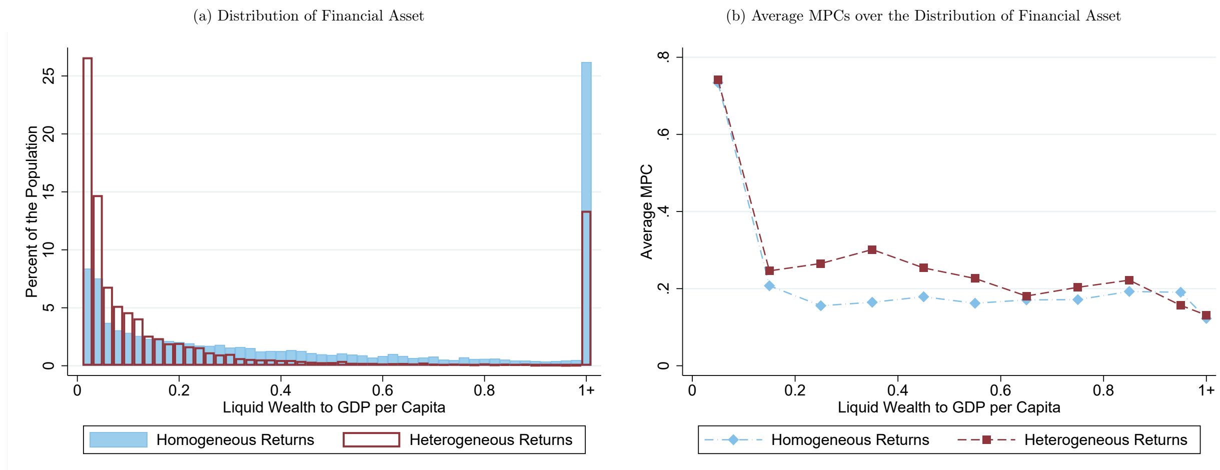
Table 5 reports the average annual MPC across all households, the proportion of wealthy and poor hand-to-mouth households, and the average MPC across different subgroups in the stationary distribution of each model. Wealthy hand-to-mouth households are those who own housing but hold no financial assets, while poor hand-to-mouth households are renters with no financial assets.

The table shows that the benchmark heterogeneous returns model generates a high average MPC of 36.5%. This result mainly stems from the model's ability to produce a substantial share of both wealthy and poor hand-to-mouth households, 17.7% and 8.9% respectively. Notably, the average MPC among wealthy hand-to-mouth households is 94.7%,

[18]See Johnson, Parker, and Souleles (2006), Parker et al. (2013), and Parker et al. (2021) for details of these programs.

[19]In this section, we decompose these three mechanisms in a particular order, removing first rate of return heterogeneity, then mortgage debt, and finally illiquid housing. We think this is an informative ordering which helps illuminate the key mechanisms in operation. An alternative way to study the contributions of these different model features is presented in Appendix C, where we perform a Shapley-Owen-Shorrocks decomposition that provides an order-free decomposition of the contribution of each feature.

Figure 7: The Distribution of Financial Asset and MPC



while that of poor hand-to-mouth households is 33.2%. Due to transaction costs, wealthy hand-to-mouth households are unwilling to adjust the size of their home in response to small income shocks. Due to their substantial net worth, these households are willing to spend much more of any cash transfer compared to relatively poor hand-to-mouth households, who does not have any wealth. Across the models we consider, these wealthy hand-to-mouth households have the highest average MPCs.

We now examine how different features of the benchmark model contribute to the high average MPC.

6.1.1 The Role of Return Heterogeneity

Including heterogeneous returns in the model allows us to match the high degree of wealth inequality we observe in the data, and also contributes to the high average marginal propensity to consume (MPC). When we eliminate return heterogeneity, the average MPC falls by 15.3 percentage points to 21.2%. This difference between the heterogeneous returns model and the homogeneous returns model is mainly due to the proportion of the population who choose to be hand-to-mouth. As can be seen in Table 5, in the heterogeneous returns model 26.6% of households are hand-to-mouth, while in the homogeneous returns model it is only 8.4% of households.

Return heterogeneity allows the benchmark model to both generate a substantial fraction of hand-to-mouth households and at the same time match the aggregate wealth-to-income ratio. Households who earn lower returns on the financial asset have weaker savings motives. This not only means that they will mechanically choose to spend a large fraction of any cash transfer, but also that they will generally accumulate few financial assets, and will have limited capacity to smooth consumption in response to idiosyncratic income shocks.

In fact, more than 99% of households who choose to be hand-to-mouth are those earning low returns on their financial assets.

On the other hand, households that earn a high rate of return on their financial assets have substantially stronger savings motives and accumulate sizable financial assets. This mechanism generates the high concentration of financial assets that we see in the data, where the wealthiest households own the majority of financial wealth. The strong savings motive mechanically reduces the average MPC for these high-return households. However, they also generate a more realistic concentration of wealth, and substantially boost the aggregate wealth-to-income ratio.

By contrast, in the homogeneous returns model, savings motives are more uniform across households, resulting in a more even distribution of financial assets. As a consequence, significantly fewer households choose to be hand-to-mouth, making them far less responsive to a $500 cash rebate.

The stark contrast between the two models' savings implications can be seen in Figure 7a, which shows the distribution of financial asset in the two economies. In the heterogeneous returns model a much larger fraction of the population is bunched near the bottom of the financial asset distribution. By contrast, there are many more households with financial asset worth more than one year's GDP per capita in the homogeneous returns model.

Figure 7b shows the average MPCs over the distribution of financial asset in the two models. Average MPCs follow a similar pattern over the distribution of financial asset in both models. Individuals with the lowest levels of financial asset have the highest average MPCs, while households with more financial asset have much more moderate average MPCs. Clearly, given the high average MPCs at the bottom of the financial asset distribution, and the much higher proportion of households with little financial asset in the heterogeneous returns model, the different distributions of liquid assets across the two models generates some of the differences in average MPC. Furthermore, households with financial asset between 0.2 of GDP per Capita and 0.6 of GDP per Capita do have higher average MPCs in the heterogeneous returns model than in the homogeneous returns model. To what extent, then, are the differences in average MPC driven by differences in the distribution of financial assets versus different consumption and savings decisions across that distribution?

In order to assess this, Table 6 presents a decomposition of the average MPCs in the heterogeneous and homogeneous models using equation 12. This equation expresses the average MPC as a weighted sum of the proportions (P) of wealthy hand-to-mouth ($WHtM$), poor hand-to-mouth ($PHtM$), and liquid asset-holding (LA) households, multiplied by their

Table 6: MPC Decomposition

Proportions	$\overline{\text{MPC}}$ of Groups	P_{WHtM}	P_{PHtM}	P_{LA}	$\overline{\text{MPC}}_{WHtM}$	$\overline{\text{MPC}}_{PHtM}$	$\overline{\text{MPC}}_{LA}$	Average MPC
Homo Returns	Homo Returns	2.9	5.5	91.6	93.7	62.8	16.4	21.2
Homo Returns	Het Returns	2.9	5.5	91.6	94.7	33.2	22.9	25.5
Het Returns	Homo Returns	17.7	8.9	73.4	93.7	62.8	16.4	34.2
Het Returns	Het Returns	17.7	8.9	73.4	94.7	33.2	22.9	36.5

respective average MPCs:

$$\text{Average MPC} = P_{WHtM} \times \overline{MPC}_{WHtM} + P_{PHtM} \times \overline{MPC}_{PHtM} + P_{LA} \times \overline{MPC}_{LA} \quad (12)$$

By comparing the proportions of hand-to-mouth households in one model with the average MPCs of those same groups in the other model, we can gauge the relative importance of differences in the distribution of household types versus differences in their consumption behavior.

The first row in table 6 corresponds to the homogeneous returns model, while the fourth row corresponds to the heterogeneous returns model. The second and third rows are counterfactuals where we combine proportions of hand-to-mouth households in one model with the average MPCs of those same groups in the other model.

This decomposition clearly shows that the primary reason for the difference in average MPC between the two models is the difference in the proportion of hand-to-mouth households. Starting from the homogeneous returns model (the first row), if we keep the group proportions from that model but substitute the average MPCs across each group from the heterogeneous returns model, the overall average MPC increases from 21.2 to 25.5. Thus, the contribution of differences in group-specific MPCs accounts for only 4.3 percentage points of the total difference.

By contrast, again starting from the homogeneous returns model, if we keep the average MPCs across each group from that model but substitute in the group proportions from the heterogeneous returns model, the average MPC rises from 21.2 to 34.2, an increase of 13.0 percentage points. This indicates that the primary driver of the difference in average MPC between the heterogeneous and homogeneous returns models is the different distribution of liquid assets across households. The remaining 2.3 percentage point difference between this counterfactual and the full heterogeneous returns model again highlights the lesser importance of differing group-specific MPCs.

Are these results driven specifically by rate of return heterogeneity—or more broadly, by the concentration of wealth? In appendix D, we investigate the average MPC in an economy where wealth inequality arises from superstar income shocks, following Castañeda, Díaz-Giménez, and Ríos-Rull (2003), rather than from rate of return heterogeneity. While De Nardi, Fella, and Paz-Pardo (2016) show that empirically realistic earnings dynamics do not generate sufficient top-tail wealth inequality, this analysis helps clarify the underlying drivers of high MPC in the benchmark model. We find that the superstar income shock economy also has a much higher marginal propensity to consume than the homogeneous returns model, and conclude that it is the distribution of liquid financial assets that drives the higher marginal propensity to consume. However, the superstar income shock economy also suffers from the same limitation as the homogeneous return model: the distribution of mortgage debt is wildly inconsistent with the data. In particular, the wealthiest households carry no mortgage debt, while there is an excessive concentration of mortgage debt among households in the middle of the wealth distribution. The calibrations and results of the superstar income shock model are presented in Appendix D.

6.1.2 The Role of Mortgage Debt

Removing long-term mortgage debt from the full homogeneous returns model increases the average MPC by 3.6 percentage points to 24.8%. Three factors contribute to this increase in the average MPC. First, the absence of mortgages increases the incentive to save for home purchases, slightly reducing the calibrated discount factor to 0.92. This, in turn, lowers the MPC for all household types. Second, restricting households from borrowing against their illiquid housing wealth makes housing wealth less liquid and limits their ability to smooth consumption over time, thereby raising the aggregate MPC. Third, the share of wealthy hand-to-mouth households rises from 8.4% in the homogeneous returns model to 12.1% Since wealthy hand-to-mouth households have high MPCs, this factor also contributes to the higher average MPC in the economy.

Overall, while refinancing mortgage debt has associated transaction costs, these costs are far less than the transaction costs associated with buying or selling a new house and so preventing households from borrowing against their illiquid assets removes one margin of adjustment. Thus, removing illiquid mortgage debt increases the average MPC, but not dramatically.

6.1.3 The Role of Housing

Removing illiquid housing reduces the average marginal propensity to consume from 24.8% down to 9.4%. Thus, the presence of housing significantly contributes to the average MPC. The mechanism is similar to the one in Kaplan and Violante (2014). In the absence of illiquid housing there are no wealthy hand-to-mouth households and only 2% of the population is hand-to-mouth. The fact that a substantial fraction of aggregate wealth is

Table 7: Mortgage Relief Policy: Heterogeneous Returns vs. Homogeneous Returns Models

			Benefits By Wealth Quintile				
	Fiscal Cost	$\frac{\Delta C}{\text{Fiscal Cost}}$	0-20%	20-40%	40-60%	60-80%	80-100%
SCF Data	1.15%	-	6%	11%	26%	24%	34%
Het. Returns	1.15%	24.6%	1%	7%	33%	26%	33%
Homo. Returns	1.15%	11.4%	0%	20%	64%	17%	0%

The Survey of Consumer Finance (SCF Data) calculations in the first row of the table show the empirical distribution of mortgage debt by wealth quintile. Since our experiment gives out a cash transfer proportional to the mortgage balance, the empirical distribution of mortgage debt matches the empirical distribution of this benefit.

held in the form of illiquid assets is therefore extremely important for properly assessing the efficacy of fiscal policy.

6.2 Mortgage Relief Policy

In response to major shocks to the housing market, like the 2008 Financial Crisis, politicians have contemplated a wide variety of measures to support home owners and mortgage debtors using government funds. In this section, we compare the stimulative and distributional effects of a mortgage relief policy under both our benchmark model with heterogeneous returns and our homogeneous returns model in order to illustrate why matching the composition of wealth over the wealth distribution matters for policy evaluation.

We study a mortgage relief policy where all mortgage debtors are given a one-time cash transfer proportional to their mortgage balance. We set the total fiscal cost of the transfer equal to the cost of providing every household with \$500, and then distribute it proportionally to the level of mortgage debt any given household has. This policy is unanticipated and unfunded, and so it does not create an incentive to take out a large amount of mortgage debt or to refinance in anticipation of the policy. The fiscal cost of this policy is 1.15% of GDP in both heterogeneous and homogeneous returns economies.

Table 7 shows the efficacy and distributional consequences of this policy. The first row, labeled "SCF Data" shows the true fiscal cost and distributional benefits of this fiscal transfer if applied to the households in the SCF data. By construction, the total fiscal cost of 1.15% of GDP matches in the data and in both of our models since both models match the ratio of mortgage debt to GDP in the data. The second column shows what proportion of the total fiscal cost is spent on consumption within the year that it is dispersed. The last five columns show the proportion of the fiscal stimulus received by households across the distribution of wealth.

The key take away from this table is the difference in distributional implications of this policy. In the heterogeneous returns model, 33% of the fiscal cost of the program goes to households in the top 20% of the wealth distribution, almost perfectly matching the proportion if the same policy was applied to the SCF data. By contrast the homogeneous returns model predicts that none of the fiscal stimulus will go to that group. The homogeneous returns model therefore gives the false impression that this mortgage relief program will disproportionately benefit middle-class households.

In both models, this policy is less effective at stimulating aggregate consumption than equal cash transfers to all households, as represented by the average MPC from section 6.1. Similar to the MPC results, the heterogeneous returns model predicts a much larger consumption response to the fiscal stimulus, with 24.6% of the fiscal cost going to higher consumption, relative to only 11.4% of the fiscal stimulus in the homogeneous returns model.

While one might expect that this mortgage relief policy might better target wealthy hand-to-mouth households and thus, lead to a larger aggregate consumption response, our results show the opposite. Comparing these results to table 5, we see that giving universal cash transfers actually produce a greater increase in aggregate consumption. This result is driven by two factors.

First, the average MPC out of a transfer decreases as the transfer size increases. Under the mortgage relief policy, mortgage debtors receive transfers proportional to their mortgage size. This leads to a smaller fraction of the population receiving larger transfers compared to the equal cash transfer scenario, which dampens the policy's overall effectiveness. We investigate the dependence of the MPC on transfer size further in the next section.

Second, the households with the largest mortgages also tend to have the most financial assets. Because these households can already smooth consumption easily, they do not significantly increase their spending in response to the mortgage relief.

Overall, these results suggest that policy conclusions drawn from models that fail to generate the concentration as well as the composition of wealth observed in the data can be misleading. Even though we have focused here on the stimulative effects of temporary

Table 8: Alternative Fiscal Targeting under Heterogeneous Returns

	Fiscal Cost	$\frac{\Delta C}{\text{Fiscal Cost}}$	Benefits By Wealth Quintile				
			0-20%	20-40%	40-60%	60-80%	80-100%
Equal Cash Transfers	1.15%	36.5%	20%	20%	20%	20%	20%
Target Homeowners	1.15%	37.1%	1%	3%	27%	34%	35%
Target Renters	1.15%	20.1%	45%	44%	11%	1%	0%

mortgage relief policies, similar conclusions can be applied to permanent mortgage relief policies, such as the mortgage interest deduction. In our framework, since mortgage amortization rates are the same across mortgages, the mortgage interest deduction would be proportional to the mortgage payment under flat income taxes. This makes the distributional implications of the mortgage interest rate deduction similar to those of the mortgage relief transfer we have just analyzed, with the main difference being that the former is permanent.

6.3 Alternative Fiscal Targeting

In response to adverse aggregate shocks, governments often seek to boost consumption through direct fiscal stimulus. To maximize the short-run impact, targeting households most likely to increase spending—such as hand-to-mouth households—can be effective. However, identifying these households poses a challenge. Western democratic governments typically do not access to detailed financial information to identify these households, and there may be good privacy reasons why governments should not acquire this information. Instead, governments may consider targeting identifiable subgroups that are likely to contain a high proportion of hand-to-mouth households.

In this section, we assess whether targeting subgroups of the population could improve the effectiveness of fiscal stimulus programs. We compare three policies: (1) equal cash transfers to all households, (2) cash transfers to home owners, and (3) cash transfers to renters. Table 8 shows the efficacy and distributional consequences of these programs from our benchmark heterogeneous returns model.

We fix the size of all of these fiscal transfers at 1.15% of GDP, which is the amount necessary to finance an equal \$500 cash transfer to every household. The first policy is the one analyzed in section 6.1, where every household receives a \$500 cash transfer. Just as in our MPC results in section 6.1, 36.5% of the total transfer is consumed within the year. By construction, this equally benefits all households over the distribution of wealth.

In the second policy, where transfers are targeted to the 59% of the population that own their own home, the aggregate consumption response out of the policy is slightly higher at 37.1%. However, this policy is regressive, as homeownership rates increase with wealth. In the third policy, the same aggregate fiscal transfer is directed to the 41% of households that are renters. These households are disproportionately poorer than homeowners, making this policy more progressive than equal cash transfers, with 89% of the total transfers going to the bottom 40% of the wealth distribution. However, it generates a smaller consumption response, 20.1%, compared to equal cash transfers.

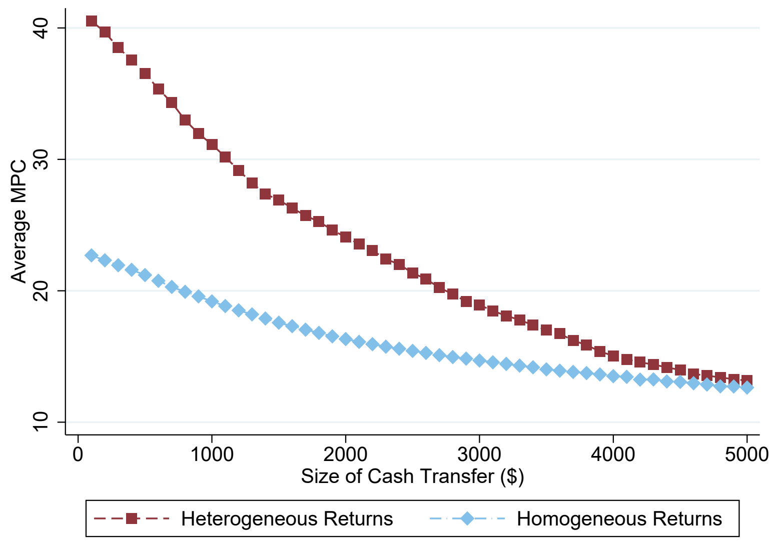
Two opposing forces drive the differences in aggregate consumption response across these policies. First, the proportion of a transfer spent on current consumption declines as the size of the transfer increases. Figure 8 illustrates this effect, by plotting the average marginal propensity to consume across all households for varying transfer sizes. The percentage of the transfer that is spent on consumption declines substantially with transfer size. In the heterogeneous returns model, 42% of a $100 cash transfer is spent on consumption in the year compared to only 14% of a $5,000 transfer. Because targeted transfers involve larger amounts of money distributed to a smaller group of recipients, this size effect reduces the aggregate consumption response. This mechanism applies to both types of targeted transfers.

On the other hand, targeting homeowners results in more transfers per household reaching wealthy hand-to-mouth households, those with the highest MPCs out of transfers. In contrast, targeting renters channels more transfers per household to poor hand-to-mouth households, who have lower MPCs than their wealthier counterparts. Since homeowners represent a larger share of the population, the size-dependence issue is less pronounced in this case. Combined with their higher MPCs, this leads to a significantly stronger consumption response when transfers are targeted to homeowners.

This size-dependency of the average marginal propensity to consume is highly dependent on the distribution of liquid financial assets. In our homogeneous returns model, not only is the average MPC much lower, but the average MPC is much less dependent on the size as shown in Figure 8. 27% of a $100 cash transfer is spend on consumption in the year compared to 14% of a $5,000 transfer. This 13 percentage point difference is much less than the 28 percentage point difference in the heterogeneous returns model.

In Table 9, we repeat the same experiment, targeting fiscal stimulus to every household, only to homeowners, and only to renters, using the homogeneous returns model. In contrast to the heterogeneous returns model, targeting any subgroup in the homogeneous returns model results in smaller aggregate consumption responses than the equal cash transfers. Most strikingly, targeting homeowners results in the lowest average MPC among the three

Figure 8: Average MPC by Size of the Transfer: Heterogeneous vs. Homogeneous Returns



This figure plots the average MPC out of equal cash transfers by transfer size in the heterogeneous and homogeneous returns models.

Table 9: Alternative Fiscal Targeting under Homogeneous Returns

	Fiscal Cost	$\frac{\Delta C}{\text{Fiscal Cost}}$	Benefits By Wealth Quintile				
			0-20%	20-40%	40-60%	60-80%	80-100%
Equal Cash Transfers	1.15%	21.2%	20%	20%	20%	20%	20%
Target Homeowners	1.15%	17.1%	0%	6%	26%	34%	34%
Target Renters	1.15%	19.5%	48%	39%	12%	0%	0%

policies.

This stark contrast in policy implications between the two models is primarily driven by the share of wealthy hand-to-mouth households. This group constitutes 17.7% of households in the heterogeneous returns model but only 2.9% in the homogeneous model, whereas the proportions of poor hand-to-mouth households are much more similar. As a result, while both models imply that targeting renters leads to a lower average MPC than equal cash transfers, they offer very different prescriptions when it comes to targeting homeowners. Given that the heterogeneous returns model more accurately replicates the observed distribution of wealthy hand-to-mouth households, its policy prescription, that targeting homeowners can generate a stronger consumption response, is likely the more relevant guide for fiscal policy.

Table 10: Effects of a Monetary Policy Shock

	$\%\Delta C$	$\%\Delta M$	$\%\Delta H$	$\%\Delta A$	ΔHome Ownership Rate
Heterogeneous Returns	0.16%	10.56%	2.92%	0.11%	+2.%
Homogeneous Returns	0.59%	39.44%	9.26%	1.34%	+6.13%

6.4 Monetary Policy Shock

Recent work has emphasized the role of mortgage refinancing in the transmission of monetary policy to aggregate consumption.[20] This work has argued that by reducing interest rates, monetary policy can stimulate refinancing, increase disposable income, and boost household spending. As a result, the refinancing channel can be a powerful mechanism through which monetary policy influences consumption, particularly in economies with high levels of mortgage debt.

In this section, we study the effects of an unanticipated monetary policy shock that reduces the risk-free interest rate that financial intermediaries are borrowing at, while keeping returns on financial assets unchanged. Since the financial intermediaries are assumed to operate competitively, this will directly reduce the mortgage interest rates households facing. We contrast the effects of this shock in our heterogeneous and homogeneous returns models. In both economies, we shock the steady-state of the economy with an unanticipated and permanent 100 basis point reduction in the risk-free rate. Table 10 reports the resulting changes in aggregate consumption, mortgage debt, housing and financial assets in the first period after the shock.

As shown in Table 10, responses of aggregate variables to the shock are much stronger in the homogeneous returns model. Thus, monetary policy is a much more effective policy tool in the standard homogeneous returns economy than the heterogeneous returns economy.

The stark differences between the two models are driven by the stark differences in their mortgage distribution. To see this, note that, in both models, the reduction in the mortgage interest rate lowers mortgage payments, proportional to the mortgage balance, for existing borrowers through refinancing and incentivizes households to take on larger mortgage debt. As shown in Figures 5d and 6, the biggest beneficiaries from refinancing are the wealthy in the heterogeneous returns model, whose housing share is the lowest and who have the lowest loan-to-value ratios. Thus, the mortgage relief constitutes a small fraction of their lifetime wealth for them. On the other hand, the biggest beneficiaries in the homogeneous-returns model are those in the middle of the wealth distribution, who have a high housing share and high LTV ratios. For these households, the mortgage relief represents a much larger

[20]See Garriga, Kydland, and Šustek (2017), Beraja et al. (2018), Kinnerud (2021), Berger et al. (2021) and Eichenbaum, Rebelo, and Wong (2022).

fraction of their lifetime wealth. Thus, even though both models are calibrated to match the aggregate mortgage debt-to-GDP ratio and the potential aggregate mortgage relief is the same, they generate very different responses because the relief ultimately benefits very different segments of the population. These findings highlight that conclusions about the effectiveness of monetary policy critically depend on accurately capturing both the concentration and composition of wealth. Now we discuss each variable of interest in turn.

Lowering the risk-free rate substantially increases the amount of mortgage debt in the economy. As households face lower mortgage rates, they substantially increase the amount of mortgage debt they borrow in. Aggregate mortgage debt increases by 10.56% and 39.44% in the heterogeneous returns model and the homogeneous returns respectively. Most of this additional debt is used to finance housing. In the heterogeneous returns model, home ownership rises by 2.38 percentage points, and aggregate housing consumption increases by 2.92%. This effect is larger in the homogeneous returns model where home ownership rises by 6.13 percentage points and aggregate housing consumption increases by 9.26 percent. Note that in both of these models, the supply of owner-occupied housing and rental housing are both perfectly elastic at the prevailing prices.

The response of aggregate consumption also differs markedly across the two models, with the heterogeneous returns model generating only a quarter of the aggregate consumption response observed in the homogeneous returns model (0.16% versus 0.59%). This disparity arises because, in the heterogeneous returns model, a significant portion of mortgage debt is held by wealthy households. Additionally, the gap between the borrowing rate and the saving rate varies significantly across households in the heterogeneous returns model, whereas it remains constant across households in the homogeneous returns model.

A permanent decrease in the mortgage interest rate has two distinct effects. First, it lowers the mortgage payments for existing mortgage holders, creating a positive wealth effect. However, the transmission of this wealth effect to consumption is weaker in the heterogeneous returns model, as a sizable share of the households benefiting from it are wealthy individuals with substantial financial asset holdings that therefore have low marginal propensities to consume (MPCs).

Second, the lower mortgage interest rate reduces the cost of obtaining a mortgage, encouraging both prospective home-buyers and existing homeowners to take on larger mortgage debt—either at the time of purchase or through refinancing. This effect is more pronounced in the homogeneous returns model, where all households face the same return on savings, so the decline in the mortgage rate uniformly alters incentives across the population. In contrast, in the heterogeneous returns model, households face different returns on savings. As a result, the same decline in the mortgage interest rate has varying

Table 11: Monetary Policy Shock Decomposition

Model	Aggregate Consumption Response	P_{MD}	$\overline{\Delta \text{c}}_{MD}$	P_{ORO}	$\overline{\Delta \text{c}}_{ORO}$	P_R	$\overline{\Delta \text{c}}_R$
SCF Data		39.6		20.2		40.2	
Het Returns	0.16%	41.9	1.06	19.0	0.01	42.2	-0.7
Homo Returns	0.59%	30.8	3.07	31.0	0.39	41.3	-1.2

effects across households, depending on their individual rates of return. More importantly, it has only a minimal impact on the majority of individuals, who face very low returns on their savings.

We decompose the aggregate consumption response into the average consumption response of mortgage debtors (MD), outright homeowners (ORO), and renters (R) according to equation 13 to highlight the differential responses across groups with and without mortgages:

$$\Delta \text{C} = P_{MD} \times \overline{\Delta c}_{MD} + P_{ORO} \times \overline{\Delta c}_{ORO} + P_r \times \overline{\Delta c}_R \tag{13}$$

In both models the largest consumption response is from mortgage debtors. Given that the reduction in the risk-free interest rate directly reduces their mortgage interest expenses, they can directly increase their consumption as a consequence. In the heterogeneous returns model, some mortgage debtors are extremely wealthy and earn high returns. These households' respond much less. By contrast, in the homogeneous returns model, there are no mortgage debtor who are very wealthy. Mortgage debtors in the middle of the wealth distribution respond more.

In both models, outright homeowners, who have fully paid off any mortgage debts, change their consumption relatively little as the mortgage interest rate does not directly impact their budget constraint, unless they anticipate upgrading to a larger house and taking out a mortgage at some point in the future. Renters consumption on average declines in both models, as the reduction in mortgage interest costs makes it more affordable for them to purchase a house. Some renters therefore save more in anticipation of being able to buy a house in the future, while others buy a house immediately reducing their current consumption in order to afford a down-payment.

7 Conclusion

This paper studies the importance of both the concentration and the composition of wealth. To do so, we build a quantitative life-cycle model with rate of return heterogeneity, illiquid housing, and long-term mortgage debt. We calibrate this model to key aggregate and distributional facts, and show how this model can closely match both the distribution of wealth, as well as the composition of that wealth. We then demonstrate the importance of matching both the concentration and composition of wealth with four applications.

First, we study the determinants of an economy's average marginal propensity to consume (MPC). Our full model with rate of return heterogeneity generates a high average annual MPC of 36.5%. Our results show that the presence of illiquid housing and return heterogeneity are the two most important contributors to the average MPC, accounting for 15.4 and 15.3 percentage points, respectively. These findings highlight the crucial role of incorporating return heterogeneity to generate the high MPCs observed in the data.

Secondly, we study a mortgage relief policy. While both our heterogeneous and homogeneous returns models predict that the mortgage relief is less effective than equal cash transfers, the homogeneous returns model gives very misleading distributional implications, suggesting that the mortgage relief policy is falsely progressive.

Thirdly, we compare the response of aggregate consumption to equal cash transfers versus more targeted fiscal stimulus. We find that the two models suggest widely different policy prescriptions. The heterogeneous-returns model ranks targeting homeowners as the most effective policy, whereas the homogeneous-returns model ranks it as the least effective in generating an aggregate consumption response. This stark difference occurs because the heterogeneous-returns model, consistent with empirical data, closely replicates the large fraction of wealthy hand-to-mouth households. In contrast, the homogeneous-returns model cannot generate this observed fraction of wealthy hand-to-mouth households, who have the highest MPCs. Because the heterogeneous-returns model more accurately captures the distribution and composition of wealth, its core implication, that targeting homeowners can generate a stronger consumption response, is the more relevant guide for fiscal policy.

Finally, we study a monetary policy shock that lowers mortgage interest rates. This shock leads to a much smaller response in aggregate variables in the heterogeneous returns model than in the homogeneous returns model.

We conclude that both the concentration and composition of wealth play an important role in determining households' responses to fiscal and monetary policy. As policy makers attempt to evaluate the likely effect of different policies, they should careful consider the heterogeneity in households' portfolios.

References

Aguiar, Mark, Mark Bils, and Corina Boar. 2024. "Who are the Hand-to-Mouth?" *Review of Economic Studies* :rdae056.

Akin, Jim. 2023. "How Does a Foreclosure Affect Credit?" *Experian.com* URL https://www.experian.com/blogs/ask-experian/how-does-a-foreclosure-affect-credit/.

Arslan, Yavuz, Bulent Guler, and Burhan Kuruscu. 2025. "Credit Supply versus Housing Demand in the U.S. Boom-Bust Cycle." *Working Paper* .

Arslan, Yavuz, Bulent Guler, and Temel Taskin. 2015. "Joint Dynamics of House Prices and Foreclosures." *Journal of Money, Credit and Banking* 47 (S1):133–169.

Attanasio, Orazio, Agnes Kovacs, and Patrick Moran. 2020. "Temptation and Incentives to Wealth Accumulation." *National Bureau of Economic Research Working Paper Series* (28938).

Audoly, Richard, Rory McGee, Sergio Ocampo-Diaz, and Gonzalo Paz-Pardo. 2024. "The Life-cycle Dynamics of Wealth Mobility." *Working Paper* .

Bach, Laurent, Laurent E. Calvet, and Paolo Sodini. 2020. "Rich Pickings? Risk, Return, and Skill in Household Wealth." *American Economic Review* 110 (9):2703–2747.

Benhabib, Jess and Alberto Bisin. 2018. "Skewed Wealth Distributions: Theory and Empirics." *Journal of Economic Literature* 56 (4):1261–1291.

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

Beraja, Martin, Andreas Fuster, Erik Hurst, and Joseph Vavra. 2018. "Regional Heterogeneity and the Refinancing Channel of Monetary Policy*." *The Quarterly Journal of Economics* 134 (1):109–183. URL https://doi.org/10.1093/qje/qjy021.

Berger, David, Veronica Guerrieri, Guido Lorenzoni, and Joseph Vavra. 2018. "House Prices and Consumer Spending." *The Review of Economic Studies* 85 (3):1502–1542.

Berger, David, Konstantin Milbradt, Fabrice Tourre, and Joseph Vavra. 2021. "Mortgage Prepayment and Path-Dependent Effects of Monetary Policy." *American Economic Review* 111 (9):2829–2878. URL https://www.aeaweb.org/articles?id=10.1257/aer.20181857.

Boar, Corina, Denis Gorea, and Virgiliu Midrigan. 2022. "Liquidity Constraints in the US Housing Market." *The Review of Economic Studies* 89 (3):1120–1154.

Boutros, Michael. 2022. "Windfall Income Shocks with Finite Planning Horizons." *Working Paper* .

Cagetti, Marco and Mariacristina De Nardi. 2006. "Entrepreneurship, Frictions, and Wealth." *Journal of Political Economy* 114 (5):835–870.

Campbell, John Y., Tarun Ramadorai, and Benjamin Ranish. 2019. "Do the Rich Get Richer in the Stock Market? Evidence from India." *AER: Insights* 1 (2):225–240.

Carroll, Christopher, Jiri Slacalek, Kiichi Tokuoka, and Matthew N. White. 2017. "The Distribution of Wealth and the Marginal Propensity to Consume." *Quantitative Economics* 8 (3):977–1020.

Carroll, Christopher D. 2017. "Buffer-Stock Saving and the Life Cycle/Permanent Income Hypothesis." *Quarterly Journal of Economics* :55.

Castañeda, Ana, Javier Díaz-Giménez, and José-Víctor Ríos-Rull. 2003. "Accounting for the U.S. Earnings and Wealth Inequality." *Journal of Political Economy* 111 (4):818–857.

Chatterjee, Satyajit and Burcu Eyigungor. 2015. "A Quantitative Analysis of the U.S. Housing and Mortgage Markets and the Foreclosure Crisis." *Review of Economic Dynamics* 18 (2):165–184.

De Nardi, Mariacristina, Giulio Fella, and Gonzalo Paz-Pardo. 2016. "The Implications of Richer Earnings Dynamics for Consumption, and Wealth." *National Bureau of Economic Research Working Paper Series* (21917).

Delcoure, Natalya, Norm G Miller et al. 2002. "International Residential Real Estate Brokerage Fees and Implications for the US Brokerage Industry." *International Real Estate Review* 5 (1):12–39.

Díaz, Antonia and María José Luengo-Prado. 2010. "The Wealth Distribution with Durable Goods." *International Economic Review* 51 (1):143–170.

Eichenbaum, Martin, Sergio Rebelo, and Arlene Wong. 2022. "State-Dependent Effects of Monetary Policy: The Refinancing Channel." *American Economic Review* 112 (3):721–761. URL https://www.aeaweb.org/articles?id=10.1257/aer.20191244.

Fagereng, Andreas, Luigi Guiso, Davide Malacrino, and Luigi Pistaferri. 2020. "Heterogeneity and Persistence in Returns to Wealth." *Econometrica* 88 (1):115–170.

Fagereng, Andreas, Martin B. Holm, and Gisle J. Natvik. 2021. "MPC Heterogeneity and Household Balance Sheets." *American Economic Journal: Macroeconomics* 13 (4):1–54.

Federal Reserve Board. 2008. "A Consumer's Guide to Mortgage Refinancings." URL https://www.federalreserve.gov/pubs/refinancings/default.htm.

Gabaix, Xavier, Jean-Michel Lasry, Pierre-Louis Lions, and Benjamin Moll. 2016. "The Dynamics of Inequality." *Econometrica* 84 (6):2071–2111.

Garriga, Carlos, Finn E Kydland, and Roman Šustek. 2017. "Mortgages and monetary policy." *The Review of Financial Studies* 30 (10):3337–3375.

Goodman, Lucas, Jacob Mortenson, Kathleen Mackie, and Heidi R Schramm. 2021. "Leakage from Retirement Savings Accounts in the United States." *National Tax Journal* 74 (3):689–719.

Guler, Bulent. 2015. "Innovations in Information Technology and the Mortgage Market." *Review of Economic Dynamics* 18 (3):456–483.

Guvenen, Fatih, Gueorgui Kambourov, Burhan Kuruscu, Sergio Ocampo, and Daphne Chen. 2023. "Use It or Lose It: Efficiency Gains from Wealth Taxation." *The Quarterly Journal of Economics* 138 (2):835–894.

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

Harding, John P., Stuart S. Rosenthal, and C.F. Sirmans. 2007. "Depreciation of Housing Capital, Maintenance, and House Price Inflation: Estimates from a Repeat Sales Model." *Journal of Urban Economics* 61 (2):193–217.

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

Jappelli, Tullio and Luigi Pistaferri. 2014. "Fiscal Policy and MPC Heterogeneity." *American Economic Journal: Macroeconomics* 6 (4):107–136.

———. 2020. "Reported MPC and Unobserved Heterogeneity." *American Economic Journal: Economic Policy* 12 (4):275–297.

Johnson, David S., Jonathan A. Parker, and Nicholas S. Souleles. 2006. "Household Expenditure and the Income Tax Rebates of 2001." *The American Economic Review* 96 (5):1589–1610.

Jones, Charles I and Jihee Kim. 2018. "A Schumpeterian Model of Top Income Inequality." *Journal of Political Economy* 126 (5):42.

Kaplan, Greg, Kurt Mitman, and Giovanni L Violante. 2020. "The Housing Boom and Bust: Model Meets Evidence." *Journal of Political Economy* 128 (9):3285–3345.

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

———. 2022. "The Marginal Propensity to Consume in Heterogeneous Agent Models." *Annual Review of Economics* 14 (1):747–775. URL https://doi.org/10.1146/annurev-economics-080217-053444.

Kinnerud, Karin. 2021. "The Effects of Monetary Policy through Housing and Mortgage Choices on Aggregate Demand." .

Kuhn, Moritz and Jose-Victor Rios-Rull. 2016. "2013 Update on the U.S. Earnings, Income, and Wealth Distributional Facts: A View from Macroeconomics." *Federal Reserve Bank of Minneapolis Quarterly Review* :75.

Lewis, Daniel J., Davide Melcangi, and Laura Pilossoph. 2021. "Latent Heterogeneity in the Marginal Propensity to Consume." *NYFED Staff Reports* .

Parker, Jonathan A., Jake Schild, Laura Erhard, and David S. Johnson. 2021. "Household Spending Responses to the Economic Impact Payments of 2020: Evidence from the Consumer Expenditure Survey." *Working Paper* .

Parker, Jonathan A., Nicholas S. Souleles, David S. Johnson, and Robert McClelland. 2013. "Consumer Spending and the Economic Stimulus Payments of 2008." *The American Economic Review* 103 (6):2530–2553.

Pennington-Cross, Anthony. 2006. "The Value of Foreclosed Property." *Journal of Real Estate Research* 28 (2):193–214. URL https://doi.org/10.1080/10835547.2006.12091177.

Piazzesi, Monika, Martin Schneider, and Selale Tuzel. 2007. "Housing, Consumption and Asset Pricing." *Journal of Financial Economics* 83 (3):531–569.

Quadrini, Vincenzo. 2000. "Entrepreneurship, Saving, and Social Mobility." *Review of Economic Dynamics* 3 (1):1–40.

Smith, Matthew, Danny Yagan, Owen M Zidar, and Eric Zwick. 2019. "Capitalists in the Twenty-First Century." *The Quarterly Journal of Economics* 134 (4):1675–1745.

Smith, Matthew, Owen Zidar, and Eric Zwick. 2023. “Top wealth in america: New estimates under heterogeneous returns.” *The Quarterly Journal of Economics* 138 (1):515–573.

Sommer, Kamila, Paul Sullivan, and Randal Verbrugge. 2013. “The equilibrium effect of fundamentals on house prices and rents.” *Journal of Monetary Economics* 60 (7):854–870. URL https://www.sciencedirect.com/science/article/pii/S0304393213000664.

Storesletten, Kjetil, Chris I. Telmer, and Amir Yaron. 2004. “Cyclical Dynamics in Idiosyncratic Labor Market Risk.” *Journal of Political Economy* 112 (3):695–717.

APPENDIX

A Concentration of Assets in the Model and Data

Table A.1: Concentration of Net Worth, Assets, and Debt

			Percentiles		
Networth	Top 1%	Next 9%	90 - 61	61 - 30	30 - 1
SCF (1995)	39	32	24	5	-0
Het. Returns	39	24	31	6	0
Homo. Returns	11	38	41	9	1
Financial and Business Assets					
SCF (1995)	52	31	14	3	0
Het. Returns	70	20	7	3	0
Homo. Returns	20	51	19	9	1
Housing					
SCF (1995)	7	25	44	21	2
Het. Returns	3	25	52	18	2
Homo. Returns	2	18	51	28	1
Mortgage Debt					
SCF (1995)	5	17	36	42	7
Het. Returns	3	15	37	39	5
Homo. Returns	0	0	15	80	5

B Distribution of persistent returns

In this section, we compare the permanent component of returns on net worth in our model to an empirical counterpart. Given that administrative data on U.S. wealth is not available, we compare our model to results from Norwegian administrative data as reported by Fagereng et al. (2020). Specifically, we run the following regression on our model-generated returns:

Table B.2: Distribution of Fixed Effects

	Mean	SD	Sk.	Kurt.	P10	P25	P50	P75	P90	P99	P99.9
Norwegian Data	0.00	6.02	-5.26	78.42	-3.43	-1.70	0.28	2.29	4.28	11.6*	23.4*
Hete. Returns Model	0.00	1.93	5.38	41.25	-1.00	-0.65	-0.33	-0.06	0.51	9.59	18.07
Homo. Returns Model	0.00	0.10	-0.52	5.08	-0.12	-0.05	0.00	0.06	0.12	0.23	0.31

The Norwegian Data row comes from table 7 in Fagereng et al. (2020), except for the last two values, which are taken from Guvenen et al. (2023), to whom Fagereng et al. (2020) had kindly provided the data.
The Hete. Returns Model row reports statistics about the distribution of fixed effects that are estimated in regression 14 from model-generated data.

$$r_{i,j} = \alpha_i + \beta_L \text{Leverage}_{i,j} + \beta_{HS} \text{Housing Share}_{i,j} + \sum_{k=2}^{J} \beta_k^{Age} \mathbb{I}_j^{k=j} + \sum_{k=2}^{100} \beta_k^{Wealth} \mathbb{I}_{i,j}^{\text{Wealth Percentile}_{i,j}=k} + \epsilon_{i,j} \tag{14}$$

where $r_{i,j}$ is the return that household i earned on their net worth at age j. α_i is a set of household fixed effects, $\text{Leverage}_{i,j}$ is the ratio of mortgage debt to net worth and $\text{Housing Share}_{i,j}$ is the ratio of the gross value of housing to net worth. $\{\mathbb{I}_j^{k=j}\}$ and $\{\mathbb{I}_{i,j}^{\text{Wealth Percentile}_{i,j}=k}\}$are sets of indicator variables for each age and for each wealth percentile.

Given the importance of persistent heterogeneity in rates of return for generating a high degree of wealth inequality, we are primarily interested in comparing the distribution of household fixed effects (α_i) between the data on the Norwegian data. In table B.2 we present statistics about the distribution of fixed effects (α_i) from regression 14 and compare it to the results from table 7 in Fagereng et al. (2020). The fixed effects we estimate from regression 14 in the heterogeneous returns model have a similar dispersion to the fixed effects estimated in administrative Norwegian data by Fagereng et al. (2020). The standard deviation of the permanent component of returns is actually lower at 1.93 in our model than in the Norwegian data (6.02). At the top, our model generates 99.9th quantile fixed effects that is similar to the Norwegian data, 18.07 compared to 23.4. By contrast, the homogeneous returns model generates far less dispersion in fixed effects. The standard deviation is only 0.10 and the 99.9th quantile in the homogeneous returns model is only 0.31.

C Shapley-Owen-Shorrocks Decomposition

In section 6.1, we study how rate-of-return heterogeneity, long-term mortgage debt, and illiquid housing contribute to generating a high average marginal propensity to consume (MPC) in the economy. To do so we removed each of these features, re-calibrated, and calculated the average MPC in the resulting model. The order in which we removed these features matters for these results. In this section, we employ an order-free decomposition technique, the Shapley-Owen-Shorrocks decomposition to study the contribution of each of these features. Intuitively, the Shapley-Owen-Shorrocks decomposition gives the average contribution across all possible versions of the model

Table C.3: Shapley-Owen-Shorrocks Decomposition

	MPC
Full Model	36.5%
Contribution of Heterogeneous Returns	+9.4%
Contribution of Mortgage Debt	-5.0%
Contribution of Illiquid Housing	+22.6%
One-Asset Model	9.4%

without a specific feature for adding that feature. See Audoly et al. (2024) for additional technical details.

Table C.3 gives the Shapley-Owen-Shorrocks decomposition of our three model features. Here the contribution of heterogeneous returns of 9.4% is less than in our main results, where it increases the average MPC by 15.3%. This is because heterogeneous returns have a much larger impact in an economy with illiquid housing. In a model without illiquid housing, all assets are liquid. Adding heterogeneous returns to a one-asset model increases the concentration of assets, but leaves households in the middle of the distribution with large liquid balances. These liquid balances allow them to smooth their consumption and therefore substantially reduce the average MPC in the economy. The contribution of heterogeneous returns in this decomposition reflects the average of the larger effect from adding heterogeneous returns to an economy with illiquid housing and a small effect of adding heterogeneous returns to an economy without illiquid housing. Our main results in section 6.1 therefore reflect an important interaction effect between illiquid housing and heterogeneous returns.

The contribution of mortgages is a little larger in this decomposition than in our main results. While, the contribution of illiquid housing is a little larger than in our main results. We conclude that illiquid housing clearly is the most important feature in generating a high average MPC, though both rate of return heterogeneity and long-term mortgage debt play important roles.

D Superstar Income Shocks

In our benchmark economy in section 3 the high concentration of wealth at the top of the distribution is generated by heterogeneity in rates of return. We focus on heterogeneity in rates of return because there is good empirical evidence that different households earn persistently different rates of return on their wealth (See for example Bach, Calvet, and Sodini, 2020; Fagereng et al., 2020). In this section, we explore how these results would differ if the high concentration of wealth is generated by a different mechanism, namely superstar income shocks. Castañeda, Díaz-Giménez, and Ríos-Rull (2003) show how very large transitory income shocks can also generate empirically realistic wealth inequality. While De Nardi, Fella, and Paz-Pardo (2016) show that quantitatively realistic earnings dynamics cannot generate as much top-tail wealth inequality as exists in the data, we use this mechanism to generate a realistic degree of wealth inequality so that we can assess the extent to which it is rate of return heterogeneity specifically that generates a higher average marginal propensity to consume or just higher wealth inequality.

To add this superstar income shock mechanism, we add an additional grid point to the discretized labor income process in 4 to represent a "superstar" level of income. We then calibrate three parameters, the level of this superstar income, the probability of entering the superstar

Table C.4: Additional Heterogeneous Returns Calibrations

Targets	Data	Model	Parameters	Values
Housing (No Mortgages)				
Wealth to Income Ratio	3.84	3.92	β	0.88
Housing Share of Wealth for Top 10%	0.28	0.28	$\bar{h}$	10.54
Housing Expenditure as a Share of Income	0.25	0.20	γ_s	0.60
Top 1% Wealth Share	0.39	0.38	Pareto Shape	17.12
Top 10% Wealth Share	0.72	0.59	Pareto Scale	0.97
Top 50% Wealth Share	0.98	0.98	σ_ϵ	0.25
One Asset				
Wealth to Income Ratio	3.84	3.84	β	0.96
Housing Expenditure as a Share of Income	0.25	0.25	γ_s	0.22
Top 1% Wealth Share	0.39	0.39	Pareto Shape	19.71
Top 10% Wealth Share	0.72	0.72	Pareto Scale	0.98
Top 50% Wealth Share	0.98	0.98	σ_ϵ	0.05

This table presents the calibrated parameters and moments for two additional versions of the model that are necessary to perform the Shapley-Owen-Sharrocks decomposition.

Table D.5: Superstar Shock Calibration

Targets	Data	Model	Parameters	Values
Wealth to Income Ratio	3.84	3.92	β	0.91
Proportion of Homeowners	0.60	0.57	p^h	1.00
Housing Share of Wealth for Top 10%	0.28	0.28	$\bar{h}$	6.24
Housing Expenditure as a Share of Income	0.25	0.23	γ_s	0.25
Debt to Income Ratio	0.67	0.69	r^m	6.85%
Top 1% Wealth Share	0.39	0.38	ν_{n_ν}	4.03
Top 10% Wealth Share	0.72	0.73	$Prob(\nu_{n_\nu}\|\cdot)$	0.07%
Top 50% Wealth Share	0.98	0.99	$Prob(\nu_{n_\nu}\|\nu_{n_\nu})$	88.94%

income state, and the probably of remaining in the state.[21] To discipline this superstar shock process we target the same three statistics as we targeted in the calibration of our heterogeneous rate of return model in section 4; the top 1, top 10, and top 50 percentile wealth shares.

In the calibrated model, households that receive the superstar income shock earn a large amount of income for a few periods. However, since the shock is not very persistent, they have strong incentives to save a large fraction of their large income. This leads to very high savings rates among these superstars.

Table D.6 presents the average marginal propensity to consume (MPC) results of our superstar

[21]We assume households of all income levels are equally likely to enter the superstar income state, and that if a household falls out of the superstar income state, they are equally likely to end up in each of the remaining income levels.

Table D.6: The Average Marginal Propensity to Consume

	Average MPC	Proportion of Hand-To-Mouth			Average MPC		
					Hand-To-Mouth		>0 Liquid
		All	Wealthy	Poor	Wealthy	Poor	Wealth
SCF Data		26.0	9.8	16.2			
Het. Returns	36.5	26.6	17.7	8.9	94.7	33.2	22.9
Superstar Shocks	36.9	22.7	10.6	12.2	93.7	57.5	25.9

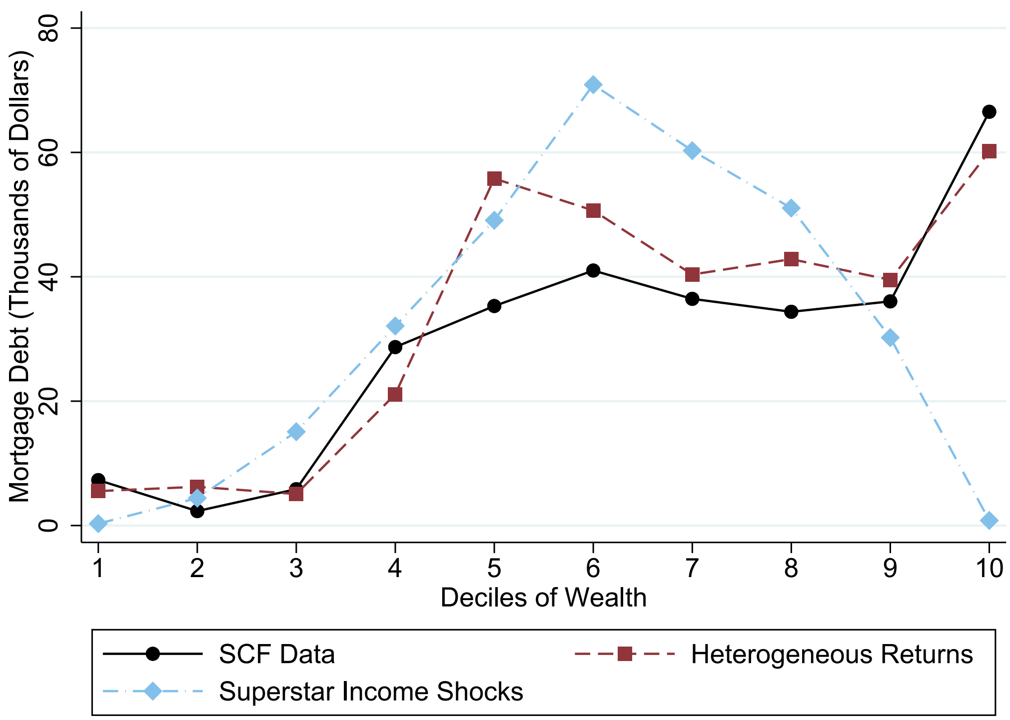
We calculate the proportion of hand-to-mouth households in the data as the proportion of households with liquid financial assets less than half of their monthly income. In the model, given that households do not need to engage in transactions across periods, we consider households with zero liquid financial assets to be hand-to-mouth.

income shock model. The average MPC in the superstar shocks model is 36.9%, extremely similar to the 36.5% in our heterogeneous returns model. This high average MPC is again driven by a substantial fraction of hand-to-mouth households, with 22.7% of the population being hand-to-mouth in the superstar shock model.

We conclude from this experiment that it is primarily the distribution of wealth that matters for the average MPC rather than the specific mechanism that generates a high concentration of wealth. Higher degrees of wealth inequality will tend to concentrate liquid financial assets among the wealthiest households, which leads to more poor and middle-class households owning few financial assets and being hand-to-mouth. The greater the proportion of households that are hand-to-mouth the higher will be the average MPC in the economy.

Of course, that is not to say that every experiment will produce similar results as long as the distribution of wealth is realistic. Figure D.1 shows the level of mortgage debt over the wealth distribution in the data, the heterogeneous returns model and the superstar income shock model. As with homogeneous returns, the wealthiest households in the superstar income shock model have no incentive to take out large mortgage balances. As a consequence, the superstar income shock model predicts far too much mortgage debt in the middle of the distribution and far too little at the top of the distribution. Therefore the distributional consequences of mortgage relief will be inaccurate in this model, just as they were in the homogeneous returns model in section 6.2.

Figure D.1: Mortgage Debt over the Wealth Distribution



ONLINE APPENDIX

Not for Publication

I Empirical Facts over Time

\

In this section, we show that our empirical facts from section 2 hold across different waves of the Survey of Consumer Finances.

Figure I: **Composition of Assets over the Wealth Distribution**

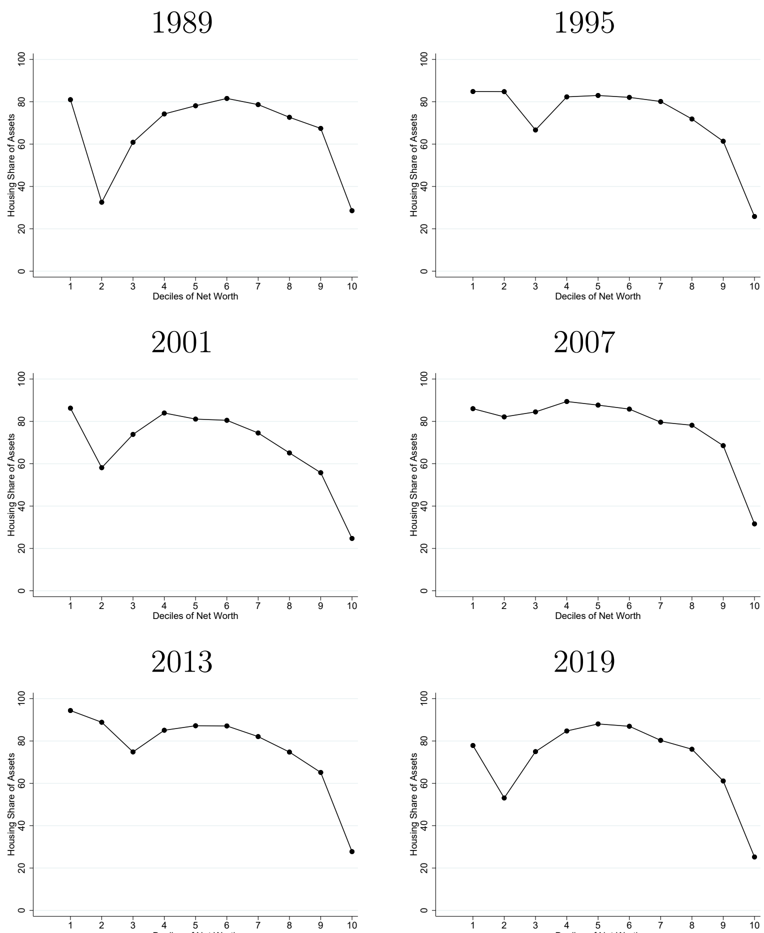


Figure I compares the asset composition over the wealth distribution across different waves of the Survey of Consumer Finances. Across all of these waves, the housing share of assets declines starkly over the wealth distribution. Variability in the house share around a net worth of zero, usually in the second or third decile of net worth, is often driven by a small number of households and as such is likely subject to sampling variability.

Figure II shows the average level of mortgage debt over the wealth distribution. In all years, the largest amount of mortgage debt is held by the wealthiest households.

Figure ?? shows what proportion of households could liquidate financial assets and fully pay off their mortgage debt. In all years, for households within the wealthiest 10%, around 50% of them could fully pay off their mortgages by liquidating financial assets.

Figure II: **Mortgage Debt over the Wealth Distribution**

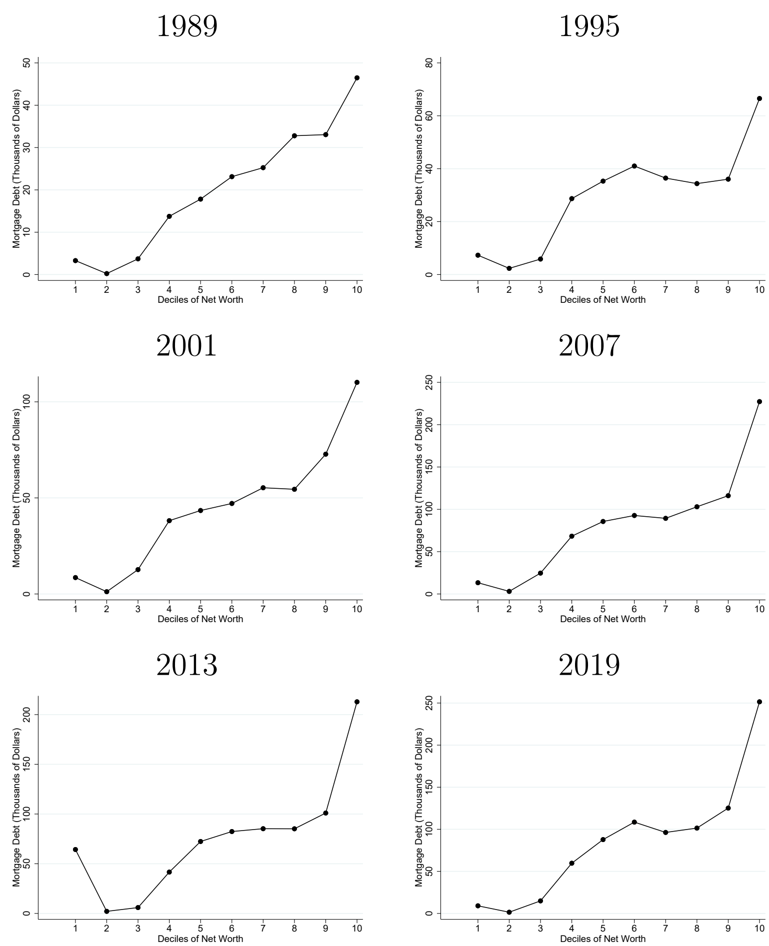
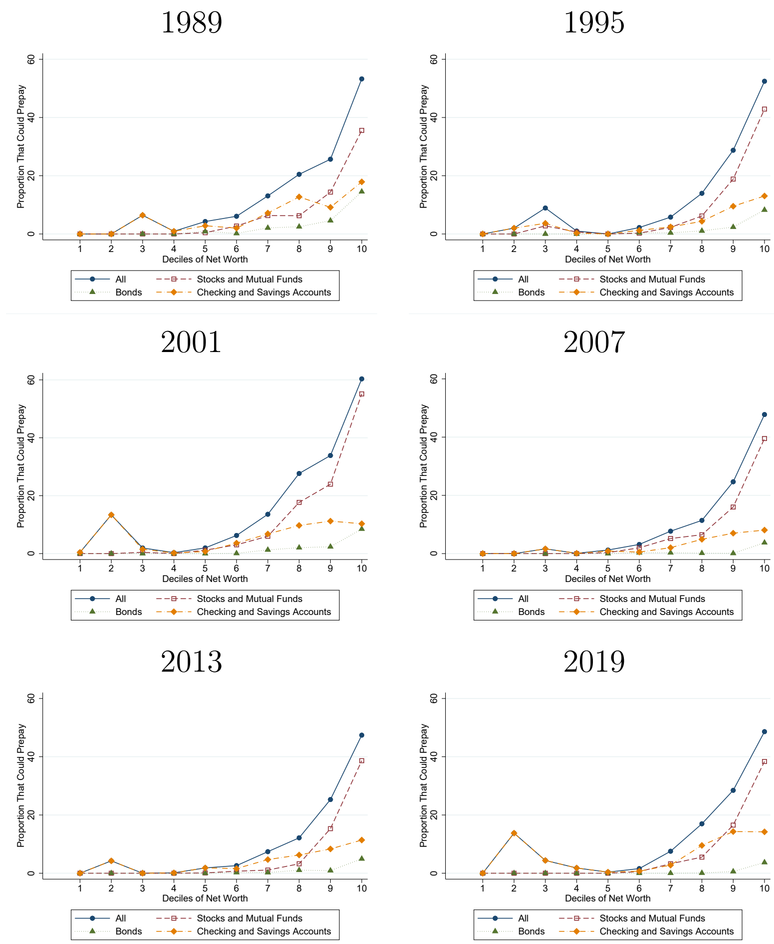


Figure III: Payable Mortgage Debt over the Wealth Distribution



II Computational Solution

Algorithm Overview

Given the life-cycle structure of the model, we solve the decision rules at each age through backwards induction. Starting from the terminal period, where savings are zero, we can solve the household's problem conditional on each discrete choice. Specifically for each age j, we solve the problem conditional on each of the possible discrete choices. For a homeowner, the possible discrete choices are: selling-to-rent, defaulting on a mortgage, selling-to-buy a new house, staying in the house, or refinancing the mortgage. For a renter without a default flag, the possible discrete choices are remaining a renter or buying a new house. Renters with default flags have no discrete choice. After computing the optimal decision rules conditional on these discrete choices, we choose the optimal discrete choice for each position on the state space.

Hand-to-Mouth Status

We follow Kaplan and Violante (2014) and define hand-to-mouth households as the households that choose to be at the kink in their budget constraint, here with zero financial assets. As we discuss above, these households have a high marginal propensity to consume out of fiscal transfers. Note that these households may start the period with positive liquid assets from the prior period, but they choose within this period to save nothing in the liquid asset.

MPC Calculation

We calculate marginal propensities to consume by comparing a household's consumption to their consumption if they were given an unanticipated \$500. We follow the empirical literature in referring to this consumption response as the marginal propensity to consume. For some households on the margin between different discrete choice, for example to buy a new house or to refinance a mortgage, an additional \$500 may lead them to choose a different discrete choice. Changes in these discrete choices can sometimes lead to calculated marginal propensities to consumer that are either negative or larger than one. As some of these responses end up being very large, we follow Kaplan and Violante (2014) in trimming the top and bottom 1.5% of consumption responses. This provides the best analogue to empirical estimates of the marginal propensity to consume, as these types of discrete choices will also occur in reality. In order to ensure comparability between the results across all policy experiments, we trim the same 3% of households out of each of the policy experiments in the paper.