Income Inequality and the Rise of Risky Capital*

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Abstract

I document that the rise in U.S. income inequality since the 1980s coincided with a marked increase in the aggregate share of risky assets in household portfolios. This comovement is consistent with the cross-sectional fact that higher-income households hold riskier portfolios. I propose a mechanism in which non-homothetic savings motives generate decreasing relative risk aversion, implying that higher income concentration raises aggregate risk-taking. Embedding this mechanism in an incomplete-markets general equilibrium model with firm heterogeneity, I show that higher inequality reallocates capital toward riskier, more productive firms, increasing aggregate productivity. The model jointly accounts for a substantial share of the rise in the wealth–income ratio and risky asset share, and the decline in safe interest rates and risk premia.

Keywords: Income inequality, Portfolio allocation, Firm heterogeneity

JEL Codes: D31, E21, E22, G11

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1 Introduction

The stark rise in income inequality since the 1980s in the United States has been proposed as a central explanation for the secular decline in safe real interest rates.[1] The basic idea builds on the empirical observation that high-income households have higher saving rates than low-income households. A higher income share earned by high-income households therefore lifts the aggregate demand for savings, which, for a given supply of savings, lowers the interest rate. This phenomenon has occasionally been referred to as the "savings glut of the rich" (Mian et al., 2020).

In this paper, I propose that higher income inequality not only raises the *level* of savings demand, but also changes its *composition*. It is well known that at the *individual* level, the asset portfolios of high-income households are tilted towards risky assets such as equities, whereas low-income households predominantly hold safe assets such as bank deposits.[2] I argue that a higher income share earned by high-income households shifts the composition of *aggregate* asset demand away from safe towards risky assets and study the implications of this shift for salient macro-finance trends.

Changes in asset demand composition matter because they directly affect which firms receive funding and which firms do not due to segmented funding markets. Large, established firms such as Walmart can issue effectively risk-free debt to finance their operations, whereas start-ups, for example, rely mostly on risky venture capital. By changing the relative prices and quantities of risky and safe capital, the composition of asset demand therefore shapes the distribution of firms in terms of characteristics that are correlated with the type of funding that firms rely on.

I analyze the implications of changes in asset demand composition using a quantitative general equilibrum model with endogenous portfolio choice and household and firm heterogeneity. The central prediction of the model is that higher income inequality raises aggregate productivity when the firms supplying the risky asset are on average more productive than firms supplying the safe asset. When income inequality increases, households demand relatively more risky assets which induces a reallocation of capital from less productive to more productive firms, yielding higher aggregate productivity. The assumption that riskier firms are more productive is fairly natural. Investors in the risky asset need to be compensated for taking on risk with returns that are on average higher than those on the safe asset. The higher expected returns are generated through

[1] See, for example, Rachel and Smith (2015); Auclert and Rognlie (2018); Rachel and Summers (2019); Straub (2019); Mian et al. (2021a,b); Platzer and Peruffo (2022)

[2] See, for example, Carroll (2000); Bach et al. (2020); Fagereng et al. (2020); Smith et al. (2023).

higher productivity.

The model also delivers a novel explanation for several salient macro-finance trend of the last decades, most prominently the secular decrease in safe interest rates against the backdrop of stable returns to capital. While existing explanations center on changes in market power (Farhi and Gourio, 2018; Eggertsson et al., 2021), demographics (Kopecky and Taylor, 2022), or risk (Farhi and Gourio, 2018), I show that higher income inequality can match the empirical trends through a combination of two forces, an overall increase in the level of savings and a reallocation of savings towards riskier assets. While jointly, these channels reduce both safe and risky returns, the reallocation from safe to risky assets yields a stable overall return to capital through changing the composition of capital.

I begin by revisiting several stylized facts about the rise in income inequality and household portfolio allocation. Income inequality, as measured by the share of disposable income held by the Top 10%, has increased from 29 percent in 1980 to 39 percent in 2019. This increase has been particularly concentrated in the right tail of the income distribution – the income share of the Top 0.01% more than tripled over this period. A large part of the overall increase in income inequality has been due to higher labour income inequality, as evidenced for example in Piketty et al. (2018).

At the same time, household asset portfolios differ substantially across the distribution of income. The share of risky assets, defined as the sum of equity and business wealth, varied from less than 10 percent for the lowest decile to almost 40 percent for the top decile of the income distribution in 2019. Recent evidence suggests that these differences in portfolio composition also persist among ultra-high net worth individuals, roughly corresponding to the Top 1 percent who hold a large fraction of overall wealth in the economy (Balloch and Richers, 2021; Gabaix et al., 2024).

Turning to aggregate household portfolios, Figure 1 depicts the two key trends that this paper is motivated by. It shows that both aggregate savings and the share of risky assets among these savings increased substantially since 1989. The wealth-to-income ratio increased from 3.9 to 5.9 between 1989 and 2019, whereas the share of risky assets rose from 29 to 43 percent.[3]

The aggregate rise in risky asset holdings reflects both compositional shifts and changes in portfolio behavior within income groups. A shift-share decomposition shows that roughly equal contributions come from rising income concentration at the top and from growing risky asset shares among high-income households. Exploiting cross-state varia-

[3]This rise occured primarily at the expense of a decrease in relatively safe asset holdings such as housing and liquid financial assets. A similar increase in risky assets is observable when housing is excluded from the denominator, or when only financial assets are considered (Figure A.10).

Figure 1: Rising wealth and risky assets in the United States

Notes: US Survey of Consumer Finances. The figure reports the evolution of the aggregate wealth-to-income ratio and the fraction of risky assets in total assets between 1989 and 2019. Income refers to labour income. Risky assets are defined as the sum of public and private equity. Details on the sample selection are provided in Appendix A.1.1.

tion within the U.S., I further document that states with higher top income shares exhibit larger aggregate risky asset holdings.

To quantify the role of income inequality for the evolution of household portfolios, I develop a dynamic general equilibrium model in the spirit of Angeletos (2007). The model features heterogeneity on the household and the firm side. Households differ in their permanent and transitory productivity types, which influence their consumption-savings and portfolio allocation decisions between a safe and a risky investment. Firms are heterogeneous in their productivity process, which determines the type of capital they supply between safe and risky capital.

A main contribution of the model is to integrate a household block that matches cross-sectional patterns of savings behaviour and portfolio allocation into a production economy with productivity risk on the firm side. The central feature of the household block are non-homothetic preferences over bequests, a common assumption in the literature on income inequality (Straub, 2019; Mian et al., 2021a). Several papers have argued that such non-homothetic preferences are critical to match the empirically observed high savings level of the right tail of the wealth distribution (Benhabib et al., 2019; Gaillard et al., 2023; Halvorsen et al., 2024).

I show that the standard formulation of the non-homothetic bequest motive not only alters the level, but also the composition of savings once portfolio choice is endogenized. With CRRA utility over consumption and bequests, the curvature of utility over bequests needs to be lower than the curvature of utility over consumption for bequests to be a luxury good.[4] When household income increases, a larger share of utility is derived from bequests relative to consumption. This effectively lowers the household's risk aversion, which is a weighted average of the curvature over consumption and bequest utility. All else equal, this yields a higher share of risky assets for wealthier households.[5] I formalize this insight by proposing a new approximation for optimal risky asset shares under non-homothetic bequest preferences that extends the canonical results in Merton (1969) and Samuelson (1969).

In the aggregate, the model therefore generates an explicit link between the distribution of labour income and the aggregate level and composition of savings demand. By affecting the allocation of resources across households with different risk-bearing capacities, the degree of labour income inequality effectively determines the level of risk aversion of the hypothetical representative agent in the economy.

The supply of safe and risky saving opportunities in the economy is given by firms with different productivity processes. As in Angeletos (2007), there are two types of firms, a representative safe firm with deterministic productivity and a continuum of risky firms which are more productive but subject to idiosyncratic and non-diversifiable productivity risk. These productivity differences map directly into the trade-off that households as the providers of capital in this economy face: lend capital to the safe firm at the risk-free rate or lend to a risky firm at a higher expected return as compensation for bearing additional risk. Because this risk is not diversifiable, its existence is sufficient to generate a risk premium, even in the absence of aggregate risk. This way of modelling risk is convenient because its tractability allows me to enrich the model across other dimensions that are important to accurately capture household savings behaviour.

The model nests a version of the economy in Angeletos (2007) as a special case in which preferences are homothetic and idiosyncratic income risk, borrowing constraints and asset market participation costs are absent. In this case, the non-linear individual decision rules collapse to linear rules and the model allows for exact aggregation. I use such a stylized version of the model to study analytically the role of shifts in the income distribution for the allocation of capital across safe and risky firms and the returns to capital. Despite the absence of non-homothetic preferences, I can broadly capture the effects of income inequality by performing comparative statics on two structural parameters that mimic the role of non-homotheticities, the discount factor and risk aversion. Variation in

[4] An alternative way to introduce non-homothetic preferences over bequests is to assume the same curvature over consumption and bequest utility, but introduce a Stone-Geary shifter in the bequest component (De Nardi, 2004).

[5] This mechanism was proposed in Carroll (2000) as one potential explanation for the cross-sectional differences in portfolio allocation.

the discount factor captures changes in the level of savings demand, whereas variation in risk aversion captures changes in the composition of savings demand. The usage of Epstein-Zin preferences allows me to explicitly disentangle risk aversion from the elasticity of intertemporal substitution. I illustrate how higher patience and lower risk aversion as proxies for higher income inequality raise the overall capital stock, increase the share of risky capital and reduce returns on both safe and risky capital.

To perform quantitative experiments, I calibrate the model to the US economy in 1980. The calibration strategy consists of targeting cross-sectional moments on household saving levels and portfolio composition and using aggregate moments of the income and wealth distribution for validation. The model performs well across several dimensions. First, it correctly captures the increasing saving levels and risky asset shares across the distribution of income and wealth. Second, it predicts that average returns to wealth are increasing in wealth, as suggested in Piketty (2014) and evidenced, for example, in Xavier (2021). Third, it jointly accounts for the observed concentration of consumption, labour income, wealth and capital income, a puzzle for heterogenous agent models raised in Gaillard et al. (2023). The fact that the combination of non-homothetic preferences and endogenous portfolio choice endogenously generates scale-dependent returns presents a separate contribution of this paper.

The main experiment consists of tracing out the effects of the stark rise in labour income inequality between 1980 and 2019. I make two assumptions in conducting this exercise. First, labour income inequality increased exogenously and I remain agnostic on its source, i.e. whether it was driven by technological change or by changes in taxation, for example. Second, I assume that dispersion increased in the permanent component of income as opposed to the transitory one, based on empirical evidence for the US (DeBacker et al., 2013; Guvenen et al., 2022). Specifically, I adjust the distribution of the permanent component of labour income through a mean-preserving spread to match the empirical top income shares in 2019, leaving all other parameters unchanged. As such, the exercise isolates the effects of changes in the distribution of permanent income without affecting its overall level.

The model predicts an increase in the aggregate share of risky assets by five percentage points, or 40 percent of the observed increase in the data. This reallocation of capital towards risky firms is accompanied by an overall increase in capital of 20 percent, again accounting for around 40 percent of the increase in the data. With respect to prices, both safe real interest rates and risk premia are lower, but the overall return to capital remains relatively stable due to a reallocation of capital from the low-return towards the high-return sector.

A direct consequence of inequality-induced capital reallocation is a rise in total factor productivity. Because more productive firms make up a higher share of the overall capital stock, aggregate productivity increases through a compositional effect. This increase in productivity benefits all households in the economy through higher wages. The latter partly compensates low-income households for their income losses caused by the changes in the distribution of permanent income.

Related literature. This paper contributes to a large literature that documents portfolio heterogeneity across the distribution of income and wealth by developing a theoretical framework that matches the empirical evidence and studying its macroeconomic implications. Using data from the Survey of Consumer Finances, Carroll (2000) shows that the portfolios of the rich are heavily skewed towards risky assets, while Xavier (2021) also shows that wealthier households generate higher returns. Similar evidence has been found using administrative tax data both in the US and in other countries (Bach et al., 2020; Fagereng et al., 2020; Smith et al., 2023). Balloch and Richers (2021) and Gabaix et al. (2024) use a proprietary database of investment portfolios to document substantial heterogeneity in portfolio composition and returns among ultra-high net worth individuals who are typically not well captured in survey data.

The idea that portfolio heterogeneity can be explained by non-homothetic preferences dates back to at least Carroll (2000) who argues that if wealth is a luxury good, wealthier households hold riskier assets. Several papers build on variations of this argument and show that the existence of luxury bequest motives (Ding et al., 2014), luxury goods (Wachter and Yogo, 2010) or a subsistence level of consumption (Achury et al., 2012) yield similar predictions. A different set of papers shows how ex-ante heterogeneity in risk preferences (Azzalini et al., 2023; Fernández-Villaverde and Levintal, 2024) can be used to match the empirically observed portfolio heterogeneity. This paper introduces a non-homothetic bequest motive into a general equilibrium model with endogenous portfolio choice and endogenously determined asset returns and quantifies its relevance for the determination of household portfolios. It also identifies a central tension that is introduced by the bequest motive. All else equal, the bequest motive increases the risky portfolio share through lowering effective risk aversion, but decreases it by making households accumulate more wealth relative to income.

The paper firmly relates to the literature that studies the long-term macroeconomic implications of rising income inequality. Several papers focus on the effect of income inequality on the overall level of savings and through that on the equilibrium interest rate (Straub, 2019), the efficacy of monetary and fiscal policy (Mian et al., 2021a) or the occurence of financial crises (Kumhof et al., 2015). Fewer papers study the effects on the composition of household asset portfolios. Doerr et al. (2022) documents that rising income inequality reduces job creation in a model in which households have a preference for holding deposits. Elina and Huleux (2023) analyzes the portfolio choice over liquid and illiquid assets and shows that income inequality affects the valuation of capital. I show, instead, that income inequality affects the portfolio choice over safe and risky investments, and how that, in turn, affects the composition of firms issuing different types of capital. Favilukis (2013) and Laudati (2024) also study the role of increased income inequality, but focus on changes in income risk and the labour share, whereas I study an increase in permanent labour income inequality.

Motivated by rich micro-data on household savings behaviour, several papers argue that non-homothetic preferences, wealth-dependent returns, or a combination of the two are needed to explain the large concentration of wealth in the economy (Benhabib et al., 2019; Hubmer et al., 2021; Gaillard et al., 2023; Halvorsen et al., 2024). I show that introducing endogenous portfolio choice in a model with non-homothetic preferences endogenously generates wealth-dependent returns that are in line with the data. Another literature studies the asset pricing implications of household heterogeneity and inequality. As in my framework, these models typically build on the observation that wealthier households hold riskier assets, be it through preference heterogeneity, participation frictions or other exogenous forces (Gollier, 2001; Guvenen, 2009; Gomez et al., 2016; Toda and Walsh, 2020; Cioffi, 2021). In contrast to these papers, I also consider how changes in asset prices affect firm's funding conditions and through that the overall economy.

Finally, this paper also contributes to the literature on financial frictions and venture capital by highlighting the link between income inequality and the supply of risky capital. A large body of literature has shown that access to finance spurs growth (King and Levine, 1993a,b; Brown et al., 2009). Samila and Sorenson (2011), for instance, document that increases in the supply of venture capital positively affect firm starts, employment, and aggregate income. Even though venture capital investment only constitutes 2% of total investment, it is an important catalyst of growth. Venture capital-backed firms contributed 15.8% of aggregate growth in terms of payroll between 1990 and 2019 (Ando, 2024) and accounted for 37% of R&D expenditure in 2014 (Greenwood et al., 2022).

2 Stylized facts

This section documents a set of stylized facts that motivate the quantitative analysis. I first revisit the rise in U.S. income inequality since the early 1980s and decompose it into capital versus labor income and, within labor income, permanent versus transitory components. I then show how household asset portfolios vary systematically across the income distribution, and how these gradients have evolved over time. Finally, I provide evidence that income inequality is positively associated with aggregate risky asset shares, both across U.S. states and euro area countries.

2.1 The rise in income inequality

Several papers have documented a substantial rise in income inequality over the last decades in the United States (see, for example, the reviews in Alvaredo et al. (2013) or Hoffmann et al. (2020)). I review some of these findings using data from the World Inequality Database (WID) based on Piketty et al. (2018), the dataset compiled in Piketty and Saez (2003) and the Global Repository of Income Dynamics (GRID) (Guvenen et al., 2022). Combining these datasets allows me to decompose the rise in income inequality along two dimensions, the split between labour and capital income, and between the permanent and risky component of labour income.[6]

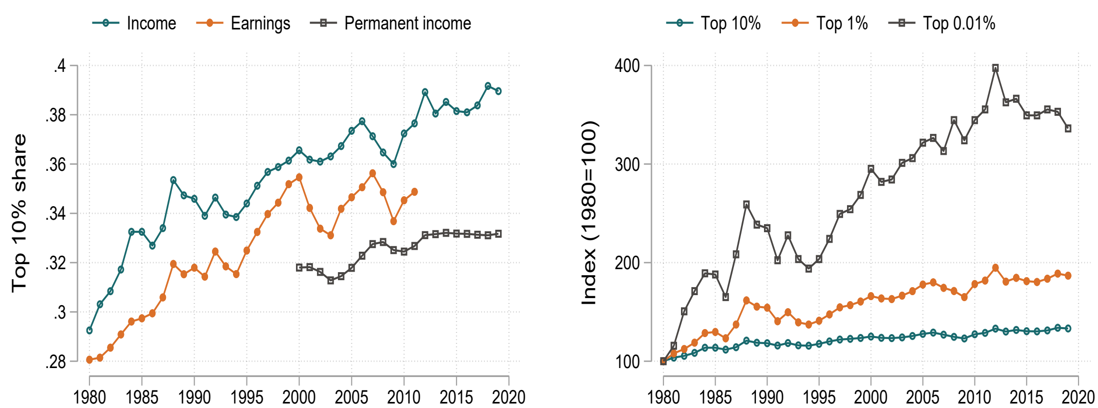
Distinguishing between the sources of income inequality is important for understanding their implications for household portfolio choice as different income components constitute distinct forms of background risk. Capital income is typically more volatile than labour income. The risky component of labor income is, by definition, more volatile than the permanent component, which reflects, for example, longer-term human capital. These differences in income volatility fundamentally shape household decisions regarding portfolio allocation, as households exposed to higher background risk exhibit a greater desire for safer assets.

The left panel in Figure 2 plots the evolution of several types of income inequality in the United States since 1980. The share of total income, which includes labour and capital income net of taxes and transfers, earned by the Top 10% of the distribution increased by 10 percentage points from 29 to 39 percent. Much of this increase, in particular between 1980 and 2000, was driven by the labour component (Piketty et al., 2018; Hoffmann et al., 2020). The Top 10% earnings share increased by 8 percentage points over that period.

Rising earnings inequality may reflect both higher dispersion in permanent earnings or an increase in income risk. This distinction is important from a theoretical perspective because transitory income risk is typically insurable whereas permanent income differences are not. The empirical evidence points towards larger permanent differences as the

[6]The WID combines national accounts and survey data with fiscal data sources, but does not consistently distinguish between labour and capital income. Piketty and Saez (2003) and GRID provide estimates of earnings inequality based on administrative data. Earnings in GRID are defined as market income from employment services including bonuses, overtime pay, tips and commissions but excluding self-employment income.

Figure 2: Evolution of income inequality in the US



(a) Top 10% income share

(b) Income concentration

Notes: Income inequality data are from the WID and denote disposable income which includes labour and capital income net of taxes and transfers. Earnings inequality data are from Piketty and Saez (2003). Permanent income inequality is computed from GRID data where permanent income is proxied by 3-year averages of earnings. The right panel reports figures for disposable income inequality.

main driver of the rise in earnings inequality (DeBacker et al., 2013; Guvenen et al., 2022). I construct my own measure of permanent income inequality based on 3-year averages of household earnings in GRID as a proxy for household's permanent income. The grey line in the left panel of Figure 2 plots the evolution of the Top 10% permanent income share based on this measure. Unfortunately, I can only construct this measure starting in 2000 due to data limitations. Even so, one can see that permanent income inequality is large and accounts for the bulk of overall earnings inequality.

The right panel illustrates that the increase in income inequality was concentrated in the very right tail of the income distribution. The share of disposable income earned by the Top 1% roughly doubled, while the share of the Top 0.01% more than tripled.

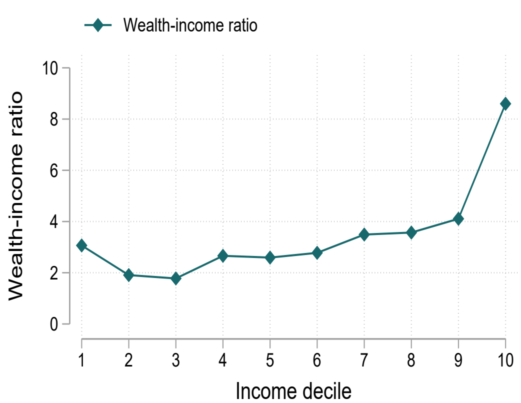
2.2 Portfolio allocation across the income distribution

It is a well established fact from the household finance literature that higher income households hold more wealth relative to income (Carroll, 1998; Dynan et al., 2004; Brendler et al., 2024) and a higher share of risky assets, both in the United States (Carroll, 2000; Smith et al., 2023) and in other countries (Bach et al., 2020; Fagereng et al., 2020). In this section, I revisit this evidence using data from the Survey of Consumer Finances (SCF) and quantify how these cross-sectional patterns evolved over time. Income is defined as labour income, which includes wages and salaries, business income, social security income and transfers.[7] Risky assets are defined as the sum of public and private equity. The former includes all financial assets that are invested in stocks, both directly and indirectly. The latter includes all business wealth in which the household has an active or nonactive interest. Appendix A.1.1 provides details on the sample selection and variable definitions.

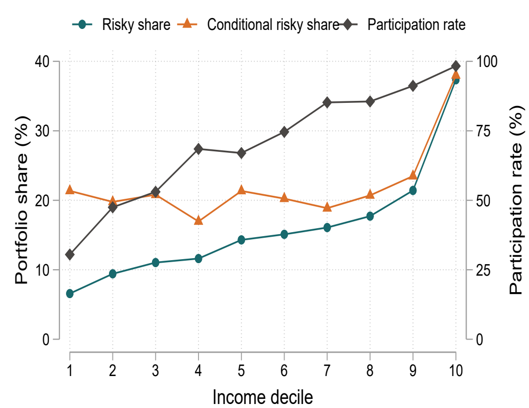
The left panel of Figure 3 divides households into deciles based on income and shows the average wealth-income ratio for each bin, using data from 2019. Wealth holdings remain relatively stable as a proportion of income for the bottom half of the income distribution but start increasing thereafter. While the median household holds wealth worth slightly more than twice its annual income, the average household in the top decile holds wealth exceeding eight times its income.

The right panel shows risky asset holdings as a fraction of total assets across the distribution of income. Higher-income households invest a substantially larger part of their portfolios in risky assets. The risky asset share increases from close to zero percent for the bottom decile to almost 40 percent for the top decile. The rise in the risky asset share is particularly steep for higher income deciles and doubles, for example, between the eight and the tenth decile.

Figure 3: Wealth and risky portfolio shares across the income distribution



(a) Wealth-income ratio



(b) Risky asset shares

Notes: Survey of Consumer Finances 2019. Income refers to labour income. Risky assets are defined as the sum of public equity and private equity. Conditional portfolio shares condition on households that participate in risky asset markets. Details on the sample selection are provided in Appendix A.1.1.

[7] Appendix A.1.3 shows that the analysis yields similar results using alternative income concepts.

It is well known that not all households participate in risky asset markets.[8] The right panel shows that not only overall risky asset shares, but also participation in risky asset markets is more common across high-income households. Whereas only 11 percent of households in the lowest income decile hold any type of risky asset, essentially all households in the top decile do. This raises the question to what extent overall risky portfolio shares are a result of differences in participation. Conditional on participation, the risky asset share is still increasing steeply in income, albeit somewhat less than unconditionally, in particular for low-income households. This suggests that both the extensive and intensive margin play a role, but that the intensive margin is more relevant for the right tail of the income distribution. Appendix A.1.2 provides a more detailed discussion of portfolio heterogeneity based on a finer split of individual asset categories into equity, business wealth, housing and liquid assets.

Two potential concerns with the income definition are (i) the inclusion of business income which may generate a mechanical relationship between income and risky asset shares and (ii) the fact that it refers to current, not permanent income. To address these concerns, Appendix A.1.3 reconstructs Figure 3b across the distribution of earnings and households' "normal" income, i.e. the income a household would expect to receive in a normal year. Figure A.4 shows that also across these alternative income measures, risky asset shares are particularly high for the top decile.

The time-series evidence in Figure 1 points to a marked increase in the aggregate risky asset share between 1989 and 2019. This raises the question whether this rise was driven by compositional effects, i.e. overall asset holdings shifting from low- to high-income households, or by changes in cross-sectional portfolio allocation patterns over time, i.e. households at different income deciles exhibiting changes in their portfolio shares. To answer this question, I inspect changes in cross-sectional portfolio allocation between the early sample period from 1989-1995 and the late sample period from 2013-2019. Each period averages over three waves of the SCF to obtain smoother asset shares. Figure 4 shows a broad-based increase in risky asset shares that was particularly strong for higher income households.[9] At the same time, the top half of the income distribution, in particular the top decile, experienced a large increase in wealth-income ratios.

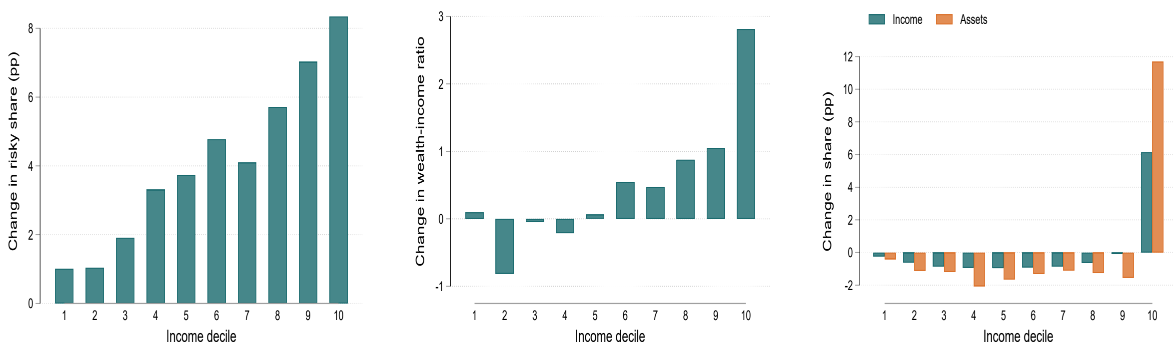
The right panel shows how income and overall asset shares changed over time. The largest changes are observable for the top income decile, for which both income and asset share increased substantially. Taken together, both changing overall asset shares across

[8]See, for example, Mankiw and Zeldes (1991); Haliassos and Bertaut (1995); Vissing-Jorgensen (2003).

[9]Appendix Figure A.3 shows that there was also a broad-based increase in participation rates, which was particularly pronounced for middle-income households.

income deciles and changing risky asset shares conditional on income deciles appear to have contributed to the aggregate rise in the risky asset share.

Figure 4: Cross-sectional portfolio allocation: Change between 2013-2019 and 1989-1995



(a) Risky asset share (b) Wealth-income ratio (c) Income and asset share

Notes: Survey of Consumer Finances. The panels show the changes in risky asset shares, participation rates and overall income and asset shares between the period 1989-1995 and 2013-2019. Income refers to labour income. Risky assets are defined as the sum of public equity and private equity. Details on the sample selection are provided in Appendix A.1.1.

To quantify more formally which components contributed to the rise in the aggregate risky asset share, I decompose the aggregate change into changes in income shares, asset shares and risky asset shares using the following decomposition:

$$\Delta S^{risky} = \sum_i \underbrace{\mathrm{s}^{risky}_{i,89-95} \cdot \mathrm{s}^{asset}_{i,89-95} \cdot \Delta \mathrm{s}^{inc}_i}_{\text{Change in income shares}} + \underbrace{\mathrm{s}^{risky}_{i,89-95} \cdot \mathrm{s}^{inc}_{i,89-95} \cdot \Delta \mathrm{s}^{asset}_i}_{\text{Change in asset shares}} + \underbrace{\mathrm{s}^{inc}_{i,89-95} \cdot \mathrm{s}^{asset}_{i,89-95} \cdot \Delta \mathrm{s}^{risky}_i}_{\text{Change in risky shares}}$$
$$+ \text{higher-order terms} \tag{1}$$

where $\Delta s^j_i = s^j_{i,13-19} - s^j_{i,89-95}$ and higher-order terms refer to the interaction between changes in the respective shares. The first term captures the effect of changes in the total income share held by each income decile. The second term captures the effect of the total asset share held by each decile. The third term captures the change in risky asset shares conditional on the income decile. The decomposition yields that approximately 40 percent of the change in aggregate risky asset shares is driven by changes in risky asset shares within income deciles, 40 percent by higher income and asset shares of high-income households, and the remainder by the interaction of these changes. This confirms that both margins, higher-income households holding more income and assets, and higher income households holding a larger share of risky assets, contributed to the rise in the aggregate risky asset share. These findings will be useful once the model is introduced to distinguish between different theories of household savings heterogeneity.

2.3 Income inequality and aggregate risky asset shares

The concurrent rise in income inequality and the aggregate risky asset share in the U.S. is suggestive but, taken in isolation, does not identify the underlying mechanism. In particular, the time-series correlation may reflect reverse causality or the influence of confounding aggregate trends. To assess whether the relationship reflects a more general empirical regularity, I exploit two additional sources of variation: differences in inequality across U.S. states and cross-country variation within a panel of euro area economies. I begin with the former and defer the euro area evidence to Appendix A.1.6.

Cross-state variation within the U.S. provides a useful laboratory for identifying empirical relationships, as it allows one to difference out common aggregate trends. This strategy has been widely employed, for example, to study the relationship between income inequality and household wealth (Mian et al., 2021a) and its implications for local labor market outcomes (Doerr et al., 2022). I adopt a similar approach to examine whether the positive association between income inequality and risky asset holdings is also present at the state level.

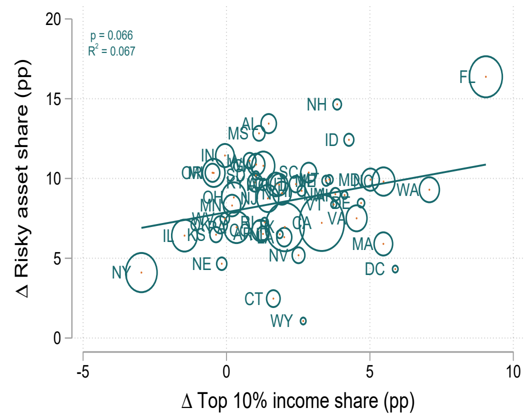
I take measures of income inequality from Frank (2009), which provides annual state-level series constructed from IRS tax return data. Leveraging administrative tax records in the Statistics of Income (SOI), I construct state-level measures of aggregate risky asset shares. Because the SOI report income flows from assets rather than their stocks, I construct a proxy for the risky asset share based on these flows. Specifically, I define risky asset income as the sum of dividend income (ordinary and qualified) and capital gains, and safe asset income as interest income. The risky asset share is then computed as the ratio of risky asset income to the sum of risky and safe income. Because data on capital gains and qualified dividends are only available beginning in 2010, I restrict the baseline sample to 2010–2019.[10]

The left panel of Figure 5 plots, for each U.S. state, the average top 10 percent income share against the average aggregate risky asset share over the period 2010–2019. The right panel instead relates changes in these variables over the same horizon to account for time-invariant state characteristics that may confound the cross-sectional relationship. In both specifications, the correlation is positive. States with higher income inequality tend to exhibit larger aggregate risky asset shares, and states that experienced larger increases in

[10] This extends prior work that uses SOI data to proxy for household participation in equity markets (Lin, 2020).

Figure 5: Income inequality and risky asset shares across US states

(a) Averages 2010-2019



(b) Change 2010-2019

Notes: The left panel plots the average top 10% income share against the average risky asset share over the period 2010-2019 for each US state. The right panel plots the percentage point changes in those variables over the same period. The bubble size indicates population size. p-values and R^2 are computed from unweighted regressions. Data from Frank (2009) and IRS.

income inequality over the decade also saw more pronounced rises in risky asset holdings.

The cross-sectional evidence suggests that both the wealth-income ratio and the risky asset share are increasing functions of income. Under a simple shift-share logic, higher income inequality is therefore expected to raise both the aggregate wealth-income ratio and risky asset share, even if individual portfolio rules remain unchanged. This type of compositional argument has previously been used to account for the rise in the aggregate wealth–income ratio in models with non-homothetic preferences for wealth, where the marginal propensity to accumulate wealth increases with permanent income (Straub, 2019). In the next section, I extend this reasoning to portfolio composition. When preferences generate not only higher wealth levels but also systematically higher risky asset shares at higher income levels, an increase in income inequality induces a reallocation of aggregate portfolios toward riskier assets.

3 Portfolio choice with non-homothetic preferences

A standard result in the household finance literature is that with CRRA utility, no borrowing constraints and no income risk, the share of risky assets is constant in wealth and given by the canonical Merton-Samuelson formula $\varphi_H^* = \frac{\mathbb{E}[R^r]-R^s}{\sigma^2}\frac{1}{\gamma}$, i.e. the excess return over the return variance and the degree of risk aversion. With non-homothetic preferences, the relevant risk aversion parameter for the optimal risky portfolio share changes. Besides the curvature of the utility over consumption γ, also the curvature of the utility over bequests η now influences the optimal risky asset share. In particular, as more utility is derived from bequests, the magnitude of η becomes increasingly important in the determination of the portfolio composition.

To understand this intuition, consider an investor who derives utility from both consumption and terminal wealth. She invests an amount y across a risk-free asset with gross return R_s and a single risky asset with expected excess return μ and variance σ^2. An exogenous fraction θ is consumed, with the remaining $(1-\theta)$ held as wealth.

$$\begin{aligned} &\max_{\varphi} \mathbb{E}\left[\frac{c^{1-\gamma}}{1-\gamma} + \frac{w^{1-\eta}}{1-\eta}\right], \\ &\text{s.t. } c = \theta y\left(\varphi R_r + (1-\varphi)R_s\right), \\ &\quad\;\; w = (1-\theta)y\left(\varphi R_r + (1-\varphi)R_s\right) \end{aligned} \tag{2}$$

Under normally distributed returns and $R_s = 1$, we can obtain an approximate closed-form solution by a second-order Taylor expansion of the objective function around $\varphi = 0$.

Proposition 1. *The optimal risky asset share with non-homothetic preferences is given by:*

$$\varphi^*_{NH} \approx \frac{\mathbb{E}[R^r] - R^s}{\sigma^2} \frac{\theta^{1-\gamma}y^{1-\gamma} + (1-\theta)^{1-\eta}y^{1-\eta}}{\gamma\theta^{1-\gamma}y^{1-\gamma} + \eta(1-\theta)^{1-\eta}y^{1-\eta}}. \tag{3}$$

Next, we turn to characterizing the optimal risky asset share in more detail. When all wealth is consumed, i.e., $\theta = 1$, or preferences are homothetic, i.e., $\gamma = \eta$, we get the standard portfolio choice solution $\varphi^*_H \approx \frac{\mathbb{E}[R^r]-R^s}{\sigma^2}\frac{1}{\gamma}$. The next proposition summarizes how the risky share is affected by the amount invested.

Proposition 2. *The optimal risky asset share satisfies the following properties:*

(i) It is increasing in the amount invested:

$$\frac{\partial \varphi^*_{NH}}{\partial y} > 0 \tag{4}$$

(ii) In the limit of large wealth, it converges to

$$\lim_{y\to\infty} \varphi^*_{NH} = \frac{\mathbb{E}[R^r] - R^s}{\sigma^2} \cdot \frac{1}{\eta} \tag{5}$$

where $\eta < \gamma$.

This proposition shows that non-homothetic preferences induce portfolio choices consistent with decreasing relative risk aversion (DRRA). In particular, the parameter relevant for portfolio allocation gradually transitions from γ at low wealth levels to η in the limit of high wealth.

Further intuition for these results is provided in Appendix C.1. There, I illustrate numerically how the risky share changes with wealth and the consumption share θ, and how endogenizing the consumption-savings decision alters the allocation. The appendix also extends the discussion to the dynamic case with labor income.

Discussion and related empirical evidence. The main takeaway from this section is that the non-homothetic preference for bequests effectively generates decreasing relative risk aversion (DRRA). This implication of non-homothetic preferences has been suggested by Carroll (2000) in the context of 'capitalist spirit' utility as a potential explanation for cross-sectional portfolio shares. Bakshi and Chen (1996) make a similar point in an economy with status preferences that are not separable from consumption preferences.

There is ample empirical evidence that supports the existence of decreasing relative risk aversion. Several papers find that the portfolio share invested in risky assets, including participation rates, is increasing in financial wealth using different research designs such as exploiting panel data (Calvet et al., 2009), inheritances (Andersen and Nielsen, 2011), lotteries (Briggs et al., 2021) or hypothetical survey questions (Christelis et al., 2022). Brunnermeier and Nagel (2008) and Chiappori and Paiella (2011) use panel data to argue in favour of CRRA preferences based on the observation that the risky share does not respond to changes in wealth. However, as evident from the policy functions in this section, this is not necessarily evidence against DRRA as the offsetting wealth effect of higher financial relative to human wealth might dominate.

Arguably better tests of DRRA are provided in studies which identify the effects of both increases in wealth *and* permanent income. Calvet and Sodini (2014), for example, finds that both financial wealth and human capital affect risk-taking positively. Meeuwis (2020) uses panel data on investors and finds that positive and persistent shocks to income increase the equity share, while increases in financial wealth lead to a small decline. On balance, however, the sum of the two effects combined is positive, suggesting DRRA.

4 Model

This section presents a dynamic general equilibrium model featuring heterogeneous households and firms, designed with two primary objectives. First, the model aims to jointly replicate the cross-sectional patterns observed in household savings behavior and portfolio allocation. Second, it examines the impact of the labor income distribution on capital allocation and return rates, as well as the resulting broader macroeconomic implications.

The model is an overlapping-generations variant of the economy developed in Angeletos (2007). The main contribution lies in incorporating a richer household sector which generates non-linear decision rules and therefore enables the model to capture the influence of the income and wealth distribution on aggregate economic outcomes.

4.1 Households

Overview. Time is discrete and indexed by t. The economy is populated by a continuum of households who die at a constant rate ε. Households are indexed by i and are ex-ante heterogeneous in their permanent productivity type s_i, which I interchangeably refer to as permanent income type, and ex-post heterogeneous in their stochastic productivity level z_{it}. Each household supplies one unit of labour inelastically in a competitive labour market.

Each period, households choose how much to consume and how much to save. They also face a portfolio choice between saving in a safe and a risky asset. Investing in the safe asset yields a deterministic return, whereas investing in the risky asset yields an idiosyncratic stochastic return.

Preferences. Households derive utility from consumption c and leaving bequests a. The utility functions are given by:

$$u(c) = \frac{c^{1-\gamma}}{1-\gamma}, \quad v(a) = \psi \frac{a^{1-\eta}}{1-\eta} \tag{6}$$

where I assume that $\eta < \gamma$, and ψ parametrizes the relative weight of leaving bequests in total utility. This formulation yields preferences that are non-homothetic because the marginal utility of leaving bequests declines more slowly than the marginal utility of consumption. This makes bequests effectively a luxury good.

By choosing this preference structure, I build on a large body of literature that aims to capture the empirically documented differences in saving rates across households (Carroll, 1998; Dynan et al., 2004; Fagereng et al., 2019; Straub, 2019).[11] Based on rich microdata, several papers have argued that non-homothetic preferences are needed, at least in an accounting sense, to match the savings behaviour of the right tail of the wealth distri-

[11]See, for example, Straub (2019); Mian et al. (2021a); Platzer and Peruffo (2022) who study the role of income inequality for the decline in real interest rates. Lockwood (2018) and De Nardi et al. (2021) argue for including luxury bequest motives to match the savings behaviour of retirees.

bution (Benhabib et al., 2019; Gaillard et al., 2023; Halvorsen et al., 2024).[12]

Labour income. Household labour income is given by the product of the aggregate wage rate ω_t, the permanent productivity type s_i and the transitory productivity state z_{it}. The permanent component s_i is assigned at birth and drawn from a four-point distribution representing the *Bottom 50%*, *Middle 50-90%*, *Middle 90-99%* and the *Top 1%* of the income distribution. The permanent component can be interpreted as the innate ability, skill or education of the household and is the main object through which changes in income inequality will be introduced.[13] The transitory productivity state is stochastic and consists of two separate components. The first component is a process $\tilde{z}$ whose log follows an AR-1 with mean zero, persistence ρ_z and a normally distributed mean-zero innovation with variance σ_z^2. The second component is a nonemployment state $\nu_z \in (0, 1)$ that scales down transitory productivity and occurs with probability p_ν that is allowed to depend on the realization of $\tilde{z}$:

$$y_{it} = w_t s_i z_{it} \tag{7}$$

$$z_{it} = \nu_{it} \tilde{z}_{it} \tag{8}$$

$$\log \tilde{z}_{it} = \rho_z \log \tilde{z}_{it-1} + \epsilon_{it}, \qquad \epsilon_{it} \sim N(0, \sigma_z^2) \tag{9}$$

$$\nu_{it} \sim \begin{cases} 1 & \text{with prob. } 1 - p_\nu(\tilde{z}) \\ \tilde{\nu} & \text{with prob. } p_\nu(\tilde{z}) \end{cases} \tag{10}$$

The introduction of a state-dependent non-employment state helps capture the skewness and kurtosis of income that is observed in the data in a parsimonious way (Guvenen et al., 2021). Having a realistic representation of the income process is important because the degree of income uncertainty faced by households is an important determinant of household portfolio choice due to the interaction of different types of risks (Guiso et al., 1996).

Dynamic optimization problem. Formally, the recursive household problem is given by:

[12] An alternative interpretation of the bequest motive is a warm-glow motive of holding wealth, often referred to as 'capitalist spirit' (Kumhof et al., 2015).

[13] Cooper and Zhu (2016), for example, documents large differences in portfolio choice across education groups and explains these based on differences in mean income.

$$V(s,z,w) = \max_{c,a^{s\prime},a^{r\prime}} \frac{c^{1-\gamma}}{1-\gamma} + \epsilon\psi\frac{(a^{s\prime}+a^{r\prime})^{1-\eta}}{1-\eta} + (1-\epsilon)\beta\mathbb{E}_{z'|z,r^{r\prime}}\left[V(s,z',w')\right] \tag{11}$$

$$\text{s.t.} \quad c + a^{s\prime} + a^{r\prime} + I_{a^{r\prime}>0}\kappa = \omega s z + (1+r^s)a^s + (1+r^r)a^r \tag{12}$$

$$a^{s\prime}, a^{r\prime} \geq 0 \tag{13}$$

$$w \equiv (1+r^s)a^s + (1+r^r)a^r \tag{14}$$

where β is the subjective discount factor. The permanent income type s, idiosyncratic productivity state z and wealth w fully describe the household state. Wealth is given by the sum of the safe asset a^s which pays a deterministic return r^s and the risky asset a^r which pays a stochastic return r^r. In case of death, the household derives utility from leaving a bequest, given by total savings, i.e. the sum of the safe asset and the risky asset. The household forms expectations about two variables, the idiosyncratic productivity state z' and the idiosyncratic return to the risky investment $r^{r\prime}$. The distribution that underlies risky returns will be described once firms are introduced. I impose a zero borrowing constraint on both types of assets. Households that want to invest in the risky asset need to pay a fixed participation cost κ each period. This cost captures the well documented information and search frictions in risky asset markets.

Demographic structure. Each newly born household inherits the permanent income state of her predecessor. The stochastic income state is drawn from the unconditional distribution of z. I assume that bequests are expropriated by the government with some probability, but are otherwise fully passed on to the next generation. This assumption helps ensure the stationarity of the cross-sectional wealth distribution.

4.2 Firms

The economy consists of two types of firms, a representative safe firm and a continuum of risky firms. The labels "safe" and "risky" are assigned based on the nature of the stochastic productivity technology that the firm uses.[14] The safe firm is owned by all households in the economy while each risky firm i can only be owned by one household, and index i of the firm therefore corresponds to index i of the household. The safe firm corresponds to the supplier of the safe asset, while risky firms supply the risky asset.

Safe firm. A representative safe firm produces output by hiring capital and labour and

[14] In the language of Angeletos (2007), the safe firm corresponds to a "public" firm and the risky firm to a "private" firm. This paper does not make a distinction between the public and private sector, and is purely about the diversifiability of risk associated with each firm.

faces constant returns to scale. The firm's production technology is given by:

$$F(Z^s, K^s, L^s) = Y_t^s = Z^s K_t^{s,\alpha} L_t^{s,1-\alpha} \tag{15}$$

where superscript s is used to refer to the safe firm. Z^s denotes the time-invariant productivity of the safe firm. The parameter $\alpha \in (0, 1)$ denotes the output elasticity of capital. The firm's optimization problem is given by:

$$\max_{K^s, L^s} \Pi_t^s = Y_t^s - (r_t^s + \delta)K_t^s - \omega_t L_t^s \tag{16}$$

where r_t^s denotes the rental rate of capital, ω_t the wage rate and δ the depreciation rate of capital. Note that r_t^s corresponds to the safe return that households earn on their savings. The capital and labour demand of the firm are given by:

$$K_t^s = \left(\frac{\alpha Z^s}{r_t^s + \delta}\right)^{\frac{1}{1-\alpha}} L_t^s, \qquad L_t^s = \left(\frac{(1-\alpha)Z^s}{\omega_t}\right)^{\frac{1}{\alpha}} K_t^s \tag{17}$$

It follows directly that the labour-capital ratio depends only on prices and technology parameters. Combining the two conditions, the wage can be expressed as a function of the interest rate:

$$\omega_t = (Z^s)^{\frac{1}{1-\alpha}}(1-\alpha)\left(\frac{\alpha}{r_t^s + \delta}\right)^{\frac{\alpha}{1-\alpha}} \tag{18}$$

These expressions will be helpful for characterizing differences between the safe and risky firms. For the rest of the analysis, I normalize, without loss of generality, Z^s to 1.

Risky firms. There is a continuum of risky firms of mass one operated by households. Each household i can operate one firm i. Risky firms use the same production technology as the safe firm, but differ in two important aspects. First, the capital of risky firms is subject to idiosyncratic productivity risk through a shock ζ_{it}. Second, risky firms are more productive than the safe firm by a factor $\mu > 1$, such that $Z^r = \mu Z^s = \mu > Z^s$. The assumption of higher productivity is needed for households to be willing to supply capital to the risky firm as a compensation for risk. The production technology of risky firms is thus described by:

$$f(Z^r, k^r, l^r, \zeta) = y_{it}^r = \mu(\zeta_{it} k_{it}^r)^\alpha l_{it}^{r,1-\alpha}, \quad \ln \zeta_{it} \sim N(-\frac{\sigma_\zeta^2}{2}, \sigma_\zeta^2) \tag{19}$$

The idiosyncratic productivity shock is assumed to be iid log-normally distributed with mean one and variance σ_ζ^2. The timing of the shock is such that uncertainty over the idiosyncratic shock resolves after the firm makes the capital input choice, but before it makes the labour input choice. This, together with the constant returns to scale assumption, yields the same labour-capital ratio across risky firms, irrespective of the realization of the idiosyncratic shock. The firm's problem is:

$$\max_{k^r, l^r} E[\pi_{it}^r] = \mu(\zeta_{it} k_{it}^r)^\alpha l_{it}^{r,1-\alpha} - \delta k_{it}^r - \omega_t l_{it}^r \tag{20}$$

where risky and safe firms face the same wage rate due to a competitive, frictonless labour market. Modelling the productivity shock as capital-augmenting is useful because it yields that a mean preserving spread in ζ is equivalent to a mean preserving spread in individual returns and parsimoniously parametrizes the amount of uninsured idiosyncratic return risk faced by the household with the variance of the idiosyncratic productivity shock σ_ζ^2. Note that the mapping from expected profits to the expected gross return rate is simply given by $E[R_{it}^r] = E[\frac{\pi_{it}^r}{k_{it}^r}]$.

Discussion. Based on this firm block, one could narrowly interpret the choice of the household to invest in the risky asset as the choice to become an entrepreneur for one period. This is not the interpretation that I pursue in this paper. The investment in the risky asset should be interpreted in a broader sense in which the risky asset could constitute any type of investment that is associated with an uncertain return that cannot be diversified away. Starting a business is one such interpretation but the risky asset could equivalently capture investment into a venture capital fund that supplies capital to entrepreneurs or alternatively the investment in a public stock.

4.3 General equilibrium

Risk premium and wages. We can use the firm optimality conditions to determine the relation between the expected risky and safe interest rate. Using the first order conditions with respect to labour, we can show that the productivity differential μ pins down the difference in the optimal labour-capital ratio across sectors:

$$\frac{l_t^r}{k_t^r} = \mu^{\frac{1}{\alpha}} \frac{L_t^s}{K_t^s} \tag{21}$$

This follows directly from the fact that $f(Z^r, k^r, l^r, \zeta) = f(\mu, \zeta k^r, l^r)$ and $\mu f(\zeta k^r, l^r) = F(K^s, L^s)$. Because factor markets are competitive, $\frac{L^i}{K^i} = \frac{(1-\alpha)(R^i+\delta)}{\alpha\omega}$, and we can thus express return to capital before depreciation of the risky firm as $\mathbb{E}[R^r] + \delta = \mu^{\frac{1}{\alpha}}(R^s + \delta)$.

We can then define the risk premium as:

$$\mathbb{E}[R^r] - R^s = (\mu^{\frac{1}{\alpha}} - 1)(R^s + \delta) \tag{22}$$

The risk premium is a function of the productivity differential μ, the capital intensity α, the depreciation rate δ and the level of the safe return R^s. This model therefore generates an endogenous risk premium without the inclusion of aggregate risk. It is purely based on the presence of idiosyncratic productivity risk that that cannot be diversified away.

We can also express the wage as a function of the safe interest rate by combining the firm's first order conditions:

$$\omega = (1 - \alpha)\left(\frac{\alpha}{r^s + \delta}\right)^{\frac{\alpha}{1-\alpha}} \tag{23}$$

Market clearing. This economy features three markets that need to clear, the market for safe capital, labour and goods.

$$K^s = A^s \equiv \int a^s(s, z, w) dF(s, z, w) \tag{24}$$

$$1 = L^s + L^r \tag{25}$$

where $a^s(s, z, w)$ denotes the household policy function for safe assets and $F(s, z, w)$ the invariant household distribution over states. The market for goods clears by Walras' law. Together with the optimality conditions of households and firms, the market clearing conditions determine the three equilibrium prices, the safe interest rate r^s, the risky interest rate r^r and the wage rate ω, together with the quantities of safe capital K^s, risky capital K^r, and the split of labour across private and public firms, $L^s = 1 - L^r$. We can now define a stationary equilibrium of this economy.

Equilibrium definition. A stationary recursive equilibrium consists of prices (r^r, r^s, ω), quantities $(C, K^s, K^r, L^s, L^r, Y^s, Y^r)$, policy functions $a^s(s, z, w), a^r(s, z, w)$, a value function $V(s, z, w)$ and an invariant distribution of households $F(s, z, w)$ such that for given prices, the value and policy functions solve the household maximization problem, firms maximize profits, i.e. factor prices are consistent with their marginal products, the goods, safe capital and labour markets clear and the distribution of households is stationary.

Special case. The model nests a version of the two-sector economy of Angeletos (2007) for the special case in which households face an infinite horizon and households have no preference for leaving bequests, i.e. $\varepsilon = \psi = 0$, idiosyncratic income uncertainty is absent, i.e. $\sigma_z = 0$, the borrowing limit corresponds to the natural borrowing limit and there is no asset market participation cost, i.e. $\kappa = 0$.[15] In that case, household optimal decision rules are linear in wealth and the model can be solved analytically.

5 Understanding the model mechanisms

Before quantifying the full model, this section develops a stylized model version that allows for closed-form expressions of equilibrium interest rates and capital allocation. It shows that the role of non-homothetic preferences can be captured through changes in patience and risk aversion.

The baseline model does not allow for an analytical characterization of the economy due to the non-linearity of households' decision rules in wealth. To obtain closed-form expressions for equilibrium prices and quantities, I make several simplifications and one extension to the household problem. Households are infinitely lived and have no preference over bequests, i.e. $\varepsilon = \psi = 0$, there is no income uncertainty, i.e. $\sigma_z = 0$, the borrowing limit is given by the natural borrowing limit and the depreciation rate δ is set to zero. Compared to the time-separable utility in the baseline model, I introduce Epstein-Zin preferences to distinguish risk aversion from the intertemporal elasticity of substitution (IES). Under these assumptions, the economy collapses to the two-sector economy in Angeletos (2007). The contribution of the analysis is to perform comparative statics on key parameters of the economy analytically, which complements the numerical simulations in Angeletos (2007).

The derivations of the policy functions and equilibrium outcomes are summarized in Appendix B.1 and described in more detail in the original paper. What follows is a brief review of the main objects of interest.

In this simplified economy, the policy functions for consumption and capital are linear in wealth. This yields aggregate quantities and prices that are independent of the wealth distribution. In particular, the gross returns on safe and risky capital are given by:

$$R^s = \beta^{-1} \varrho^{\frac{1}{\theta}-1} \left(\varphi \left(\mu^{\frac{1}{\alpha}} - 1 \right) + 1 \right)^{-\frac{1}{\theta}}, \quad \mathbb{E}[R^r] = \mu^{\frac{1}{\alpha}} R^s \tag{26}$$

where θ denotes the intertemporal elasticity of substitution, ϱ the certainty equivalent of the portfolio return and φ the share of risky assets. The latter two objects are functions of exogenous parameters only. This yields R^s and $\mathbb{E}[R^r]$, the expected return on the risky investment. From there, one can compute the wage and labour-capital ratio using Equation

[15] Unlike Angeletos' model, which features Epstein-Zin preferences, this model uses CRRA preferences and a slightly different productivity specification.

23 and 21 as functions of the risk-free rate.

The allocation of capital across the risky and safe sector is given by:

$$K^r = \frac{\frac{1}{l^s(\omega)} + \frac{\omega}{r^s}}{\mu^{\frac{1}{\alpha}} + \frac{1}{\varphi} - 1}, \quad K^s = \frac{1}{l^s(\omega)} - \mu^{\frac{1}{\alpha}} K^r \tag{27}$$

where $l^s(\omega) \equiv \frac{L^s}{K^s}(\omega) = \left(\frac{1-\alpha}{\omega}\right)^{\frac{1}{\alpha}}$. For the rest of the analysis, I make two further simplifying assumptions. First, I make use of the Epstein-Zin preference structure and assume a unit intertemporal elasticity of substitution, i.e. $\theta = 1$. This yields a simpler expression for the equilibrium interest rate, while preserving the possibility to study the role of varying degrees of risk aversion. Intuitively, by setting $\theta = 1$ the saving rate depends only on the discount factor and not the risk-adjusted return ϱ because income and substitution effects cancel out. Second, I approximate the optimal portfolio allocation using a second-order Taylor expansion to obtain a closed-form solution for the optimal portfolio share φ:

$$\varphi \approx \frac{\mu^{\frac{1}{\alpha}} - 1}{\gamma \sigma_\zeta^2} \tag{28}$$

Taken together, this yields the following expression for the safe interest rate:

$$R^s \approx \beta^{-1} \left(\frac{\left(\mu^{\frac{1}{\alpha}} - 1\right)^2}{\gamma \sigma_\zeta^2} + 1 \right)^{-1} \tag{29}$$

Comparative statics. Given the expressions for equilibrium quantities and prices, I now turn to analyzing how varying patience β and risk aversion γ affects returns and capital allocation. Changes in these parameters mimic the effects of non-homothetic preferences across the income distribution. Starting with returns, we can establish the following relationships:

Proposition 3. *With $\theta = 1$, the return on risky and safe capital is decreasing in the discount factor β and increasing in the degree of risk aversion γ. The risk premium is also decreasing and increasing, respectively.*

$$\frac{\partial R^s}{\partial \beta} < 0, \quad \frac{\partial R^r}{\partial \beta} < 0, \quad \frac{\partial R^s - R^r}{\partial \beta} < 0; \qquad \frac{\partial R^s}{\partial \gamma} > 0, \quad \frac{\partial R^r}{\partial \gamma} > 0, \quad \frac{\partial R^r - R^s}{\partial \gamma} > 0$$

Proof. For the discount factor, this follows trivially from the expression for R^s and R^r. For risk aversion, note that:

$$\frac{\partial R^s}{\partial \gamma} = \beta^{-1}\left(\frac{\left(\mu^{\frac{1}{\alpha}}-1\right)^2}{\gamma\sigma_\zeta^2}+1\right)^{-2}\frac{\left(\mu^{\frac{1}{\alpha}}-1\right)^2}{\gamma^2\sigma_\zeta^2} > 0 \quad \Rightarrow \frac{\partial R^r}{\partial \gamma} > 0$$

$\square$

The fact that the interest rate is increasing in risk aversion might be surprising, but is consistent with Proposition 5 of Angeletos (2007). Under a low enough intertemporal elasticity of substitution, which is the case if $\theta = 1$, the reallocation of capital towards safe firms reduces productivity and therefore wages, which increases the interest rate according to the firm FOCs.

With respect to the allocation of capital, we first establish auxiliary results for wages and labour demand:

Lemma 1. *With $\theta = 1$, the wage ω is increasing in β and decreasing in γ. Labour demand $l^s(\omega)$, in contrast, is decreasing in β and increasing in γ.*

$$\frac{\partial \omega}{\partial \beta} = \underbrace{\frac{\partial \omega}{\partial R^s}}_{<0}\underbrace{\frac{\partial R^s}{\partial \beta}}_{<0} > 0, \qquad \frac{\partial l^s(\omega)}{\partial \beta} = \underbrace{\frac{\partial l^s(\omega)}{\partial \omega}}_{<0}\underbrace{\frac{\partial \omega}{\partial \beta}}_{>0} < 0$$

$$\frac{\partial \omega}{\partial \gamma} = \underbrace{\frac{\partial \omega}{\partial R^s}}_{<0}\underbrace{\frac{\partial R^s}{\partial \gamma}}_{>0} < 0, \qquad \frac{\partial l^s(\omega)}{\partial \gamma} = \underbrace{\frac{\partial l^s(\omega)}{\partial \omega}}_{<0}\underbrace{\frac{\partial \omega}{\partial \gamma}}_{<0} > 0$$

The next proposition describes how changes in patience and risk aversion affect the allocation of capital towards safe and risky firms.

Proposition 4. *With $\theta = 1$, risky capital is increasing in the discount factor β and decreasing in the degree of risk aversion γ. Safe capital is increasing both in the discount factor and the degree of risk aversion. The share of risky capital is independent of the discount factor and decreasing in risk aversion.*

$$\frac{\partial K^r}{\partial \beta} > 0, \qquad \frac{\partial K^s}{\partial \beta} > 0, \qquad \frac{\partial \frac{K^s}{K^r}}{\partial \beta} = 0$$

$$\frac{\partial K^r}{\partial \gamma} < 0, \qquad \frac{\partial K^s}{\partial \gamma} > 0, \qquad \frac{\partial \frac{K^s}{K^r}}{\partial \gamma} > 0$$

Proof. See Appendix B.2 $\square$

Higher patience increases the overall capital stock, but does not affect the allocation between safe and risky capital. Higher risk aversion, instead, increases the share of risky capital by raising the level of safe capital and lowering the level of risky capital. An increase in income inequality therefore unambiguously increases the share of risky capital through higher effective patience and lower risk aversion.

Appendix C.2 extends the analytical results of the stylized model with numerical simulations. I use the simulations to illustrate the quantitative relevance of changes in the discount factor and risk aversion and to validate the analytical results which were based on approximations of the optimal portfolio shares. I also use the simulations to investigate the role of the size of the IES which I assumed to be 1.

6 Calibration

The calibration strategy is guided by the aim of understanding how changes in the income distribution between 1980 and 2019 in the United States affected macroeconomic outcomes. For this purpose, I calibrate the baseline model to the US economy in 1989 which is the earliest period for which I observe detailed household balance sheets. I then use this baseline parametrization to study shifts in the income distribution by tweaking the parameters governing the income processes in this economy.

The calibration exercise consists of two parts. I first calibrate a set of parameters outside the model and then calibrate the remaining parameters internally. Table 1 reports the calibration results.

6.1 External parameters

A model period is one year. The household death probability is set to $\varepsilon = 0.02$, yielding an average productive life span of 50 years. On the production side, I choose an output elasticity of capital of $\alpha = 0.36$ and a depreciation rate δ of 8 percent a year. I normalize the productivity parameter of the safe firm Z^s to 1.

I set the standard deviation of idioysncratic returns to $\sigma_\zeta = 0.4$, based on the estimates in Herskovic et al. (2016) for 1980. This estimate is based on the residuals of a regression of firm-level returns on the market-return and is therefore purged of aggregate risk. In a robustness exercise, I also consider $\sigma_\zeta = 0.16$ to match the standard deviation of the equity premium over the period 1980-2019.

The calibration of the income process involves choosing parameters for the permanent and the transitory component of income. With regards to the former, I select permanent

Table 1: Baseline calibration

Parameter	Description	Value	Target/Source
Panel A: Externally calibrated			
Households			
ε	Death Probability	0.02	Standard
Income			
s^1	Permanent income pct 0-50 %	0.45	Income share of 20.5%
s^2	Permanent income pct 50-90%	1.45	Income share of 48.0%
s^3	Permanent income pct 90-99%	2.5	Income share of 22.8%
s^4	Permanent income of top 1%	6.4	Income share of 8.7%
ρ_z	Persistence of stochastic income	0.8	PSID
σ_z^2	Standard deviation of income innovation	0.02	PSID
$\tilde{\nu}$	Non-employment income factor	0.4	Avg. unemployment benefits
p_ν	Non-employment probability	0.1, 0.05, 0.02, 0.01	Guvenen et al. (2021)
Production			
Z^s	Productivity of safe firms	1	Normalized
σ_ζ	Standard deviation of idiosyncratic firm shock	0.4	Standard deviation of idiosyncratic firm returns
α	Output elasticity of capital	0.36	Standard
δ	Depreciation	0.08	Standard
Panel B: Internally calibrated			
β	Discount factor	0.94	Real interest rate
γ	Curvature u(c)	4	Wealth and portfolio shares across income
η	Curvature v(a)	3.4	Wealth and portfolio shares across income
ψ	Utility weight of v(a)	1.4	Wealth and portfolio shares across income
κ	Participation cost	0.02	Risky share of bottom half
μ	Productivity of risky firms	1.025	Risk premium

Notes: The table reports the calibrated parameters of the baseline economy.

income levels for the Bottom 50%, Middle 40%, Top 10% and Top 1% of the distribution in order to match the share of aggregate labour income held by each group in the respective percentile range using data from Piketty and Saez (2003) on wage income inequality. Because I only observe the split of income of the bottom 90% between the bottom 50 and mid % starting in 1998, I assume that the relative shares within that group have not changed over time. This yields labour income shares of 8.7% for Top 1%, 22.8% for the remaining households in the Top 10%, 48.0% for the Mid 40% and 20.5% for the Bottom 50%. The persistence and variance of the transitory income component are calibrated based on household-level income data in the PSID. I directly take the estimates provided in Kaplan and Violante (2022) for the annual model with permanent heterogeneity and persistent-transitory shocks, but abstract from the fully transitory shock to keep the model tractable. I take estimates for the state-dependent transitions into non-employment from Guvenen et al. (2021). An implicit assumption behind this choice is that the stochastic income process remained stable over time.

6.2 Internal parameters

The remaining parameters $(\beta, \gamma, \eta, \psi, \mu, \kappa)$ are calibrated internally by targeting selected moments of the data. In particular, I use a set of aggregate and cross-sectional moments regarding wealth-to-income levels and risky asset shares to discipline these parameters. While all parameters jointly affect the targeted moments, some parameters are more informative about individual moments than others. The discount factor is set to match the long-term real interest rate. The preference parameters over consumption and bequests are calibrated to generate the savings level heterogeneity across the distribution of income. The productivity differential between safe and risky firms is set to match the risk premium based on Harris et al. (2014). The fixed cost of asset market participation is calibrated to match the risky asset share of the bottom half of the income distribution.

An alternative strategy to calibrate these parameters would be to choose moments that are unrelated to households' savings and portfolio decisions and see to what extent the model can match these moments endogenously. However, for the purpose of the main exercise of comparing two steady-states across different periods in time, it is important to match the cross-sectional heterogeneity in savings behaviour precisely to be able to quantify the effects of changes in income inequality. In the next section, I discuss the validity of the calibration by showing that the model matches untargeted moments of the data fairly well.

6.3 Validation

Solution method. The model is solved globally over a discretized grid of wealth, transitory productivity and return states. I use 100 grid points for wealth, 6 grid points for productivity and 11 grid points for returns. For a given guess of the safe interest rate r^s, I obtain the risky rate r^r and wage ω using Equations 22 and 23. Given prices, I can solve the firm problem yielding capital demand and the household problem using value function iteration yielding capital supply. The equilibrium safe interest rate is obtained through iteration on guesses of the safe interest rate until the capital market clears.

Targeted moments. Panel A of Table 2 compares the data moments targeted in the calibration exercise with the model-generated moments. The model matches the targeted moments well overall. Both wealth-to-income ratios and risky asset shares are reproduced closely, as is the safe interest rate and the risk premium. The model also generates the distribution of labour income observed in the data.

Untargeted moments. How well does the model match other moments of the data? I first investigate to what extent differences in labour income inequality translate into dif-

Table 2: Model versus data moments

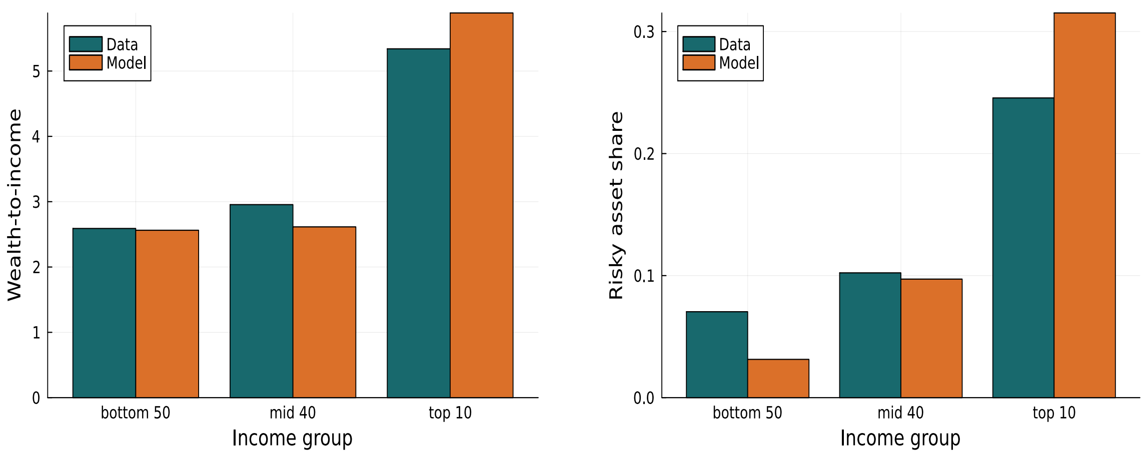
Moment	Data	Model	Source
Panel A: Targeted moments			
Household portfolios			
Wealth-to-income ratio of top 10%	5.2	5.7	SCF 1989
Wealth-to-income ratio of mid 40%	3.0	2.8	SCF 1989
Risky asset share of top 10%	0.24	0.31	SCF 1989
Risky asset share of bottom 50%	0.07	0.02	SCF 1989
Labour income distribution			
Top 1% share	8.7	8.7	Piketty and Saez (2003)
Top 10% share	22.8	22.8	Piketty and Saez (2003)
Mid 40% share	47.8	47.8	Piketty and Saez (2003)
Bottom 50% share	20.6	20.6	Piketty and Saez (2003)
Interest rates			
Safe rate	4.5	4.5	10-year treasury yield
Risk premium	7.5	7.5	Harris et al. (2014)
Panel B: Untargeted moments			
Household portfolios			
Aggregate wealth-to-income ratio	4.6	4.4	SCF 1989
Aggregate risky asset share	0.28	0.15	SCF 1989
Wealth distribution			
Gini	80.8	63.8	WID
Top 10% share	65.0	44.0	WID
Income distribution			
Gini	37.2	43.0	WID
Top 10% share	29.3	33.1	WID

Notes: This table reports targeted and untargeted moments of the calibration exercise and compares the model to the data.

ferences in wealth inequality. The model predicts a wealth Gini index that is substantially larger than the Gini index for income. The model, however, slightly underestimates the degree of wealth inequality in the data. It also somewhat understates the concentration of wealth, with a top 10% share of 44% compared to 65% in the data. In terms of total income inequality which includes both labour and capital income, the model matches the data quite well. The model Gini index is 43.0 compared to 37.2 in the data, and the top 10% share is close to the 29.3 observed empirically. The model also closely captures the aggregate wealth-income ratio, but understates the share of risky assets in the aggregate.

Cross-sectional wealth levels and portfolio shares. Figure 6 illustrates graphically differences in savings levels and portfolio allocation by plotting the average wealth-to-income ratio and share of risky assets for the Bottom 50, Middle 40 and Top 10% of the income distribution. The model closely captures the heterogeneity observed in the data across both saving levels and portfolio allocation.

Figure 6: Risky portfolio shares across income in the model



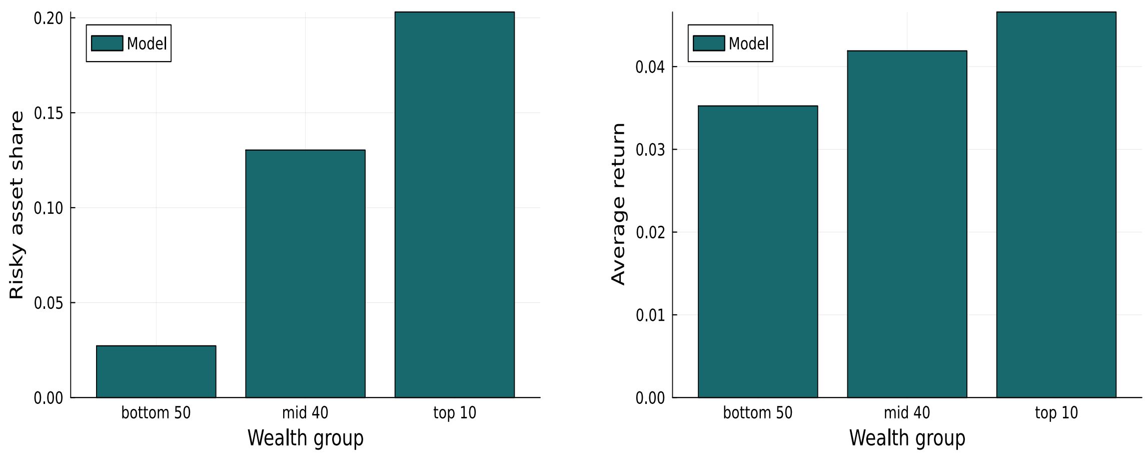
(a) Wealth-to-income (b) Risky asset share

Notes: The figure reports wealth-to-income ratios and risky asset portfolio shares across different income groups for the baseline model calibration and the data. Data moments are computed using the SCF 1989.

Return rate heterogeneity. A large literature has documented not only differences in risky asset shares, but also in returns across the distribution of wealth (Balloch and Richers, 2021; Xavier, 2021). Figure 7 shows that the model captures both dimensions of the data. First, risky asset shares are not only increasing in income, but also in wealth. Second, also average returns are increasing in the level of wealth, which directly follows from the portfolio composition in this model. The average return of the top 10 percent of the wealth distribution is 1.1 percentage points larger than that of the bottom 50 percent. This is not too far off from the results in Xavier (2021) who reports a return differential of 4.7 percentage points between the 20th and the 99th percentile of the wealth distribution in the SCF. The difference between the top 10 percent and the top 1 percent is somewhat smaller in the model with 0.4 percentage points. This is consistent with the evidence in Balloch and Richers (2021) that finds an average differential of 0.5 percentage points comparing the top 10 percent with the top 0.01 percent.

Pareto tail coefficients. Gaillard et al. (2023) raises a puzzle for heterogeneous agent models. Canonical models cannot jointly account for the observed concentration of consumption, labor income, wealth, and capital income. The underlying reason is that con-

Figure 7: Portfolio share and return rate heterogeneity across wealth



(a) Risky asset share (b) Returns

Notes: The figure reports risky asset portfolio shares and average return rates across different wealth groups for the baseline model calibration.

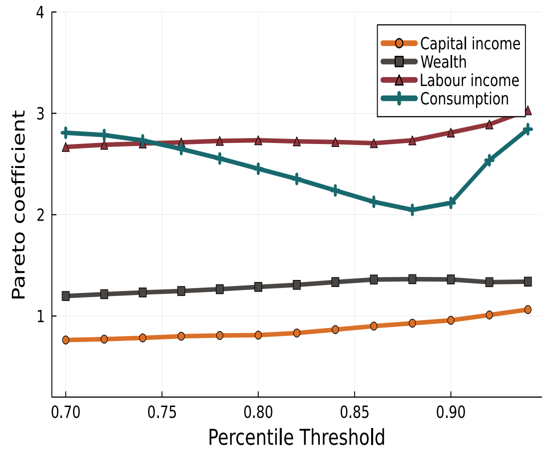
sumption and capital income are asymptotically linear in wealth, and therefore equally concentrated. Models that are able to match the concentration of wealth therefore often overstate the concentration of consumption. The authors develop a model with non-homothetic preferences and exogenously imposed scale-dependent returns to account for these patterns.

I show that the combination of non-homothetic preferences is sufficient to generate the observed concentration patterns once endogenous portfolio choice is introduced. Figure 8 plots the Pareto coefficients of consumption, labour income, wealth and capital income generated by the model. The x-axis denotes different cut-off values of the distribution that are used to estimate the Pareto tail, and higher values of the Pareto coefficient indicate a lower concentration. Across all cut-offs, the model predicts that capital income is the most concentrated, followed by wealth, and then labour income and consumption. Due to the discrete nature of the permanent income component, however, the ordering of consumption and labour income is not constant across cut-offs, but corresponds to the ordering that Gaillard et al. (2023) uncover in US data for lower cut-offs.

7 Quantitative analysis

This section quantifies the effects of the rise in income inequality in the US over the period 1980 and 2019. The analysis consists of comparing steady-states between 1980 and 2019,

Figure 8: Pareto tail coefficients in the model



Notes: The figure reports Pareto tail coefficients of the distribution of consumption, labour income, wealth and capital income. The x-axis indicates the percentile of the distribution above which the Pareto distribution is fit.

in which the steady-state in 1980 and 2019 are characterized by a different labour income distribution. The main questions that this section answers are what happens to the allocation of capital across sectors, the returns to capital across sectors and consequently the more general macroeconomic implications, in particular with regards to productivity.

7.1 The effects of rising permanent income inequality

Description of experiment. The experiment consists of changing the distribution of permanent income s such that the labour income distribution matches the empirical distribution in 1980 and 2019. The implicit assumption is that the rise in income inequality was driven by the permanent component of income, which is supported by empirical evidence (DeBacker et al., 2013; Guvenen et al., 2022). Notably, this is an assumption about the change in the statistical process underlying the income distribution. I do not take a stance on what was driving these changes, i.e. if it was due to technological changes, such as a rise in the college-skill premium, or, for example, by changes in taxation.[16] Specifically, I increase the labour income share of the Top 1% from 6.4 to 10.9%, the Top 10% from 28.1 to 35.9%, and decrease the share of the Middle 40% from 50.3 to 45.1% and the Bottom 50% from 21.6 to 19.0%.

Aggregate effects. Table 3 compares the main macroeconomic variables across the two models. The first observation is that the aggregate share of risky assets increased by 28.5 percent. This increase accounts for more than half of the increase observed in the

[16]There is evidence for rising returns to education, see for example Hoffmann et al. (2020).

data.[17] The second observation is that both the return on safe and risky capital decreased as a consequence of increased inequality. At the same time, the overall return to capital decreased less due to the reallocation of capital towards the risky sector.

Table 3: Effects of the rise in permanent labour income inequality

Variable	Change between 1980 and 2019	Data
Prices		
Risk-free rate (pp)	-1.52	-5.5
Risk premium (pp)	-0.09	
Return to capital (pp)	-1.27	
Wage (%)	8.13	
Quantities		
Output (%)	8.9	
Capital (%)	24.88	
Risky capital share (%)	28.5	48.2*
TFP (%)	0.1	
Distributions		
Wealth Top 10% share (pp)	0.12	0.08
Income Top 10% share (pp)	0.08	0.08
Labour Income Top 10% share (pp)	0.08	0.08

Notes: The table reports differences in macroeconomic variables between the baseline model calibrated to 1980 and the model calibrated to the 2019 labour income distribution. The difference between the models is given by the labour income shares of the different income groups, which for the Top 1% increases from 6.4 to 10.9%, the Top 10% increases from 28.1 to 35.9%, and for the Middle 40% and Bottom 50% decreases from 50.3 to 45.1% and from 21.6 to 19.0%, respectively.

Output in the economy increased by 8.9 percent. This is a result of the combined level and composition effect on asset demand that is induced by the change in income inequality. While the overall capital stock increased as a result of higher overall asset demand, the reallocation of capital through the composition effect raised total factor productivity in the economy. This is a central prediction of the model. Higher income inequality is associated with higher productivity because it tilts asset demand towards riskier, but more productive firms.

The increase in productivity benefits all households in the economy through higher wages. Wages increase by 8 percent overall. This implies that bottom earners are partly compensated for their permanent productivity loss through an increase in wages.

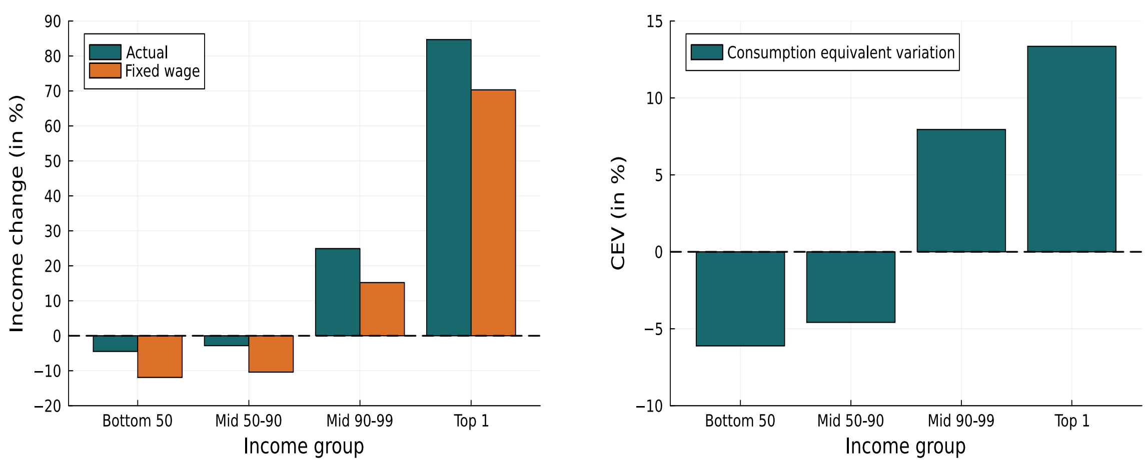
Distributional effects. Figure 9 compares the change in the permanent productivty level

[17] Note that in the data, I only observe the risky share from 1989 on. The model generated difference in risky shares between 1989 and 2019 amounts to roughly one third of the data increase.

of each household group to the change in the income level. In particular, it shows the income change compared to a scenario in which the wage rate would not have changed in response to the rise in income inequality. It turns out that more than two thirds of the income loss through lower productivity are offset by a higher wage rate for the Bottom 90 percent of the distribution. This effect stems from two channels: the wage increase due to a higher capital stock, and a wage increase due to higher productivity.

The right panel quantifies the welfare changes expressed in consumption equivalents across income groups instead. It is computed as the fixed proportional consumption transfer across all future states that makes the household indifferent between the two steady states. The distribution of welfare changes follows qualitatively that of income changes. The bottom 50 and mid 40 percent would have to be compensated by 6.1% and 4.6% on average to be indifferent between the economy in 1980 and that in 2019. The top 10 percent, instead, experience relatively large welfare gains, in particular the top 1 percent. The average welfare change across all households is, however, negative at 4.0%.

Figure 9: Distributional effects of rising income inequality



(a) Income changes

(b) Welfare changes

Notes: The figure reports income changes (left panel) and welfare changes (right panel) across permanent income groups following the simulated rise in income inequality. Welfare changes are expressed in terms of the fixed proportional consumption transfer across all future states in 2019 that makes households indifferent between the two steady states. Negative values denote welfare losses, i.e. positive consumption transfers.

Discussion. Risk-free rates have declined gradually over the last decades. At the same time, the return to capital has remained relatively stable (Gomme et al., 2011). Several explanations for this trend have been put forward, such as changes in market power (Farhi and Gourio, 2018; Eggertsson et al., 2021), demographics (Kopecky and Taylor, 2022), financial frictions (Ilut et al., 2023), or risk (Caballero et al., 2017; Farhi and Gourio, 2018; Marx et al., 2021).

I show that the rise in income inequality presents an alternative explanation. Whereas income inequality has been shown to contribute to the decline in the risk-free rate (Mian et al., 2021b), I demonstrate that it can also account for the stability of the return to capital by changing the composition of asset demand. The stability of the return to capital is a result of capital reallocation from safe, less productive to risky, more productive firm. In that sense, the channel is similar to the one proposed by Irie (2024) but the underlying cause of reallocation is different. In Irie (2024), the reallocation is a result of improved entrepreneurial equity financing, while I argue that the changes in capital allocation are caused by shifts in the distribution of income.

The fact that risky returns have decreased jointly with safe returns is consistent with the findings in Greenwald et al. (2019). They estimate a model of the US equity market and show that risk premia have declined since the 1980s, in particular between 1980 and 2000, which coincides with the period of sharp labour income inequality growth. I illustrate how the documented variation in the price of risk can be traced back, at least to some extent, to variation in income inequality.

The model also makes stark predictions about the link between income inequality and total factor productivity. The degree of income inequality effectively determines which firms receive financing, with higher income households disproportionally investing in more productive firms. Higher income inequality therefore raises productivity through a capital allocation effect.

How does this square with the observation that productivity growth has been slowing in the US, despite increasing income inequality? This prediction is not necessarily at odds with the data, once one acknowledges the existence of parallel developments in the economy that are not captured in the model. For example, productivity growth has been stagnating across most advanced economies. The relevant thought experiment is therefore to what extent productivity growth has been stronger in the US than in other comparable economies that experienced a smaller rise in income inequality. To make that point, Appendix Figure **??** reports TFP growth between 1980-1989 and 2019-2019 and the change in the share of disposable income held by the Top 10% for the same period for a set of advanced economies. The figure suggests that countries with higher income inequality growth experienced more TFP growth. The next section tests several other hypotheses that are implied by the model using regression analysis with cross-country data.

7.2 The effects of rising income risk

What if the rise in income inequality was a consequence of higher income risk? Does that have implications for the aggregate and distributional effects of higher income inequality? To answer this question, I conduct an alternative experiment in which I leave the distribution of permanent productivity unchanged, but change the distribution of the transitory component instead. In particular, I adjust the variance of the AR-1 process σ_z^2 to match the income shares in 1980 and 2019. Because I have only one free parameter, I target the income share of the Top 10%.

Table 4 reports the aggregate effects of the rise in income risk, in the same format as for the rise in permanent income inequality. Overall, the effects are qualitatively similar. The returns to safe and risky capital decrease, the share of risky capital increases and with that comes an increase in total factor productivity, capital and wages. However, the rise in income risk predicts negligible effects on the distribution of wealth, which is at odds with the stark increase in wealth inequality observed in the data. Higher income uncertainy triggers precautionary savings which are concentrated at the bottom of the income distribution and therefore compress the wealth distribution. Note that the income risk scenario predicts an increase in the capital stock that is almost twice as large as in the permanent income inequality scenario, while the risky capital shares are similar across the two. This is a direct consequence of the precautionary motive, as most wealth gains accrue to the bottom of the distribution who tend to save less in risky assets.

7.3 Alternatives to non-homothetic preferences

This section discusses two alternative models that do not rely on the non-homotheticity of preferences and highlights which features of the data they miss. The first alternative is a homothetic variant of the baseline model. The second model introduces preference heterogeneity in the discount factor and risk aversion.

Homothetic model. The homothetic model considers a special case of the baseline model in which $\eta = \gamma$. I leave all other parameters of the economy unchanged. Figure 10 compares the cross-sectional predictions of the homothetic model against those of the non-homothetic model. The left panel reports wealth-to-income ratios across income groups and illustrates the main shortcoming of the homothetic model. It generates flat wealth-to-income ratios across the distribution of income, whereas the non-homothetic model correctly predicts the higher wealth-income ratios for high-income households observed in the data. Notably, this discrepancy arises despite the fixed cost of asset market participation, which introduces a degree of non-homotheticity outside of the preference struc-

Table 4: Effects of the rise in income risk

Variable	Change between 1980 and 2019	Data
Prices		
Risk-free rate (pp)	-2.35	-5.5
Risk premium (pp)	-0.14	
Return to capital (pp)	-2.02	
Wage (%)	13.82	
Quantities		
Output (%)	14.14	
Capital (%)	43.28	
Risky capital share (%)	35.71	48.2*
TFP (%)	0.1	
Distributions		
Wealth Top 10% share (pp)	-0.01	0.08
Income Top 10% share (pp)	0.07	0.08
Labour Income Top 10% share (pp)	0.08	0.08

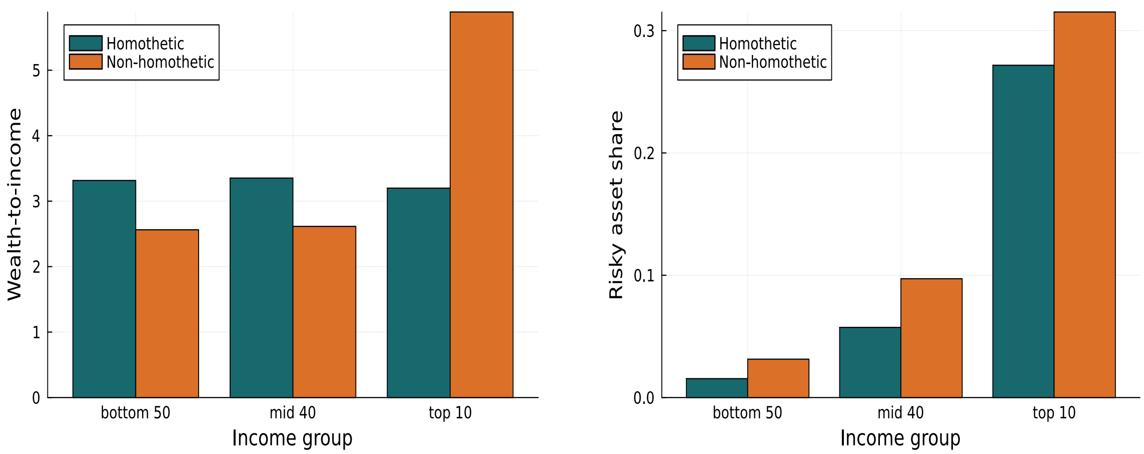
Notes: The table reports differences in macroeconomic variables between the baseline model calibrated to 1980 and the model calibrated to the 2019 labour income distribution. The difference between the models is given by differences in the variance of the persistent income component σ_z^2, which is adjusted to match the labour income share of the Top 10% of the distribution.

ture. Turning to the composition of portfolios, the right panel shows that the homothetic model reproduces reasonably well risky asset shares across the income dsitribution. The main shortcoming of the homothetic model is therefore that it is not able to *jointly* match the heterogeneity in the level and the composition of savings.

Preference heterogeneity. What if higher-income households are simply more patient and less risk-averse and therefore save both more overall and in riskier assets? As shown in the stylized GEmodel, changes in patience and risk aversion can qualitatively capture the changes in asset quantities and returns observed in the data. This raises the question of how to disentangle ex-ante preference heterogeneity from non-homothetic preferences.

One answer lies in tracking cross-sectional savings behaviour over time. As evidenced in Figure 4 and the decomposition in Equation 1, aggregate risky asset shares increased due to both compositional effects, i.e. overall asset holdings shifting from low- to high-income households, and cross-sectional changes in portfolio allocation patterns over time, i.e. high-income households saving increasingly more in risky assets. Whereas the non-homothetic model captures both channels, the model with preference heterogeneity only captures the compositional effect. The effective patience and risk aversion of high-income households remains unaffected by an increase in their income, yielding broadly stable

Figure 10: Cross-sectional savings behaviour in the homothetic economy



(a) Wealth-to-income

(b) Risky asset share

Notes: The figure reports wealth-to-income ratios and risky asset portfolio shares across different income groups for the baseline model and the homothetic model in which $\eta = \gamma$.

cross-sectional savings patterns over time.

8 Conclusion

This paper provides a novel perspective on how rising income inequality influences macro-financial outcomes by altering the composition of household savings demand. While previous literature has emphasized the role of increased income inequality in elevating savings levels, I demonstrate that a higher concentration of income shifts demand away from safe towards risky assets. This shift can have profound effects on the economy by affecting firms' financing conditions.

By integrating realistic household saving behavior and endogenous portfolio choice into a general equilibrium model, I provide a framework through which long-term trends in asset returns, capital allocation, and productivity can be analyzed. The central result is that higher income inequality induces a reallocation of capital from less productive, safer firms to more productive, riskier firms, leading to higher aggregate productivity. This reallocation helps explain the stability of the return to capital against the backdrop of the secular decline in safe real interest rates.

From a policy perspective, these findings underscore the importance of understanding the broader implications of income inequality on financial markets and the macroeconomy. Policymakers have a direct role in shaping the distribution of income through fiscal and monetary policies, and this paper suggests that doing so has important cross-sectional and aggregate ramifications. Under certain conditions, rising inequality might generate broader economic gains, mitigating some of the adverse effects on lower-income households.

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A Empirical appendix

This section provides details on the empirical analysis and presents additional evidence that supports the main analysis.

A.1 Portfolio allocation

A.1.1 Sample selection and variable definitions

Sample. Figures are based on the Survey of Consumer Finances extract files for the years 1989-2019. I keep households who report to be employed and self employed of age 25-65. I drop all households with labour income or total household income of less than 20,000 USD. I replace negative observations for total assets, business wealth, wage income, transfer income and business income with zero values.
Variable definitions. Income includes wages, self-employment and business income, taxable and tax-exempt interest,dividends, realized capital gains, food stamps and other support programs provided by the government, pension income and withdrawals from retirement accounts, Social Security income, alimony and other support payments, and miscellaneous sources of income. I define labour income as total household income excluding interest, dividendes, realized capital gains and miscellaneous income (*wageinc* + *bussefarminc* + *transfothinc* + *ssretinc*). Public equity denotes the total value of financial assets held by household that are invested in stock. Private equity denotes the total value of business(es) in which the household has either an active or nonactive interest. Liquid assets denotes the total value of all types of transactions accounts. Wealth and wealth-income ratios are winsorized at the 99 percent level for each wave.

A.1.2 Detailed portfolio shares

Figures A.1 shows portfolio shares and participation rates across the labour income distribution for a more detailed split of asset categories. Risky assets are split into public and private equity, while housing and liquid assets are shown as examples of safe assets. The portfolio share of equities is rising gradually in income, while that of business wealth is fairly stable up to the top decile, where it increases materially. A similar picture emerges for participation rates. Conditional on participation, the equity share is increasing in income, while the shar of business wealth is relatively stable. figures illustrate that most of the rise in risky asset shares, both across income and time, comes from the equity component. Figure A.2 depicts the evolution of aggregate portfolio shares and participation rates. Over time, the most notable changes occured for equities where both portfolio shares and participation rates increased notably.

Figure A.1: Detailed portfolio shares and participation rates across the income distribution

(a) Portfolio shares (b) Participation rates (c) Portfolio shares conditional on participation

Notes: Survey of Consumer Finances 2019. Income refers to labour income.

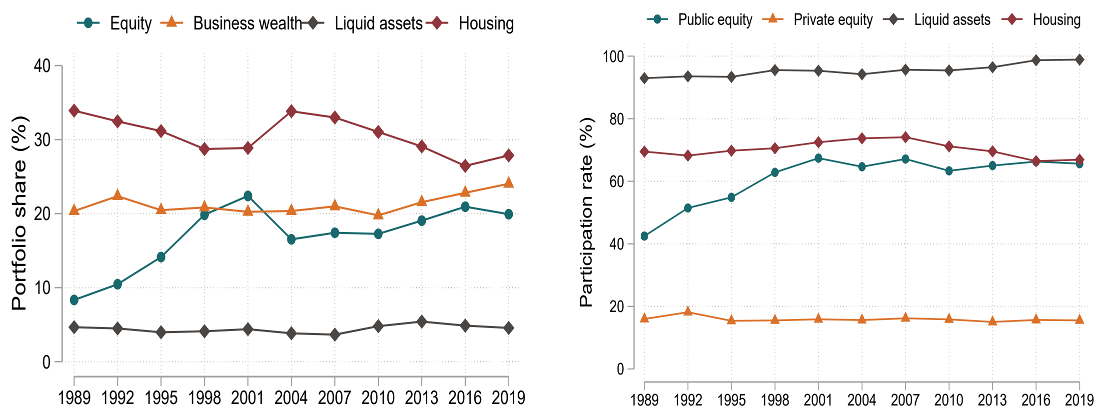
A.1.3 Portfolio allocation across total income, wage income, wealth and wealth-income

This section inspects portfolio heterogeneity across the distributions of total income, wage income and normal income. Figure A.4 shows that the cross-sectional patterns are similar across all distributions. Only across the distribution of wage income, the bottom decile holds a relatively large share of risky assets. This can be explained by the presence of business owners, whose income primarily accrues from business income and not wages.

A.1.4 Decomposing the rise in the equity share

Could the rise in equity shares be driven by rising equity participation of pension funds, i.e. not active decisions by households? And is the rise driven by more investment into individual stocks or mutual funds? The left panel in Figure A.5 shows that both the share of directly and indirectly held stocks went up. The right panel shows that the increase in directly held equity is due to both larger holdings of stocks and mutual funds. Looking at participation rates, Figure A.6 reveals diverging trends between directly and indirectly held equity. Whie the rise in indirectly held equity can be partly explained by a rise in participation rates, participation in directly held equity decreased, if anything. That trend is similar across stocks and mutual funds, suggesting that the intensive margin contributed materially to the riise in directly held equity.

Figure A.2: Detailed portfolio shares and participation rates over time



(a) Portfolio shares

(b) Participation rates

Notes: Survey of Consumer Finances.

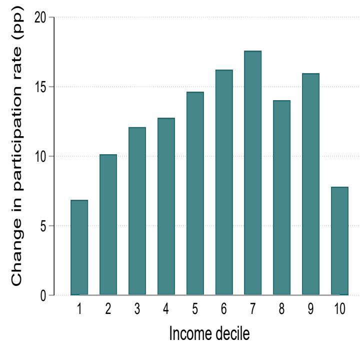
Figure A.7 zooms into different labour income deciles. The left panel plots the previous decomposition of equity holdings into direct and indirectly held equity across labour income deciles in 2019. Both types of equity are held disproportionately more by high-income households, in particular the top decile. The right panel splits directly held equity in to stocks and mutual funds and shows that both are held in similar quantities conditional on being in the same income decile. Figure A.8 complements these findings by showing participation rates. Lower income households primarily participate in equity markets through indirectly held equity. Participation rates for stock and mutual fund markets are similar for the bottom half of the income distribution, but start diverging towards more direct stock market participation as income increases.

Figure A.9 finally illustrates how portfolio shares across equity types changed across the income distribution between 1989-1995 and 2013-2019. Indirect equity holdings increased across all deciles. The top decile is again different and experienced the largest increase in direct equity holdings. The rise in direct holdings for the top decile was driven by both increasing stock and mutual fund shares.

A.1.5 Aggregate rise in risky assets

This section presents additional evidence on the aggregate rise in risky asset shares. Figure A.10 plots the share of risky assets in total assets excluding housing, and the share of equity in financial assets. Both series show an increase in the share of risky assets. Figure A.11 shows that most of that risk is undiversified by plotting the share of business wealth

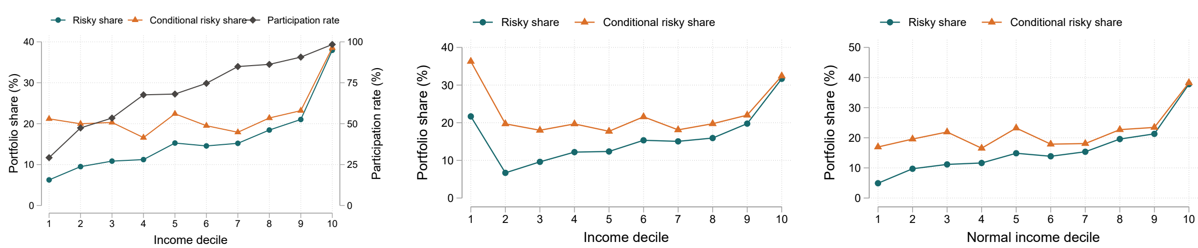
Figure A.3: Cross-sectional portfolio allocation: Change between 2013-2019 and 1989-1995



(a) Risky participation rates

Notes: Survey of Consumer Finances. The panels show the changes in risky asset participation rates between the period 1989-1995 and 2013-2019. Income refers to labour income. Risky assets are defined as the sum of public equity and private equity. Details on the sample selection are provided in Appendix A.1.1.

Figure A.4: Cross-sectional portfolio shares and participation rates



(a) Total income (b) Wage income (c) Normal income

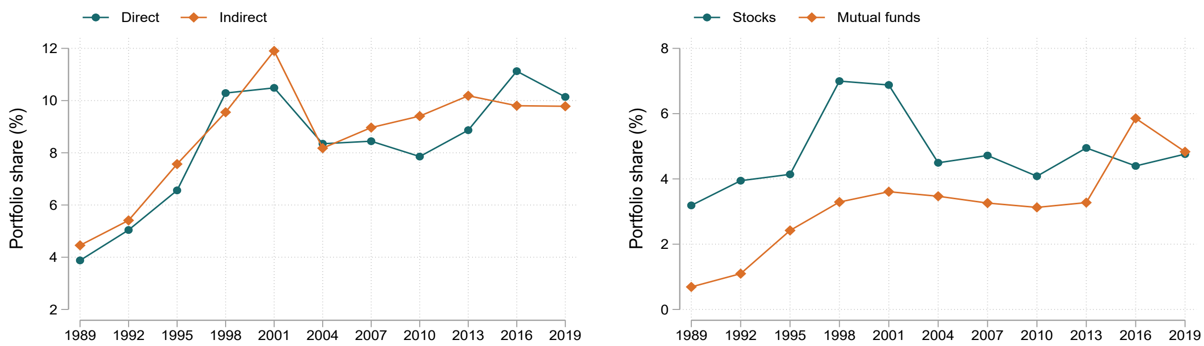
Notes: Survey of Consumer Finances 2019. "Normal" income refers to the income a household would expect to receive in a "normal" year.

and individual stock holdings in total risky assets. This is a relatively conservative measure of undiversified risk as mutual fund holdings are classified as fully diversified. The SCF does not provide detailed information on the fund structure. The assumption that stock holdings are undiversified is supported by the fact that the median stock market participant holds a portfolio of five stocks only.

A.1.6 Evidence from euro area countries

To assess whether the relationship between income inequality and risky asset shares extends beyond the U.S., I turn to cross-country evidence from the euro area. Specifically, I

Figure A.5: Decomposition of the rise in the equity share: portfolio shares

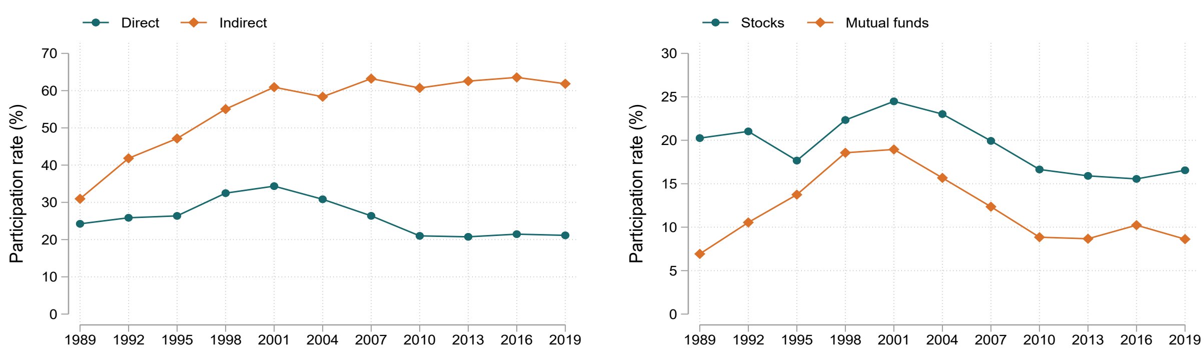


(a) Direct vs indirect holdings

(b) Stocks vs mutual funds

Notes: Survey of Consumer Finances. Directly held equity includes stocks and stock mutual funds, where the latter also includes half of the value of combination mutual funds. Indirect equity includes IRAs, thrift type retirement accounts invested in stock and other managed assets with equity interest.

Figure A.6: Decomposition of the rise in the equity share: participation rates



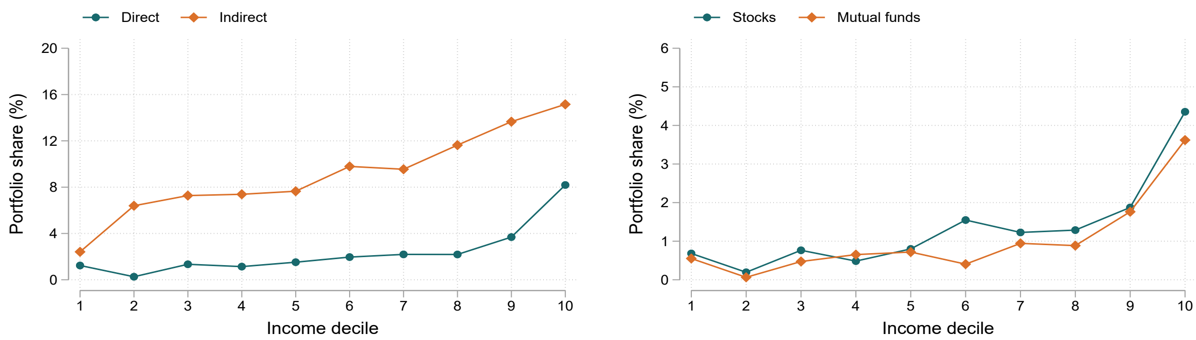
(a) Direct vs indirect holdings

(b) Stocks vs mutual funds

Notes: Survey of Consumer Finances. Directly held equity includes stocks and stock mutual funds, where the latter also includes half of the value of combination mutual funds. Indirect equity includes IRAs, thrift type retirement accounts invested in stock and other managed assets with equity interest.

use data from the Household Finance and Consumption Survey (HFCS) for ten euro area countries over the period 2010–2017 (waves 1–4). The HFCS is the euro area counterpart to the Survey of Consumer Finances and provides harmonized microdata on household balance sheets, which allows me to construct country-level measures of aggregate risky asset shares. To ensure comparability with the U.S. analysis, I define risky assets as the sum of publicly traded and private equity holdings. I combine these data with measures of top income shares from the World Inequality Database (WID).

Figure A.7: Decomposition of equity holdings across the income distribution: portfolio shares

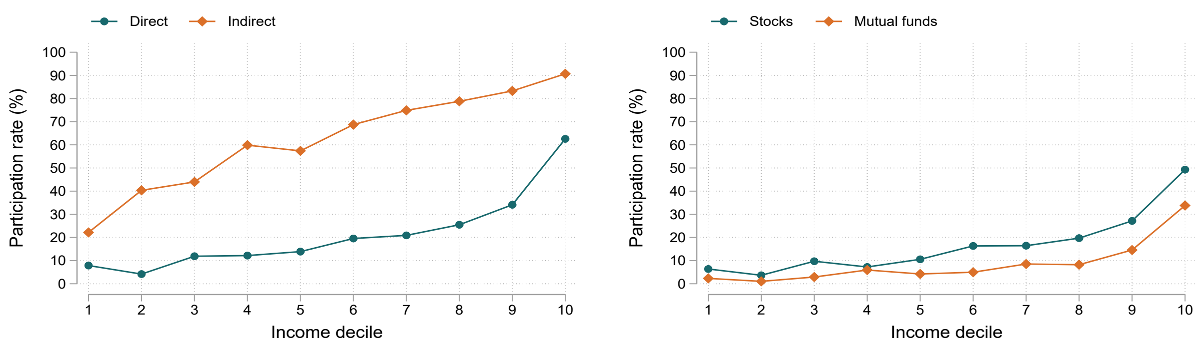


(a) Direct vs indirect holdings

(b) Stocks vs mutual funds

Notes: Survey of Consumer Finances. Income denotes labour income. Directly held equity includes stocks and stock mutual funds, where the latter also includes half of the value of combination mutual funds. Indirect equity includes IRAs, thrift type retirement accounts invested in stock and other managed assets with equity interest.

Figure A.8: Decomposition of equity holdings across the income distribution: participation rates



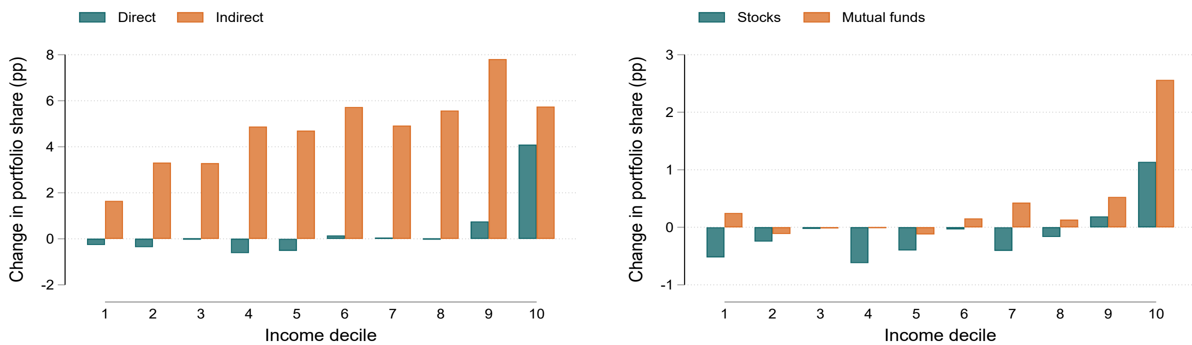
(a) Direct vs indirect holdings

(b) Stocks vs mutual funds

Notes: Survey of Consumer Finances. Income denotes labour income. Directly held equity includes stocks and stock mutual funds, where the latter also includes half of the value of combination mutual funds. Indirect equity includes IRAs, thrift type retirement accounts invested in stock and other managed assets with equity interest.

The left panel of Figure A.12 plots, for each country, the average top 10% income share against the average risky asset share over the period 2010-2017. The right panel instead relates changes in these variables over the same horizon. Consistent with the U.S. evidence, the cross-country patterns reveal a positive association in both levels and changes.

Figure A.9: Decomposition of equity holdings across the income distribution: change between 1989-1995 and 2013-2019

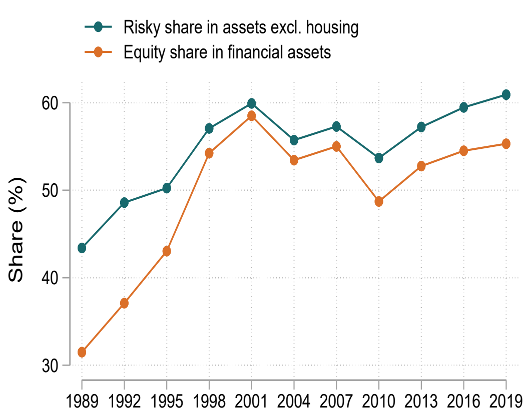


(a) Direct vs indirect holdings

(b) Stocks vs mutual funds

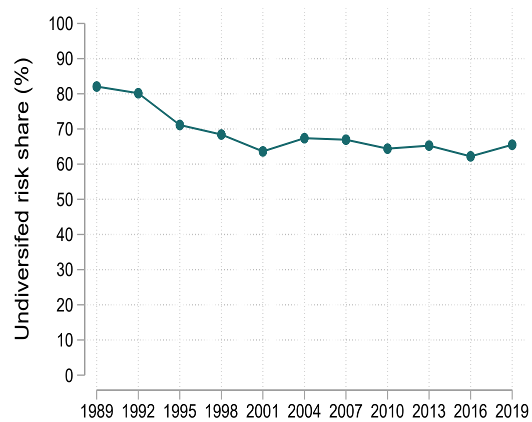
Notes: Survey of Consumer Finances. Income denotes labour income. Directly held equity includes stocks and stock mutual funds, where the latter also includes half of the value of combination mutual funds. Indirect equity includes IRAs, thrift type retirement accounts invested in stock and other managed assets with equity interest.

Figure A.10: Rising risky assets shares in the United States



Notes: US Survey of Consumer Finances. The figure reports the evolution of the fraction of risky assets in total assets excluding housing and the share of equity in financial assets between 1989 and 2019. Risky assets are defined as the sum of public and private equity. Details on the sample selection are provided in Appendix A.1.1.

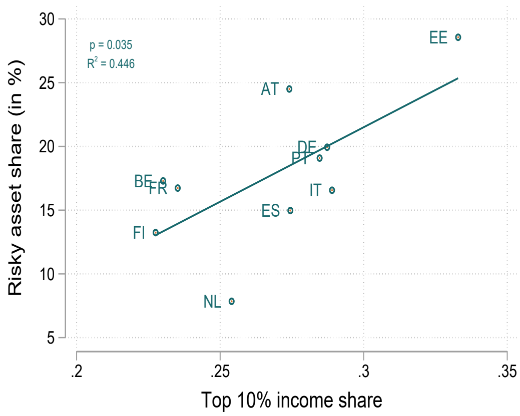
Figure A.11: Share of undiversified risk in household portfolios



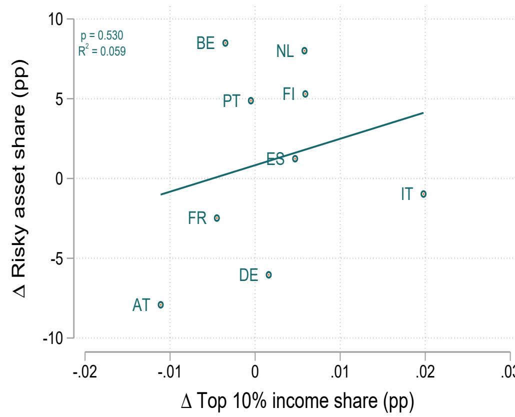
Notes: US Survey of Consumer Finances. The figure reports the share of assets with undiversified risk, defined as business wealth and stock holdings, in total risky assets between 1989 and 2019. Risky assets are defined as the sum of public and private equity. Details on the sample selection are provided in Appendix A.1.1.

Countries with higher income inequality tend to exhibit larger risky asset shares, and those countries that experienced higher inequality growth also display more pronounced

Figure A.12: Income inequality and risky asset shares across euro area countries



(a) Averages 2010-2017



(b) Change 2010-2017

Notes: The left panel plots the average top 10% income share against the average risky asset share over the period 2010-2017 for ten euro area countries. The right panel plots the percentage point changes in those variables over the same period. p-values and R^2 are computed from unweighted regressions. Data from the HFCS and WID.

increases in risky asset holdings.

B Theoretical appendix

B.1 Derivations

This section summarizes the derivations to obtain equilibrium interest rates and quantities of capital in the analytical model and derives optimal portfolio shares. It follows the derivations in Angeletos (2007) and is primarily included for completeness. More details are provided in the Appendix of the original paper.

Equilibrium prices. The expression for the risk-free interest rate R^s is derived from the stationarity condition of aggregate savings: $\beta^\theta \rho^{\theta-1}[\varphi \bar{R}^r(\omega) + (1-\varphi)R^s] = 1$, where $\varphi \equiv \arg\max_{\phi\in[0,1]} CE_t\left(\phi\mu^{\frac{1}{\alpha}}\zeta_{t+1} + 1 - \phi\right)$ and $\rho = \varrho R$ with $\varrho \equiv \max_{\phi\in[0,1]} CE_t\left(\phi\mu^{\frac{1}{\alpha}}\zeta_{t+1} + 1 - \phi\right)$. This stationarity condition is derived from the Euler condition and the resource constraint of the economy. $\beta^\theta\rho^{\theta-1}$ denotes the saving rate and the term in brackets the return to savings. Using the fact that $\bar{R}^r = \mu^{\frac{1}{\alpha}} R^s$ and solving for R^s yields the equilibrium risk-free interest rate.

Equilibrium quantities. In steady-state, $K^r = \varphi\beta^\theta\rho^{\theta-1}(Y+H)$ and $K^s = \beta^\theta\rho^{\theta-1}(1-\varphi)(Y+H) - H$ where H denotes human wealth. Combining this with the labour market condition $\bar{l}^r(\omega)K^r + l^s(\omega)K^s = 1$ and $\bar{l}^r(\omega) = \mu^{\frac{1}{\alpha}} l^s(\omega)$ yields the allocation of capital across the private and public sector:

$$K^r = \frac{\frac{1}{l^s(\omega)} + \frac{\omega}{R^s - 1}}{\mu^{\frac{1}{\alpha}} + \frac{1}{\varphi} - 1}, \quad K^s = \frac{1}{l^s(\omega)} - \mu^{\frac{1}{\alpha}} K^r$$

Approximate portfolio shares. This section derives the approximation of the optimal portfolio composition. We start by simplifying the maximization problem:

$$\varphi \equiv \arg\max_{\phi\in[0,1]} CE_t\left(\phi\mu^{\frac{1}{\alpha}}\zeta_{t+1} + 1 - \phi\right) = \arg\max_{\phi\in[0,1]} E_t\left[\left(\phi\mu^{\frac{1}{\alpha}}\zeta_{t+1} + 1 - \phi\right)^{1-\gamma}\right]$$

We next take logs because maximizing logs is the same as maximizing levels and then simplify the expression. Note that because ζ_t is log-normally distributed, $\mathbb{E}_t[\zeta_{t+1}] = e^{\mu_\zeta + \frac{1}{2}\sigma_\zeta^2}$.

$$\begin{aligned}
&\arg\max_{\phi\in[0,1]} \log \mathbb{E}_t\left[\left(\phi\mu^{\frac{1}{\alpha}}\zeta_{t+1} + 1 - \phi\right)^{1-\gamma}\right] \\
&= \arg\max_{\phi\in[0,1]} (1-\gamma)\mathbb{E}_t\left[\log\left(\phi\mu^{\frac{1}{\alpha}}\zeta_{t+1} + 1 - \phi\right)\right] + \frac{1}{2}(1-\gamma)^2\phi^2\mu^{\frac{2}{\alpha}}(e^{\sigma_\zeta^2} - 1) \\
&\approx \arg\max_{\phi\in[0,1]} \mathbb{E}_t\left[\log\left(\phi\mu^{\frac{1}{\alpha}}\zeta_{t+1} + 1 - \phi\right)\right] + \frac{1}{2}(1-\gamma)\phi^2\sigma_\zeta^2
\end{aligned}$$

where the last step uses approximation for small σ and μ. Next, we want to take a second-order Taylor expansion around the mean and then take expectations.

$$\begin{aligned}\mathbb{E}_t \log\left(\phi\mu^{\frac{1}{\alpha}}\zeta_{t+1} + 1 - \phi\right) &\approx \log\left(\phi\mu^{\frac{1}{\alpha}} + 1 - \phi\right) - \frac{1}{2(\phi\mu^{\frac{1}{\alpha}} + 1 - \phi)^2}\phi^2\mu^{\frac{2}{\alpha}}\sigma_\zeta^2 \\ &\approx \phi(\mu^{\frac{1}{\alpha}} - 1) - \frac{1}{2}\phi^2\sigma_\zeta^2\end{aligned}$$

Now we plug this approximation back into the maximization problem and solve for ϕ:

$$\begin{aligned}&\max_\phi \phi(\mu^{\frac{1}{\alpha}} - 1) - \frac{1}{2}\phi^2\sigma_\zeta^2 + \frac{1}{2}(1-\gamma)\phi^2\sigma_\zeta^2 = \max_\phi \phi(\mu^{\frac{1}{\alpha}} - 1) - \frac{1}{2}\gamma\phi^2\sigma_\zeta^2 \\ &\Rightarrow \varphi \approx \frac{\mu^{\frac{1}{\alpha}} - 1}{\gamma\sigma_\zeta^2}\end{aligned}$$

This yields the optimal portfolio shares which equal the solution from the standard Merton-Samuelson portolio choice problem.

B.2 Proofs

Across all proofs, we make the simplifying assumption that $\theta = 1$ and we use the approximate portfolio shares derived in the previous section.

Proof of Proposition 4. Starting with the discount factor, we can show the following for the quantity of risky capital:

$$\frac{\partial K^r}{\partial \beta} = \frac{1}{\tilde{\mu} + \frac{1}{\varphi} - 1}\left(\underbrace{\frac{\partial (l^s)^{-1}}{\partial \beta}}_{>0} + \underbrace{\frac{\partial \frac{\omega}{r^s}}{\partial \beta}}_{>0}\right) > 0$$

where $\tilde{\mu} \equiv \mu^{\frac{1}{\alpha}}$. To obtain results for safe capital and the safe capital share, rewrite the safe to risky capital share as:

$$\frac{K^s}{K^r} = \left(\frac{1}{l^s} - \tilde{\mu}\frac{\frac{1}{l^s} + \frac{\omega}{r^s}}{\tilde{\mu} + \frac{1}{\varphi} - 1}\right)\frac{\tilde{\mu} + \frac{1}{\varphi} - 1}{\frac{1}{l^s} + \frac{\omega}{r^s}} = \frac{\tilde{\mu} + \frac{1}{\varphi} - 1}{1 + \frac{\omega l^s}{r^s}} - \tilde{\mu} = \frac{\tilde{\mu} + \frac{1}{\varphi} - 1}{1 + \frac{1-\alpha}{\alpha}} - \tilde{\mu}$$

where the last equality follows from $l = \frac{1-\alpha}{\alpha}\frac{r^s}{\omega}$. The safe capital share is independent of the discount factor. Because the risky capital quantity is increasing in the discount factor and the risky share is constant, the safe capital quantity must also be increasing in patience.

For risk aversion, we start again with the risky capital quantity:

$$\frac{\partial K^r}{\partial \gamma} = \underbrace{\frac{\partial \frac{1}{\tilde{\mu}+\frac{1}{\varphi}-1}}{\partial \gamma}}_{<0} \left(l^{-1} + \frac{\omega}{r^s}\right) + \frac{1}{\tilde{\mu}+\frac{1}{\varphi}-1} \left(\underbrace{\frac{\partial l^{-1}}{\partial \gamma}}_{<0} + \underbrace{\frac{\partial \frac{\omega}{r^s}}{\partial \gamma}}_{<0} \right) < 0$$

From the expression for the safe capital share, it is also evident that $\frac{\partial \frac{K^s}{K^r}}{\partial \gamma} > 0$ because $\frac{\partial \varphi}{\partial \gamma} < 0$.

C Model appendix

C.1 Portfolio allocation with non-homothetic preferences

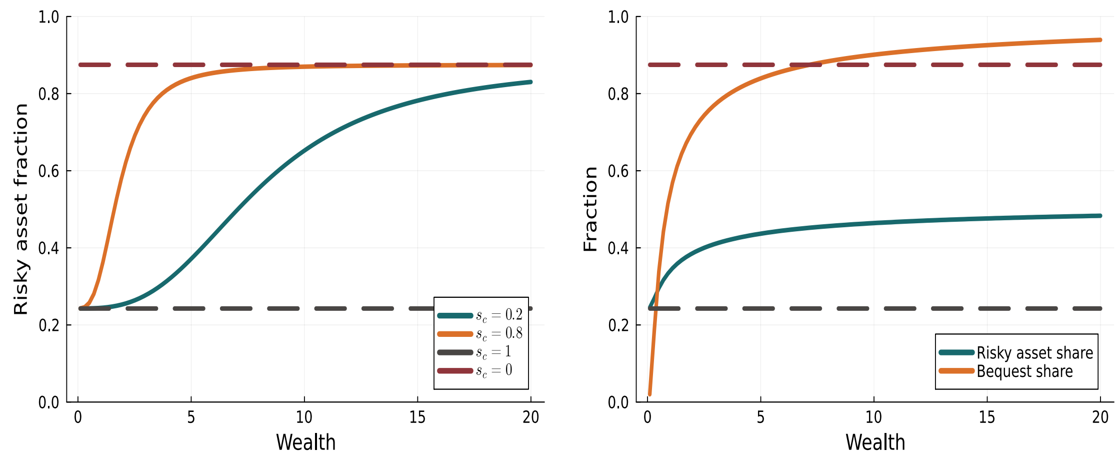
To build intuition for the role of non-homothetic preferences for households' portfolio decisions, I inspect household policy functions for risky assets and contrast them with the policy functions derived from homothetic preferences. I begin with a simple one-period problem and then turn to the dynamic case.

Static case. The left panel of Figure C.1 reports the optimal risky portfolio share φ^*_{NH} for different values of the consumption share of wealth s_c. The first observation is that the risky asset share is increasing in the level of wealth, unless $s_c = 0$ or $s_c = 1$, i.e. utility is only derived from either consumption or bequests. For low levels of wealth, the optimal share is close to the case in which utility is only derived from consumption with curvature parameter γ. For higher levels of wealth, instead, the optimal share approaches the optimal value from the case in which all utility is derived from bequeathing, with curvature parameter η. The second observation is that the magitude of s_c governs how fast φ^*_{NH} converges to its upper bound. When the consumption share is low, the marginal utility of consumption is higher than the marginal utility of bequests, and the curvature over consumption utility γ predominantly governs asset allocation, i.e. the risky asset share is lower. However, as the wealth level increases, this effect fades out because the marginal utility of consumption decays faster than the marginal utility of bequests, and the level effect of higher wealth dominates the asset allocation.

The right panel illustrates the case in which the consumption share s_c is endogenized. For this example, I assume that the household jointly decides on the portfolio allocation and how the resulting wealth is split between consuming and bequeathing. Endogenizing the consumption decision yields two insights. First, the share of wealth allocated to bequests is increasing in wealth. This is just a confirmation of the fact that bequests are a luxury good in this economy due to the assumption of $\eta < \gamma$. Second, the risky asset share is lower once the consumption share is endogenized because the higher share of bequests partly offsets the effect of higher wealth – an effect that was already visible in the left panel.

Dynamic case. I now turn to the dynamic case with labour income. In particular, I use a parsimonious parametrization of the baseline economy without idiosyncratic income risk and asset market participation costs to numerically illustrate the relevance of non-homothetic preferences for portfolio choice. The upper panel of Figure C.2 shows the share of risky assets for different levels of financial wealth and permanent income across

Figure C.1: Optimal risky asset shares with non-homothetic preferences



(a) Exogenous consumption-savings (b) Endogenous consumption-savings

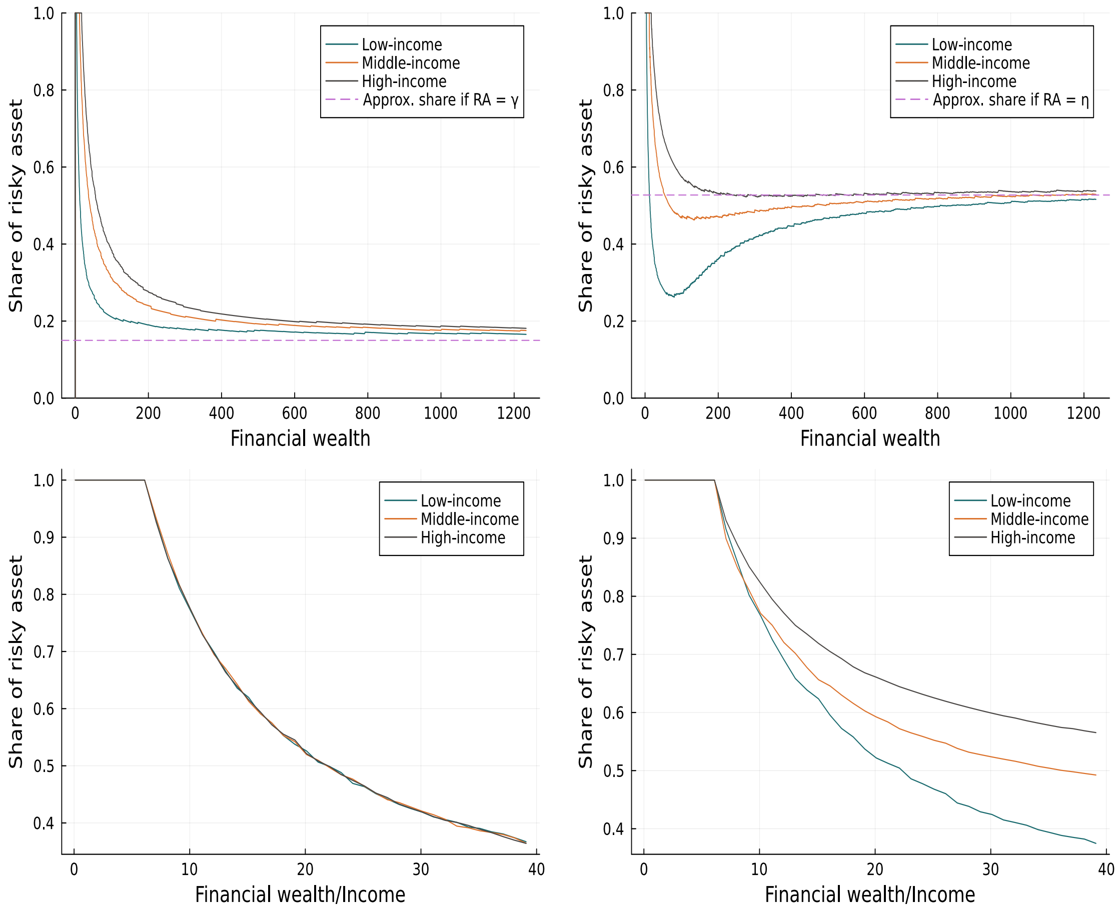
Notes: This figure reports the optimal share of risky assets from a one-period portfolio choice problem with a bequest motive. s_c denotes the share of wealth that is consumed. I set $\gamma = 4$ and $\eta = 1.1$. The left panel assumes an exogenous consumption share s_c. In the right panel, s_c is endogenous.

the homothetic and non-homothetic economy. In the homothetic economy, the risky share is decreasing in the amount of financial wealth held. This is a well known result. The underlying reason is that the net present value of labour income, often referred to as human wealth, is a substitute for the riskless asset. High labour income relative to financial wealth means that a large share of resources is risk-free, inducing riskier behaviour. Following the same logic, for a given level of financial wealth, higher permanent income predicts a higher risky share because relatively more wealth is held in safe human capital. Therefore, the split of total wealth across financial and human wealth is of first-order for portfolio allocation.

Turning to portfolios with non-homothetic pereferences, there are two differences. First, the risky share is non-monotonic in financial wealth. While higher financial wealth still lowers the risky asset share through changing the composition of total wealth, decreasing relative risk aversion partly offsets this effects and raises the risky asset share. Second, the risky asset share converges to a higher level. The relevant risk aversion parameter for the portfolio approximation formula, given a high enough level of wealth, is not γ, the curvature of the utility over consumption, but η, the curvature of the utility over wealth. As a larger fraction of utility is derived from holding wealth, the magnitude of η becomes increasingly important in the determination of the portfolio shares.

Another way to illustrate the role of non-homothetic preferences is to look at risky asset shares across financial wealth relative to income. The bottom panel shows that in the homothetic economy, the portfolio allocation is affected by the ratio of financial wealth to income, but not by the level of income itself. That is, the portfolio share is scale-invariant. Non-homothetic preferences, instead, break this prediction. Risky asset shares are higher for higher levels of permanent income, holding the financial wealth to income ratio fixed.

Figure C.2: Optimal risky asset shares in a dynamic setting



(a) Homothetic (b) Non-homothetic

Notes: This figure reports the policy functions for risky asset shares in the homothetic and the non-homothetic economy. In the homothetic economy, there is no bequest motive, i.e. $\psi = 0$.

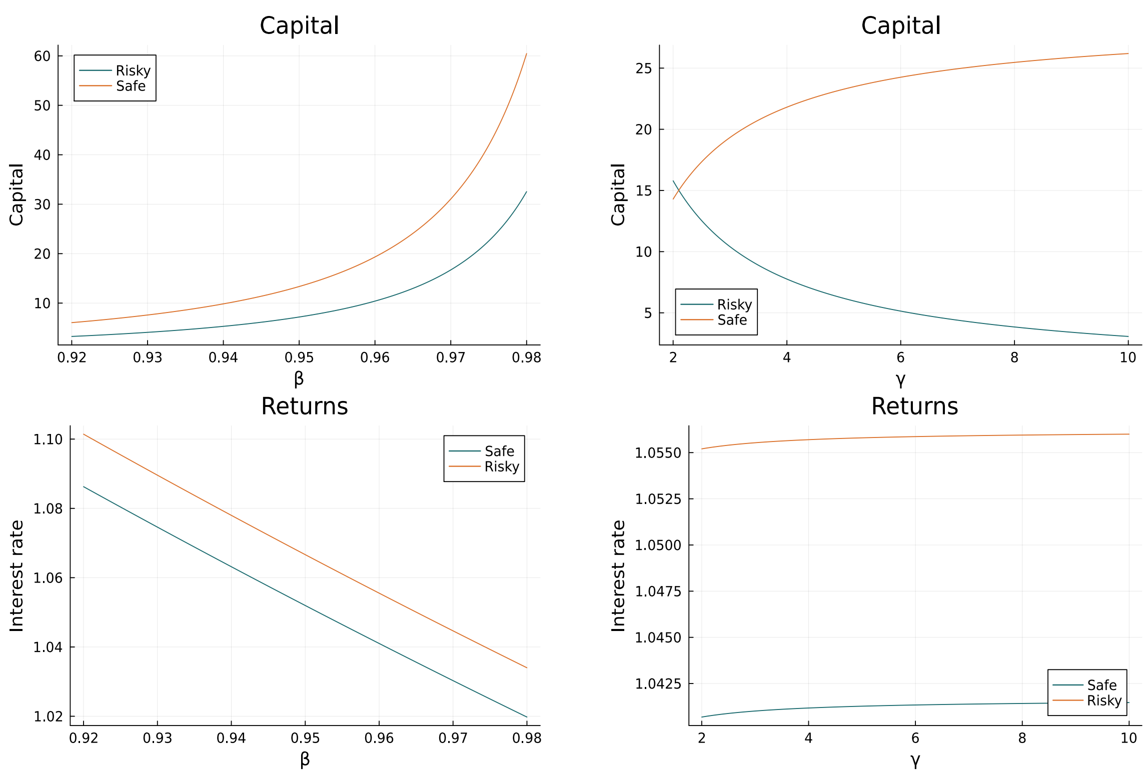
C.2 Simulations of the stylized model

This sections complements the analytical results of the stylized model with numerical simulations. The simulations are useful in three ways. First, they illustrate quantitatively the relevance of changes in the discount factor and risk aversion for the price and allocation of capital. Second, they validate the analytical results which were based on approximations of the optimal portfolio shares. Third, they allow me to study the relevance of the magnitude of the IES which was previously assumed to be 1.

I set the following baseline parameters for the simulation: $\sigma_\zeta = 0.2, \gamma = 3, \theta = 1, \beta = 0.96, \alpha = 0.36, \mu = 1.005$. Across all simulations, I vary one parameter at a time and hold all other parameters fixed at their baseline values.

Figure C.3 shows how risky and safe capital and their respective returns vary across different levels of patience and risk aversion. Overall, the simulations validate the analytical results. The amount of risky capital is increasing with higher discount factors and lower risk aversion which is precisely what higher income inequality should induce with non-homothetic preferences. Safe capital is also increasing in patience and in the degree of risk aversion. Turning to prices, returns to capital are decreasing in the discount factor approximately linearly. With respect to risk aversion, returns are slightly increasing, but are relatively inelastic.

Figure C.3: The role of patience and risk aversion for risky and safe returns and capital



(a) Patience (b) Risk aversion

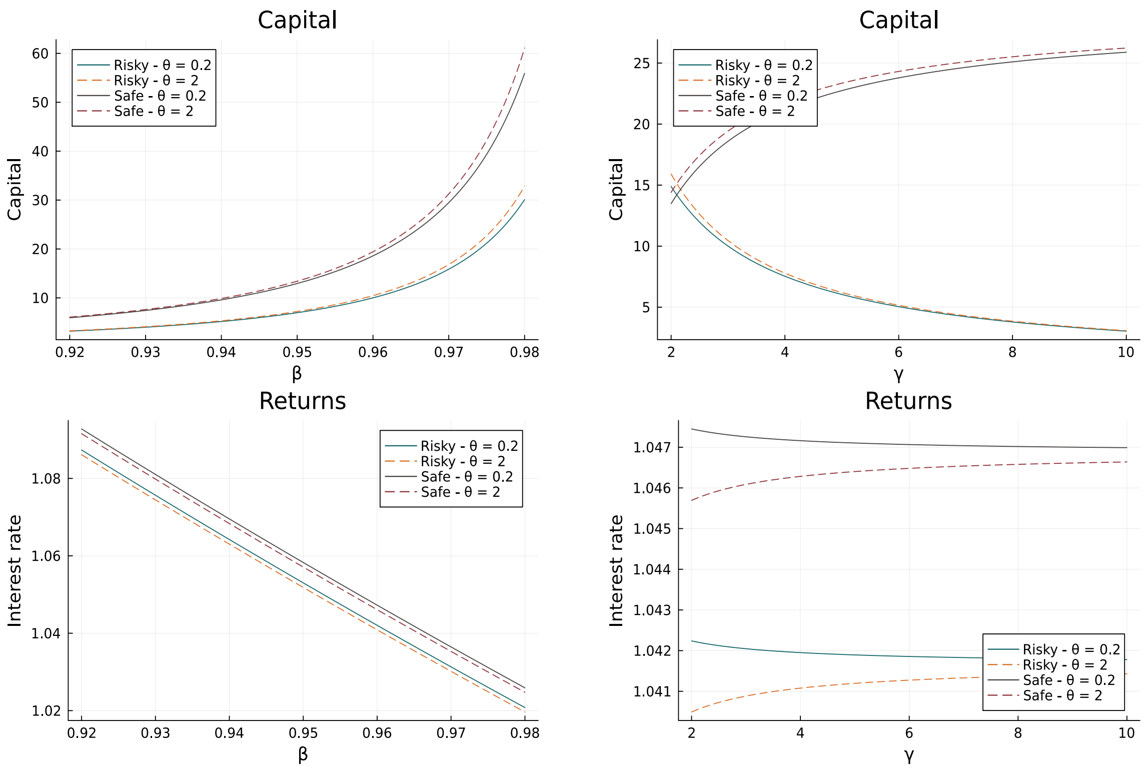
Notes: This figure reports capital quantities and returns across different values of the discount factor β and risk aversion γ. The baseline parametrization is $\sigma_\zeta = 0.2, \gamma = 3, \theta = 1, \beta = 0.96, \alpha = 0.36, \mu = 1.005$.

I now turn to the role of the intertemporal elasticity of substitution, which I assumed to be 1 until now. I will use the simulations to answer two questions. First, to what extent are the comparative statics for the discount factor and risk aversion dependent on the size of the IES? And second, how do returns and quantities vary with the size of the IES? Figure C.4 plots again the sensitivity of quantities and prices to changes in patience and risk aversion, but this time for low and high values of the IES, namely $\theta^L = 0.2$ and $\theta^H = 2$. These values capture the commonly used range of IES values used in the literature. The figure shows that irrespectively of the level of the IES, the sensitivity of the two capital types behaves similarly. The behaviour of returns, on the other hand, flips signs. For low levels of θ, interest rates decrease with the degree of risk aversion. This suggests that the result derived in Proposition 3 that interest rates are increasing in risk aversion holds only above a certain threshold level of the IES, which is below $\theta = 1$.[18]

Figure C.5 plots the response of capital and returns to changes in the IES itself. Investigating the sensitivity to different values of the IES is of interest because standard non-time separable CRRA preferences parametrize the magnitude of the IES and risk aversion with just one parameter. Understanding to what extent capital quantities and returns respond differently to variations in these two parameters is informative about the adequacy of the CRRA utility specification in that context. The left panel shows that both risky and safe capital are increasing in the IES. Because $\theta = \frac{1}{\gamma}$ under CRRA, this means that these two forces are working in the opposite direction for safe capital, but in the same direction for risky capital. The decrease in risky capital from an increase in risk aversion is not offset by an increase from a lower IES. Quantitatively, capital is much less elastic to changes in θ than γ. Note that the range of risk aversion values for which quantities are most elastic is not shown in the figure ($\gamma < 2$), while this corresponds to the range of values for θ for which capital is least elastic ($\theta > 0.5$). Similarly, both decreasing risk aversion and increasing IES lower the interest rate. Quantitatively, the elasticities or returns are broadly similar across IES and risk aversion.

[18]This is consistent with the findings in Angeletos (2007).

Figure C.4: The interaction between patience, risk aversion, and the IES

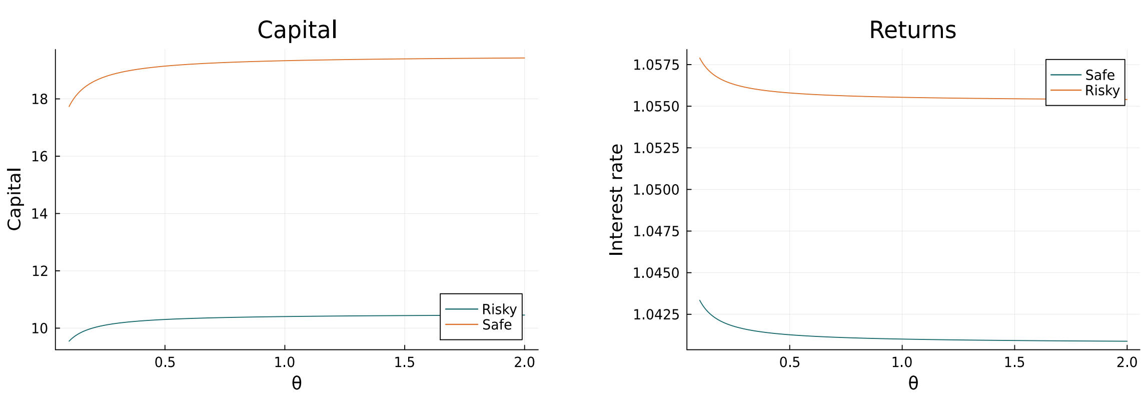


(a) Patience

(b) Risk aversion

Notes: This figure reports capital quantities and returns across different values of the discount factor β and risk aversion γ for two levels of the EIS, $\theta^L = 0.2$ and $\theta^H = 2$. The baseline parametrization is $\sigma_\zeta = 0.2, \gamma = 3, \beta = 0.96, \alpha = 0.36, \mu = 1.005$.

Figure C.5: The role of the IES for risky and safe returns and capital



Notes: This figure reports capital quantities and returns across different values of the intertemporal elasticity of substitution θ. The baseline parametrization is $\sigma_\zeta = 0.2, \gamma = 3, \beta = 0.96, \alpha = 0.36, \mu = 1.005$.