Inequality and the Rise of Finance

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Abstract

This paper studies the causes behind the rise of the financial sector observed in the United States from the 1980s. The growth of the financial sector is seen from the perspective of an endogenous rise of non-bank financial institutions (shadow banking sector). The shadow banking sector rises as a result of a domestic safe asset shortage. An increase in wealth inequality induces a higher amount of savings to invest in the hands of the wealthier households – the investors. Investors need to allocate their holdings between risky and safe assets. Given a constrained supply of public safe assets, real interest rates decline to accommodate the larger demand. A compression of the real interest rates reduces the costs of issuing debt for the poorer households, and represents the incentive for the shadow banking system to step in by transforming the debt of the poorer households into the private safe assets that the investors demand. The model allows for an endogenous and non-mechanical feedback loop between inequality and finance. The primitive increase in wealth inequality is obtained through non-trivial dynamics generated by an exogenous decline in the labor share. The financial sector rises in size and changes in structure as a result of secular macroeconomic forces. The paper is quantitative in spirit with a few empirical exercises which corroborate the model predictions.

Keywords: Growth of finance, inequality, shadow banking system, savings glut, safe asset shortage.

JEL codes: E21, E44, E51, G11, G23, G51, N22.

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1 Introduction

The largest industry of the U.S. economy by value added is the one composed by Finance, Insurance, and Real Estate (*FIRE*). This was not always the case. After a period of mild growth following WWII, the size of the financial sector strongly increased from the early 1980s before reaching a plateau in the aftermath of the Great Financial Crisis of 2008. A similar trend over time can be noticed both in the amount of financial assets intermediated relative to GDP, and in the wage premium earned by workers in the financial sector vis-à-vis the ones employed elsewhere. Despite the economic significance of the rise of finance, no consensus in the macroeconomics and finance literature has been reached on the explanations of such growth (Philippon and Reshef, 2013; Philippon, 2015).

This paper highlights the importance of analyzing the rise of the financial sector in conjunction with the endogenous rise of other non-banking financial intermediaries. The rise of finance is expressed in terms of assets intermediated by the financial sector as a share of nominal output. However, such growth has not been characterized by a mere rise of the same institutions and instruments that existed before the 1980s. Rather, it has been led mostly by the explosive growth of other non-bank financial institutions, which often go under the name of "shadow banking system". The shadow banking system is composed of a network of institutions, operations, and instruments that replicate similar credit functions banks perform, but without relying on the traditional structure of depository chartered banks. In the theory I propose, the emergence of the shadow banking system occurs endogenously when not enough risk-free financial assets are available for investors – what goes under the name of "safe assets shortage" (Caballero, Farhi, and Gourinchas, 2017). In this respect, the approach is consistent with the hypothesis advanced by part of the finance literature (Gorton, 2017). However, I do not take the financial phenomenon in isolation, and I treat the safe asset shortage as a proximate cause.

I seek a root cause explanation by looking at the structural transformations happening in the broader macro-economy. The decline of the labor share is taken as a primitive change to connect factor income inequality with personal income inequality. A higher capital share (interpreted as non-labor share) generates higher income and wealth inequality in the economy due to non-trivial dynamics. The wealthier quantiles of the population need to solve a portfolio composition problem on how to allocate their savings between risky and safe assets. When inequality increases non-homothetically, the amount of assets under management held by the richer quantiles increases, i.e., keeping the savings rates constant, as a result of incomplete markets. If the public supply of safe assets is constrained, the higher demand for safe assets puts a downward pressure on the real interest rates to clear the markets.

The lower the interest rates fall, the lower the costs of poorer households to issue debt to finance part of their consumption. As a result of cheaper debt, households' leverage increases. Such environment creates the conditions for other non-bank financial institutions – the shadow banking system – to step in and complete a market by manufacturing private safe assets. These are obtained by transforming the debt that the poorer households wish to issue to finance part of their consumption into quasi-safe assets that investors wish to hold to hedge their risks. The financial sector rises in size and changes in composition as a result of the endogenous rise of shadow banks. Importantly, a higher amount of assets under management leads also to higher price valuations, which endogenously create a feedback mechanism that exacerbates wealth inequality.

The paper contributes to the literature along several dimensions. First, it pins down the endogenous rise of the shadow banking system as emerging from structural macroeconomic forces. Second, it is able to link (for the first time to my knowledge) a change in the production technology of the economy with a change of its banking structure. Third, it allows to study in an internally-consistent framework both the direct channel of larger inequality inducing a larger financial system, and the feedback loop of higher asset prices valuation exacerbating the level of inequality. In short, the current parsimonious set-up is able to connect disjoint parts of the macroeconomic and finance literature and predict: The endogenous rise of income and wealth inequality, the compression of real interest rates, the rise of households indebtedness, the higher leverage in the economy, the change in size and composition of the financial sector, and the feedback loop between inequality and market-based finance in a parsimonious set-up.[1] Finally, on the methodological side – it is able to deliver the previous results by relying only on incomplete markets and precautionary motives. Allowing for elements such as preferences for liquidity and/or wealth and non-homothetic savings rates may further strengthen the overall quantitative findings; however, these are not strictly necessary.

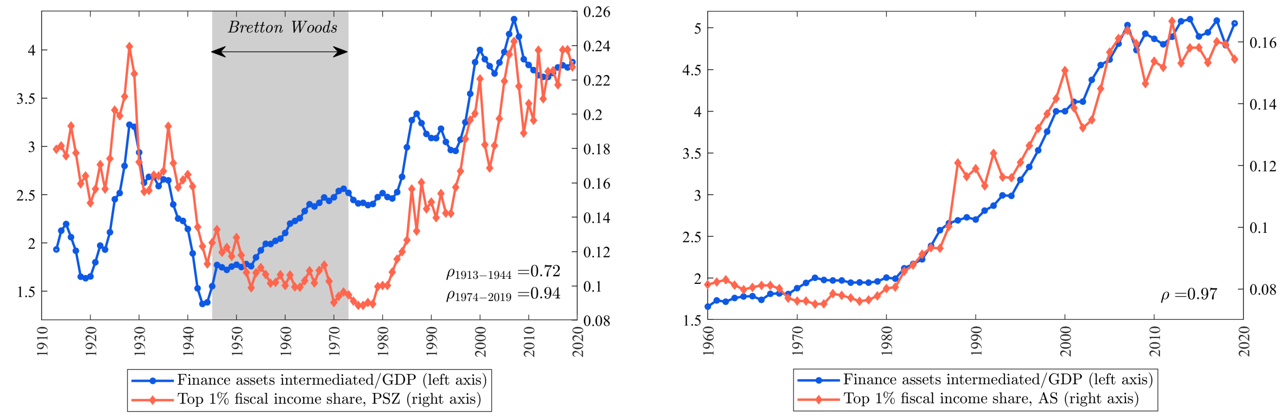
The paper is mostly quantitative in spirit, allowing for a model and its quantification, and a series of policy experiments. The empirical section further tests the theoretical mechanisms and implications. Quantitatively, taking the periods 1970-1979 and 2010-2019 as the initial and final steady states, the model is able to explain 73 per cent of the growth of shadow banking, when wealth inequality increases by 20 per cent as a result of the corresponding capital share increase. In terms of real interest rates, the model can explain up to 40 per cent of such compression over time when the aforementioned increase in inequality is obtained. The portfolio shares between risky and safe assets are not in line with the values observed in the data even though they are not targeted and they are not the main objective of study. The model also features a qualitative increase in the equity risk premium in line with the data.

Historically speaking, when looking at the *longue durée* — the connection between inequality and finance seems to be systematically at play when financial markets are left largely free of shackles. Figure 1a helps visualizing the relationship between inequality, measured by the fiscal income share of the top 1 per cent, and the domestic financial system in the United States over the period 1913-2019.[2] The two series strongly co-move for almost a century, except for the thirty years from 1944 to 1973 following the Bretton Woods Accords of July 1944. During the latter period, Western economies attempted to immobilize financial markets in the hope

[1]See Mian and Sufi (2018) for a discussion on the importance of understanding whether the following patterns where connected at all: (*i*) The rise of households indebtedness; (*ii*) The compression of the risk-free interest rate; and (*iii*) The rise of finance itself (seen as amount of assets intermediated).

[2]Focusing on the fiscal income measure of inequality allows to account for capital gains – which are an essential element for this paper. The top quantile is chosen because it is the only measure made available by Auten and Splinter (2024). Data from the World Income Database suggest that a similar pattern has been followed also by the top 5 and 10 percent of the distribution.

Figure 1: Gross and net measures of financial assets intermediated as a share of GDP and top 1 per cent income share in the United States over the long run



(a) Inequality and net measure of finance, 1913-2019

(b) Inequality and gross measure of finance, 1960-2019

Notes: In Panel (a) the net size of the financial sector up to 2010 refers to the domestically held claims adjusted to account for informational quality produced by Philippon (2015). The series is spliced up to 2019 by accounting for the size of the domestically held liabilities of the financial sector as a share of GDP. The top 1 percent income share includes capital gains as developed by Piketty and Zucman (2014). In Panel (b), the fiscal income measure of inequality includes capital gains and the adjustments made by by Auten and Splinter (2024). *Sources*: See Tables A.5 and A.6 in Section A.5 of the Appendix for details on the variables sources and construction.

that financial stability could be gained as a result. In this respect, more than the limitations to speculative international capital *per se* (coming in the form of "hot money"), the post-WWII world was characterized by outright *financial repression* at the domestic level. In the rest of the paper, I will focus precisely on the post-1970s world. Panel (b) shows that the relationship between gross total financial sector assets and inequality from the 1960s is almost perfect. The two series correlate at 97 per cent and share the same hockey-stick pattern. As shown later, the tight relationship between inequality and finance seems to be true more in general for a host of advanced economies.

In the empirical section, I test the extent to which we can find statistically significant evidence of the lockstep movements between inequality and finance over the past century. In this respect, I build on the work by Müller and Watson (2018) on co-variability. I do find evidence that in the pre- and post-Bretton Woods world the two series systematically co-moved *in growth rates*. Such result can be thought to be in the same spirit as the "great ratios" hypotheses related to the Kaldor facts.

Furthermore, I run more empirical analyses to test the importance of the "mechanism", i.e., the role of market-based vs. bank-based financial structure, by analyzing a panel of advanced economies. I follow the approach by Rancière, Tornell, and Westermann (2008), and I find more evidence about the importance of considering a market-based financial sector as a key aspect to think at the two-way relationship between finance and inequality.

Related literature. This work relates and tries to bridge different literature strands in macroeconomics and finance. First, the rise of finance has been acknowledged to be an important area of study after the Great Financial Crisis (*GFC*) through detailed data work by Philippon and Reshef (2012, 2013), and Philippon (2015). Such effort naturally engendered a quest for theories to explain the trends. Gennaioli, Shleifer, and Vishny (2014) provided an initial attempt by means of a neo-classical growth model augmented with asset managers. However, this line of research overall did not gain sufficient traction to provide additional answers from a theoretical standpoint. Rather, in the post-GFC world researchers have preferred to investigate the extent to which the increase in finance has been "excessive" (Arcand, Berkes, and Panizza, 2015, among others).[3] This work places the stream of literature on the explanations for the secular rise of finance back to the fore, and contributes to it by providing a hypothesis on its root causes. In this respect, it takes a positive angle rather than a normative one by not addressing the issue about whether the size of the current financial sector is excessive or not.

Second, the paper relates to the macroeconomic consequences of higher inequality.[4] Kumhof, Rancière, and Winant (2015) established a link between increased inequality and higher financial crises probabilities. Here, I do not look at the financial fragility component *per se* (even

[3]See Cochrane (2013) for a rebuttal of this exercise. See Brunnermeier, Palia, Sastry, and Sims (2021) for a novel way of empirically identifying the effects of financial deepening on output in the U.S..

[4]The debate on the *causes* leading to higher inequality is still open. Stansbury and Summers (2018) document an increasing gap between productivity and wages since at least 1973. Many other works have highlighted: the importance of changes in the taxation regimes adopted (e.g. Piketty and Zucman, 2014), "China shocks" and off-shoring of jobs to lower income countries (Autor, Dorn, and Hanson, 2016, for a review), the rise of automation and capital-enhancing technologies (Acemoglu and Restrepo, 2022), the rise of college premium, and de-unionization. Such list is not meant to be exhaustive and potentially a combination of all the previous items and others is important to explain the rise of inequality. See Hubmer, Krusell, and Smith (2021) for a quantitative assessment of the different drivers explaining the rise in wealth inequality.

though the model does deliver higher leverage and lower capital buffers), but rather at structural explanations for the secular rise of finance. More recently, inequality has been studied in conjunction with the rise of households indebtedness and richer households savings in a series of papers by Mian, Straub, and Sufi (2021a,b,c). However, this paper differs from the previous along several dimensions. First, it proposes a novel connection between the production technological shifts and the rise of finance. Second, it emphasizes that higher inequality leads to a larger financial sector because of its interactions with risks and a lack of public safe assets. Taking seriously the portfolio allocation choices of the investors, higher inequality generates a domestically-driven safe asset shortage, which ultimately creates the conditions for the shadow banking system to emerge. Third, as aforementioned, it looks at the change in finance size and the rise of other financial intermediaries as inextricably related. The growth of the sector becomes intertwined with the rise of new financial intermediaries in response to the changes in the macroeconomic environment. Methodologically, I contribute to this latter literature by not relying on non-homotheticities but on precautionary motives. I leave the savings rates constant over time and across households to focus on the increase in the absolute amount of money under management by investors, i.e. the change in the *levels* of savings.[5]

A host of other studies focus on the connection between inequality and other specific macro-financial trends covered in this work. Favilukis (2013) and Auclert and Rognlie (2017, 2020) focus on the macroeconomic implications of increased inequality connecting it with aggregate demand and decrease in real interest rates. A broader set of papers looks at the effects of inequality for asset pricing. Lansing (2015), and Markiewicz and Raciborski (2022) look at the implications of rising inequality (generated by higher capital income share) on lower interest rates and equity risk premium. Recently, Fagereng, Gomez, Gouin-Bonenfant, Holm, Moll, and Natvik (2023) and Gomez (2023) look at the aspects of inequality linked to asset valuations. Panageas (2020) carries out a literature review and attempts to reconcile the most seminal studies on the matter. Also, the specific effects of higher income inequality on households debts

[5]See also Fagereng, Holm, Moll, and Natvik (2021) for an important study on wealth-related non-homotheticities.

dynamics have been studied by Iacoviello (2008) and Coibion, Gorodnichenko, Kudlyak, and Mondragon (2020), amongst others. Azzimonti, de Francisco, and Quadrini (2014) investigate the higher demand for *public* debt stemming from higher inequality in an international setting.[6] In this respect, this paper has the benefit of encompassing different and relevant aspects in a single overarching framework.

This paper relates also to the broader safe assets shortage and "savings glut" literature. The early literature on these topics is rather rich but almost exclusively focused on the international dimension of the issue. More recently, Caballero and Farhi (2018) and Barro, Fernández-Villaverde, Levintal, and Mollerus (2022) focus on the U.S., and look at the macroeconomic implications that stem from acute safe assets shortages reaching some diverging conclusions on the importance of public safe assets to mitigate such issue. See also Caballero, Farhi, and Gourinchas (2017) for a review. More similar to this paper, Ordoñez and Piguillem (2021) also address the macroeconomic importance of the savings glut from a domestic point of view by taking a demographic angle.

The recent macro-finance literature has also produced several works to place the safe assets demand – and the insurance function of banking liabilities – at the center of stage by looking at them as an extension of money instruments (Krishnamurthy and Vissing-Jorgensen, 2012; Brunnermeier and Sannikov, 2016; Quadrini, 2017; Kiyotaki and Moore, 2019; Krishnamurthy and Li, 2023; among others).

Other aspects of the finance literature are also important to mention. On the one hand, the paper speaks to the causes behind the rise of the asset management industry (Greenwood and Scharfstein, 2013) by linking it to inequality; on the other hand, the emergence of the shadow banking system has been conjectured to be linked to the higher demand for safe assets (Gorton, 2017), which is in line with what shown here. In a recent paper, Sarto and Wang (2022) assess the connection between the rise of shadow banking and lower interest rates, as theorized here.

The paper is structured as follows. Section 2 describes key stylized facts to place the study

[6]See Benhabib and Bisin (2018) for review the literature on theories and empirics surrounding wealth inequality.

in perspective. Section 3 describes the macro-finance model proposed. Section 4 explains the calibration exercise, and Section 5 assesses the quantitative performance of the baseline scenario and a few policy experiments. Section 6 provides empirical evidence of the relations and channels between inequality and finance in the U.S. and across countries. Section 7 concludes. Additional stylized facts, proofs, results, and data description are available in the Appendix.

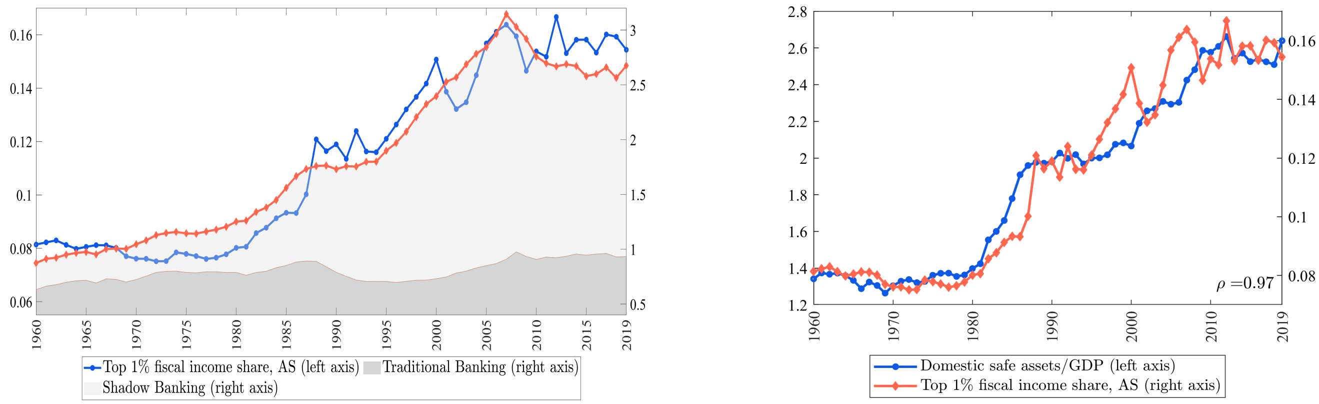
2 Stylized facts and background

A number of stylized facts consistent with the proposed narrative can help to provide descriptive evidence of the mechanism investigated.

The rise of finance from the 1980s has been characterized by the burgeoning rise of "other non-bank financial institutions" and instruments. The literature has often called this broad universe with the name of "shadow banking" or "parallel banking" system. Albeit being more lightly regulated than the traditional banking system, and not enjoying an explicit safety net from the government, shadow banking should not be interpreted as a set of operations catering to "shady" and illegal activities. Instead, it relates to the creation of credit instruments by non-depository institutions (say, mortgages issued by finance companies) ultimately funded with short-run money-like instruments such as repurchase agreements (RePos) and money markets mutual funds (MMMFs) shares which differ from the publicly-guaranteed bank deposits. To this extent, I will sometimes prefer to refer to the shadow banking system as the "market-based banking" system to reflect the intrinsic banking nature of this network of transactions generated through market mechanisms.

In Panel (a) of Figure 2, I plot the size of traditional and shadow banking sector vis-à-vis the inequality measure over the period 1960-2019. Over a thirty years time span from the 1980s to 2010s, the banking sector almost tripled in size as a share of GDP before reaching a new steady state in the aftermath of the 2008 crisis. However, what is striking is that most of the growth in the banking sector has been driven by market-based banking institutions. The sector

Figure 2: Traditional and shadow banking assets as a share of GDP and top 1 per cent income share (left); and domestically-held safe assets as a share of GDP and top 1 per cent income share (right), in the United States over the period 1960-2019



(a) (b)

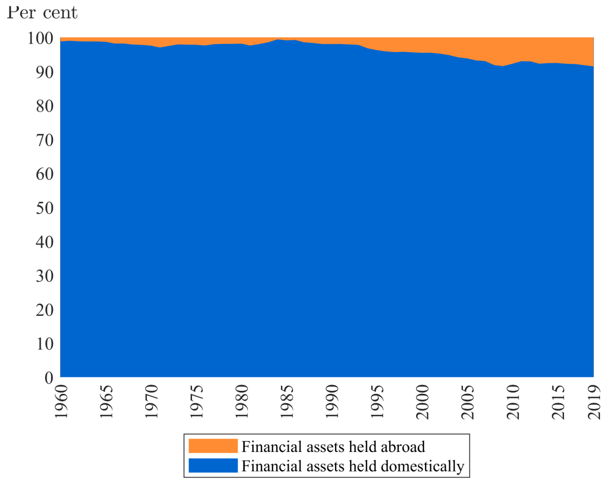
Notes: In Panel (a), the traditional banking sector is defined by the total financial assets of private depository institutions, which are composed of: U.S.-chartered depository institutions, foreign banking offices in U.S., banks in U.S.-affiliated areas, and credit unions. The shadow banking sector is given by the sum of the financial assets of: agency- and GSE-backed mortgage pools, ETFs, finance companies, GSEs, issuers of asset-backed securities, money market mutual funds, private pensions funds, real estate investment trusts, security brokers and dealers. In Panel (b), the domestically-held safe assets are obtained by removing the rest of the world component from the following total financial assets: treasuries, municipal bonds, checking deposits and currency, saving and time deposits, money market mutual funds, security repurchase agreements (RePos), commercial paper, and GSEs and bonds accounted for 85 percent of their volume to be consistent with the measurement proposed by Gorton, Lewellen, and Metrick (2012). *Sources*: See Tables A.5 and A.6 in Section A.5 of the Appendix for details on the variables sources and construction.

skyrocketed from the 1980s becoming twice as large as the amount of national output before stabilizing after the GFC. The traditional banking system, on the other hand, has been virtually flat from the the 1970s. As argued before, most of the growth in banking is linked to the rise of other non-financial institutions rather than banking activities traditionally intended.[7] The share of income in the hands of the top 1 per cent of the income distribution (accounting for capital gains) plotted in blue, on the other hand, rose from a steady level of about 0.08 in the 1960s to about 0.16 fifty years later.

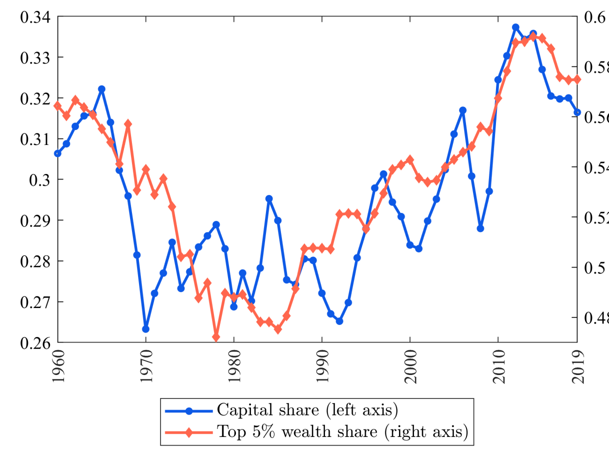
One of the leading theories in the finance literature behind the rise of the shadow banking sector entertains the hypothesis of a shortage of safe assets. In Figure 2b, I show to what extent

[7]Similarly, it is possible to show that the size of market-based banking out of traditional banking tracks the rise of inequality.

Figure 3: Decomposition of the Unites States financial assets held domestically vis-à-vis in the rest of the world (left); capital income share and top 5 per cent wealth share in the United States over the period 1960-2019



(a)



(b)

Sources: See Tables A.5 and A.6 in Section A.5 of the Appendix for details on the variables sources and construction.

the production of safe assets is connected to the rise of inequality after removing the claims held abroad.[8] As inequality moved, the production of domestically-held safe assets closely mirrored the same path.[9] The overall correlation for a 60 years time span (1960-2020) is 97 per cent. This should be the case if higher inequality generates a higher demand for safe assets by investors in order to hedge potential risks from their investments.

After WWII, the world has become more globalized not only in terms of international trade but also financially. Therefore, it is interesting to investigate whether such massive rise of finance has been driven by international forces. Figure 3a looks at this by decomposing each U.S. financial instrument according to the location of the owners of the claims — domestic vs. rest of the world —, as provided by the Financial Accounts of the Federal Reserve. It is true that the share of finance has progressively moved more in the hands of foreigners over time, however, foreigners have been holding at most 10 per cent of the total financial claims over the past

[8]In the appendix, I show that the share of private safe assets to public safe assets is also tightly associated with the rise of the shadow banking sector over time.

[9]The picture is the net measure after removing the foreign claims on U.S. safe assets.

decades. Also, notice that until the mid-1990s the share was not larger than it was back in the 1970s. The acceleration began after 1994 and became more pronounced in the 2000s – in line with the arguments on foreign reserves accumulation happening after the Mexican and Asian Financial Crisis of 1994 and 1997, and the entering of China in the World Trade Organization in 2002.[10]

Given that the proposed theory takes the rise of the capital share as a primitive measure to generate an increase in wealth inequality, Panel (b) displays such joint occurrence over time. Up to a stronger cyclical behavior of the capital share, the two series are very closely connected. They display a downward trend during the redistributive forces of the 1960s and 1970s before rising again from the 1980s and stabilizing over the past decade.

With that in hand, it is of interest to generate a theoretical framework that is able to rationalize such joint movements in a more formal fashion.

3 A macro-finance model

The current section builds a theoretical framework to analyze the mechanisms described in the introduction. The model is set in discrete time, and agents live over the time horizon $t \in \{0, 1, \dots\}$. The model features a representative firm, two sets of heterogeneous households — investors and workers —, a financial technology (representing the market-based banking system), and a Government budget constraint.[11]

Firms. Firms are price-takers, and maximize profits statically every period. They employ two factors of production, capital and labor, and they produce a final good, y_t, whose price I take as numéraire. Capital is represented by a non-reproducible stock, k_t, which is owned by the

[10]Figure A.1 in the Appendix shows that the same cannot be said for U.S. Treasuries. In this case, the fraction held by foreigners over the past two decades has fluctuated between 30 and over 40 per cent.

[11]I abstract from the traditional banking sector, as it was relatively constant over time. Therefore, one could think at this as a time-invariant technology whose output is normalized to zero.

investors. Labor, N_t, is inelastically supplied by the workers.[12] Firms combine the two factors according to a Cobb-Douglas production function facing constant returns to scale. The time-varying capital share is represented by α_t, and the labor share is $1 - \alpha_t$.

The rented capital is remunerated at rate, d_t, which represents the dividends paid off by the capital stock. Labor is paid according to the wage schedule, w_t. The amount of capital is normalized to one. Similarly, a constant population (and labor force) is normalized to one. The problem of the firms is provided in ($\mathscr{P}_F$):

$$\max_{k_t, N_t} \; y_t - d_t k_t - w_t N_t \quad \textbf{sub} \; y_t = k_t^{\alpha_t} N_t^{1-\alpha_t} \tag{$\mathscr{P}_F$}$$

As a result of labor being inelastically supplied for a constant population, the production of final output is $y_t = 1 \;\; \forall t$. It follows that the amount of dividends earned by capital-owners and the wages earned by workers correspond to the factor shares of capital and labor, respectively: $d_t = \alpha_t, \; w_t = (1 - \alpha_t)$.

Households. Households (both investors and workers) discount future levels of utility by the same discount factor $\tilde{\beta} \in (0, 1)$. The dynastic structure features a constant survival probability, $\delta \in (0, 1)$; therefore, a constant fraction of the population $(1-\delta)$ exits every period. This fraction is re-born with average income at each time *t* to ensure that the total population and assets in the economy are constant. The exit probability ensures the stationarity of the model.[13] I define the "effective" discount rate as: $\beta \triangleq \tilde{\beta}\delta$. Both agents have homothetic preferences and maximize utility derived from personal consumption.

— Investors/Capital-owners. Investors face two joint problems: A consumption-savings decision, and a portfolio allocation problem. In other words, in each period investors need to

[12] Workers do not have access to financial markets, therefore markets are segmented. On the other hand, investors do not supply labor to maintain a parsimonious structure.

[13] This is a standard approach in the macroeconomic literature to prevent the accumulation of all the income by a single individual, and it will become clearer from the law of motion of assets.

decide the amount to allocate to consumption vis-à-vis savings, and contemporaneously determine how to invest their savings across different financial asset classes. They maximize their utility according to log-preferences.[14] The assets space is composed of three instruments: risky, public safe assets, and privately-produced quasi-safe assets. The recursive problem faced by investors is represented by the Bellman equation in ($\mathscr{P}_I$):

$$V_{it}^{(I)}(b_{it}, m_{it}, k_{it}) = \max_{\substack{c_{it}^{(I)}, b_{i,t+1}, \\ m_{i,t+1}, k_{i,t+1}}} \left\{ \log\left(c_{it}^{(I)}\right) + \underbrace{\tilde{\beta}\delta}_{\triangleq \beta} \mathbb{E}_t \left[V_{it}^{(I)}(b_{i,t+1}, m_{i,t+1}, k_{i,t+1}) \right] \right\} \tag{$\mathscr{P}_I$}$$

$$\text{sub} \;\; c_{it}^{(I)} + p_{Kt}k_{i,t+1} + q_{Bt}b_{i,t+1} + q_{Mt}m_{i,t+1} =$$

$$= \underbrace{(p_{Kt}(1+\epsilon_{it}) + d_t)k_{it} + b_{it} + (1+\zeta_{it}^M)m_{it}}_{\triangleq A_{it}}$$

The problem for the investors features four control variables and three state variables. The control variables are consumption in the current period, $c_{it}^{(I)}$, and investment decisions over next period in: risky capital shares, $k_{i,t+1}$, public safe assets, $b_{i,t+1}$, and private quasi-safe assets, $m_{i,t+1}$. The total value of wealth for each household *i* is denoted by A_{it}, and it is obtained by summing the latter three elements evaluated at market prices. Notice that the assets distribution is not a state variable. This result stems from the fact that the model features aggregation, as pertaining to the class of models with idiosyncratic capital shocks described by Angeletos (2007). The returns on capital and quasi-safe assets are subject to idiosyncratic shocks. The shocks on capital are drawn from a distribution such that: $F_\epsilon \sim (0, \sigma_\epsilon)$, and the ones on quasi-safe assets from $F_\zeta \sim (0, \sigma_\zeta)$. Both distributions are assumed to be uniform for simplicity.

Investors own the capital stock of the economy ($k_t = \int_i k_{it} \; di$), and each investor *i* owns a share of the capital of the economy, k_{it}. Capital is risky. Each investor is hit by idiosyncratic shocks on their capital holdings, and risks cannot be insured away with *ad-hoc* contingent

[14] Log preferences are a conservative choice for this model structure. Other CRRA utility functions would be perfectly acceptable, and strengthen my results by allowing for more concavity of the utility function to exacerbate the precautionary motives.

claims. It follows that perfect diversification is not attainable, and that investors become ex-post heterogeneous after the shocks are realized even if they start as ex-ante identical.[15] Therefore, the model allows for a full-fledged distribution of wealth types with some investors becoming zero-wealth holders and others extremely wealthy. I do not allow for aggregate uncertainty, thus, the total supply of capital is known with certainty. The capital stock is priced at value p_{Kt}, and it pays off non-storable dividends, d_t, every period. Given that the shocks hit the *shares* of capital, this can be seen as leading to a stochastic variation in the value of individual capital holdings.[16]

Safe assets, b_{it}, are risk-free instruments issued by the Government. They generate perfect insurance and they are provided in positive but limited net supply, $\bar{b}$.

Privately-issued quasi-safe assets, m_{it}, are created by the financial sector by transforming the debt of the workers in exchange for a fee. Hence, investors fund the debt of the workers. A classical no-arbitrage condition holds in the aggregate such that $\mathbb{E}[R_{Mt}] = \mathbb{E}[R_{Bt}]$. In other words, the model continues to feature no aggregate uncertainty, and some funds are able to provide small returns while others marginally "break the buck". Given the complete absence of risk on the Government-guaranteed safe assets, this ensures that a safety discount on public assets is achieved endogenously.[17] However, the degree of uncertainty is small enough not to lead to substantial changes in the equilibrium outcome as a result of this modeling choice. All prices and returns are endogenously determined by trading on their respective markets.

Log preferences induce linear policy functions.[18] Consumption and assets holdings policy functions can be written as a linear function of the total assets owned by investors:

$$c_{it}^{(I)} = (1 - \beta)A_{it} \tag{1}$$

[15]Guvenen, Pistaferri, and Violante (2022) show that the volatility of income earnings for top quantiles is larger than for the lower quantile. See Figure A.5 in the Appendix for the results for the whole population and divided by age cohort and gender.

[16]This is also isomorphic to idiosyncratic depreciation (or appreciation) rates of the individual capital shares.

[17]The existence of safe and quasi-safe assets will make easier to conduct comparable quantitative counterfactual exercises later on.

[18]Log preference with total capital depreciation and aggregation lead to a Brock and Mirman (1972) world with analytically derivable policy functions.

$$q_{Bt}b^{(I)}_{i,t+1} = \beta\phi_{1t}A_{it} \tag{2}$$

$$q_{Mt}m^{(I)}_{i,t+1} = \beta\phi_{2t}A_{it} \tag{3}$$

$$p_{Kt}k^{(I)}_{i,t+1} = \beta(1-\phi_{1t}-\phi_{2t})A_{it} \tag{4}$$

where ϕ_{1t}, ϕ_{2t}, and $(1-\phi_{1t}-\phi_{2t})$ are the portfolio shares of public safe assets, private safe assets, and risky assets, respectively. It is important to stress that such portfolio shares are endogenously determined as a result of risk-reward decisions that investors make in equilibrium. The expressions for ϕ_{1t}, ϕ_{2t}, and $(1-\phi_{1t}-\phi_{2t})$ are provided by the no arbitrage conditions in Equations (6)-(5), and solved for numerically.

Lemma 1. *Investors allocate their savings endogenously to risky, safe, and quasi-safe assets so that the following conditions are satisfied:*

$$1 = \mathbb{E}_t\left[\frac{R_{i,t+1}}{\phi_{1t}R_{B,t+1} + \phi_{2t}R_{M,t+1} + (1-\phi_{1t}-\phi_{2t})R_{i,t+1}}\right] \tag{5}$$

$$1 = \mathbb{E}_t\left[\frac{R_{B,t+1}}{\phi_{1t}R_{B,t+1} + \phi_{2t}R_{M,t+1} + (1-\phi_{1t}-\phi_{2t})R_{i,t+1}}\right] \tag{6}$$

$$1 = \mathbb{E}_t\left[\frac{R_{M,i,t+1}}{\phi_{1t}R_{B,t+1} + \phi_{2t}R_{M,t+1} + (1-\phi_{1t}-\phi_{2t})R_{i,t+1}}\right] \tag{7}$$

with $R_{i,t+1} = (p_{K,t+1}(1+\epsilon_{i,t+1}) + d_{t+1})/p_{Kt}$*,* $R_{Bt} = 1/q_{Bt}$*, and* $R_{M,i,t} = (1+\zeta^M_{it})/q_{Mt}$*.*

Proof. See Section A.2 in the Appendix.

From the perspective of the single investor, the assets law of motion for the modeled economy follows a CAPM-like setting. Lemma 2 makes this statement formally.

Lemma 2. *The model features a two factors structure for investors, where Equation (8) represents the* *law of motion of assets for each agent:*

$$A_{i,t+1} = \beta A_{it} \left[\phi_{1t} R_{B,t+1} + \phi_{2t} R_{M,t+1} + (1 - \phi_{1t} - \phi_{2t}) R_{i,t+1} \right] \tag{8}$$

with $R_{i,t+1} = (p_{K,t+1}(1 + \epsilon_{i,t+1}) + d_{t+1})/p_{Kt}$.

Proof. See Section A.2 in the Appendix.

Moving on to the model mechanics, it is important to stress the importance of precautionary demand for safe assets by investors. The idiosyncratic and non-insurable shocks on capital create a demand to hedge against risk exposure. None of the investors has informational advantage before shocks get realized; therefore, their ex-ante preferences on portfolio composition are identical. Shocks on larger capital stocks induce a greater hedging demand as a result of potential larger capital losses to face.[19] Once the idiosyncratic shocks are realized, an ex-post distribution of investors is formed according to the individual-specific capital gains and losses. In equilibrium, the model features a baseline degree of inequality where a portion of agents that faced a series of negative shocks is left with an arbitrarily small amount of assets while a small fraction of agents who faced a series of positive shocks will hold a large fraction of the economy's assets.

A change in the technological structure of the economy (α_t higher) induces a larger return on capital, i.e., higher dividends d_t, paid to the investors. When capital promises higher dividend payoffs, investors' wealth rises. However, as they get richer and they own a larger amount of assets, they hold also a larger share of the risk in the economy. Therefore, two opposite effects emerge as capital promises higher gains. On the one hand, higher expected returns push investors to tilt their portfolios more towards risky assets, as this could ensure to harvest a greater amount of valuable fruits in the future. It follows that the trading activity of shares surges, and p_{Kt} increases to absorb the excess demand. Effectively, there is a stock market boom. On the other hand, higher returns come with higher risks. Risk aversion under incomplete markets

[19] A similar argument is proposed by Di Tella (2019) to justify regulation of financial intermediaries.

gives rise to precautionary motives. As such, investors buy *jointly* both shares of risky, safe, and quasi-safe assets in order to minimize the potential losses from negative idiosyncratic shocks. This type of market incompleteness leads to increased trading activity also for the safe and quasi-safe assets. Consequently, safe assets prices also rise (higher q_{Bt}, q_{Mt}), and returns get compressed. In general equilibrium, the share of risky assets holdings increases as a result of higher expected dividends although the portfolio tilting towards the risky share gets partially dampened by the lower returns.

It is also important to notice that the model features a *feedback effect*. As higher capital returns generate higher demand, the price of risky assets p_{Kt} increases. Hence, capital valuations increase, and induce investors to become effectively wealthier, and thus with higher savings to invest back in the system.

— Workers. The fringe of labor-owning households maximizes its intertemporal utility derived from consumption, $c_t^{(W)}$, and chooses an optimal amount of loans to borrow, l_{t+1}. In order to pay for the interest on loans and for consumption, the workers inelastically supply labor, N_t, to the final good firms at the competitive wage, w_t. Labor earnings are assumed to be deterministic, thus workers effectively do not feature either idiosyncratic or aggregate risk. The constrained optimization presented in ($\mathscr{P}_W$) describes the problem faced by workers.

$$
\begin{aligned}
V_t^{(W)}(l_t) &= \max_{c_t^{(W)}, l_{t+1}} \left\{ u(c_t^{(W)}) + \beta \mathbb{E}_t \left[V_t^{(W)}(l_{t+1}) \right] \right\} \qquad (\mathscr{P}_W) \\
\text{sub} \quad & c_t^{(W)} + l_t + \frac{\lambda}{2} q_{Lt} \left(l_{t+1} - \underline{L}/\lambda \right)^2 + T_t^{(W)} = q_{Lt} l_{t+1} + w_t N_t
\end{aligned}
$$

The amount of debt that workers can take on is limited by the quadratic costs on the left hand side of the budget constraint. This represents a "soft" borrowing constraint where each additional unit of debt gets more expensive to issue, and can be thought of as the costs that financial intermediaries would impose on workers for greater monitoring. The parameter λ governs the steepness of such borrowing constraint — the larger the value, the steeper the costs, and therefore the more stringent the conditions for workers.[20]

The parameter $\underline{L}$ contributes to the formation of the wedge that allows to obtain an implicit representation of the financial sector.[21] It contributes to the return spread per unit of debt charged by financial intermediaries to transform the debt issued by the workers into quasi-safe assets, m_{it}, held by investors. In this baseline set-up, the earnings per unit of finance are thus assumed to be constant.

Lump-sum taxes, $T_t^{(W)}$, are paid by the workers in order to finance the budget of the Government. Qualitatively, by allowing taxes to be paid by the workers – the role of the Government becomes non-Ricardian.[22] From a quantitative point of view, lump-sum taxes play a marginal role for the overall behavior of the system.

It is important to notice that workers' willingness to issue debt stems from its costs. The precautionary demand for quasi-safe assets by the investors leads to a reduction of the real interest rate below the inverse of the effective discount factor – which is the shadow price of debt for the workers under complete markets. As such, it is always advantageous for workers to issue debt, and increase consumption at the proposed market rates.

The larger the precautionary demand for safe assets, the more the interest rates decrease, and the larger the amount of debt issued by households. However, notice that this mechanism also allows for an increase in the *leverage* of the system. As debt gets progressively cheaper, lower interest rates induce workers households to raise an amount of funds which becomes relatively bigger as a share of total income.

A soft borrowing constraint produces an upward-sloping supply curve for debt rather than an inelastic vertically-sloped curve generated for the case of a strict threshold. An upward sloping supply curve has the advantage of allowing both prices and quantities of debt to move

[20]This type of borrowing constraint modeling is isomorphic to a penalty function in the utility function, and sometimes modeled as such in the macro literature.
[21]It is normalized to separate the direct effects of moving $\underline{L}$ with respect to the unit cost λ.
[22]If investors were to be taxed instead of workers, rich households would earn an interest on safe assets. Therefore, if they were to be taxed by the same amount the two effects would cancel out.

rather than fixing any of the two.[23]

Government balanced budget constraint. The Government imposes a lump-sum tax on the workers and issues debt up to a borrowing limit, $\bar{b}$, in each period.

$$T_t^{(W)} + q_{Bt} b_{t+1} - b_t = 0 \quad \text{sub} \;\; b_t \leq \bar{b}_t \qquad \forall t \tag{$\mathscr{P}_G$}$$

Financial technology. To maintain a parsimonious structure, the implicit financial sector transforms the debt of the workers into quasi-safe assets for the investors according to a simple linear technology $l_{t+1} = m_{t+1} \;\; \forall t$.

Market clearing. In equilibrium, the total number of capital shares has to sum to the normalized size of the capital stock: $\int_i k_{it} \; di = k_t = 1, \;\; \forall t$. Markets for the shares of capital clear endogenously at price p_{Kt}. The market for safe assets is cleared at price q_{Bt} for the amount provided exogenously $\int_i b_{it} = \bar{b}_t \;\; \forall t$. The total amount of debt issued by the workers is equalized to the amount of quasi-safe assets invested by the investors, thus $\int_i m_{it} = l_t$, and the market-clearing prices are $q_{Mt} = q_{Lt}, \;\; \forall t$. The labor force is constant, and labor is inelastically supplied: $N_t = 1$, remunerated at wage $w_t = 1 - \alpha_t$. Capital is rented at price $d_t = \alpha_t$. Final output is valued at price equal to one by construction (the numéraire), and consumed by both households. See Section A.2 in the Appendix for a complete characterization of the competitive equilibrium.

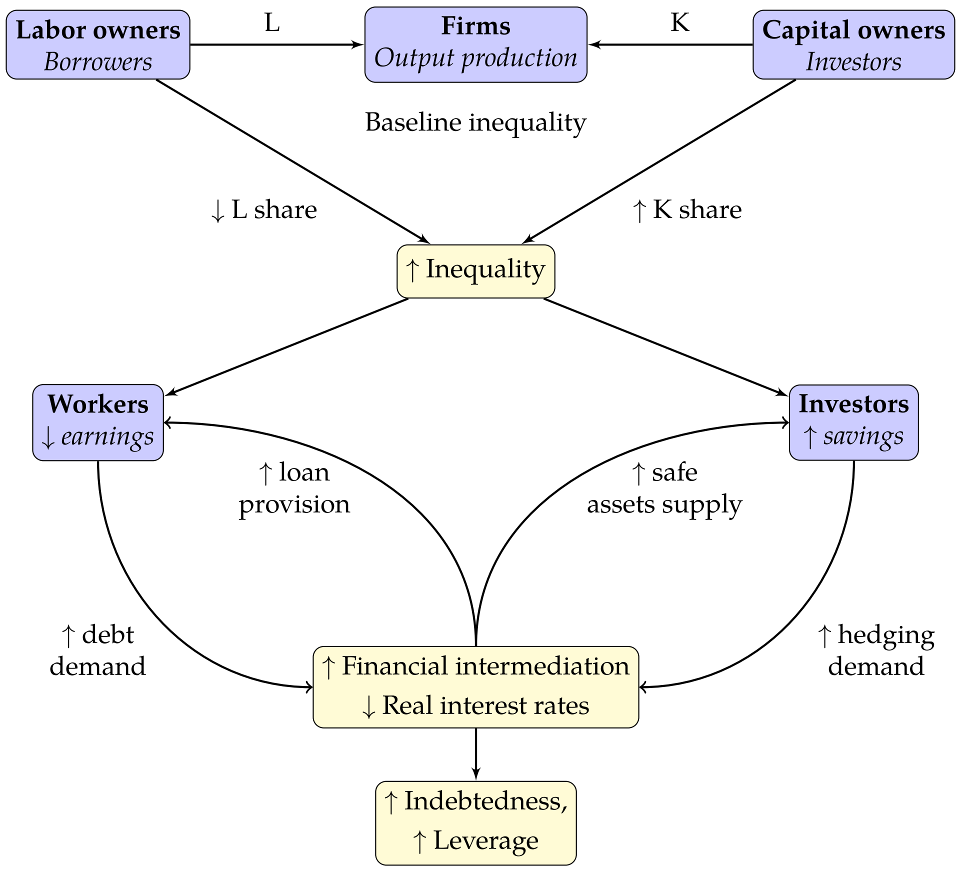
To help visualize the model structure, Figure 4 provides a representation of the model.

3.1 Sensitivity analysis

In order to clarify the properties of the model, Figures 5 and 6 present a series of sensitivity analyses for the cases in which income volatility and the capital income share share change, respectively. Without loss of generality, for the simulation results only — I further simplify the

[23]Without constraints, the price schedule of debt would be flat, and interest rates would be mechanically independent from the amount of debt in the economy.

Figure 4: Visual representation of the model



Note: Placeholders in yellow stand for the trends the model captures. Placeholders in blue stand for market participants in the economy. Text outside of placeholders helps motivating the driving forces and initial set-up.

model structure by assuming that the government does not issue any public bonds ($\bar{b} = 0$), and that the private safe assets produced by the financial sector are perfectly safe. All the properties would go through if we were to generalize such conditions, as in the exposition provided in the previous section.

Panel (a) shows that investors demand more safe assets when capital income becomes more volatile as a result of precautionary motives. Investors demand a larger amount of privately produced safe assets to hedge their idiosyncratic risks.

In Panel (b) it is possible to see that the returns decline as a result of such higher safe assets demand. This result stems from the upward sloping supply curve of debt coming from the soft budget constraint of the workers. If the supply of debt is not perfectly elastic, then returns decline when the demand increases.

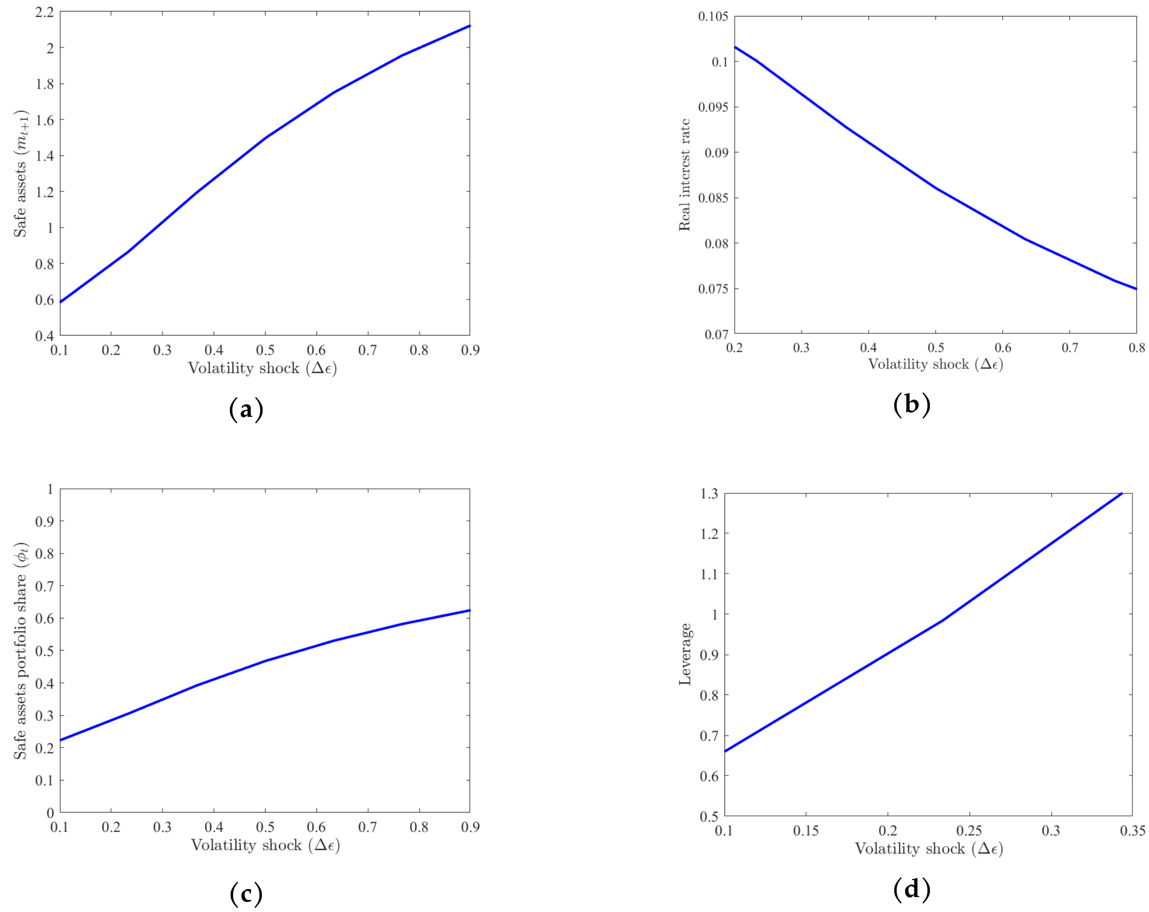
Panel (c) provides a description of the portfolio tilting happening as a result of variations in volatility. When volatility rises, not only the absolute amount of safe assets increases, but also the relative share of safe vs. risky tilts more towards safety (i.e. ϕ surges). In a traditional Merton setting, portfolio share would not adjust because interest rates are taken in partial equilibrium. However, when interest rates do decline – as in the current general equilibrium framework – this has an effect on the portfolio composition. On the one hand, an increase in capital risk pushes the allocation more towards safe assets to obtain a greater hedge; however, such effects are partially reduced by the fact that safe assets generate a lower return. Rather sticky portfolio shares emerge as a result (although portfolio shares cannot stay constant in equilibrium).

In Panel (d), I show that an increase in income volatility pushes up the leverage of the workers as a result of debt becoming cheaper. If real interest rates decline, the costs of repayment decline, which incentivizes a larger fraction of debt to be issued.[24]

Figure 6 presents the results for a constant volatility of the income shocks when the capital share, α, rises. Many of the same qualitative result are similar to what seen before except for the portfolio composition. The amount of safe assets surges when the capital share increases, as shown in Panel (a). This is an important feature of the model. A higher capital share induces larger expected dividends but also larger potential absolute portfolio losses coming from a greater amount of wealth under management. As a result, investors contemporaneously increase both the demand for risky and safe assets. Panel (b) shows that interest rates decrease when that is the case, which in turns pushes leverage upwards for the reasons expressed above. See Panel (d).

[24]Households leverage is computed as the amount of debt issued, $q_{Mt}m_{t+1}$, divided by the net disposable income after paying the interests on debt, w_t.

Figure 5: Sensitivity analysis under different volatility scenarios

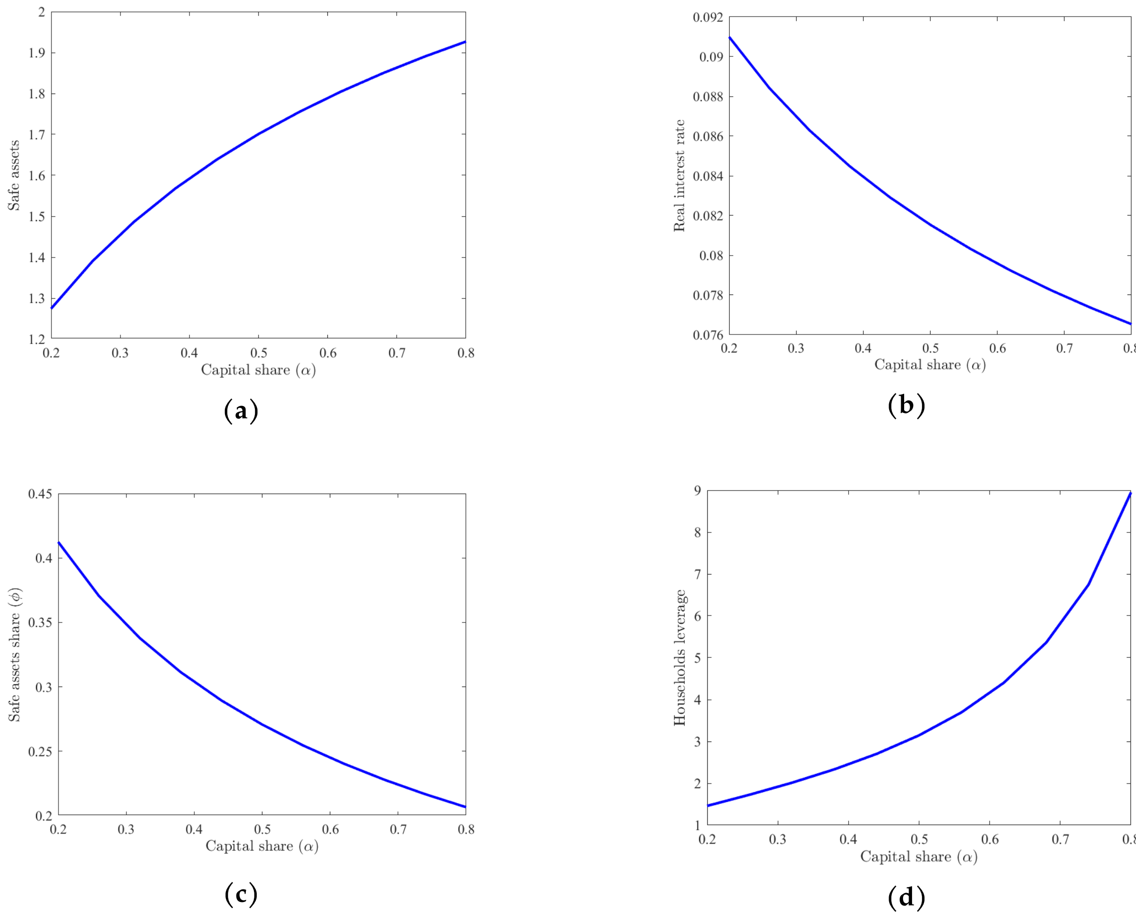


Note: The model parameters for the simulations are: $\beta = 0.96,\ \delta = 0.94,\ \lambda = 0.02,\ \underline{L} = 0.01, \alpha = 0.2$. All shocks are assumed to be drawn from *iid* uniform distributions $U(1 - \Delta\epsilon, 1 + \Delta\epsilon)$.

The safe assets share declines in this case, as illustrated in Panel (c). Even though investors demand more safe assets in absolute terms, their *relative* portfolio composition tends more towards holding risky assets because of the extra returns that can be gained under the new scenarios.

I move now to the calibration exercises needed to bring the model to the data.

Figure 6: Sensitivity analysis under different capital share scenarios



Note: The model parameters for the simulations are: $\beta = 0.96$, $\delta = 0.94$, $\lambda = 0.02$, $\underline{L} = 0.01$, $\Delta\epsilon = 0.4$. All shocks are assumed to be drawn from *iid* uniform distributions $U(1 - \Delta\epsilon, 1 + \Delta\epsilon)$.

4 Calibration

The model features some parameters estimated in the data, and a few free parameters internally calibrated jointly to match the moments of interest. Table 1 provides the overall list of calibrated parameters. Tables A.5 and A.6 in the Appendix explain in detail the data sources and construction.

The levels of wealth inequality of the top 5 per cent share are obtained from the World Inequality Database (WID.world). Such measure is a mildly conservative figure. Wealth inequality has rose mostly for the top 10 per cent of the distribution but the gains have been very skewed in favor of the top fractiles of the top 1 per cent.

The capital share is computed as $(1 - \ell_t)$, where ℓ_t is the labor income share. Figure 3 represents the time series of $(1 - \ell_t)$. The labor income share is obtained from Table 2 of the National Income and Product Accounts (NIPA) as compensation of employees divided by personal income plus subsidies minus taxes. As such, the capital share is intended as non-labor share.[25]

The construction of idiosyncratic volatility (σ_ϵ) is based on daily stock returns available from CRSP; it follows the asset pricing literature on the matter (Fu, 2009), and it is explained in detail in Section A.5 of the Appendix.

The levels of shadow banking financial intermediation refer to the "net" measure, i.e., the claims held in the hands of households, after stripping away the interbank holdings. To do so, I use the data from the Financial Accounts of the Federal Reserve. The final measure takes into account a "direct" and an "indirect" shadow component in order to avoid double counting or defining as "shadow banking" elements that could be seen as spurious. The direct portfolio holdings I can read directly from households balance sheets are given by: Money market mutual funds and GSEs. For other financial intermediaries that are not clearly definable as either inside or outside the such perimeter, I need to obtain a weighted average of how "shadow" they are. These mixed intermediaries are: mutual funds, pension funds, and life insurance funds. In this case, the indirect portfolio holdings are obtained by looking at the amount of shadow banking assets (money market funds, repurchase agreements, commercial paper, and GSEs) implicitly held by households through these mixed financial intermediaries. In case there is a further nest, e.g., RePos held by mutual funds, which in turns are held by pension funds, I operate a double weighted average by looking at how sizable each component is with respect to the total assets of the financial intermediary considered.

The real interest is calibrated by subtracting the personal consumption expenditures inflation (PCE) to the Moody's AAA Corporate Bonds Yield. By doing so, I aim to mitigate the potential confounding factors stemming from the foreign demand of Government securities.

[25]See Tables A.5 and A.6 in the Appendix for the specific NIPA tables lines used for computation.

The series on AAA Corporate Bonds Yield and 10 years Treasuries rates correlates at over 98 per cent for the 1970-2019 period.

The share of publicly available safe assets $q_{Bt}b_{t+1}/y_t$ is obtained from the U.S. Financial Accounts as the sum of Treasuries, and municipal bonds, and checking deposits and currency held by households as a fraction of nominal output.[26]

The model predicts a small fraction of the population to have negative asset values, in this respect, I use to the estimates from the Survey of Consumer Finances.

Table 1: Calibrated parameters

Parameters	*Value*	*Source*
Debt issuance variable cost (λ)	0.0092	Internal calibration
Debt issuance fixed cost ($\underline{L}$)	-0.0718	Internal calibration
Survival rate (δ)	0.9823	Internal calibration
Discount factor ($\tilde{\beta}$)	0.9174	Internal calibration
Quasi-safe shock (ζ_{it})	0.050	Internal calibration
Moments baseline		
Capital share 1970-79 (α_1)	0.279	NIPA Tables
Idiosyncratic variance 1960-72 (σ_ϵ)	0.543	CRSP
Public safe assets to GDP, 1970-79 ($q_B b_1/y$)	0.200	Fed Financial Accounts
Moments experiment		
Capital share 2010-2019 (α_2)	0.327	NIPA Tables
Idiosyncratic variance 2010-19 (σ_ϵ)	0.570	CRSP
Public safe assets/GDP, 2010-2019 ($q_B b_2/y$)	0.220	Fed Financial Accounts

The other parameters left are obtained by joint internal calibration to result in the desired initial steady state values for wealth inequality, financial intermediation and real interest rate. In this respect, one needs to calibrate the survival rate, δ, the discount rate, $\tilde{\beta}$, the debt issuance variable cost for workers, λ, the debt issuance fixed cost, $\underline{L}$, and the maximum gains or loss on the quasi-safe assets, ζ_M.[27]

[26] The Financial Accounts of the Fed do not allow to separate currency from checking deposits. However, given that a large fraction of checking deposits is Government-guaranteed through the FDIC, the assumption is consistent with the modeling choice.

[27] If the chosen values of the parameters do not allow to match the initial level of inequality, they need to be fine-tuned until inequality and the two other moments are matched.

The initial steady state is solved by using the aforementioned policy function conditions (Equations (1)-(4) in the previous section), the endogenous portfolio shares in Equations (6) and (7), the budget constraint and the Euler equation of the workers emerging from ($\mathscr{P}_W$), the government budget constraint, and the market clearing conditions. Given aggregation, the equilibrium values of $\{\phi_1^*, \phi_2^*, p^*, m^*, b^*, k^*\}$ are then used to compute the income distribution according to the law of motion in Equation (8).

As part of the baseline quantitative exercise, I keep all parameters fixed except the rise of the capital share, α, used to generate higher inequality, the related estimated change in idiosyncratic volatility, σ_ϵ, and the safe assets share held by the households.

5 Quantitative results and policy experiments

The model performance is tested by looking at its predictions across steady states: 1970-79 vs. 2010-2019. I first target the level of inequality, financial intermediation as a share of GDP, and real interest rates over the period 1970-1979 consistent with the capital share that I see in the data. This is taken as a first steady state. Subsequently, I introduce an exogenous structural change in α_t (the model reduced-form parameter leading to higher capital share) consistently with the estimates from the NIPA tables.[28]

Even though the theoretical approach is more interested in the effects of inequality (overall, regardless of the source) on the rise of finance, I follow a conservative approach that generates only a fraction of the overall inequality seen in the data in order to understand how far the current micro-foundations can bring the model performance, and unveil a new macro-finance relationship. The performance of the model is assessed by looking at how well other dimensions of interest can be predicted, especially the rise of the financial sector and the decline of the real interest rates. A few further moments endogenously generated by the model are provided such

[28]In order to be model-consistent, I also need to estimate the idiosyncratic volatility of capital in the two steady states. I do so by using CRSP data, and I follow the approach by Fu (2009). Section A.5 this Appendix describes the process in detail.

as the share of risky assets, and the price level of capital.

Quantitative analyses based on the calibration provided above are carried out to test the model performance: I call this the baseline scenario. A set of counterfactuals is then provided to assess the behavior of the system under different policy regimes.

5.1 Baseline scenario

Table 2 presents the results for the quantitative exercise conducted comparing the 1970-1979 period to the following one spanning over 2010-2019, as a result of the structural change in the technology parameter, α. Qualitatively, the model correctly predicts all the directions of the moments of interest: Higher inequality, higher financial intermediation as a share of output, lower real interest rates, and a rather stable portfolio composition.[29]

The increase in the capital share is able to deliver 20 per cent of the increase in inequality seen in the data. The rise of financial intermediation responds by explaining 73 per cent of the increase seen in the data; while the real interest rates decrease from 3.0 to 2.8 per cent (40 per cent of the variation). In this respect, it is more than plausible that other macroeconomic factors are at play to exacerbate the safe asset shortage and the reduction in interest rates.

In terms of non-targeted moments, the risky asset portfolio shares is not in line with the one in the data. Given that this is not a moment the model tries neither to target nor to predict, it is not particularly worrisome. On the other hand, the model correctly predicts the rise in the equity premium albeit less than in the data. In the model, it rises from 8.8 to 9.3 per cent, while in the data I see a rise from 5.5 to 8.1 per cent.

5.2 Dividends taxes

As a first counterfactual experiment, I allow the government to tax also investors on their dividends gains with a proportional tax, τ_t. In this first scenario, I do not allow the government to

[29] A perfect stability in the portfolio composition share – as seen in the data – is impossible to attain in the current model by construction.

Table 2: Quantitative results for the baseline model

Targeted moment	1970-79 Model	1970-79 Data	2010-2019 Model	2010-2019 Data
Top 5% wealth share	0.508	0.508	0.523	0.582
Shadow Banking holdings ($q_{Mt}m_{t+1}/y_t$)	0.026	0.026	0.161	0.212
Real interest rate (R_{Mt})†	0.030	0.030	0.028	0.025
Additional moments	Model	Data	Model	Data
Equity Premium†	0.088	0.055	0.093	0.081
Risky assets share ($1-\phi_1-\phi_2$)	0.914	0.652	0.878	0.654

Notes: † Results refer to the period 1960-1972 for the real interest rates to avoid the oil shocks to play a role.

issue more public bonds as a result of higher taxation but, rather, to effectively redistribute its revenues to workers – which now will endogenously receive a negative tax (a subsidy), $T^{(W)}$. The modified budget constraint of the investors' problem ($\mathscr{P}_I$) can be re-written as in Equation (9):

$$c_{it}^{(I)} + p_{Kt}k_{i,t+1} + q_{Bt}b_{i,t+1} + q_{Mt}m_{i,t+1} = \left[(p_{Kt}(1+\epsilon_{it}) + d_t(1-\tau_t))\right]k_{it} + b_{it} + (1+\zeta_t)m_{it} \tag{9}$$

while the modified Government budget constraint is represented as follows:

$$T_t^{(W)} + \tau_t d_t - b_t + q_{Bt}b_{t+1} = 0 \qquad \text{sub} \quad b_t \leq \bar{b} \tag{10}$$

The first column of the counterfactuals in Table 3 shows the results of such policy for a tax of 10 percent on the dividends gains after the change in α has occurred. As can be seen, the share of income held by the top 5 per cent increases up to 0.521 rather than 0.523. In other words, inequality would have increased only slightly less than in the baseline scenario. The effect of subsidies in this model is not very strong because most of the rise of inequality happens *within* investors. As a consequence of a smaller increase in inequality, the financial sector would have increased up to 0.129 rather than 0.161 documented before. Interest rates would have been

Table 3: Policy experiments results

	Baseline		Counterfactuals	
Moments	1970-79	2010-19	$\tau = 0.10$	$\tau = 0.015$, $b_t = 0.378$
Top 5% wealth share	0.508	0.523	0.521	0.519
Shadow Banking holdings ($q_{Mt}m_{t+1}/y_t$)	0.026	0.161	0.129	0.027
Real interest rate (R_{Mt})	0.030	0.028	0.029	0.030
Risky assets share ($1 - \phi_1 - \phi_2$)	0.914	0.878	0.876	0.870
Equity premium	0.088	0.093	0.106	0.094

almost completely untouched by such shift going from 3.0 to 2.9 per cent. The portfolio share in risky assets would have been overall similar as a result of still substantial gains (0.876 in the counterfactual vis-à-vis 0.878 found before).

Overall, the lower dividend gains produce an expected decrease in inequality (by construction), and a reduction in the amount of loanable funds, which decrease the surge of finance, and put a lower pressure on real interest rates.

5.3 Unconstrained public safe assets supply

As a follow up exercise, I reduce the dividend tax to $\tau = 0.015$, but I allow the government to issue as much debt as demanded by the investors in the form of public safe assets (up to fiscal capacity). To help comparing the results with the 2010-19 baseline scenario, I fix the lump-sum taxes that were imposed on the workers in the baseline scenario, $\overline{T}^{(W)}$. Thus, the new Government budget constraint can be represented as: $\overline{T}^{(W)} + \tau_t d_t + q_{Bt} b_{i,t+1} - b_{it} = 0$. Results are provided in the last column on the right of Table 3.

The first key insight is that — when allowing the government to issue debt up to fiscal capacity —, the supply expands dramatically: from 0.220 to 0.378 times the national output.[30] By construction, such a large increase in quantities is possible because of a flattening of the (pre-

[30] In this case, the *ceteris paribus* assumption is crucial. I am allowing for all the extra supply to be taken up by the U.S. households rather than by foreigners.

viously rigid) supply of public bonds. As a result, the model now predicts the real interest rates to be virtually unchanged. However, what is more interesting is that such an expansion of public safe assets strongly reduces the increase of inequality allowing it to decrease from 0.523 to 0.519. This stark result is the by-product of safe assets becoming more attractive (because of higher interest rates paid on debt), which reduces the "search for yield" for investors and the increase in capital assets valuations, p_{Kt}. As a result, the feedback effects through capital gains is dampened. In other words, if the real interest rates do not change much, then the incentive to move away from them is strongly reduced, and the feedback effect derived from capital gains is diminished, which prevents investors to become wealthier.

The shadow banking sector is left virtually unchanged as a result of fewer loanable funds to be privately intermediated. Importantly, this happens because funds are now being diverted towards public bonds — and it is consistent with literature on crowding-out of public vs. private safe assets (Krishnamurthy and Vissing-Jorgensen, 2015).

An important note of *caution* should be used when interpreting these results. The model does not speak to the importance of removing all fiscal discipline, thereby satisfying investors demands. Rather, it speaks to the feedback effects of the "reach for yield" and the large opportunity costs of holding safe assets when money yields are exceptionally compressed.[31]

6 Empirical analyses

In the empirical section, I study the predictions of the theoretical framework in two different ways. In Section 6.1, I investigate the extent to which finance and inequality have been intertwined in the United States over the very long run by using data for the longest time span available for this type of exercise, i.e., from 1913 to 2019. In this respect, I use the novel econometric techniques of "co-variability" proposed by Müller and Watson (2018).

Subsequently, Section 6.2 tests the model mechanism itself behind the rise of finance. The

[31] See Acharya and Dogra (2022) on the welfare effects of increasing the public safe assets amount in a context where investments are allowed and monetary policy is constrained by the zero lower bound.

model implies the rise of finance happened through market-based banking mechanisms, not traditional banking instruments. Given that banking structures can be very different across countries, I lever on the identifying mechanism technique proposed by Rancière, Tornell, and Westermann (2008) to test whether the industrial organization of banking plays a crucial role to generate an expansion of credit. Results are consistent with this interpretation in terms of feedback effects.

6.1 The long-run co-variability of inequality and finance

In the this subsection, I investigate the extent to which the inequality and financial time series have proportionally co-moved over the long-run. As noted by Chudik, Pesaran, and Smith (2023), over the very long-run, major events such as wars, pandemics, or other regime-shifting episodes may induce problems when estimating the long-run coefficients across time series even when the series are co-integrated. To this extent, having a clear understanding about the nature of the historical process connected to Bretton Woods (seen as a double regime shift), I tranche the over hundred years period of data in three sub-periods. The long-run co-variability analysis of Müller and Watson (2018) is applied for the sample periods: 1913-1943, 1947-1972, and 1973-2019, separately.[32]

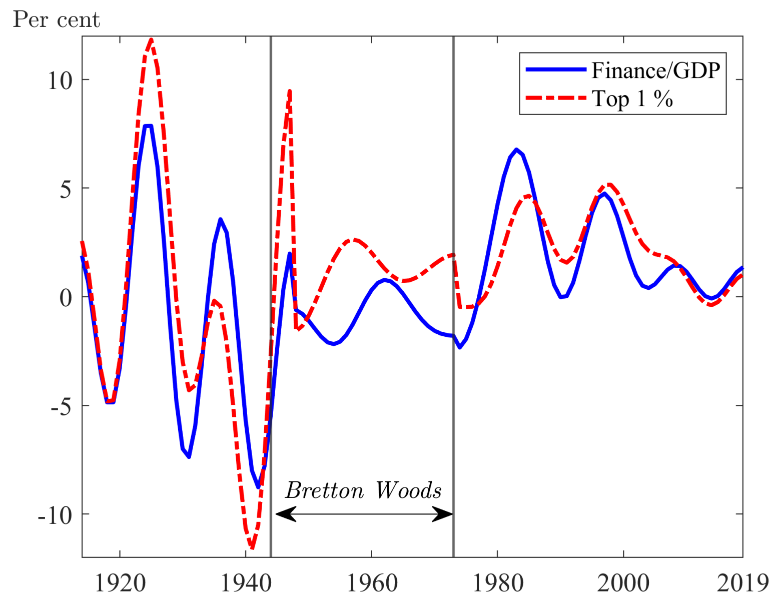
Given an integrated process $z_t \sim I(d)$, where d is the degree of integration, Müller and Watson's approach allow for any degree of integration conditional on $d \in (-0.5, 1.5)$. To tie my hands in the most conservative way, I take the inequality process and the financial assets as a share of GDP in rates of change — *de facto* studying the stationary, $I(0)$, processes. In this way, I study the extent to which a given per cent increase in inequality is linked to a given per cent of the financial sector over time.

The exponential smoothing filter to isolate the long-run variation from cycles is chosen to

[32] The data between 1880-1913 cannot be utilized here because they rely on linear interpolations at decade level, which would spuriously affect the results. The second period starts from 1947 to use internally-consistent data from the Federal Reserve Financial Accounts, which extends to today, rather than the one by Philippon (2015), which stops in 2010. The latter series is used only for the first sample of the analysis as it represents the best historical quantification going back in time.

be 7-years in the post-WWII world, while a longer 11-years cyclicality is used to account for the Great Depression event in the first part of the sample. In this case, the choice is consistent with the choice of the authors in their paper. The long-run projections are presented in Figure 7.[33]

Figure 7: Long Run Projections



It seems rather evident that the timing of the cycles in the pre-/post-Bretton Woods world is identical with the one of the financial sector, although the latter reacts more than proportionally to the former in the pre-Bretton Woods era. A result that is clearly driven also from the credit boom effect before 1929, and the subsequent dramatic collapse. Yet, even accounting for such spectacular rise and fall of finance, the two similarly co-move. The series become much more independent during the financial repression and strong re-distributive period from the 1940s to the early 1970s, before going back to move synchronously in the following period until today.

Table 4 presents the results for the ρ coefficients, referring to the long-run correlation coefficients, and the $\hat{\beta}$ coefficients, referring to the long-run best linear prediction of the long-run projections of finance growth by the long-run projection of inequality growth. The $\sigma_{y|x}$ coefficient refer to the average variance of the prediction error (with y being the finance to GDP

[33] For matters of the picture purpose only, the initial period is extended to 1946 using Philippon (2015) data. Results would be extremely similar by removing the last three years, and leaving a discontinuity between 1944-1946.

Table 4: Long-run co-variability results over the three relevant sub-periods

	1913-1943		
	ρ	β	$\sigma_{y\|x}$
Point estimate	0.733	1.137	0.043
67% Conf. Interval	(0.470, 0.899)	(0.750, 1.503)	(0.032, 0.062)
90% Conf. Interval	(0.160, 0.945)	(0.428, 1.947)	(0.027, 0.086)
	1947-1972		
	ρ	β	$\sigma_{y\|x}$
Point estimate	-0.079	-0.232	0.015
67% Conf. Interval	(-0.512, 0.311)	(-1.024, 0.506)	(0.010, 0.024)
90% Conf. Interval	(-0.750, 0.700)	(-1.847, 1.546)	(0.008, 0.039)
	1973-2019		
	ρ	β	$\sigma_{y\|x}$
Point estimate	0.714	0.592	0.013
67% Conf. Interval	(0.490, 0.870)	(0.407, 0.785)	(0.010, 0.017)
90% Conf. Interval	(0.273, 0.923)	(0.166, 1.143)	(0.008, 0.026)

Note: ρ refers to long run correlation coefficient, $\hat{\beta}$ refers to the long run regression coefficient of finance responding to changes in inequality, and $\sigma_{y|x}$ is the related standard errors of the regressions.

ratio, and x the effect of inequality). As evident, for the post Bretton Woods world the relationship is very strong and significant: $\hat{\beta} = 0.592$. In other words, the size of the financial sector responded to the increase in the top 1 per cent income share almost with the same elasticity as GDP growth responded to TFP growth documented by the authors in the original study. Such coefficient becomes largely non-statistically significant for the 1947-1972 period (as expected), while it suggests an overshooting over the period 1913-1943 ($\hat{\beta} = 1.137$) — probably as a result of the large shock due to the pre-1929 boom and subsequent devastating Great Depression.

The long-run correlation coefficients are also high for the periods of *laissez-faire* (0.733 pre-Bretton Woods, and 0.714 post-Bretton Woods), and as strong as the relationship between TFP growth and output growth found in other long-run econometrics works. See Müller and Watson (2018) empirical section itself.

6.2 Testing for the identifying mechanism across advanced economies

The previous subsection provided evidence on the degree of long-run co-variability between inequality and finance. Figure 8 looks at the correlation between loans issued and inequality over the very long run, and suggests that the relationship is there for a host of advanced economies for the period before and after the Bretton Woods regime (1912-1943, 1974-2019), but not during the Bretton Wood era. However, the model provides sharper predictions that can be tested by levering on a panel of countries.

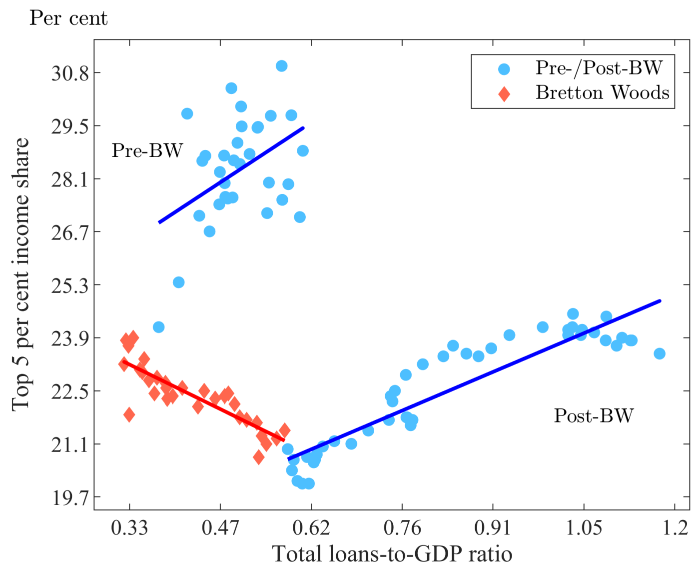
By taking advantage of the MacroHistory database compiled by Jordà, Schularick, and Taylor (2017), I can study whether the impact of inequality on credit holds more in general outside the United States. Inequality has increased in a rather pervasive but not uniform fashion across advanced economies, which ensures enough variation to test the model prediction of higher inequality leading to a larger financial sector.[34]

Furthermore, the model predicts that a feedback effect is at play, but that this holds true because of an increase in asset prices valuations. In order for that to be true, contracts need to be continuously priced as in a market-based economy. However, credit systems around the developed world fall into two broad categories: Bank-based – more typical of continental Europe and Japan –, and market-based financial systems – more common in Anglo-Saxon countries.[35] In bank-based economies, the asset pricing valuation effect is much less pronounced as contracts are not traded at market prices, while this tends to be the case by construction in a market-based economy. In order to address this point more concretely, I take advantage of the identifying mechanism approach proposed by Rancière, Tornell, and Westermann (2008), who test the relationship between financial crises and growth by exploiting the interaction of skewness effects typical of financial crises, and politico-economic proxies. I proceed in a similar spirit by interacting the dependent variables of interest with a dummy variable that accounts

[34] Countries such as Belgium, France, and Spain have experienced almost no increase in inequality over time. Conversely, Denmark, Germany, and Italy went through impressive distributional changes. Other countries have followed yet other patterns – almost proceeding in waves like Austria or the Netherlands.

[35] See Levine (2002) for a classic reference on the matter.

Figure 8: Total loans to GDP ratio, and top 5 per cent income share for a panel of 18 advanced economies over the period 1912-2019



Notes: Each dot in the figure represents results for one year. The (x,y)-coordinates are obtained by regressing the variables of interest (inequality and credit) on time-year fixed effects, and country fixed effects. More specifically, I run separately the regression: $y_{it} = c_i + \kappa_t + \epsilon_{it}$, with y_{it} being: first, log of the top 5 per cent income share, and then, the log of total loans to GDP ratios. The figure reports the year fixed effects for the two regressions. Standard errors are robust, clustered at country level. The pre-Bretton Woods period is 1912-1943; the Bretton Woods period is 1944-1973; and the post-Bretton Woods period is 1974-2019. The blue and red lines represent linear best fits over the periods considered. The sample of countries is composed by: Australia, Belgium, Canada, Denmark, Finland, France, Germany, Ireland, Italy, Japan, the Netherlands, Norway, Portugal, Spain, Sweden, Switzerland, the United Kingdom, and the United States. The actual values for loans to GDP and top 5 per cent income inequality corresponding to the specific time-year fixed effects coefficients have been used on the axes to facilitate the understanding of the true levels of the variables. *Sources*: Loans and nominal GDP data are from the the macro-history data base by Jordà, Schularick, and Taylor (2017). The top 5 per cent income share is the pre-tax and transfers measure from the World Inequality database.

for the fact that a country may have a more financialized structure.

In line with the literature on growth equations, I run the regressions provided in Equations (11) and (12) through ARDL estimation allowing for time and country fixed effects besides a host of control variables. More specifically, I run:

$$\Delta y_{it} = \kappa_t + \beta_{0i} + \beta_1 \Delta y_{i,t-1} + \sum_{s=2}^{5} \beta_s \Delta x_{i,t-s} + \gamma' X_{it} + \epsilon_{it}, \tag{11}$$

$$\Delta y_{it} = \kappa_t + \beta_{0i} + \beta_1 \Delta y_{i,t-1} + \sum_{s=2}^{5} \beta_s \Delta x_{i,t-s} + \sum_{s=2}^{5} \beta_s \Delta x_{i,t-s} \mathbb{1}(i \in M) + \gamma' X_{it} + \epsilon_{it}, \tag{12}$$

where κ_t is the time fixed effect, β_{0i} is the country fixed effect, β_1 pins down the coefficient of the auto-regressive component, the coefficients $\beta_2 - \beta_5$ are the estimate of the cumulated impact of the main dependent variable, X_{it} is the matrix of domestic and international control variables. For the regressions studying the direct effect of inequality on finance, the variables $\{y_{it}, x_{it}\}$, are the growth of lending activity and the top 5 per cent of the income share, respectively; they switch when studying the feedback mechanism. This structure can be effectively thought as an augmented Granger non-causality test in a panel setting. It follows that the dependent variables of interest are not taken contemporaneously to avoid spurious effects. The number of lags is chosen following the suggestion by Hamilton (2018) in order for relatively slow-moving variables to fully manifest their effect, but it is robust to adjacent lag orders. In the latter equation, M is the set of the most financialized countries, as emerging from IMF Financial Development Index. Therefore, the dummy variable allows to accommodate for financial market structure differences. In this case, M includes: Australia, Canada, Switzerland, the Netherlands, the United Kingdom, and the United States.

In Table 5a, it is possible to notice that an increase in inequality is a predictor of a size in credit activities. Such estimates are very robust to a number of different specifications with domestic and international variables used as controls. The elasticity is systematically around 0.35 for the cumulated long run effect; namely, an increase of one percent of the top 5 per cent income share happening over the previous 5 years induces a 0.35 per cent increase in the amount of loans issued. The coefficients are stable and strong in terms of statistical significance. Interestingly, the fact that economies are bank- or market-based does not matter for the direct channel. In other words, when system become more unequal they tend to generate a larger amount of credit activity regardless of the characteristics of the intermediation sector. The results are consistent with the idea that higher inequality generates an increase in the amount of savings to intermediate by financial intermediaries.

Table 5b looks at the feedback mechanism – and the identifying mechanism for the feedback effect itself. As predicted in the model, an increase in the credit sector generates higher

Table 5a: Regression results for the effects of inequality on total loans issuance for a host of 18 economies over the period 1974-2019

	Total loans							
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Top 5 income share	0.593***	0.356***	0.309**	0.315**	0.663***	0.414***	0.359***	0.336**
(*LR effect*)	(0.167)	(0.134)	(0.130)	(0.135)	(0.189)	(0.138)	(0.136)	(0.138)
Top 5 income share ×					-0.348	-0.306	-0.260	-0.117
Mkt-based dummy (*LR*)					(0.311)	(0.285)	(0.283)	(0.254)
Time fixed effect	✓	✓	✓	✓	✓	✓	✓	✓
Domestic controls		✓	✓	✓		✓	✓	✓
Globalization controls			✓	✓			✓	✓
USA excluded				✓				✓
R^2	0.588	0.636	0.649	0.650	0.591	0.637	0.650	0.650
Countries/Obs.	18/674	18/674	18/670	17/621	18/674	18/674	18/670	17/621

Note: The long run effect, θ, is estimated as: $\theta = \sum_{s=2}^{5} \beta_s/(1-\beta_1)$. See Chapter 6 of Pesaran (2015). The top 5 per cent income share is the pre-tax national income of adults (households evaluated as equal-split), and retrieved from the World Inequality Database following the distributional national accounts (variable code: *sptinc992j*). The post-tax and transfers measure would result in the loss of most observations for most countries; hence, it has been avoided on small sample size grounds. The market-based bank dummy equals one for: Australia, Canada, Switzerland, the Netherlands, the United Kingdom, and the United States. The remaining countries are: Belgium, Denmark, Finland, France, Germany, Ireland, Italy, Japan, Norway, Portugal, Spain, Sweden. Domestic controls include: old dependency ratio rate of change, gross domestic product growth, population growth, money supply growth, government expenditures rate of change, and inflation. Globalization controls include the rate of change of: trade balance, and debt liabilities constructed by Milesi-Ferretti (2022). Debt liabilities include the sum of the stocks of portfolio debt liabilities and other investment liabilities in the hands of nonresidents. All variables are at annual frequency, and taken in real terms after deflating for inflation. All the domestic and trade controls are retrieved from Jordà, Schularick, and Taylor (2017). $^{***}p < 0.01,^{**} p < 0.05,^{*} p < 0.1$. Standard errors are clustered at country level.

inequality only if these securities can be continuously priced, and thus appreciate and generate a wealth effect for its owners. The results are in line with such prediction. On average, when pooling all countries together there is no feedback mechanism. In this respect, this is similar to what most literature has found: the causality link from finance to inequality is elusive at best. See Demirgüç-Kunt and Levine (2009). However, when interacting the credit variable with the dummy variable capturing the market-based banking structure, results become strongly significant and extremely stable across specifications. A result that corroborates the theoretical prediction, and that may be further tested in the future by the literature.

Table 5b: Regression results for the effects of total loans on inequality for a host of 18 economies over the period 1974-2019

	Top 5 income share							
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Total loans (*LR effect*)	-0.071* (0.040)	-0.029 (0.032)	-0.027 (0.033)	-0.032 (0.034)	-0.116*** (0.040)	-0.065* (0.055)	-0.065* (0.036)	-0.064* (0.036)
Total loans $\times$ Mkt-based dummy (*LR*)					0.200*** (0.055)	0.150*** (0.049)	0.138*** (0.051)	0.132*** (0.051)
Time fixed effect	✓	✓	✓	✓	✓	✓	✓	✓
Domestic controls		✓	✓	✓		✓	✓	✓
Globalization controls			✓	✓			✓	✓
USA excluded				✓				✓
R^2	0.185	0.263	0.272	0.274	0.215	0.290	0.299	0.302
Countries/Obs.	18/732	18/732	18/728	17/679	18/732	18/732	18/728	17/679

Note: See notes in Table 5a.

7 Concluding remarks

In this paper, I bring back to the fore the question about what generated the massive increase in the financial sector intermediation that has occurred in the United States from the early 1980s. I claim that the growth in size needs to be understood in conjunction with the endogenous rise of the shadow banking sector.

The paper claims that the rise in inequality observed over the same period may be responsible for such increase, and studies such relationship when the production technology of the economy changes. The paper builds the first connection, to my knowledge, between a change in the technological structure and a change in the size and composition of the financial sector. In the theoretical mechanism, a rise in the capital share generates higher inequality that accounts not only for the phenomena aforementioned but also for parallel macro-financial trends: Lower interest rates, higher households indebtedness, and higher leverage in the system. The model features also a feedback effect that goes from higher asset prices valuations to higher wealth inequality.

The stylized facts provide descriptive evidence of such joint behaviors. In this respect, the levels of correlation seem to be particularly high and persistent in the very long run except for periods of structural change such as Bretton Woods.

With that in hand, I build a macro-finance model in which a rise in the share of income and wealth held by the top 5 per cent share of the population generates an increase in the funds to invest and allocate across both risky and safe assets. When safe assets are not abundant, precautionary motives lead to compressed real interest rates. A low interest rate environment decreases the costs of issuing debt, thus, facilitating higher indebtedness of the workers. In this scenario, financial intermediaries can step in to manufacture privately-produced safe assets that the government is not able to supply.

Quantitatively, I study the rise of inequality as resulting merely from a change in the technological structure of the economy, and look at how far the results can go. Through the lenses of the model, the rise of the capital share accounts only for a fraction of the overall rise in inequality (20 per cent), but it is still able to explain more than 70 per cent of the overall growth of finance. The model can explain up to 40 per cent of the decline in real interest rates. A broader set of structural changes in the economy consistent with the full rise of inequality (such as college premium) may lead to much stronger results.

Finally, the empirical section corroborates both the long-run co-variability between inequality and finance in the post-1970s world, and the importance of the market-based mechanisms to induce or dampen the effect of inequality on credit production.

Although the paper is not structured to delve into welfare analyses of the problem at stake, the good news arising from it is that there is room for policy to potentially affect the macroeconomic consequences of banking and its feedback effects.

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Appendix to

Inequality and the Rise of Finance

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April 3, 2024

The Appendix is structured as follows. Section A.1 describes additional stylized facts to complete the picture provided in the main body of the paper. Sections A.2 and A.3 provide model's proofs, a full-fledged characterization of the equilibrium conditions, and the computation strategy description. Section A.4 describes additional results. Details on data sources and construction can be found in Section A.5.

A.1 Additional facts

Figure A.1 shows that the share of U.S. Treasuries owned domestically vs. by the rest of the world. The latter component has surged spectacularly from the mid-1990s – when it was below 20 per cent – until the Great Financial Crisis (*GFC*) of 2010, when it reached a peak of over 40 per cent. In more recent times, this has partially reverted to fall back in a range of about 30 per cent.

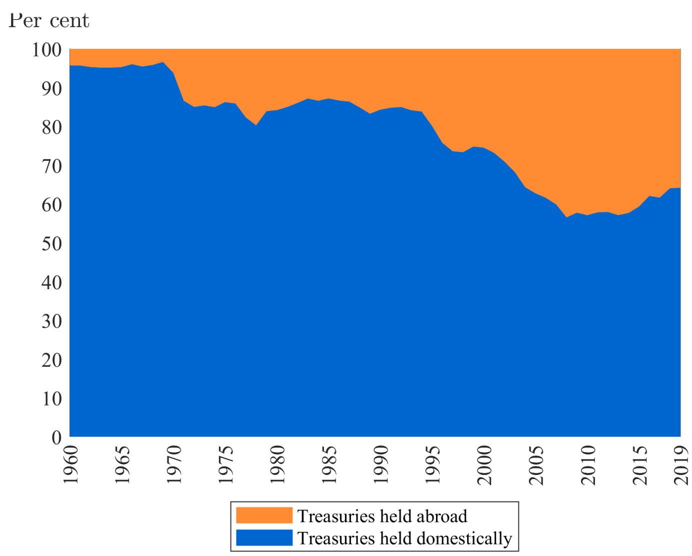
Figure A.2 shows that the increase of market-based banking with respect to the traditional banking system is strictly correlated with the increase of private safe assets production with respect to traditional banking safe assets. The correlation between the two series is 97 per cent.

Figure A.3 plots the increase in inequality vis-à-vis the portfolio share of U.S. households invested with to institutional investors. As inequality increases, the portfolio share directed to asset managers has similarly increased.

Figure A.4 plots the relationship between the top 5 percent income share and the credit to GDP for 18 economies over a period from 1970-2019. The plot is presented for each data point, and presented in a quantile fashion to reduce the visual burden. Each dot represents 5 per cent of observations. The relationship seems to be quite strong across geographies and over time.

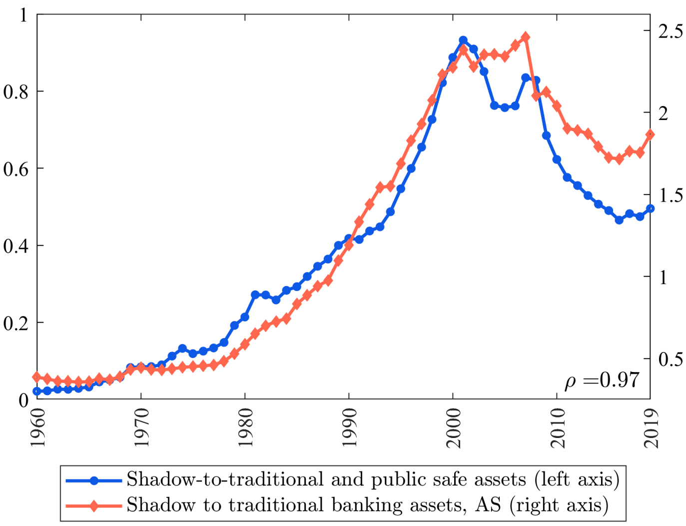
Figure A.5 plots the income volatility process using the data by Guvenen, Pistaferri, and Violante (2022). The level is particularly high for the very top quantile of the distribution.

Figure A.1: Share of U.S. Treasuries held domestically vis-à-vis abroad over the period 1970–2019



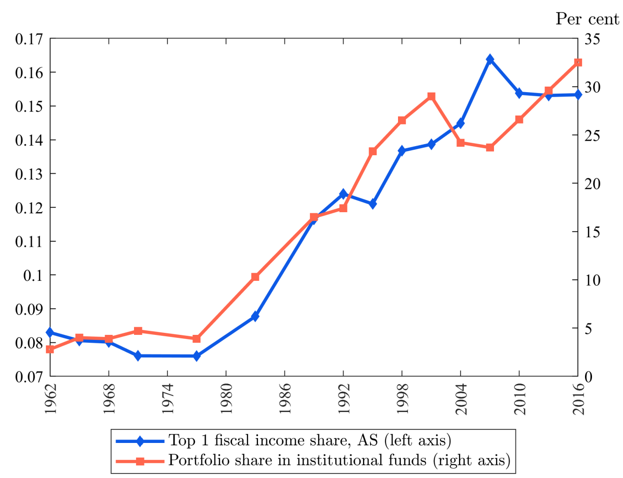
Notes: See Tables A.5 and A.6 in Section A.5 of the appendix for details on the variables sources and construction.

Figure A.2: Domestically-held private safe assets as a share of domestically-held public safe assets, and shadow banking sector as a share of traditional banking sector in the United States over the period 1950-2019



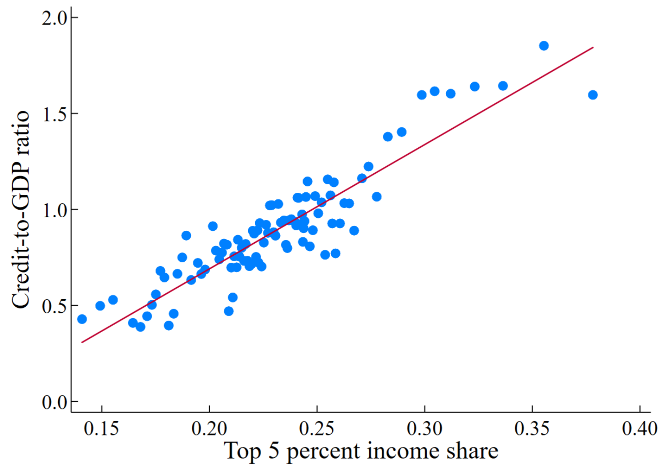
Notes: The private safe assets are composed of: market mutual funds, commercial paper, and RePos. The public safe assets are composed of: Treasuries, checking, and savings and time deposits. Both aggregates refer to domestically held claims. See Tables A.5 and A.6 in Section A.5 of the appendix for details on the variables sources and construction.

Figure A.3: Top 1 percent share of the income distribution and households' portfolio share invested in institutional investors in the United States over the period 1971-2019



Notes: The portfolio share in institutional funds mimics the one built by Jordà et al. (2019). *Sources*: Data on inequality are retrieved from the online appendix of Auten and Splinter (2024). Data on households' portfolio shares are from the extended Survey of Consumer Finances (SCF+). See Tables A.5 and A.6 in Section A.5 of the Appendix for details on the variables sources and construction.

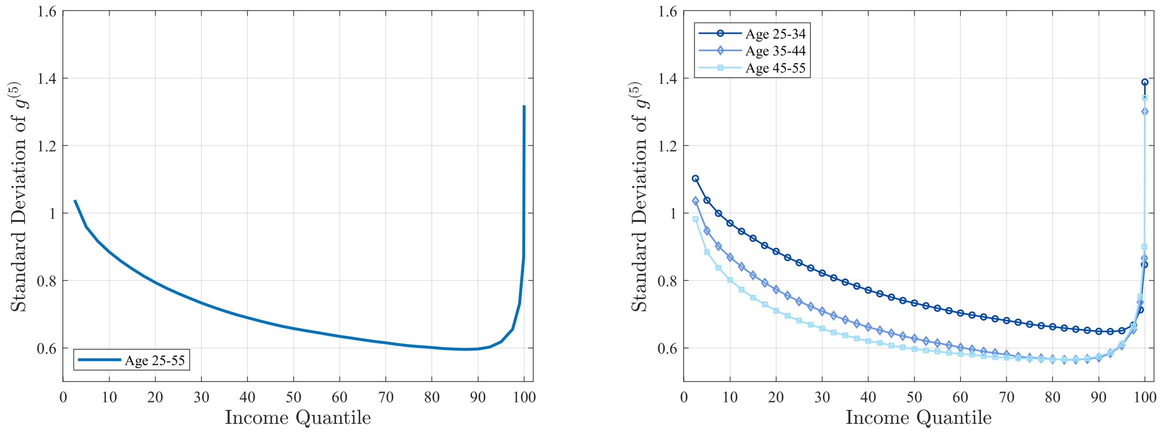
Figure A.4: Quantile plot showing the correlation between top 5 per cent share of the income distribution and credit to GDP (in logs) for 18 economies over the period 1970-2019



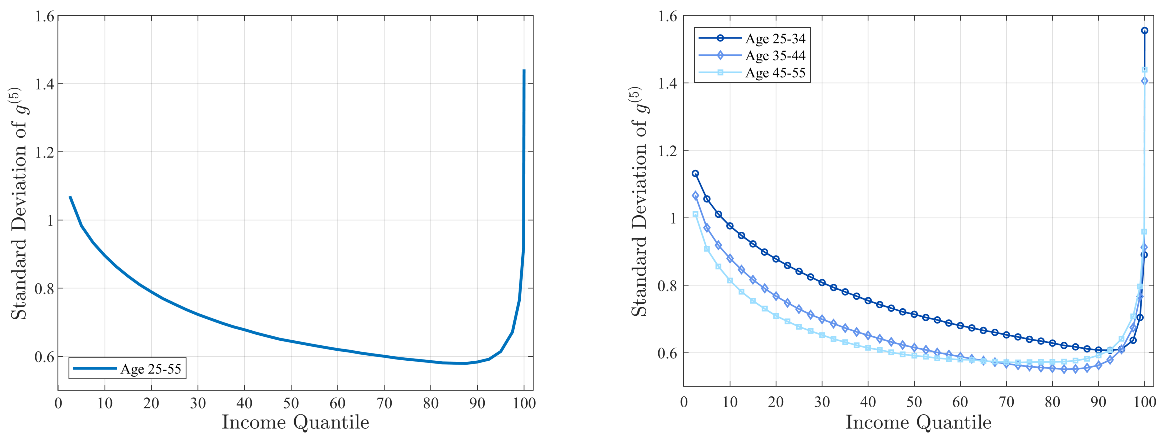
Notes: Each dot represents a bin of one per cent across all the inequality-credit pairs. The line of best fit is constructed as the correlation between all the credit and inequality pairs in the panel. *Sources*: Credit data is obtained from the Bank of International Settlements. See Table A.5 in Section A.5 of the appendix for details on the variables sources.

Figure A.5: Income volatility by income level in the United States across quantiles over the period 1998-2019

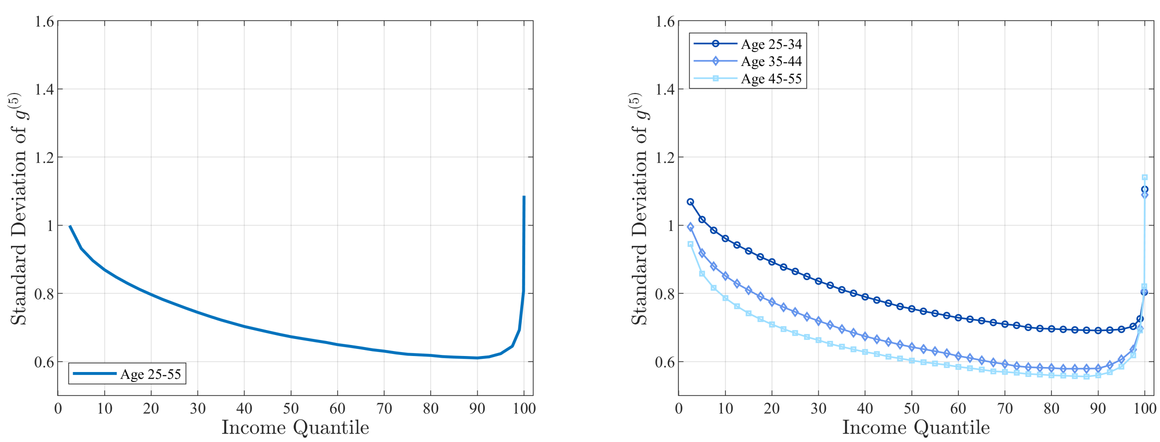
Panel A: Total population across genders



Panel B: Male population



Panel C: Female population



Source: Guvenen, Pistaferri, and Violante (2022). *Notes:* See the cited paper for variables description and construction.

A.2 Model derivations

Equilibrium definition. A sequential market equilibrium for the economy presented in Section 3 of the paper is a set of prices $\{p_{Kt}, q_{Bt}, q_{Mt}, q_{Lt}, d_t, w_t\}_{t=0}^{\infty}$ and quantities $\{c_t^{(I)}, k_t^{(I)}, b_t^{(I)}, m_t^{(I)}, l_t, c_t^{(P)}, \phi_{1t}, \phi_{2t}\}_{t=0}^{\infty}$ such that:

1. Investors maximize their utility and the returns on their portfolio according to Problem ($\mathscr{P}_I$) at the optimal prices.

2. Workers maximize their utility according to Problem ($\mathscr{P}_W$) at the optimal prices.

3. Firms are price-takers and statically maximize their profits from Problem ($\mathscr{P}_F$) given optimal factor prices d_t^*, w_t^*.

4. Price-taker financial intermediaries transform debt into safe assets according to a linear technology $l_t = m_t$, at optimal prices $q_{Lt}^* = q_{Mt}^*$.

5. The Government budget constraint holds with equality in each period at the optimal price q_{Bt}^*, subject to a constraint $\bar{b}$.

6. Markets for goods, risky capital, safe assets, quasi-safe assets, and labor clear.

Optimality conditions. The model features aggregation (Angeletos, 2007), therefore the overall amount of assets for each agent, $A_{it} = (p_{Kt}(1+\epsilon_{it}) + d_t)\, k_{it} + b_{it} + \chi_{it}^M m_{it}$, is a sufficient state variable. Log preferences ensure that consumption is a constant fraction $(1-\beta)$ of income. The overall policy function for savings is therefore βA_{it}, which one can segment according to three different shares — one for each of the financial assets. It follows that investors' policy functions are:

$$c_{it}^{(I)} = (1-\beta)A_{it} \tag{A.1}$$

$$q_{Bt}b_{i,t+1}^{(I)} = \beta\phi_{1t}A_{it} \tag{A.2}$$

$$
\begin{aligned}
q_{Mt} m^{(I)}_{i,t+1} &= \beta \phi_{2t} A_{it} && \text{(A.3)} \\
p_{Kt} k^{(I)}_{i,t+1} &= \beta (1 - \phi_{1t} - \phi_{2t}) A_{it} && \text{(A.4)}
\end{aligned}
$$

By taking the FOCs of the Problem ($\mathscr{P}_I$) with respect to $c^{(I)}_{it}$ and $b^{(I)}_{i,t+1}$, the Euler Equation of Investors pinning down the marginal decisions between intertemporal consumption and safe bonds can be written as:

$$
q_{Bt} = \beta \mathbb{E}_t \left[\frac{c^{(I)}_{it}}{c^{(I)}_{i,t+1}} \right] \tag{A.5}
$$

Substitute Equation (A.1) twice in (A.5) and obtain:

$$
q_{Bt} = \beta \mathbb{E}_t \left[\frac{\cancel{(1-\beta)} A^{(I)}_{it}}{\cancel{(1-\beta)} A^{(I)}_{i,t+1}} \right]
$$

Use the definition of $A^{(I)}_{is} = (p_{Ks}(1 + \epsilon_{is}) + d_s) k_{is} + b_{is} + \chi^M_{is} m_{is}$ for $s = t + 1$, and plug back in the previous equation.

$$
q_{Bt} = \beta \mathbb{E}_t \left[\frac{A^{(I)}_{it}}{(p_{K,t+1}(1 + \epsilon_{i,t+1}) + d_{t+1}) k_{i,t+1} + b_{i,t+1} + \chi^M_{i,t+1} m_{i,t+1}} \right] \tag{A.6}
$$

Substitute the policy functions analytic forms in (A.2), (A.3), (A.4) and Equation (A.6) to obtain:

$$
\begin{aligned}
q_{Bt} &= \cancel{\beta} \mathbb{E}_t \left[\frac{\cancel{A_{it}}}{(p_{K,t+1}(1+\epsilon_{i,t+1}) + d_{t+1}) \cancel{\beta A_{it}} \frac{(1-\phi_{1t}-\phi_{2t})}{p_{Kt}} + \cancel{\beta A_{it}} \frac{\phi_{1t}}{q_{Bt}} + \cancel{\beta A_{it}} \frac{\phi_{2t}}{q_{Mt}} \chi^M_{i,t+1}} \right] \\
q_{Bt} &= \mathbb{E}_t \left[\frac{1}{\phi_{1t} R_{Bt} + \phi_{2t} R_{Mt} + (1-\phi_{1t}-\phi_{2t}) R_{t+1}} \right] \\
1 &= \mathbb{E}_t \left[\frac{R_{Bt}}{\phi_{1t} R_{Bt} + \phi_{2t} R_{Mt} + (1-\phi_{1t}-\phi_{2t}) R_{t+1}} \right] && \text{(A.7)}
\end{aligned}
$$

where $R_{Bt} = 1/q_{Bt},\ R_{Mt} = \chi^M_{it}/q_{Bt}$, and $R_{t+1} = [p_{K,t+1}(1 + \epsilon_{i,t+1}) + d_{t+1}]/p_{Kt}$.

Similarly, by taking the FOCs with respect to consumption and quasi-safe assets ($m_{i,t+1}$), it is possible to write the implicit optimal condition for ϕ_{2t}:

$$1 \quad = \quad \mathbb{E}_t\left[\frac{R_{Mt}}{\phi_{1t}R_{Bt}+\phi_{2t}R_{Mt}+(1-\phi_{1t}-\phi_{2t})R_{t+1}}\right] \tag{A.8}$$

□

The optimal condition for the workers is:

$$q_{Lt} = \beta\frac{u'(c_{t+1}^{(W)})}{u'(c_t^{(W)})}(1-\underline{L}+\lambda l_{t+1}) \tag{A.9}$$

Market Clearing Conditions.

$$b_{t+1} = \bar{b} \quad \forall t \tag{A.10}$$

$$l_{t+1} = m_{t+1} \iff q_{Mt} = q_{Lt} \quad \forall t \tag{A.11}$$

$$k_{t+1} = 1 \quad \forall t \tag{A.12}$$

$$L_t = 1 \quad \forall t \tag{A.13}$$

The price of consumption is taken as numéraire.

Proof of Lemma 2.

The law of motion for the assets distribution follows from the definition of assets for the economy:

$$A_{it} \triangleq (p_t(1+\epsilon_{it})+d_t)k_{it}+b_{it}++\chi_{it}^{M}m_{it} \qquad \forall t$$
$$\Rightarrow A_{i,t+1} = \left(p_{t+1}(1+\epsilon_{i,t+1})+d_{t+1}\right)k_{i,t+1}+b_{i,t+1}+\chi_{i,t+1}^{M}m_{i,t+1}$$

By re-arranging and plugging the policy functions into the previous equation, we can re-write it as:

$$\begin{aligned} A_{i,t+1} &= (p_{K,t+1}(1+\epsilon_{i,t+1})+d_{t+1})\frac{\beta A_{it}(1-\phi_{1t}-\phi_{2t})}{p_{Kt}} + \frac{1}{q_{Bt}}\phi_{1t}\beta A_{it} + \frac{\chi^M_{i,t+1}}{q_{Mt}}\phi_{2t}\beta A_{it} \\ &= \beta A_{it}\left[(1-\phi_{1t}-\phi_{2t})R_{i,t+1} + \phi_{1t}R^B_{t+1} + \phi_{2t}R^M_{i,t+1}\right] \end{aligned} \tag{A.14}$$

□

A.3 Numerical solution

The model features "aggregation", therefore the income distribution is not a relevant variable to pin down the equilibrium prices and quantities. I can proceed then to solve numerically in two parts. First, I compute the steady state abstracting from the income distribution of agents. In this case, I solve a system of non-linear equations around the steady state. The system is composed by the policy functions (A.1)-(A.4), the optimal conditions for portfolio shares (A.7) and (A.8), the Euler equation (A.9) and the budget constraint for the workers problem, and the market clearing conditions (A.10)-(A.12), which can be solved for $\{c_t^{(P)}, \phi_{1t}, \phi_{2t}, p_{Kt}, k_{t+1}, q_{Mt}, m_{t+1}, q_{Bt}, b_{t+1}, q_{Lt}, l_{t+1}\}$.

With that in hand, I use the steady state values for $\{p^*_{Kt}, q^*_{Mt}, q^*_{Bt}, \phi^*_{1t}, \phi^*_{2t}\}$, and plug them in the law of motion in Equation (A.14) to solve for the ergodic income distribution.[1] The algorithm to find the distribution proceeds according to the following steps:

- Guess an initial asset distribution, $\widetilde{M}_t$, over a grid, $\tilde{A}_t$, with an arbitrarily small bin size, $\tilde{\mu}$.

  Let the grid lower bound be a scalar $\underline{A} > 0$ arbitrarily close to zero for all t. Choose an upper bound for the grid $\bar{A}_t$ large enough to include at least the true total income of the economy, A^*, computed before.

  Let $\tilde{m}_t$ be the initial distribution mass for a bin located on the grid point $\tilde{a}_{mt} \in \tilde{A}_t$ such that $\sum_{\tilde{m}=1}^{\overline{M}_t} \tilde{m}_t = 1 \; \forall t$.

[1] Such procedure is isomorphic, yet computationally faster, than the contemporaneous solution for the distribution and the steady state variables.

- Let every bin, $\tilde{m}_t$, be hit by idiosyncratic shocks, $\epsilon_{i,t+1},\ i \in \{1, 2, \ldots I\}$. Compute the new asset values $\tilde{a}_{i,m,t+1}$ for each $\tilde{m}_t$ (originally located in position $\tilde{a}_{i,m,t}$) using the assets law of motion in (A.14).

- Allocate each shock realization on the new grid $\tilde{A}_{t+1}$. To do so, assume $\epsilon \sim U[\underline{\epsilon}, \bar{\epsilon}]$, then each shock realization will carry a weight $1/I$ to be multiplied by the original probability mass, $\tilde{m}_t$, associated with each grid point, $\tilde{a}_{mt}$. In other words, each shock realization moves a mass m_t/I.

  - If $\tilde{a}_{i,m',t+1} < \underline{A}$, then allocate all of the distribution weight carried by the realization, m_t/I, to the first point on the grid, $\underline{A}$.
  - If $\underline{A} < \tilde{a}_{i,m',t+1} < \bar{A}_t$, then allocate a part, ω, of the weight, m_t/I, to the grid point $\tilde{a}_{m',t+1}$ and $(1-\omega)$ to $\tilde{a}_{m'+1,t+1}$ according the their distance from the grid points $\omega = 1 - (\tilde{a}_{i,m',t+1} - \tilde{a}_{m',t+1})/\mu$. In this way, each original weight is split according to the linear distance between the two most adjacent grid points.[2]
  - If $\tilde{a}_{i,m',t+1} > \bar{A}_t$, then add new grid points to the previous grid, $\tilde{A}_t$ to form a new grid $\tilde{A}_{t+1}$. The number of new points to add depends on how far away the top realizations fall with respect to $\bar{A}_t$: $(\tilde{a}_{i,m',t+1} - \bar{A}_t)/\mu$ gives the number of grid points to add. Compute the specific weights ω for each bin between the new adjacent grid points according to the procedure illustrated above.

- Sum all probability masses, $m_{i,t+1}$, for each new grid point, $a_{m,t+1}$ on the new grid $\tilde{A}_{t+1}$ to achieve a new distribution $\widetilde{M}_{t+1}$.

- Remove a fraction $(1-\delta)$ from each bin to account for the survival rate δ.

- Re-allocate the fraction of population $(1-\delta)$ to the individuals with average value on the grid to ensure that no income destruction occurs.

[2]To be sure, the "point of departure" on the initial grid $\tilde{a}_{m,t}$ is not necessarily the same as the "point of arrival" in the new grid $\tilde{a}_{m',t+1}$.

  - If the average income value falls between two grid points, allocate them with a weight that is proportional to the distance to their closest point — as explained above.

- Check if the new and the old distribution coincide up to an arbitrarily small scalar: $\widetilde{M}_t \approx \widetilde{M}_{t+1}$.
  - If not, impose $\widetilde{M}_t = \widetilde{M}_{t+1}$, and start the loop over.
  - Else, convergence has been reached. The sought-after stationary distribution has been found.

- Make sure that the total level of income for the economy corresponds to the true value: $\widetilde{M} * \tilde{A} = A^*$. If not, change the initial distribution guess $\tilde{A}_t$, and start over.

- Repeat by refining the grid to make sure the result is robust.

In other words, to find the stationary distribution I guess an initial distribution for the equilibrium values, and I subsequently operate an asymmetric grid expansion (for the right tail) until equilibrium is found. The grid expansion is asymmetric because – on the one hand – Inada conditions prevent agents from consuming negative amounts; therefore, even agents with a complete streak of negative shock realizations will be able to obtain a strictly positive asset level albeit arbitrarily close to zero. On the other hand, lucky agents with a complete streak of positive income shocks may become arbitrarily rich *ex-post*. To avoid the distribution from depending excessively on the last bin of rich lucky agents, the expanding distribution spreads the lucky agents over new bins according to their income level. In this way, agents are appropriately allocated to their actual income rather than be approximated by an arbitrary last bin of an otherwise fixed grid. The initial guess of the distribution can be slightly changed to begin with in order to make sure that the overall income of the economy corresponds to the steady state levels. However, robustness checks have proved that the sensitivity to such changes is very low.

A.4 Empirical robustness checks

In order to provide further evidence to the empirical results in a panel setting showed in Tables 5a and 5b allowing for the Arellano-Bond correction method to be taken into account.

$$\Delta y_{it} = \delta \Delta y_{i,t-1} + \sum_{s=2}^{5} \beta_s \Delta x_{i,t-s} + \beta_{0,i} + \kappa_t + \gamma' X_{it} + \epsilon_{it}, \tag{A.15}$$

$$\Delta y_{it} = \delta \Delta y_{i,t-1} + \sum_{s=2}^{5} \beta_s \Delta x_{i,t-s} + \sum_{s=2}^{5} \beta_s \Delta x_{i,t-s} \mathbb{1}(i \in A) + \beta_{0,i} + \kappa_t + \gamma' X_{it} + \epsilon_{it} \tag{A.16}$$

Given that the panel is dynamic, it is important to carry out an additional robustness check to check that nuisance parameters do not affect the estimates. The results are provided in Tables A.1 and A.2. The tables show that the long-run coefficients are the just as large as the ones found in the body of the paper for the direct channel (around 0.29). Furthermore, the inclusion of the market based dummy variable is not important. The short-run effects are about half the magnitude of the long-run effects (0.15) – consistent with the idea that it may take time to fully manifest – and sometimes less precise than the long-run counterparts.

About the feedback effects, the results are again not true in general. More credit activity does not seem to lead to more inequality, unless a dummy accounting for the market-based system and the pricing effects of asset valuation is included.

In light of the potential bias arising from the auto-regressive component in a panel setting, I repeat the analysis with the Arellano-Bond estimator in Tables A.3 and A.4. Results are consistent therefore the bias tends to zero rapidly enough.

Table A.1: Regression results for the short- and long-run effects of inequality on total loans for a host of 18 economies over the period 1970-2019

	Total loans							
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Top 5 income share	0.593***	0.344***	0.283**	0.293**	0.638***	0.389***	0.319**	0.296**
(*Long run effect*)	(0.167)	(0.131)	(0.123)	(0.134)	(0.185)	(0.140)	(0.135)	(0.138)
Top 5 income share ×					-0.295	-0.292	-0.237	-0.018
Mkt-based dummy (*Long run*)					(0.401)	(0.375)	(0.392)	(0.329)
Top 5 income share	0.242***	0.157**	0.133*	0.139*	0.258***	0.176**	0.150**	0.140*
(*Short run effect*)	(0.076)	(0.068)	(0.065)	(0.070)	(0.078)	(0.071)	(0.068)	(0.071)
Top 5 income share ×					-0.119	-0.132	-0.111	-0.008
Mkt-based dummy (*Short run*)					(0.154)	(0.166)	(0.180)	(0.156)
Time fixed effect	✓	✓	✓	✓	✓	✓	✓	✓
Domestic controls		✓	✓	✓		✓	✓	✓
Globalization controls			✓	✓			✓	✓
USA excluded				✓				✓
R^2	0.588	0.637	0.641	0.642	0.591	0.638	0.643	0.643
Countries/Obs.	18/674	18/673	18/669	17/620	18/674	18/673	18/669	17/620

Table A.2: Regression results for the short- and long-run effects of total loans on inequality for a host of 18 economies over the period 1970-2019

	Top 5 income share							
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Total loans	-0.071*	-0.039	-0.042	-0.049	-0.112***	-0.075**	-0.076**	-0.076**
(*Long run effect*)	(0.040)	(0.036)	(0.037)	(0.039)	(0.038)	(0.051)	(0.037)	(0.038)
Total loans ×					0.228***	0.204***	0.183***	0.187***
Mkt-based dummy (*Long run*)					(0.051)	(0.042)	(0.044)	(0.043)
Total loans	-0.074*	-0.041	-0.045	-0.052	-0.117***	-0.081**	-0.083**	-0.082*
(*Short run effect*)	(0.040)	(0.037)	(0.039)	(0.041)	(0.039)	(0.038)	(0.039)	(0.040)
Total loans ×					0.239***	0.221***	0.199***	0.202***
Mkt-based dummy (*Short run*)					(0.050)	(0.041)	(0.044)	(0.043)
Time fixed effect	✓	✓	✓	✓	✓	✓	✓	✓
Domestic controls		✓	✓	✓		✓	✓	✓
Globalization controls			✓	✓			✓	✓
USA excluded				✓				✓
R^2	0.185	0.213	0.237	0.238	0.214	0.243	0.267	0.271
Countries/Obs.	18/732	18/731	18/727	17/678	18/732	18/731	18/727	17/678

Table A.3: Regression results for the short- and long-run effects of inequality on total loans using the Arellano-Bond estimator for a host of 18 economies over the period 1970-2019

	Total loans							
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Top 5 income share (*Long run effect*)	0.593*** (0.156)	0.344*** (0.122)	0.283** (0.114)	0.293** (0.124)	0.638*** (0.172)	0.389*** (0.129)	0.319** (0.125)	0.296** (0.127)
Top 5 income share × Mkt-based dummy (*Long run*)					-0.295 (0.372)	-0.292 (0.347)	-0.237 (0.362)	-0.018 (0.302)
Top 5 income share (*Short run effect*)	0.242*** (0.071)	0.157** (0.063)	0.133** (0.060)	0.139** (0.065)	0.258*** (0.072)	0.176*** (0.066)	0.150** (0.063)	0.140** (0.065)
Top 5 income share × Mkt-based dummy (*Short run*)					-0.119 (0.143)	-0.132 (0.153)	-0.111 (0.166)	-0.008 (0.143)
Time fixed effect	✓	✓	✓	✓	✓	✓	✓	✓
Domestic controls		✓	✓	✓		✓	✓	✓
Globalization controls			✓	✓			✓	✓
USA excluded				✓				✓
R^2	0.588	0.637	0.641	0.642	0.591	0.638	0.643	0.643
Countries/Obs.	18/656	18/655	18/651	17/603	18/656	18/655	18/651	17/603

Table A.4: Regression results for the short- and long-run effects of total loans on inequality using the Arellano-Bond estimator for a host of 18 economies over the period 1970-2019

	Top 5 income share							
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Total loans (*Long run effect*)	-0.077** (0.039	-0.042 (0.036	-0.044 (0.037	-0.051 (0.039	-0.114*** (0.039	-0.078** (0.060	-0.077** (0.038	-0.077* (0.039
Total loans × Mkt-based dummy (*Long run*)					0.232*** (0.060	0.213*** (0.047	0.192*** (0.048	0.202*** (0.047
Total loans (*Short run effect*)	-0.080** (0.040	-0.045 (0.038	-0.047 (0.039	-0.055 (0.041	-0.120*** (0.040	-0.084** (0.040	-0.084** (0.040	-0.083** (0.041
Total loans × Mkt-based dummy (*Short run*)					0.243*** (0.059	0.230*** (0.046	0.208*** (0.048	0.218*** (0.046
Time fixed effect	✓	✓	✓	✓	✓	✓	✓	✓
Domestic controls		✓	✓	✓		✓	✓	✓
Globalization controls			✓	✓			✓	✓
USA excluded				✓				✓
R^2	0.185	0.213	0.237	0.238	0.214	0.243	0.267	0.271
Countries/Obs.	18/732	18/731	18/727	17/678	18/732	18/731	18/727	17/678

A.5 Data sources and construction

Idiosyncratic volatility. To compute the idiosyncratic risk on capital used in the calibration exercise, I use CRSP data on returns of stocks listed on the New York Stock Exchange (NYSE), the Nasdaq, and the American Stock Exchange (AMEX) over the period 1970-2019. Furthermore, by following the approach by Fu (2009), I retrieve data on Fama-French 3 market factors from Professor French website.

The steps of the procedure can be described as follows:

1. Retrieve stock returns from CRSP data for the stock exchanges listed above at *daily* frequency.

2. Retrieve daily data on T-bills and Fama-French 3 market factors — Equity premium, High-minus-Low (*HML*), Small-minus-Large (*SML*) —, and merge the data sets.

3. Run the following cross-section regressions at monthly frequency for all the trading days available:

$$R_{idm} - R^f_{dm} = \beta_{0i} + \beta_{1i}(R^M_{dm} - R^f_{dm}) + \beta_{2i}HML_{dm} + \beta_{3i}SML_{dm} + \epsilon_{idm} \quad \forall i, m$$

   where $i = 1, \ldots, N$ identifies the firm, and $d = 1, \ldots, D$ identifies the day of the month $m = 1, \ldots, M$. Compute and store the residuals $\hat{\epsilon}_{idm}$.

4. Compute the daily standard deviation, $\hat{\sigma}_{idm}$, of $\hat{\epsilon}_{idm} \ \ \forall i, m$, and transform it into monthly volatility ($\hat{\sigma}_{im}$) by multiplying it for the square root of the firm-specific number of trading days in the month, D_{im}.

5. Average the monthly volatility across firms for each month: $\hat{\sigma}_m = \sum_{i=1}^{N} \hat{\sigma}_{im}$.

6. To find the idiosyncratic volatility over a period of time such as the steady states 1970-1979 and 2010-2019, annualize the monthly volatility ($\hat{\sigma}_y = \sqrt{12}\hat{\sigma}_m$), and average the volatility over time for the horizon of interest.

Table A.5: Variables description and sources

Variable	*Variable details*	*Source*
Bottom 90 percent income share	1- US Top 10 post-tax national income share, equal split ("sdiinc992jUS")	World Inequality Database
Capital income share	1-labor income share	NIPA, Table 2
Consumer price index	Consumer Price Index: Total All Items for the United States, Index 2015=100, Annual, Seasonally Adjusted	Organization for Economic Co-operation and Development
Credit (developed economies)	Credit to Private non-financial sector from all sectors at market value, Domestic currency - Adjusted for breaks	Bank of International Settlements
Debt liabilities (developed economies)	Sum of the stocks of portfolio debt liabilities and other investment liabilities, nonresident	Milesi-Ferretti (2022)
Financial sector, total financial assets	Domestic Financial Sectors; Total Financial Assets, Level, Millions of Dollars, Annual, Not Seasonally Adjusted (FBTFASA027N)	Federal Reserve Board, Financial Accounts of the US - Z.1 Tables
Financial sector, total financial assets domestically-held	See variable construction	Federal Reserve Board, Financial Accounts of the US - Z.1 Tables
Financial sector, total financial assets held abroad	See variable construction	Federal Reserve Board, Financial Accounts of the US - Z.1 Tables
Government spending (developed economies)	Government expenditure (nominal, local currency)	Macrohistory database by Jordà et al. (2019)
GDP, nominal (developed economies)	Gross Domestic Product in current LCU (NY.GDP.MKTP.CN)	World Bank
GDP, nominal (U.S.)	Gross Domestic Product, Billions of Dollars, Annual, Not Seasonally Adjusted	IMF through FRED
Idiosyncratic volatility	Stock prices idiosyncratic volatility	CRSP

Income volatility by quantile	Earnings income volatility with respect to permanent income component	GRID dataset by Guvenen, Pistaferri, and Violante (2022)
Interest rates, nominal (AAA corporate bond yields)	Moody's Seasoned Aaa Corporate Bond Yield, Percent, Monthly, Not Seasonally Adjusted	Moody's through FRED
Interest rates, nominal (Treasuries)	Market Yield on U.S. Treasury Securities at 10-Year Constant Maturity, Quoted on an Investment Basis, Percent, Annual, Not Seasonally Adjusted	Federal Reserve Board, Financial Accounts of the US - H.15 Tables
Labor income share	Compensation employees / (Personal Income + Subsidies - Taxes). See variable construction	NIPA, Table 2
Loans (developed economies)	Total loans in local currency unit	Macrohistory database by Jordà et al. (2019)
Money supply (developed economies)	Broad money (nominal, local currency)	Macrohistory database by Jordà et al. (2019)
Old dependency ratio (developed economies)	Age dependency ratio, old (% of working-age population). Variable code: SP.POP.DPND.OL	World Bank
Population (developed economies)	Total national population	Macrohistory database by Jordà et al. (2019)
Portfolio share in institutional funds	Household balance sheet composition in the US. Agricultural land, pension, insurance and investment fund claims.	Survey of Consumer Finances (SCF+) through Jordà et al. (2019)
Quality-adjusted finance output in levels	Stock of outstanding intermediated assets adjusted for quality (*fin all ck*)	Philippon (2015), online appendix
Safe assets, domestically-held	Safe assets, total financial assets - safe assets held abroad	Federal Reserve Board, Financial Accounts of the US - Z.1 Tables
Safe assets, held abroad	See variable construction table	Federal Reserve Board, Financial Accounts of the US - Z.1 Tables

Safe assets, total financial assets	See variable construction table	Federal Reserve Board, Financial Accounts of the US - Z.1 Tables
Safe assets, public and traditional banking domestically-held	See variable construction table	Federal Reserve Board, Financial Accounts of the US - Z.1 Tables
Safe assets, shadow banking domestically-held	See variable construction table	Federal Reserve Board, Financial Accounts of the US - Z.1 Tables
Shadow banking, total financial assets	See variable construction table	Federal Reserve Board, Financial Accounts of the US - Z.1 Tables
Top 1 per cent fiscal income, AS	Top 1 per cent fiscal income share, set income groups by size-adjusted income and number of individuals	Auten and Splinter (2024), online appendix
Top 1 per cent fiscal income, PSZ	Top 1 per cent fiscal income share	World Inequality Database
Top 5 per cent income share (developed economies)	Pre-tax national income share, equal split ("sptinc992j")	World Inequality Database
Top 5 per cent wealth share	Top 5 per cent net wealth	World Inequality Database
Trade balance	Exports (nominal, local currency) - Imports (nominal, local currency)	Macrohistory database by Jordà et al. (2019)
Traditional banking, total financial assets	Private Depository Institutions; Total Financial Assets, Level (BOGZ1FL704090005A)	Federal Reserve Board, Financial Accounts of the US - Z.1 Tables
Treasuries, domestic holdings	Federal Government; Treasury Securities; Liability, Level (FL893161705A)	Federal Reserve Board, Financial Accounts of the US - Z.1 Tables
Treasuries, foreign holdings	Rest of the World; Treasury Securities; Asset, Market Value Levels (LM263061105A)	Federal Reserve Board, Financial Accounts of the US - Z.1 Tables

Notes: All values for which no specific geographic definition is provided refer to the United States. Codes in parentheses refer to the Financial Accounts series code number. Countries included among developed economies: Australia, Belgium, Canada, Denmark, Finland, France, Germany, Ireland, Italy, Japan, the Netherlands, Norway, Portugal, Spain, Sweden, Switzerland, the UK, USA.
*Accessed through FRED – Federal Reserve Economic Data, St. Louis Fed. **Accessed through Jordà, Knoll, Kuvshinov, Schularick, and Taylor (2019).

Table A.6: Construction of macro-financial variables with series references

Variable	*Variable construction details*
Financial sector, total financial assets domestically-held	Sum of the following components:
	Domestic Financial Sectors; Net Interbank Transactions; Liability, Level (BOGZ1FL794110005A)
	Domestic Financial Sectors; Checkable Deposits and Currency; Liability, Level (BOGZ1FL793120005A)
	Private Depository Institutions; Total Time and Savings Deposits; Liability, Level (BOGZ1FL703130005A)
	Money Market Funds; Total Financial Assets, Level (MMMFFAA027N)
	Domestic Financial Sectors; Federal Funds and Security Repurchase Agreements; Liability, Level (BOGZ1FL792150005A)
	Domestic Financial Sectors; Open Market Paper; Liability, Level (FBMPLIA027N)
	GSEs and Agency- and GSE-Backed Mortgage Pools; U.S. Government Agency Securities; Liability Level (GSEMPUA027N)
	Domestic Financial Sectors; Corporate and Foreign Bonds; Liability, Level (FBCFLIA027N)
	Domestic Financial Sectors; Loans; Liability, Level (BOGZ1FL794123005A)
	Mutual Funds; Mutual Fund Shares; Liability, Market Value Levels (BOGZ1LM653164205A)
	Domestic Financial Sectors; Trade Payables; Liability, Level (BOGZ1FL793170005A)
	Life Insurance Companies; Life Insurance Reserves; Liability, Level (BOGZ1FL543140005A)
	Insurance Companies and Pension Funds; Pension Entitlements; Liability (BOGZ1FL583150005A)
	Domestic Financial Sectors; Total Miscellaneous Liabilities, Level (BOGZ1FL793190005A)
Financial sector, total financial assets held abroad	Sum of the following components:
	Rest of the World; Net Interbank Transactions with Banks in Foreign Countries; Asset, Level (ROWNIBA027N)
	Rest of the World; U.S. Checkable Deposits and Currency; Asset, Level (BOGZ1FL263020005A)

	Rest of the World; U.S. Total Time and Savings Deposits; Asset, Level (ROWTDAA027N)
	Rest of the World; U.S. Money Market Fund Shares; Asset, Level (ROWMMMA027N)
	Rest of the World; Security Repurchase Agreements; Asset, Level (BOGZ1FL262051003A)
	Rest of the World; Commercial Paper; Asset, Market Value Levels (BOGZ1LM263069103A)
	Rest of the World; Agency- and GSE-Backed Securities; Asset, Market Value Levels (BOGZ1LM263061705A)
	Rest of the World; Corporate Bonds; Asset, Market Value Levels (BOGZ1LM263063005A)
	Rest of the World; U.S. Mutual Fund Shares; Asset, Market Value Levels (BOGZ1LM263064203A)
	Rest of the World; Trade Receivables; Asset, Market Value Levels (BOGZ1LM263070005A)
	Life Insurance Companies; Assumed Life Insurance Reserve Credit from Non-U.S. Insurers; Liabil Level (BOGZ1FL543141905A)
	Life Insurance Companies; Assumed Pension Entitlement Reserve Credit from Non-U.S. Insurers; Liability, Level (BOGZ1FL543151905A)
	Rest of the World; Assumed Policy Payables by U.S. Reinsurers from Non-U.S. Insurers; Liability, Level (BOGZ1FL263076005A)
Inflation	Rate of change of Consumer Price Index
Labor income share	National Income and Products Account (NIPA) – Table 2. Computed as: Compensation of employ (Line 2) / [Personal Income (Line 1) - Personal current taxes (Line 26) + Government social bene to persons (Line 17)]
Real interest rate	Interest rates, nominal (AAA corporate bond yields) - inflation
Safe assets, held abroad	Following Gorton, Lewellen, and Metrick (2012), sum of the following components (with bonds a GSEs accounted for 85 per cent of the value):
	Rest of the World; Agency- and GSE-Backed Securities; Asset, Market Value Levels (BOGZ1LM263061705A)
	Rest of the World; Commercial Paper; Asset, Market Value Levels (BOGZ1LM263069103A)
	Rest of the World; Corporate Bonds; Asset, Market Value Levels (BOGZ1LM263063005A)
	Rest of the World; Municipal Securities; Asset, Level (ROWMLAA027N)

	Rest of the World; Security Repurchase Agreements; Asset, Level (BOGZ1FL262051003A)
	Rest of the World; Treasury Securities; Asset, Market Value Levels (BOGZ1LM263061105A)
	Rest of the World; U.S. Checkable Deposits and Currency; Asset, Level (BOGZ1FL263020005A)
	Rest of the World; U.S. Money Market Fund Shares; Asset, Level (ROWMMMA027N)
	Rest of the World; U.S. Total Time and Savings Deposits; Asset, Level (ROWTDAA027N)
Safe assets, total financial assets	Following Gorton, Lewellen, and Metrick (2012), sum of the following components (with bonds a GSEs accounted for 85 per cent of the value):
	All Sectors; Agency- and GSE-Backed Securities; Asset, Level (BOGZ1FL893061705A)
	All Sectors; Corporate and Foreign Bonds; Asset, Level (BOGZ1FL893063005A)
	All Sectors; Federal Funds and Security Repurchase Agreements; Asset, Level (BOGZ1FL892050005A)
	All Sectors; Municipal Securities; Asset, Level (BOGZ1FL893062005A)
	All Sectors; Open Market Paper; Liability, Level (BOGZ1FL893169175A)
	All Sectors; Treasury Securities; Asset, Level (BOGZ1FL893061105A)
	Domestic Financial Sectors; Checkable Deposits and Currency; Liability, Level (BOGZ1FL793120005A)
	Money Market Funds; Total Financial Assets, Level (MMMFFAA027N)
	Private Depository Institutions; Total Time and Savings Deposits; Liability, Level (BOGZ1FL703130005A)
Safe assets, public and traditional banking domestically-held	Sum of the total - foreign components of the following elements:
	All Sectors; Treasury Securities; Asset, Level (BOGZ1FL893061105A) minus Rest of the World; Treasury Securities; Asset, Market Value Levels (BOGZ1LM263061105A)
	All Sectors; Municipal Securities; Asset, Level (BOGZ1FL893062005A) minus Rest of the World; Municipal Securities; Asset, Level (ROWMLAA027N)
	Domestic Financial Sectors; Checkable Deposits and Currency; Liability, Level (BOGZ1FL793120005A) minus Rest of the World; U.S. Checkable Deposits and Currency; Asset, Level (BOGZ1FL263020005A)

	Private Depository Institutions; Total Time and Savings Deposits; Liability, Level (BOGZ1FL703130005A) minus Rest of the World; U.S. Total Time and Savings Deposits; Asset, Le (ROWTDAA027N)
Safe assets, shadow banking domestically-held	Sum of the total - foreign components of the following elements:
	Money Market Funds; Total Financial Assets, Level (MMMFFAA027N) minus Rest of the World; U Money Market Fund Shares; Asset, Level (ROWMMMA027N)
	Domestic Financial Sectors; Federal Funds and Security Repurchase Agreements; Liability, Level (BOGZ1FL792150005A) minus Rest of the World; Security Repurchase Agreements; Asset, Level (BOGZ1FL262051003A)
	Domestic Financial Sectors; Open Market Paper; Liability, Level (FBMPLIA027N) minus Rest of th World; Commercial Paper; Asset, Market Value Levels (BOGZ1LM263069103A)
	0.85*(GSEs and Agency- and GSE-Backed Mortgage Pools; U.S. Government Agency Securities; Liability, Level (GSEMPUA027N) minus Rest of the World; Agency- and GSE-Backed Securities; Asset, Market Value Levels (BOGZ1LM263061705A))
Shadow banking, total financial assets	Sum of the following components:
	Agency-and GSE-Backed Mortgage Pools; Total Mortgages; Asset, Level (BOGZ1FL413065005A)
	Exchange-Traded Funds; Total Financial Assets, Market Value Levels (BOGZ1LM564090005A)
	Finance Companies; Total Financial Assets, Level (BOGZ1FL614090005A)
	Funding Corporations: Other Financial Business; Total Financial Assets, Level (BOGZ1FL504090005A)
	Government-Sponsored Enterprises; Total Financial Assets, Level (BOGZ1FL404090005A)
	Issuers of Asset-Backed Securities; Total Financial Assets, Level (BOGZ1FL674090005A)
	Money Market Funds; Total Financial Assets, Level (MMMFFAA027N)
	Private Pension Funds; Total Financial Assets, Level (BOGZ1FL574090005A)
	Real Estate Investment Trusts; Total Financial Assets, Level (BOGZ1FL644090005A)
	Security Brokers and Dealers; Total Financial Assets, Level (BOGZ1FL664090005A)