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Unpacking Rising Inequality: The Roles of Markups, Taxes, and Asset Prices*

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Abstract

We study the dynamics of income and wealth inequality using a heterogeneous-agent model that combines endogenous portfolio choice, a granular representation of the tax-and-transfer system, and a reduced-form mechanism linking markups to top incomes through entrepreneurial risk. Driven by changes in taxation, markups, and asset prices, the model accounts for the observed trends in income and wealth inequality in France since 1984, up to the top 1% income and wealth shares. We combine counterfactual simulations with a simple accounting decomposition of wealth accumulation to assess the contributions of these driving forces to inequality dynamics and to identify the channels through which they operate. We identify rising markups as the primary driver of income inequality, while all three forces – taxation, markups, and asset prices – contribute significantly to wealth inequality. Our findings highlight both the mechanical impact of differential asset price movements and the central role of endogenous saving responses in shaping wealth inequality over time.

Keywords: Heterogeneous Agents, Taxes, Market Power, Income Inequality, Wealth Inequality

JEL Class.: D4, E2, H2, O4, O52.

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1 Introduction

Over the past four decades, many countries have experienced a significant rise in both income and wealth inequality. At the same time, profound economic transformations have affected households, firms, and markets, likely shaping the dynamics of inequality. First, several interconnected forces – including technological change, globalization through trade and offshoring, financialization, and rising market power – have contributed to the expansion of superstar firms and reshaped the dynamics of markups, profits, and top incomes. Second, the evolution of asset prices has varied significantly across different types of assets (e.g., housing, equities, and deposits), leading to distinct and potentially large distributional consequences over both the short and long term. Third, both the level and the composition of taxes and transfers – as well as their degree of progressivity – have changed over time. These shifts may have attenuated or amplified inequality dynamics, not only through mechanical effects on income and wealth distributions, but also through behavioral responses affecting decisions to work, save, and invest.

What are the contributions of these driving forces to inequality dynamics and through which channels do they operate? In this paper, we break new ground on this topic, both methodologically and substantively. Methodologically, we develop an original heterogeneous-agent (HA) model with three key features: (*i*) an explicit link between firms' market power – captured by markups – and top income shares; (*ii*) endogenous portfolio choices that generate heterogeneity in wealth composition, and (*iii*) a granular representation of the tax-and-transfer system. Using France as a case study, we discipline the model with French data and show that it replicates the observed dynamics of income and wealth inequality since 1984. Substantively, we combine counterfactual simulations with a simple accounting decomposition of wealth accumulation to study the determinants of wealth inequality dynamics. This approach quantifies the respective contributions of our key driving forces – changes in taxation, markups, and asset prices – to the evolution of wealth inequality. It also identifies the transmission channels through which these forces operate, distinguishing between changes in the inequality of pretax income, taxation, saving rate, and capital gains across wealth groups. Our findings highlight both the mechanical effect of differential asset price fluctuations and the key role of endogenous saving behaviors – in response to changes in the driving forces – in shaping wealth inequality dynamics.

Regarding the model, we first introduce a key relationship between markups and top income shares through entrepreneurial risk.[1] In addition to workers exposed to idiosyncratic income risk *à la* Aiyagari (1994), we incorporate a risky entrepreneurial process in which heteroge-

[1] Given the broader complexity of the model and its focus on the dynamics of wealth inequality, we do not attempt to model the full complexity of the production side – particularly the many mechanisms potentially driving the rise in markups and their impact on income concentration. Instead, we adopt a reduced-form approach – close in spirit to the 'superstar income' formulation in Castaneda, Diaz-Gimenez, and Rios-Rull (2003) – which captures, in a simplified manner, the combined effects of various interdependent production-side forces on the evolution of income concentration. In our model, markups are identical to profits and depend entirely on the magnitude of the elasticity of substitution, which acts as a reduced-form parameter capturing the multiple, simultaneous, and interconnected mechanisms affecting profit dynamics in the production sector.

neous entrepreneurs receive a time-varying, skill-specific share of monopolistic profits. Since entrepreneurial income is highly concentrated among the most successful entrepreneurs (Levine and Rubinstein, 2017; Bhandari et al., 2024; Harju, Juuti, and Matikka, 2024), and markups have risen in France since the early 80s – though less so than in the U.S. (see De Loecker, Eeckhout, and Unger (2020) and De Loecker and Eeckhout (2018)) – the rise in market power induces an increase in top income shares.[2] Further, because the most successful entrepreneurs face significant risks of losing their status, they secure large precautionary savings and become top wealth holders, which may contribute to the rise in top wealth shares in addition to top income shares.

Second, we introduce two key features to match the upper tails of the distributions and account for the sharp rise in wealth and income concentration. Gaillard et al. (2023) show that the canonical HA model struggles to replicate both the ranking and magnitudes of the upper tails of consumption, labor income, wealth, and capital income distributions. They suggest refining the standard model by combining non-homothetic, wealth-dependent preferences (see also De Nardi (2004) or Francis (2009)) with scale-dependent returns to capital. Following this approach, we introduce wealth-in-the-utility and generate increasing returns across the wealth distribution. Wealth-in-utility captures the non-consumption benefits of wealth and leads individuals to accumulate wealth beyond precautionary savings.[3] Increasing returns along the wealth distribution arise endogenously from portfolio choices among three assets – deposits, housing, and equities – each offering a distinct return. In our model, deposits and housing provide direct utility, justifying their lower returns compared to equities. In addition, households choose whether to rent or own housing, subject to minimum housing-size requirements and borrowing constraints. This structure allows us to replicate the composition of portfolios across the wealth distribution, providing a micro-founded explanation for increasing returns and helping the model match both the level and trend of top wealth shares.[4] Moreover, endogenous portfolio choices among three assets allow us to investigate the distributional effects of asset-specific price dynamics (*e.g.*, housing vs. equities), which have varied dramatically over the last 40 years.

Third, our model incorporates the granularity of the French tax and transfer system by using a rich and realistic set of time-varying proportional and progressive tax and transfer parameters, which are applied to the relevant tax bases (payroll taxes on labor income, corporate taxes on profits, income taxes, taxes on consumption, taxes on wealth, and monetary transfers). This enables the model to replicate very precisely the mapping between pretax, disposable, and post-tax income inequalities, accounting for all potential effects (direct, indirect, general equilibrium) of tax and transfer changes on the relevant margins (savings, consumption, and labor).

We use the model to study the rise in income and wealth inequality in France since 1984,

[2] See Boar and Midrigan (2024) and Deb (2024) for a similar approach based on U.S. data, and Eggertsson, Robbins, and Wold (2021) in a representative-agent model. Luetticke et al. (2025) in the context of war-induced capital destruction leading to declining income inequality.

[3] See Carroll (1998) and Saez and Stantcheva (2018) for a detailed description.

[4] See Cao and Luo (2017) or Xavier (2024) for evidence based on U.S. data and Garbinti, Goupille-Lebret, and Piketty (2021) for similar evidence based on French data.

the year just before inequalities began to rise. We calibrate the model's stationary equilibrium in 1984 using newly available wealth and income inequality series and fiscal data. These series are part of the "Distributional National Accounts" (DINA) project, and consist of long-term series of wealth, pretax and posttax national income that (*i*) are fully consistent with national accounts, (*ii*) cover the entire distribution, and (*iii*) provide detailed information on income, asset ownership, portfolios, as well as all taxes and transfers at the individual level (see Saez and Zucman (2016); Piketty, Saez, and Zucman (2018) for the U.S.; Garbinti, Goupille-Lebret, and Piketty (2018), Garbinti, Goupille-Lebret, and Piketty (2021) and Bozio et al. (2024) for France). We also exploit the richness of these time series to gauge the quality of our stationary equilibrium (in 1984) and dynamic simulations (from 1984 to 2019) on various dimensions, including macroeconomic aggregates, income and wealth inequality, portfolios along the distribution, and the aggregate and distributional structures of taxes.

The model fits the observed 1984 characteristics of income and wealth distributions from the bottom 50% to the top 1% shares, the composition of individual and aggregate wealth, the aggregate wealth-income ratio, the aggregate and distributional structure of taxes, as well as the usual macroeconomic ratios. Alternative specifications show that the inclusion of heterogeneous entrepreneurs, wealth in the utility function, and a granular, progressive tax system are all key to match both the top and bottom of the income and wealth distributions. In addition, considering three assets is essential to match the aggregate wealth-income ratio, on top of being critical to generate increasing returns along the wealth distribution. It also matters in the dynamic simulations to account for the distributional effects of capital gains through heterogeneous asset portfolios across the wealth distribution.

Starting from the 1984 stationary distribution, we then feed the model with a set of exogenous variables: changes in markups, taxation (taxes and transfers), asset prices, and other market forces such as the rate of capital depreciation and total factor productivity (TFP hereafter). Our dynamic simulations closely track the data and reproduce two main facts regarding inequality dynamics: (*i*) the rise in income inequality is primarily driven by a significant increase in the top 1% income share, and (*ii*) the rise in wealth inequality is largely driven by a significant increase in the top 10% and top 1% wealth shares, at the expense of the bottom 50%.

We then conduct a series of counterfactual experiments to assess the contributions of our key driving forces – changes in markups, taxation, asset prices, and other market forces (such as the depreciation rate and TFP) – to inequality dynamics. When only other market forces are allowed to change, both income and wealth inequality remain stable. Rising markups account for the bulk of the increase in income inequality, primarily by boosting the top 1% income share. Changes in taxation and capital gains also contribute to the rise in income inequality, though to a lesser extent.

Wealth inequality dynamics are more complex. To better understand them, we combine counterfactual experiments with simple accounting decompositions of wealth accumulation. Beyond quantifying the contributions of the key driving forces to wealth inequality dynamics, this method allows us (i) to identify the specific transmission channels through which these forces operate – distinguishing between changes in the inequality of pretax income, taxation, saving rates, and capital gains across wealth groups – and (ii) to disentangle mechanical effects from behavioral responses and general equilibrium effects.

Our results show that changes in taxation, markups, and asset prices all play a crucial role in shaping wealth inequality. Rising markups and tax changes mainly affect wealth inequality through behavioral and general equilibrium effects that increase saving rate inequality (accounting for two-thirds of the overall effect) and, to a lesser extent, pretax income inequality (one-third). Changes in asset prices – driven largely by the housing boom – have ambiguous effects. While they generate large valuation effects that mechanically reduce wealth concentration, they also exacerbate saving rate inequality and ultimately inflate wealth inequality. More broadly, our findings highlight the central role of saving rate inequality in driving wealth inequality dynamics, underscoring the importance of thoroughly modeling endogenous saving decisions to various driving forces.

Literature. Since the pioneering works of Bewley (1977), Huggett (1993), and Aiyagari (1994), a macroeconomic literature has developed general equilibrium models with heterogeneous agents to reproduce and explain wealth and income inequality *at a given point in time* (see De Nardi and Fella (2017); Benhabib and Bisin (2018) for reviews). These models incorporate mechanisms such as switching discount factors (Krusell and Smith, 1998), super-productive workers (Castaneda, Diaz-Gimenez, and Rios-Rull, 2003), bequest motives (De Nardi, 2004), entrepreneurship (Cagetti and De Nardi, 2006), wealth-in-utility (Francis, 2009), novel labor-income processes (Ferrière et al., 2023), and stochastic jumps in asset returns (Benhabib, Cui, and Miao, 2024) as drivers of inequality.[5] Gaillard et al. (2023) highlight the importance of wealth-dependent preferences and scale-dependent returns to capital in replicating the upper tails of income and wealth distributions. Benhabib, Bisin, and Luo (2019) also emphasize heterogeneity in saving rates to explain U.S. wealth dispersion. More recently, dynamic models have been developed to study income inequality (Gabaix et al., 2016) and wealth inequality (Kaymak and Poschke, 2016; Hubmer, Krusell, and Smith, 2020) in the U.S. We contribute to both areas by developing a unified HA model – featuring entrepreneurs, three assets, and wealth-in-utility—that matches the *level* and *dynamics* of income and wealth inequality in France. We further use the model to quantify how various mechanisms drive the evolution of wealth inequality under changing exogenous conditions.

We build on recent advances in solving HA models in continuous time, using Hamilton-Jacobi-Bellman and Kolmogorov forward equations (Achdou et al., 2022), and implement fast, fully non-linear dynamic simulations. Our contribution includes an extension of the one-asset reformulation proposed by Berger et al. (2018) and applied by Fagereng et al. (2019), allowing us

[5]See Saez and Stantcheva (2018) for more on wealth-in-utility and related microfoundations, including bequests and services from wealth.

to handle a three-asset model (deposits, indivisible housing, and equity capital) more efficiently. While previous work has used multiple assets to study short-run policy effects in HA models (e.g., Kaplan, Moll, and Violante (2018), Kaplan and Violante (2022)), we show that distinguishing asset classes – based on differing returns and capital gains – is essential for explaining wealth inequality dynamics.[6]

Our work also connects to the literature documenting rising markups in the U.S. (De Loecker, Eeckhout, and Unger, 2020) and globally (De Loecker and Eeckhout, 2018), and the resulting implications for regulation (Boar and Midrigan, 2024; Eeckhout et al., 2025). We contribute by linking market power, firm profits, and top income shares via entrepreneurship, and quantifying its effect on income and wealth inequality.[7] While Eggertsson, Robbins, and Wold (2021) focuses on macroeconomic aggregates, we examine both aggregate and distributional effects. Deb (2024) links rising markups to reduced business dynamism and top income shares using a static model, but leaves wealth inequality unexplored. Luetticke et al. (2025) show that capital destruction from war can shift markups and capital shares, influencing income inequality.

Finally, our paper contributes to the applied literature constructing "Distributional National Accounts" (e.g., Piketty, Saez, and Zucman (2018) for the U.S.; Garbinti, Goupille-Lebret, and Piketty (2018); Bozio et al. (2024) for France) and analyzing wealth inequality trends (Saez and Zucman, 2016; Martínez-Toledano, 2020; Kuhn, Schularick, and Steins, 2020; Garbinti, Goupille-Lebret, and Piketty, 2021; Blanchet and Martínez-Toledano, 2023). We illustrate how such data can be used to calibrate and validate HA models for studying inequality dynamics. Our contribution lies in disentangling market and institutional forces shaping inequality, including their behavioral consequences.

The paper is structured as follows. Section 2 presents the model and discusses the main assumptions. Section 3 details the calibration, presents the characteristics of the initial stationary equilibrium and presents some counterfactual stationary distributions. Section 4 presents the predictions of the dynamic model and its empirical fit when driven by a set of exogenous variables. Section 5 offers a decomposition of the main drivers of income and wealth inequality relying on counterfactual experiments, and proposes a method to identify the main transmission mechanisms behind rising wealth inequality that highlights the key role of behavioral (savings) responses to changes in exogenous variables.

[6] Kaplan, Moll, and Violante (2018) and successors emphasize a liquid/illiquid asset divide and adjustment frictions to explain marginal propensities to consume during transitory shocks. In contrast, our classification (deposits, housing, equity) focuses on return differentials and their long-term impact on inequality.

[7] Explanations for rising market power include increasing returns from expanding markets via trade or technology (Autor et al., 2020), reallocation toward efficient firms (Baqaee and Farhi, 2020), and declining demand elasticity from reduced price sensitivity (Döpper et al., 2025).

2 Stylized facts about the driving forces of inequality dynamics

Figure 1 presents a comparative view of the evolution of income and wealth inequality in France, alongside the dynamics of three key potential driving forces: changes in markups, taxation, and asset prices. Here we provide descriptive evidence justifying the inclusion of these features in our model and providing empirical support for their relevance in explaining inequality dynamics. While our analysis focuses on France, these trends broadly reflect patterns observed across European countries and the United States, though their magnitude and timing may vary.

Panel (a) of Figure 1 illustrates the evolution of income and wealth inequality, as measured by the top 1% share. Between 1984 and 2018, both top 1% income and wealth shares increased by approximately 50%. Income inequality exhibited a steady rise, peaking at 70% above its 1984 level in 2008, followed by a decline during the global financial crisis, before stabilizing at about 50% above its initial level. Wealth inequality followed a smoother long-term upward trajectory but also experienced large short-term fluctuations, including a notable rise from 1995 to 2000, which was almost entirely reversed between 2000 and 2005.

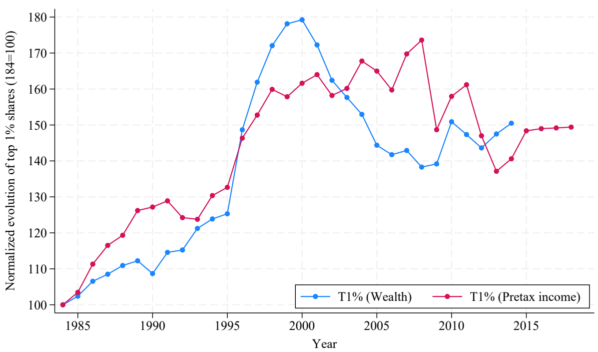
Panels (b) to (h) of Figure 1 illustrate the evolution of different potential driving forces over the same period. Panel (b) compares the cumulative capital gains on housing and equity assets since 1984. It highlights the major housing boom that occurred in France during the 2000s, with housing prices doubling in less than a decade. While cumulative capital gains on equity assets were far from negligible – reaching around 50% by 2018 – they remained comparatively modest and were marked by sharp fluctuations around the 2000 and 2008 financial crises. These asset-specific price movements are likely to have had substantial distributional consequences, given the stark differences in portfolio composition across the wealth distribution (Panel (c)). Notably, the opposing trends in housing and equity prices between 1995 and 2005 echo the large short-term fluctuation in the top 1% wealth share observed over the same period in panel (a).

Panels (d), (e) and (f) of Figure 1 offer a brief overview of how the structure and progressivity of taxation evolved along the pretax income distribution from 1984 to 2018. In 1984, the profile of taxation was only mildly progressive, with average tax rates increasing almost linearly from about 30% for bottom income groups to around 45% for the top 0.1%. Panel (e) and (f) further shows that not only the level, but also the composition of taxes varies along the income distribution, as well as over time. At the bottom, taxation is dominated by consumption taxes and non-contributive social contributions (payroll taxes). Among middle-income groups, these are progressively supplemented by income taxes. At the top, the share of consumption taxes and payroll taxes declines, giving way mostly to income and capital taxation.

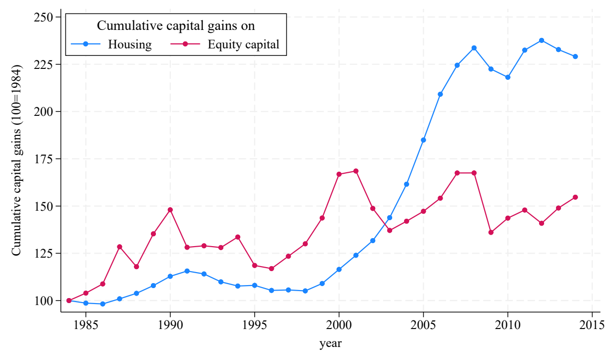
Between 1984 and 1994, the overall profile of taxation remained broadly stable, except at the very top of the distribution, where average tax rates fell sharply, resulting in local regressivity. From 1994 onward, the tax system became increasingly progressive – first through reductions in tax rates at the bottom, and then through increases in tax rates at the top. By 2018, average tax

Figure 1: Trends in Inequality and Key Driving Forces

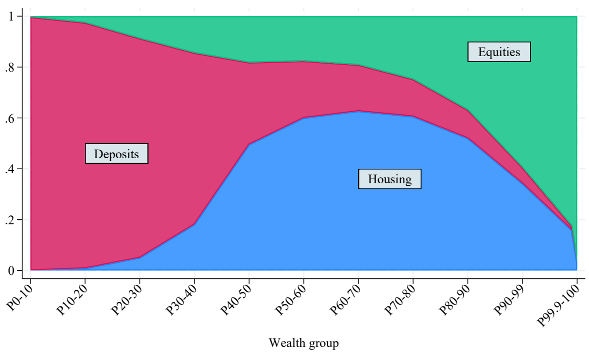
(a) Evolution of top 1% shares



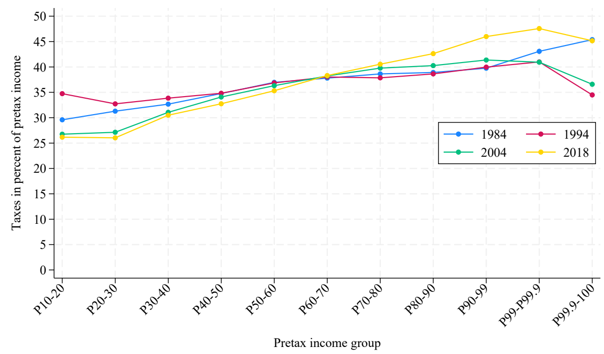
(b) Cumulative capital gains



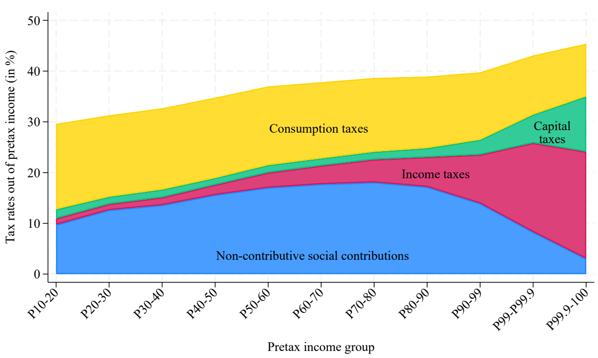
(c) Portfolio composition in 2000



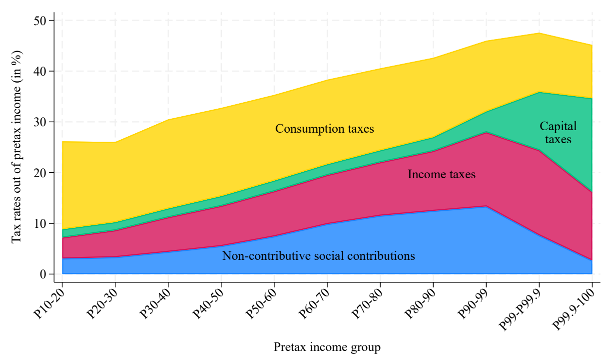
(d) Tax rates by income groups



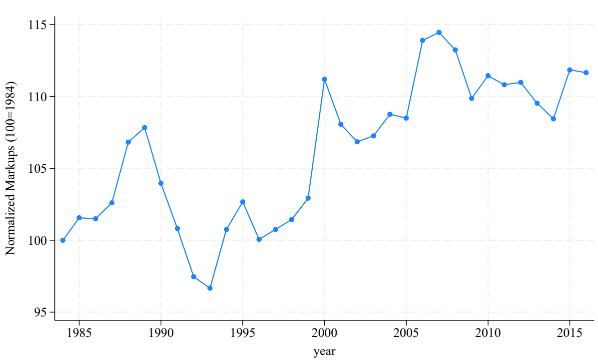
(e) Decomposition of tax rates in 1984



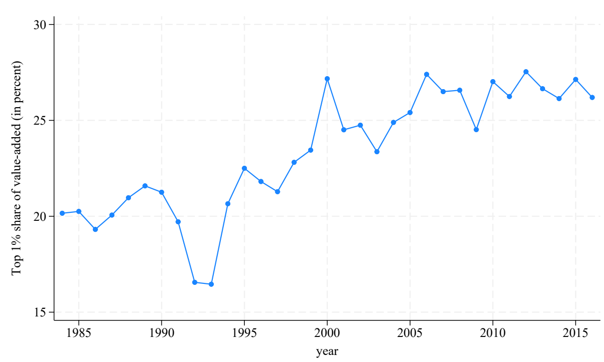
(f) Decomposition of tax rates in 2018



(g) Normalized evolutions of markups



(h) Top 1% share of value-added



rates ranged from roughly 25% for the bottom 30% to 45% for the top 10%, although regressivity persisted at the very top.[8] These changes in the profile of taxation resulted from two major policy reforms: a reduction in payroll taxes for low-income earners,[9] followed by a substantial expansion of progressive income and capital taxes targeting high-income groups.

While the overall degree of progressivity in 2018 was similar to that in 1984, the structure of taxation changed significantly. Panels (e) and (f) reveal continuous shifts in the composition of taxes across the income distribution, underscoring the need to account not only for average tax rates but also for the types of taxes levied and the corresponding tax bases for each income and wealth group. These changes have not only a direct and mechanical effect on disposable income, but also the potential to influence household behavior along various margins – such as savings, consumption, and labor supply – depending on the types of taxes considered.

Last, Panel (g) of Figure 1 presents the normalized evolution of markups, based on the estimates from Bauer and Boussard (2020). Markups rose steadily from 1984 until the global financial crisis of 2008, after which they stabilized, fluctuating around their post-crisis level. Interestingly, their trajectory closely mirrors the evolution of the top 1% income share over the same period. Panel (h) sheds light on the mechanisms underlying this trend, offering a potential explanation for the parallel movement of markups and top incomes. The rise in aggregate markups is primarily driven by a reallocation of market shares from smaller firms with moderate markups toward larger firms with higher markups, leading to increases in both average markups and market concentration. This pattern echoes similar dynamics observed in the United States, where the emergence of superstar firms has been linked to rising market concentration, aggregate markups and income inequality (Song et al. (2018), Autor et al. (2020), De Loecker, Eeckhout, and Unger (2020)).

3 Model

3.1 Overview

The model features heterogeneous households with uninsurable earnings and entrepreneurial risk along with a realistic taxation system that incorporates an extensive set of proportional and progressive taxes and transfers.

In the production sector, an intermediate good is produced using labor and capital, and sold to retailers. Retailers differentiate the intermediate good into varieties, and choose prices optimally under monopolistic competition, which resulting in markups and aggregate profits.

In the household sector, individuals can be workers or entrepreneurs. When they are workers, they face labor earning risk and supply labor endogenously. When they are entrepreneurs, they

[8] Recent work by Bach et al. (2025) provides a detailed decomposition of effective tax rates within the top 0.1% and shows that rates decline dramatically from 46% at P99.9 to 26% at P99.9998. Similar regressivity at the top is also documented in the Netherlands and Italy (see Bruil et al. (2022)).

[9] See Bozio, Breda, and Guillot (2023) for a detailed presentation of these reforms in France.

receive the monopolistic profits from firms and face a failure risk, *i.e.* the risk of becoming a regular worker. Entrepreneurial and labor earning risks push households to precautionary-save. An additional saving motive is also considered through the addition of wealth-in-the-utility function.

Households face a positive net wealth constraint, and have access to three types of assets: deposits, gross housing subject to constrained borrowing, and physical capital. Deposits and housing services provide direct utility to all households, which justifies that returns on deposits and housing are lower than returns on capital. In equilibrium, these assumptions generate a realistic composition of portfolios along the wealth distribution, and imply that returns are increasing in wealth as in the data.

The model is written in continuous time and solved numerically using the finite difference method of Achdou et al. (2022) both for the stationary equilibrium and for the dynamic transition. The method is very fast and consists in discretizing and solving the Hamilton-Jacobi-Bellman equation and the Kolmogorov Forward equation in Matlab using sparse matrix routines.[10] For the sake of clarity, time subscripts are omitted.

3.2 Firms

A representative firm produces an intermediate good y^m under perfect competition with the following technology:

$$y^m = \xi k^\alpha (\varrho \ell)^{1-\alpha}, \tag{1}$$

where α is the elasticity of capital, ξ is a measure of total factor productivity – which fluctuates but does not grow over time – and ϱ a measure of labor productivity – which grows at rate g_ϱ. Further, k is the aggregate stock of capital and ℓ is aggregate labor. The firm sells the intermediate good to the retailers at price φ. The associated after-tax profits are:

$$(1-\tau_\pi)\left(\varphi \xi k^\alpha (\varrho \ell)^{1-\alpha} - w\ell - \delta k\right) - r^k k, \tag{2}$$

where r^k is the return on equity capital and $\delta \in [0,1]$ is the depreciation rate of capital. Corporate profits are taxed at rate τ_π based on their total sales minus their wage bill with an allowance for depreciated capital.[11] Maximization with respect to capital and labor gives:

$$\alpha \frac{\varphi y^m}{k} = \frac{r^k}{1-\tau_\pi} + \delta \text{ and } (1-\alpha)\frac{\varphi y^m}{\ell} = w. \tag{3}$$

A unit-size continuum of retailers indexed in i buy the intermediate good at price φ and

[10] The method implies specifying the processes generating heterogeneity (such as the individual productivity of workers or the income of entrepreneurs) in terms of Poisson or continuous-time Markov processes. Hence, while exogenous processes are written in continuous-time, they are actually discretized in the code.

[11] Consistent with French legislation, our model assumes that dividend payments to shareholders, $r^k k$, are made after corporate taxes have been paid.

differentiate it into varieties before selling them on the goods market to households, other firms or the government. Let $p(i)$ be the price set by retailer i for its variety and $y^d(i) = (p(i)/p)^{-\theta} y^d$ the demand for this variety, where $\theta > 1$ is the (potentially time-varying) elasticity of substitution between varieties, p is the aggregate price index and y the total demand for final goods.[12] The optimal price $p(i)$ solves:[13]

$$\max_{p(i)} \pi(i) = (1-\tau_\pi)\left(\frac{p(i)}{p} - \varphi\right)\left(\frac{p(i)}{p}\right)^{-\theta} y. \tag{4}$$

Assuming symmetry across retailers ($p(i) = p$ and $y^d(i) = y = y^m$), the optimal pricing condition gives:

$$\frac{\theta}{\theta-1}\varphi = 1, \tag{5}$$

where $\frac{\theta}{\theta-1}$ is the aggregate markup. Total pretax profits are then given by $\pi = y/\theta$, and are fully redistributed to the different types of entrepreneurs. Those profits are treated as mixed-income and, following standard convention, classified as labor income (and taxed as such) for 70% and as capital income for the remaining 30%, and hence subject to the corporate tax rate.[14]

3.3 Households

The economy is populated by a unit-size continuum of heterogeneous households $j \in [0,1]$. There are two types of households, workers and entrepreneurs. Households switch types according to a two-state Markov process representing entrepreneurial dynamics. In addition, when households are workers, their individual productivity is subject to idiosyncratic shocks, as explained below. Last, when households are entrepreneurs, the share of profits they receive is subject to idiosyncratic shocks as well. All variables involved in the household problem are expressed per-capita and relevant variables are deflated by a labor productivity index that grows at the exogenous rate g_ϱ.

3.3.1 Income

As in Boar and Midrigan (2024) or Deb (2024), households can be either workers or entrepreneurs. The unconditional probability of becoming an entrepreneur (respectively staying a worker) when working is p_{ew} (resp. $1 - p_{ew}$) and the unconditional probability of becoming a

[12]These demand functions are derived from a Dixit-Stiglitz aggregator $y^d = \left[\int_0^1 y^d(i)^{\frac{\theta-1}{\theta}} di\right]^{\frac{\theta}{\theta-1}}$ where y^d is aggregate demand made of private consumption, investment and government spending, and a true price index $p = \left[\int_0^1 p(i)^{1-\theta} di\right]^{\frac{1}{1-\theta}}$.

[13]Retailers' profits are affected by the corporate tax rate but it does not affect the optimal pricing decision.

[14]This is the standard convention used in the income inequality literature (Alvaredo et al. (2020), Bachas et al. (2022)) and it is closed to the estimates by Smith et al. (2019) that show that three-quarters of top pass-through profit in the U.S. can be classified as human capital income.

worker (staying an entrepreneur) when being an entrepreneur is p_{we} (resp. $1-p_{we}$).[15]

Workers. When working, households supply ℓ^j units of labor and receive a real wage $w^j = we^{z^j}$, where z^j follows a log-normal Gaussian mixture process as in Ferrière et al. (2023):[16]

$$\dot{z}^j = -\rho_z z^j + \epsilon_z^j, \tag{6}$$

where $\exp(-\rho_z)$ measures the persistence of earning shocks ϵ_z^j and:

$$\epsilon_z^j \sim \begin{cases} N\left(\psi_1, \sigma_1^2\right) & \text{with probability } p_1, \\ N\left(\psi_2, \sigma_2^2\right) & \text{with probability } 1-p_1. \end{cases} \tag{7}$$

with $\mathbb{E}\left(\epsilon_z^j\right) = p_1\psi_1 + (1-p_1)\,\psi_2 = 0$, so that choosing ψ_1 and p_1 determines ψ_2.[17] This process can be thought of as a job-ladder process by which individual productivity most frequently increases (p_1 large and $\psi_1 > 0$) with little dispersion (σ_1^2 small) and decreases ($\psi_2 < 0$) in rare circumstances (p_2 small) such as unemployment spells, with large uncertainty (σ_2^2 large).

Entrepreneurs. When households are entrepreneurs, they supply $\ell^j = 0$ units of labor and receive a fraction of the aggregate profits $\pi^j = \omega^j \pi / e$, where π denotes aggregate profits, e is the equilibrium number of entrepreneurs, and ω^j is the productivity of entrepreneur j relative to average entrepreneur productivity (π/e) , which follows a log-normal process.

Transitions. To clarify the transitions, as the productivity and entrepreneurial processes will be discretized, the global transition matrix will be:[18]

$$\mathcal{M} = \log \begin{bmatrix} (1-p_{ew})\,\mathcal{P}^w & p_{ew}\mathcal{P}^{ew} \\ p_{we}\mathcal{P}^{we} & (1-p_{we})\,\mathcal{P}^e \end{bmatrix}, \tag{8}$$

where p_{ew} will be calibrated to match the fraction of entrepreneurs among households, $\mathcal{P}^w$ will be set based on the discretization of the productivity process (6)-(7) and $\mathcal{P}^e$ will be set based on the discretization of the process governing the dynamics of ω^j. Other transition probabilities will be set to match key moments of the distribution, as explained in Section 4.1.

[15] Unlike Cagetti and De Nardi (2006) the model is not one of occupational change. Further, Aghion et al. (2018) report a stable and close-to-zero net entry rate in France, which leads us to consider a constant probability of becoming an entrepreneur p_{ew} in the model.

[16] Variable z_t^j denotes the relative productivity of worker j and aggregate productivity is normalized in the stationary equilibrium so that the sum of labor income received by workers equals the aggregate labor income paid by firms.

[17] In the model, all relevant variables, including individual productivity levels, are deflated by the average labor productivity growth rate so that $\mathbb{E}\left(\epsilon_z^j\right) = 0$ means that individual productivity levels are growing at the pace of aggregate labor productivity on average.

[18] The continuous-time nature of the transition process is captured by the presence of the log of the discrete-time equivalent transition matrix. The latter transforms transition probabilities into Poisson intensities.

Capital income. In addition to labor or entrepreneurial income, any household j can hold three assets: housing in quantity h^j, deposits in quantity m^j, and equity capital k^j. We simplify the set-up of financial markets and consider constant risk-adjusted returns on holding deposits ($r^m = \bar{r}^m$) or housing ($r^m = \bar{r}^h$). Households can also borrow an amount d^j from the deposit market at cost $\bar{r}^m$, but only for the purpose of acquiring housing units. The total wealth of household j writes $a^j = k^j + p^h h^j - d^j + m^j$, where p^h is the relative price of housing – the price of non-durable goods being used as *numéraire*. The return on capital is r^k and adjusts in equilibrium to clear the capital market. For reasons that we explain below, the model implies $\bar{r}^m < \bar{r}^h < r^k$.

In summary, labor and capital incomes of household j are given by:

$$\Phi_\ell^j = \left(1 - \tau_\ell^j\right)\left(w^j\left(1 - \mathbb{1}_{e^j}\right)\ell^j + \mathbb{1}_{e^j} 0.7\pi^j\right), \tag{9}$$

$$Y_k^j = r^k k^j + \bar{r}^h p^h h^j + \bar{r}^m\left(m^j - d^j\right) + \mathbb{1}_{e^j}(1 - \tau_\pi)0.3\pi^j, \tag{10}$$

where $\mathbb{1}_{e^j}$ is an indicator function that equals 1 if household j is an entrepreneur and zero otherwise, and remember, τ_π denotes the tax rate on corporate profits. Variable τ_ℓ is the individual rate of non-contributive payroll taxes, *i.e.* the payroll taxes that do not finance unemployment and pension benefits.[19]

3.3.2 Preferences and optimization problem

Households derive utility from a bundle Λ^j, made of c^j, their consumption of non-durable goods, s^j the size of the housing unit they occupy which can be rented or owned (see Iacoviello (2005), Kaplan and Violante (2014), Favilukis, Ludvigson, and Nieuwerburgh (2017), among many others), and m^j, the amount of liquid assets they hold:[20]

$$\Lambda^j = \left(c^j\right)^{1-\kappa-\chi}\left(s^j\right)^{\kappa}\left(m^j\right)^{\chi}. \tag{11}$$

where κ is the weight of housing services and χ the weight of financial services.
Further, households experience a disutility from supplying labor ℓ^j, and ζ denotes the inverse of the Frisch elasticity on labor supply. Last, they derive utility from their net wealth a^j relative to the average net wealth in the economy a. Parameter μ makes wealth a luxury good as usual in the literature introducing bequest or wealth-in-utility motives, to capture the fact that asset-rich households keep on saving beyond the precautionary motive they face. Finally, households can borrow up to a fraction ς of the housing value $d^j \leq \varsigma p^h h^j$. The optimization problem of

[19] Although the model features infinitely-lived dynasties and does not explicitly account for unemployed or retired households, these groups are implicitly represented by different household types facing income risk.

[20] There is a long tradition in macroeconomic of employing the money-in-the-utility approach (see Poterba and Rotemberg (1986) among many others. Goodfriend and McCallum (1988) develop a 'shopping-time' model to motivate the demand for money. For another exposition of the shopping-time model and its connection to the log-log money demand function used frequently in empirical work, see Lucas (2000).

household j thus writes:

$$\max_{k^j,h^j,s^j,d^j,m^j,c^j,\ell^j} \mathbb{E}_0 \int_0^\infty e^{-\rho t} \left\{ \frac{\left(\Lambda^j\right)^{1-\gamma}}{1-\gamma} - \frac{\left(\ell^j\right)^{1+\zeta}}{1+\zeta} + \beta \log\left(\frac{a^j}{a} + \mu\right) \right\} dt$$

$$\begin{array}{lll} \text{s.t.} & \text{budget} & (1+\tau_c)\, c^j + \bar{r}^h p^h s^j + \Delta^j = \left(1-\tau^j\right) \left(\Phi^j_\ell + \Upsilon^j_k\right) - \phi^j a^j + T^j \\ & \text{net wealth} & a^j = k^j + p^h h^j - d^j + m^j, \\ & \text{net savings} & \Delta^j = \dot{k}^j + p^h \dot{h}^j - \dot{d}^j + \dot{m}^j + g_\varrho a^j \\ & \text{borrowing} & m^j \geq 0,\, d^j \leq \varsigma p^h h^j, \\ & \text{bounds} & a^j \geq 0,\, k^j \geq 0,\, h^j \in \left[h^{\min}, \infty\right), \end{array} \tag{12}$$

where γ is the relative degree of risk-aversion and β the weight of relative wealth.[21]

In the budget constraint, on the right-hand side, households receive labor and capital income Φ^j_ℓ and Υ^j_k respectively defined by Equation (9) and (10), and both sources of income are taxed at the progressive income tax rate τ^j. Net wealth a^j is taxed at the progressive rate ϕ^j, and T^j denotes the progressive monetary transfer received from the government. On the left-hand side, household j allocates its income on non-durable goods c^j taxed at the rate τ_c and pays a rent $\bar{r}^h$ computed on the value of occupied gross housing $p^h s^j$. Household j also saves Δ^j in capital $\dot{k}^j$, gross housing $\dot{h}^j$, deposits $\dot{m}^j$, and contract housing debt $\dot{d}^j$. Last, remember that steady-state growth implies that level quantities, including individual wealth, increase at the rate g_ϱ, so that $g_\varrho a^j$ units of wealth have to be saved each period to keep the productivity-deflated level of wealth a^j at least constant in the stationary equilibrium.

3.3.3 Reformulation

The above problem can be reformulated as a one-asset problem while preserving the endogenous composition of household portfolios. More precisely, the problem can be split into a dynamic problem that consists in choosing the total level of expenditure and savings, and thus the total amount of net wealth, and a static expenditure minimization problem that allocates total expenditure into three main categories: non-durable goods, housing asset, and liquid asset. Recall that total wealth is:

$$a^j = k^j + p^h h^j - d^j + m^j, \tag{13}$$

The budget constraint can be rewritten as:

$$\dot{a}^j + g_\varrho a^j + \overbrace{(1+\tau_c)\, c^j + R^{hj} s^j + R^{mj} m^j}^{P^{\Lambda j} \Lambda^j} = \left(1-\tau^j\right)\left(\Phi^j_\ell + \Phi^j_k\right) - \phi^j a^j + \Xi^j + T^j, \tag{14}$$

[21] As shown by Francis (2009), a key requirement for wealth-in-utility to stimulate wealth accumulation beyond a certain level of income is that the curvature parameter for Λ^j – γ in the utility function – is larger than that of wealth. In our utility function, the curvature parameter of wealth is 1 because of the log specification, which means the condition in our model is $\gamma > 1$.

where $P^{\Lambda j}$ is the true price index associated with Λ^j, to be defined later, and

$$\begin{aligned} R^{hj} &= p^h\left(\left(1-\mathbb{1}_{h^j}\right)\bar{r}_h + \mathbb{1}_{h^j}\left[\left(1-\tau^j\right)\left(\left(1-\varsigma\right)r^k+\varsigma\bar{r}^m\right)+\tau^j r^h\right]\right), \quad (15)\\ R^{mj} &= \left(1-\tau^j\right)\left(r^k-\bar{r}^m\right), \quad (16)\\ \Phi_k^j &= r^k a^j + \mathbb{1}_{e^j}(1-\tau_\pi)0.3\pi^j. \quad (17)\end{aligned}$$

Variable R^{hj} denotes the cost of housing services, R^{mj} the cost of liquidity services, and Φ_k^j is an alternative measure of capital income. For the cost of housing services R^{hj}, it depends on whether household j rents ($\mathbb{1}_{h^j}=0$) or owns ($\mathbb{1}_{h^j}=1$) its housing unit. If household j rents, then $R^{hj}=\bar{r}_h p^h$: occupying a housing unit of size s^j and worth $p^h s^j$ requires paying a rent $\bar{r}_h p^h s^j$ each period. If household j is an occupying homeowner, then $\mathbb{1}_{h^j}=1$, and the unit cost of housing is $R^{hj}=p^h\left[\left(1-\tau^j\right)\left(\left(1-\varsigma\right)r^k+\varsigma\bar{r}^m\right)+\tau^j\bar{r}^h\right]$.[22] In this case, the rent payment is almost exactly offset by the housing return – housing returns are taxed so they do not fully cover the equivalent rent, hence the presence of $\tau^j\bar{r}^h$ – and the housing cost becomes a weighted average of two components: (*a*) the interests paid on housing debt $\bar{r}^m$ for the fraction ς of debt-financed housing, and (*b*) the opportunity cost of not investing the equivalent amount in capital r^k for the fraction $1-\varsigma$ of savings-financed housing. The cost of liquidity services is $R^{mj}=\left(1-\tau^j\right)\left(r^k-\bar{r}^m\right)$, an opportunity cost of not investing savings in capital. Both wedges R^{hj} and R^{mj} are positive in equilibrium because households derive utility from housing and liquidity services. Last, $\Xi^j=\dot{p}^h h^j$ captures the housing valuation gains.[23]

This reformulation has the major advantage of reducing the program of household j to the following one-asset problem:

$$\begin{aligned} &\max_{\Lambda^j,a^j,\ell^j}\mathbb{E}_0\int_0^\infty e^{-\rho_j t}\left\{\frac{\left(\Lambda^j\right)^{1-\gamma}}{1-\gamma}-\frac{\left(\ell^j\right)^{1+\zeta}}{1+\zeta}+\beta\log\left(\frac{a^j}{a}+\mu\right)\right\}dt\\ &\text{s.t.}\quad \dot{a}^j+P^{\Lambda j}\Lambda^j=\left(1-\tau^j\right)\left(\Phi_\ell^j+\Phi_k^j\right)-\left(\phi^j+g_\varrho\right)a^j+\Xi^j+T^j\\ &\qquad a^j>0, \end{aligned} \quad (18)$$

The impact of changes in the environment on portfolio compositions is entirely encapsulated in $P^{\Lambda j}$ while, as explained below, m^j, s^j and b^j are determined *after* Λ^j, ℓ^j, and $\dot{a}^j$ have been chosen by households. Note that the above dynamic problem also solves for the endogenous labor supply decisions of workers, implying:

$$\ell^j=\left[\frac{\left(1-\tau^j\right)\left(1-\tau_\ell^j\right)\left(1-\mathbb{1}_{e^j}\right)w^j}{P^{\Lambda j}\Lambda^j}\right]^{\frac{1}{\zeta}}. \quad (19)$$

[22] Here, we consider that households who actually buy housing ($\mathbb{1}_{h^j}=1$) borrow up to the limit, *i.e.* $d^j=\varsigma p^h h^j$, which is consistent with the fact that $\bar{r}^m<\bar{r}^h<r^k$.

[23] This term stems from the fact that $\dot{a}^j=\dot{k}^j+p^h\dot{h}^j+\dot{p}^h h^j-\dot{b}^j+\dot{m}^j$. The treatment of capital gains only matters in the dynamic setting and so is explained later on. In the stationary equilibrium, $\dot{p}^h=0$ and so $\Xi^j=0$.

Workers' labor supply depends positively on the after-tax real wage and negatively on individual taxes through the substitution effect, where $1/\zeta$ is the elasticity of labor supply. Labor supply also varies negatively with aggregate expenditure $P^{\Lambda j}\Lambda^j$ through a standard wealth effect.

3.3.4 Endogenous portfolio choice

Once the above dynamic problem (18) is solved, the static problem involves choosing the composition of Λ^j subject to the relative costs of the three expenditure categories:

$$\min_{c^j,s^j,m^j} (1+\tau_c)\,c^j + R^{hj}s^j + R^{mj}m^j$$
$$\text{s.t. } \left(c^j\right)^{1-\kappa-\chi}\left(s^j\right)^{\kappa}\left(m^j\right)^{\chi} = \Lambda^j,$$

and gives the following decision rule for housing services, financial services and the non-durable goods consumption:

$$m^{dj} = \chi P^j_\Lambda \Lambda^j / R^{mj}\ ,\ s^j = \kappa P^j_\Lambda \Lambda^j / R^{hj} \text{ and } c^j = (1-\kappa-\chi)\, P^j_\Lambda \Lambda^j / (1+\tau_c)\,, \tag{20}$$

with

$$P^j_\Lambda = \left(\frac{1+\tau_c}{1-\kappa-\chi}\right)^{1-\kappa-\chi}\left(\frac{R^{hj}}{\kappa}\right)^{\kappa}\left(\frac{R^{mj}}{\chi}\right)^{\chi}. \tag{21}$$

Overall, the above decision rules show that expenditure or demand in the three categories – non-durables, housing services or liquidity services – are increasing in aggregate expenditure Λ^j, decreasing in their weight in preferences and decreasing in their relative prices.

Let us now explain the homeownership condition. While housing demand is bounded from below given the minimum size of housing units, the upper bound is given by the borrowing constraint. Homeownership is then determined by the following conditions:[24]

$$h^j = \mathbb{1}_{h^j} \min\left(s^j, \frac{a^j - k^j - m^{dj}}{\zeta p^h}\right) \text{ and } d^j = \zeta p^h h^j. \tag{22}$$

where $\mathbb{1}_{h^j} = \left(\frac{a^j - k^j - m^{dj}}{\zeta p^h} > h^{\min}\right)$. These conditions imply that homeownership occurs when households have enough wealth to buy at least the minimum housing size. The size of the housing unit bought is however limited by the borrowing constraint. Last, assuming that only

[24] Again, we consider that households who actually buy housing ($\mathbb{1}_{h^j} = 1$) borrow up to the limit, which is consistent with the cost of borrowing being systematically below the cost of renting.

homeowners can buy capital implies:[25]

$$k^j = \mathbb{1}_{h^j} \max(a^j - \left(p_h h^j - d^j\right) - m^{dj}, 0). \tag{23}$$

Any potentially remaining positive amount of wealth not allocated to housing or capital is then held in liquid form:

$$m^j = \max(a^j - \left(p_h h^j - d^j\right) - k^j, 0). \tag{24}$$

3.4 Tax and transfers system

In the model, some tax rates are proportional (the consumption tax rate τ_c and the corporate income tax rate τ_π) and some tax rates are progressive/regressive (the income tax rate τ^j, the payroll tax rate τ_ℓ^j, the wealth tax rate ϕ^j and monetary transfers T^j). The tradition in macroeconomic models regarding progressive taxes is to pool the different taxes and monetary transfers together and consider a progressive tax schedule (see Heathcote, Storesletten, and Violante (2017) for a discussion). The latter usually features a level parameter and a progressivity parameter that both apply to the entire distribution of the tax base.[26]

Leveraging the richness of DINA series, we extend the standard approach as follows. First, we apply this approach for each type of tax and for monetary transfers *separately* based on their relevant tax bases (payroll taxes on labor income, income taxes on fiscal income, wealth taxes on wealth, and monetary transfers on fiscal income). Second, we consider varying level and progressivity parameters over the distribution of tax bases. More precisely, we split the distribution of each tax base in several segments and estimate parameters for each segment. Third, we estimate all the parameters of all the tax and transfer schedules for the reference year (1984) and for each subsequent year.

Each progressive tax rate $\mathcal{T}$ (income taxes, payroll taxes, wealth taxes, and monetary transfers) is household-specific, and we assume the following functional form:

$$\mathcal{T}^j = 1 - \left(1 - \overline{\mathcal{T}}_s\right) \left(\frac{\mathcal{B}^j}{\overline{\mathcal{B}}}\right)^{-\eta_s} \text{ for } \mathcal{B}_{s-1} \leq \mathcal{B}^j \leq \mathcal{B}_s, \tag{25}$$

For each type of tax or transfer $\mathcal{T} \in \{\tau, \tau_\ell, \phi, T\}$, the individual tax rate or transfer of household j, whose tax base $\mathcal{B}^j$ belongs to segment $[\mathcal{B}_{s-1}, \mathcal{B}_s]$ is described by a level parameter $\overline{\mathcal{T}}_s$, and a

[25] This assumption is supported by panel (c) in Figure 1, which shows that equities only make up a small portion of net wealth in France, except for the wealthiest households. For further context, see Flavin and Yamashita (2002); Cocco, Gomes, and Maenhout (2005) on the relationship between owner-occupied housing and portfolio composition, as well as Badarinza, Campbell, and Ramadorai (2016); Gomes, Haliassos, and Ramadorai (2021) on household finance and equity market participation.

[26] Heathcote, Storesletten, and Violante (2017) show that this simple functional form offers a good approximation of the tax and transfer system in the U.S. See also Cagetti and De Nardi (2009), Kaymak and Poschke (2016) or Hubmer, Krusell, and Smith (2020), among others, for applications focusing on inequality dynamics. Hubmer, Krusell, and Smith (2020) propose a more granular approach that fits a step-wise tax function on the distribution of personal income.

progressivity parameter η_s, where $\overline{\mathcal{B}}$ is the average value of the tax base in total population.[27] Our approach consists in estimating level, progressivity and segment parameters for each progressive tax or transfer and for each year.

Appendix B presents the complete methodology and the fit for each tax and transfer of the model. It shows that the French tax and transfer system features very different and non-linear progressivity patterns for different tax bases and time periods.[28] The evolution of the level, progressivity and segment parameters is also reported in Figure 6.

While the traditional approach may be successful in matching the overall level of tax progressivity, it overlooks its granularity. As a consequence, it may fail to account for the effects of changes in taxes over time on the relevant margins (consumption, savings and labor supply). In Section D.2, we show that using our approach over the traditional approach improves the mapping between pretax and posttax income distributions and is instrumental in matching the wealth distribution.

3.5 Government and market clearing

Next, we present the budget constraint of the government and the market clearing conditions.

First, the government uses the revenues from the different taxes and issues deposits $\dot{m}^s$ to finance transfers, monetary transfers as well as an exogenous amount of public good and services $s_g \times y$. Its budget constraint yields:

$$
\begin{aligned}
s_g y + \underbrace{\int_j \Omega^j T^j dj}_{\text{Transfers}} + r^m m^s \quad &= \dot{m}^s + \underbrace{\int_j \Omega^j \tau_\ell^j \left(w^j \left(1 - \mathbb{1}_{e^j}\right) \ell^j + \mathbb{1}_{e^j} 0.7 \pi^j \right) dj}_{\text{Payroll tax}} \\
&+ \underbrace{\int_j \Omega^j \phi^j a^j dj}_{\text{Capital tax}} + \underbrace{\tau_\pi \left(\frac{r^k}{1-\tau_\pi} k + \int_j \Omega^j \mathbb{1}_{e^j} 0.3 \pi^j dj \right)}_{\text{Corporate tax}} \\
&+ \underbrace{\tau_c \int_j \Omega^j c^j dj}_{\text{Consumption tax}} + \underbrace{\int_j \Omega^j \tau^j \left(\Phi_\ell^j + \Upsilon_k^j \right) dj}_{\text{Income tax}},
\end{aligned}
\tag{26}
$$

where Ω^j is the distribution of households with $\int_j \Omega^j = 1$.

Second, the market clearing conditions of the capital, labor and deposit/housing debt markets

[27] Payroll tax rates τ_ℓ^j are computed on labor income (see Equation (9)), income tax rates τ^j and monetary transfers T^j are computed on the total fiscal income $\Phi_\ell^j + \Upsilon_k^j$, and wealth tax rates ϕ^j are computed on a^j. The number of thresholds differs across taxes to account for the different progressivity/regressivity profiles observed in the data. See Appendix B for details.

[28] See Figures B.1 to B.4 in Appendix B.

are:

$$k = \int_j \Omega^j k^j dj, \tag{27}$$

$$\ell = \int_j \Omega^j \left(1 - \mathbb{1}_{e^j}\right) \left(w^j / w\right) \ell^j dj, \tag{28}$$

$$m^s = m - d = \int_j \Omega^j \left(m^j - d^j\right) dj, \tag{29}$$

where deposit supply is controlled by the government and assumed to adjust to demand, given the (fixed) interest rate $\bar{r}^m$.

Third, given housing demand, exogenous housing prices and return $\bar{r}^h$, there exists an implicit housing supply h^s such that the housing market clears:[29]

$$h^s = h = \int_j \Omega^j h^j dj. \tag{30}$$

These conditions ensure that the goods market clearing condition is met by Walras' law.[30] Finally, aggregate output, the real wage and the return on capital can be respectively expressed as:

$$y = \xi k^\alpha \left(\varrho \ell\right)^{1-\alpha}, \; w = (1-\alpha)\frac{\theta - 1}{\theta}\frac{y}{\ell} \text{ and } r^k = (1 - \tau_\pi)\left(\alpha \frac{\theta - 1}{\theta}\frac{y}{k} - \delta\right). \tag{31}$$

3.6 Income concepts

Before we turn to the calibration and results, we define the different concepts of income we use, since their distribution are the basis of many objects we track in the paper. In line with the Distributional National Accounts literature, we use three basic income concepts in our analysis: pretax income, disposable income, and posttax income. By definition, aggregate pretax and posttax income are both equal to national income.[31] A full description of the income concepts is presented in Appendix A.

Pretax income is our benchmark concept to study the distribution of income before government intervention. It is defined as the sum of all income flows going to labor and capital, *after*

[29] As explained later on, we assume $p^h = 1$ in the stationary equilibrium, and that $\dot{p}^h$ is an exogenous variable in the dynamic simulations. Most papers with an explicit housing market model housing demand (as we do), consider either fixed or endogenous housing supply and assume that prices clear markets. However, to the best of our knowledge, none of these papers can generate a doubling in housing prices as an outcome. Accounting for the 2000's boom in housing prices usually requires a combination of low interest rates, loosening borrowing constraints and expectation dynamics (see Piazzesi and Schneider (2016)) that would be extremely difficult to model in our set-up. We opt for an alternative approach that imposes equilibrium prices and assumes that supply factors adjust accordingly.

[30] The latter reads:

$$\underbrace{c + \bar{r}^h p^h s}_{\text{Consumption}} + \underbrace{\dot{k} + \delta k + p^h \dot{h} + g_\xi a}_{\text{Investment}} + s_g y = y + \bar{r}^h p^h h.$$

[31] National income is defined as GDP minus capital depreciation plus net foreign income, following standard national accounts guidelines (SNA 2008).

taking into account the operation of the pension and unemployment insurance systems, but before taking into account other taxes and transfers. That is, we deduct pension and unemployment contributions and add pension and unemployment distributions. To recover the concept of pretax income in our model, we reassign corporate taxes and non-contributive payroll taxes to the labor and capital incomes of households.[32]

Disposable income is defined as pretax income minus all forms of taxes plus monetary transfers (T^j).

Post-tax income is defined as the sum of all income flows going to labor and capital, after considering all forms of government interventions. It is equal to disposable income plus in-kind transfers and collective consumption expenditure net of the government balance budget ($s_g y$ in our model, rebated on a lump-sum basis).

4 Calibration and Equilibrium

We solve the model numerically using the finite difference method of the continuous time heterogeneous agent models of Achdou et al. (2022). We first solve the stationary equilibrium where all exogenous variables except idiosyncratic shocks are constant.[33] This step consists in finding a stationary equilibrium, including a stationary distribution of asset holdings, a composition of portfolios, and policy functions over an asset grid a^j. We consider the economy to be in the stationary equilibrium in 1984 and use French data for this year to calibrate the model. We use the (log) transition matrix $\mathcal{M}$ and the associated levels of productivity (for workers) and profits (for entrepreneurs) $\{z_j, \pi_j\}$ to solve the stationary equilibrium. The second step solves for the transition dynamics using a non-linear method under perfect foresight, and analyzes the resulting aggregate and distributional dynamics. The details of both steps are given in Appendix C.

4.1 Calibration of the Stationary Equilibrium

The model is first solved along the first step and calibrated at an annual frequency using data or targeting data moments pertaining to the French economy in 1984, the year before inequalities start rising in the data. For some parameters, there is a direct mapping between the model's moment and the data. For other parameters, the mapping is too complex and we use a minimum distance method to pick the parameter values that best fit the moments. In any case, the stationary equilibrium involves constant asset prices, *i.e.* $p^h = 1$.

Earnings and transition probabilities - workers. The growth rate of labor productivity captures the average growth rate of national income per capita over the period, *i.e.* $g_\varrho = 0.01064$. The

[32] See Appendix A for more details.

[33] With labor-augmenting productivity growth, this implies that all quantities – except hours worked – grow at the exogenous rate of labor productivity g_ϱ.

Gaussian mixture process for the productivity of workers is discretized using codes by Farmer and Toda (2017) and many parameters are set following Ferrière et al. (2023). We set the probability of 'good' (positive mean and small variance) shocks to $p_1 = 0.9$, where 'bad' shocks are supposed to be associated with unemployment spell, the unemployment rate in 1984 being 10%. The mean of 'good' shocks is set to $\psi_1 = 0.02$ and the variance to $\sigma_1^2 = 0.1$. The variance of 'bad' shocks (shocks with negative mean and large variance) is set to $\sigma_2^2 = 0.5$, and the process implies $\psi_2 = -0.18$, *i.e.* average 'bad' shocks imply a 18% income drop. The persistence of the process is driven by ρ_z set to $\exp(-\rho_z) = 0.95$. This large persistence aligns well with independent empirical evidence about labor inequality in France (see Kramarz, Nimier-David, and Delemotte (2022)). Discretization yields the following transition matrix and relative productivity levels:

$$\mathcal{P}^w = \begin{bmatrix} 0.9346 & 0.0374 & 0.0220 & 0.0054 & 0.0005 \\ 0.0224 & 0.9368 & 0.0183 & 0.0135 & 0.0090 \\ 0.0237 & 0.0115 & 0.9101 & 0.0506 & 0.0041 \\ 0.0000 & 0.0155 & 0.0663 & 0.8708 & 0.0474 \\ 0.0004 & 0.0053 & 0.0232 & 0.0360 & 0.9351 \end{bmatrix} \text{ and } z^j = \begin{bmatrix} 0.3299 \\ 0.5223 \\ 0.8270 \\ 1.3094 \\ 2.0733 \end{bmatrix}.$$

Earnings and transition probabilities - entrepreneurs. For the entrepreneurial process, we set the unconditional probability of becoming an entrepreneur p_{ew} so that 10% of households are entrepreneurs which matches the share of employed population that are self-employed in France.[34] The conditional probabilities of becoming an entrepreneur of a certain type are such that the probability of becoming a successful entrepreneur increases with labor-market skills and is concentrated among high-skilled workers:[35]

$$\mathcal{P}^{ew} = \begin{bmatrix} 1/2 & 1/2 & 0 \\ 1/2 & 1/2 & 0 \\ 1/2 & 1/2 & 0 \\ 1/3 & 2/3 & 0 \\ 0 & 2/3 & 1/3 \end{bmatrix}.$$

Regarding the transition probabilities across the different types of entrepreneurs, we use

[34] According to the French National Statistical Institute (INSEE), self-employed represents 10.3% of employed individuals in 2018 (2.8 millions self-employed vs. 25.2 millions workers vs 28.0 millions employed individuals). Over the full 1989-2018 period, the share of self-employed is equal to 10%. Further, Aghion et al. (2018) report a stable an close-to-zero net entry rate in France, which leads us to consider a constant probability of becoming an entrepreneur p_{ew}.

[35] This is consistent with recent works on entrepreneurs such as Levine and Rubinstein (2017); Bhandari et al. (2024); Harju, Juuti, and Matikka (2024) that show that high-income earners establish more successful and productive businesses than others.

estimated probabilities and values of ω^j:[36]

$$\mathcal{P}^e = \begin{bmatrix} 0.9790 & 0.0209 & 0.0001 \\ 0.0104 & 0.9791 & 0.0104 \\ 0.0001 & 0.0209 & 0.9790 \end{bmatrix} \text{ and } \omega_j = \begin{bmatrix} 0.0541 \\ 2.1075 \\ 82.0687 \end{bmatrix}.$$

Finally, we assume that entrepreneurs loosing the status return to the different states of workers according to the following probabilities:[37]

$$\mathcal{P}^{we} = \begin{bmatrix} 1/5 & 1/5 & 1/5 & 1/5 & 1/5 \\ 1/5 & 1/5 & 1/5 & 1/5 & 1/5 \\ 0 & 0 & 1/3 & 1/3 & 1/3 \end{bmatrix}.$$

and adjust the unconditional probability of loosing the status of entrepreneur p_{we} to match distributional and aggregate moments as explained below.

Markups. Like Kaplan, Moll, and Violante (2018), we rely on a simple framework of monopolistic competition without fixed costs. In this setting, markups and profits coincide and depend solely on the elasticity of substitution across goods. However, the production side is much more complex in reality (*e.g.*, due to the presence of fixed costs), and as a result, empirical estimates of markups do not necessarily correspond to profits. Consequently, the estimated level of markups in the empirical literature should not – and are not – used to calibrate the elasticity of substitution in our model. In addition, De Ridder, Grassi, and Morzenti (2022) show that although trends in aggregate markups are estimated accurately, the level of markups is highly sensitive to the method used. Given these limitations, we calibrate the level of the markup in our model to $\theta/(\theta-1) = 1.0588$ (or $\theta = 18$) to match the observed top 10% and top 1% income shares.[38]

Firms and asset returns. Data from national accounts point to an aggregate labor share of 0.755 in 1984. In our model, this implies adjusting the capital elasticity to $\alpha = 0.28$. The depreciation rate of capital is taken directly from national accounts data: $\delta = 0.1128$. The real interest rates on deposits and housing in 1984 are taken from the data and adjusted for risk as in the simplified

[36]Based on the firm-level data nicely provided by Bauer and Boussard (2020), we compute the share of value-added produced by each firm and assume it is distributed as log-normal. We then estimate the mean, persistence and variance parameters of an AR(1) process that matches the 25th, 50th, 75th, 90th and 99th percentiles of the distribution of value-added for each year, and then discretize the resulting process to a 3-state Markov process.

[37]In absence of available data regarding these transitions, we use the fact that successful entrepreneurs were typically highly successful salaried workers. As such, when becoming workers after failing their business, successful entrepreneurs are more likely to become medium to high-skill workers. Note that changing these transitions has marginal effects on our results.

[38]To estimate the dynamics of markups over the 1985-2016 period, we then rely on the growth rate of the markup series computed by Bauer and Boussard (2020) (see Section 4.3 below).

procedure proposed by Kaplan and Violante (2014), which implies $\bar{r}^m = 0.01$ and $\bar{r}^h = 0.0293$.[39] As already mentioned, the initial relative price of housing is normalized to $p^h = 1$. In equilibrium, the resulting rate of return on equity capital is $r^k = 0.0595$.

Preferences. We set the relative risk-aversion parameter to its usual value $\gamma = 1.5$ and the utility weight of relative wealth to $\beta = 1$. The discount factor ρ, the utility weights of financial services χ and housing services κ, and the scale parameter for wealth in utility μ are set to match observed moments using a minimum distance method. As shown by Francis (2009) and in our counterfactual analysis, the latter is critical in matching top percentiles of the wealth distribution. The borrowing constraint parameter implies a minimum 1/4 of housing to be financed by personal net wealth, the remaining $\varsigma = 3/4$ being borrowed, and the minimum size of a housing unit h^{min} is adjusted to 3 years of the average pretax income, *i.e.* $h^{min} = 3y$, to obtain a homeownership rate close to the data (51.8% in 1984). Finally, in line with evidence by Chetty et al. (2011) on intensive margin adjustments of labor supply, we impose a Frisch elasticity of $1/\zeta = 1/2.5 = 0.4$.

Government. Our calibration focuses on *effective* – not statutory – tax rates. Using data from national accounts, the effective consumption tax (VAT) rate in 1984 was $\tau_c = 0.3388$. This number is higher than the statutory VAT rate because this tax captures several indirect taxes from the data. Similarly, the effective corporate tax rate was $\tau_\pi = 0.0803$, and the amount of government expenditure on goods and services was $s_g = 0.2934$. To model the monetary transfers and each progressive taxes (payroll taxes, wealth taxes, income taxes), we rely on Equation (25) and estimate a level parameter and a progressivity parameter for each segment of the corresponding tax base distribution. This estimation relies on the French DINA series by Bozio et al. (2024), which provide detailed annual series of the joint distribution of pretax income, posttax income and wealth, and is broken down by income and tax categories. See Appendix B for a complete presentation of the methodology and the fit for each tax and transfer of the model.

Moments matching. The following parameters of the model are set to match key distributional and aggregate moments from the data. The discount factor ρ, the probability of becoming a worker when an entrepreneur (p_{we}), and the following preference parameters χ (financial services), κ (housing services), and μ (scale parameter for wealth in utility) are all set together to match empirical moments. Our target moments are the following: the bottom 50%, middle 40%, top 10%, and top 1% shares of both pretax income and wealth, the aggregate shares of deposits (m/a) and housing (h/a) in total wealth, the wealth-income ratio a/y and the labor share computed as the aggregate labor pretax income divided by the aggregate pretax income. Our moment matching procedure implies a discount factor $\rho = 0.1845$, a probability of becoming a

[39] We consider the return on housing computed by Garbinti, Goupille-Lebret, and Piketty (2021). For each year from 1984 to 2019, we compute the risk-adjusted returns by dividing the returns by the standard deviation of the past 10 years. The average of these risk-adjusted returns between 1984 and 2019 are $\bar{r}^m = 0.01$ and $\bar{r}^h = 0.0293$.

worker $p_{we} = 0.0683$, a utility weight of financial services $\chi = 0.0277$, a utility weight of housing services $\kappa = 0.2549$ and a wealth-in-utility scale parameter of $\mu = 2.6752$. Parameter values are summarized in Table 1.

Table 1: Parameter values and initial values of exogenous variables.

Parameters		
Steady-state growth rate	$g_\varrho = 0.01064$	(av. growth rate data)
Discount rate	$\rho = 0.1845$	(moments matching)
Relative risk-aversion	$\gamma = 1.5$	(fixed)
Weight of housing services in utility	$\kappa = 0.2549$	(moments matching)
Weight of financial services in utility	$\chi = 0.0277$	(moments matching)
Elasticity of labor supply	$1/\zeta = 1/2.5 = 0.4$	(CGDW (2011))
Weight of relative wealth in utility	$\beta = 1$	(fixed)
Wealth in utility scale parameter	$\mu = 2.6752$	(moment matching)
Indivisible housing parameter	$h^{\min} = 3 \times y$	(homeownership rate)
Borrowing constraint parameter	$\varsigma = 0.75$	(fixed)
Persistence of labor income risk	$\exp(-\rho_z) = 0.95$	(fixed)
Probability of good labor income shock	$p_1 = 0.9$	(unemp. rate data)
Mean of good labor income shock	$\psi_1 = 0.017$	(FGNV (2023))
Variance of good labor income shock	$\sigma_1^2 = 0.1$	(fixed)
Mean of bad labor income shock	$\psi_2 = -0.18$	(fixed)
Variance of bad labor income shock	$\sigma_2^2 = 0.5$	(FGNV (2023))
Prob. of becoming an entrepreneur	$p_{ew} = 0.0076$	(entrepreneurs = 10%)
Prob. of becoming a worker	$p_{we} = 0.0683$	(moment matching)
Output elasticity of capital	$\alpha = 0.28$	(labor share)
Initial values of exogenous variables		
Capital depreciation	$\delta = 0.1128$	(data)
Markups	$\theta/(\theta-1) = 1.0588$	(top 10% and 1% income shares)
Return on equity	$r^k = 0.0776$	(result)
Return on housing	$r^h = 0.0293$	(data)
Relative housing prices	$p^h = 1$	(normalization)
Return on deposits	$r^m = 0.01$	(data)
Government spending to output	$s_g = 0.2934$	(data)
Consumption tax rate	$\tau_c = 0.3388$	(data)
Corporate tax rate	$\tau_\pi = 0.0803$	(data)
Progressive tax rates and transfers	See Appendix B	(data)

Fit for targeted moments. Those parameters imply that deposits represent $m/a = 0.151$ of aggregate wealth (almost the exact value of the data) and housing $p^h h/a = 0.410$ (against 0.429 in the data). This calibration delivers a wealth-income ratio of 3.175, very close to the observed ratio that is 3.241. More generally, our stationary equilibrium produces a very good fit with our target moments, as shown in Table 2. The model delivers a good match of the bottom 50%, middle 40%, top 10%, and top 1% shares of the pretax income and wealth. Further, although the model does not target any of the posttax shares of income, it matches them very well, showing that our assumptions regarding taxes and transfers capture key redistributive features of the French system. More generally, we show in the next paragraphs that our model reproduces many features of the data that are not targeted by our matching procedure.

Table 2: Moments from the data (1984) vs. model.

	Data (1984)			Model (1984)		
	Pretax	Posttax	Wealth	Pretax	Posttax	Wealth
Bottom 50% (B50)	0.230	0.337	0.081	0.209	**0.335**	0.104
Middle 40% (M40)	0.486	0.450	0.406	0.505	**0.457**	0.399
Top 10% (T10)	0.283	0.214	0.513	0.286	**0.208**	0.496
Top 1% (T1)	0.070	0.046	0.160	0.073	**0.047**	0.165
Share of deposits in agg. wealth		0.152			0.151	
Share of housing in agg. wealth		0.429			0.410	
Wealth to income ratio		3.241			3.175	

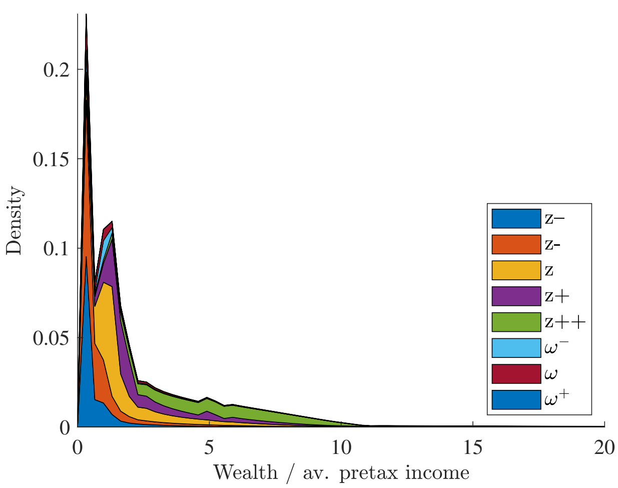
Note: Bold numbers are not targeted.

4.2 Stationary equilibrium

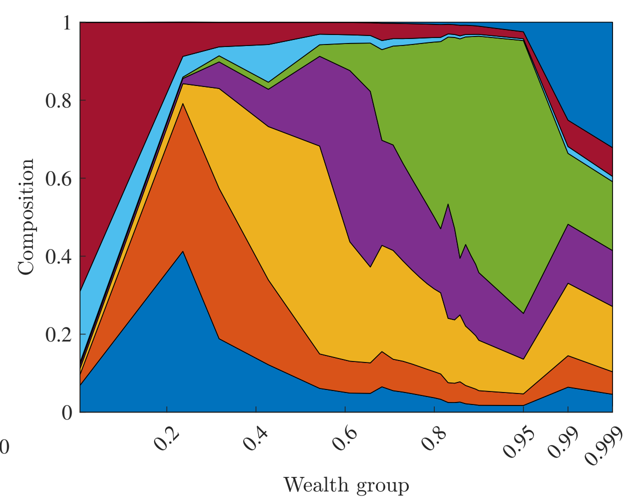
The calibration gives rise to the stationary distribution of households depicted in Figure 2.

Figure 2: Stationary distributions

(a) Stationary distributions (cumulated).



(b) Composition of the population.



As expected, Panel (a) of Figure 2 shows that the stationary distribution is highly skewed to the left and fat-tailed at the right. The double peak of the stationary distribution – one at zero and one at 1.5 times the average pretax income – arises from the indivisible housing constraint and from the fact that owning its housing unit is cheaper than renting, as it involves a lower opportunity cost R^{hj}. Hence, households face incentives to hold just enough wealth to own their housing unit. Beyond that, the other features of our stationary distribution are relatively standard. The transition probabilities implied by our labor and entrepreneurial income processes determine the respective stationary proportions of household types: workers with very low or low productivity respectively represent 15% and 18.4% of the population, workers with an average productivity represent 23.5%, workers with high or very high productivity respectively make 16.5% and 16.6%, and entrepreneurs represent the remaining 10%: 3.5% of low-skill entrepreneurs, 5.4% of mid-skill entrepreneurs and 1.1% of top entrepreneurs.

Panel (b) of Figure 2 indicates that wealth increases with the level of productivity as the fraction of high-productivity workers increases with asset holdings. In addition, top entrepreneurs are concentrated at the top of the wealth distribution and low-skill entrepreneurs at the bottom. While top entrepreneurs represent a small fraction of total population (1.1%), they are income-rich because they receive a large fraction the total profits from firms – roughly 6% of total output. In addition, they precautionary-save because the probability of becoming a worker or a lower skill entrepreneur is much larger than the probability of becoming a top entrepreneur. Hence, they represent a large share (around 35%) of top wealth owners, as shown by Panel (b) of Figure 2.

The model generates the policy functions depicted in Figure D.1 in Appendix D. They help rationalize the shape and composition of the stationary distribution: top entrepreneurs and highly productive workers at the top of the wealth distribution. They also show the usual determinants of labor supply, wealth and substitution effects. Last, Panels (d) and (e) of Figure D.1 inform about the individual compositions of portfolios by types and wealth levels. They show that households at the bottom of the asset distribution do not save enough to reach the threshold to become homeowners, and therefore keep their wealth in the form of liquid deposits. When households save enough to become homeowners, they allocate almost all of their wealth to housing. Beyond a certain level of asset, households choose to diversify their portfolios by holding capital.

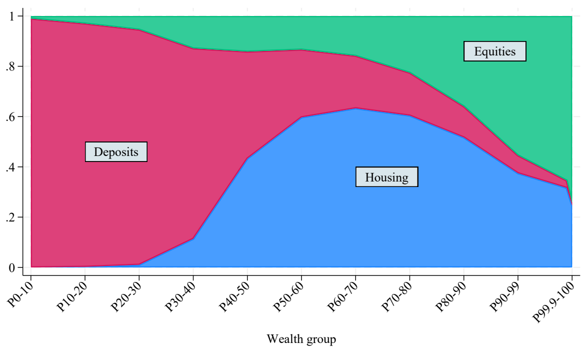
As a result of the varying composition of portfolios along the distribution of wealth, individual pretax returns on wealth are increasing in wealth (Panel (f) of Figure D.1). How do these individual policy functions interact with the distribution? Aggregating over households at the different levels of the asset grid, we obtain the aggregate portfolio compositions and portfolio returns along the wealth distribution depicted in Figure 3.

Clearly, households at the bottom of the wealth distribution hold only deposits. Above the third decile, households hold an increasingly large (up to 70%) share of their wealth in the form of housing, fewer deposits and the rest in capital. Above the seventh decile, the share of housing starts declining, the share of deposits continues to shrink, and the share of equity increases to reach 75% for the top 0.1% of the wealth distribution. These equilibrium portfolio compositions fit the data quite well and produce increasing returns along the wealth distribution, as in the data.[40] Since deposits carry the lowest returns (1%), households holding only deposits receive low returns. When portfolios start including housing, which carries a larger return (2.93%), portfolio returns start increasing. Returns further increase when households start holding equity,

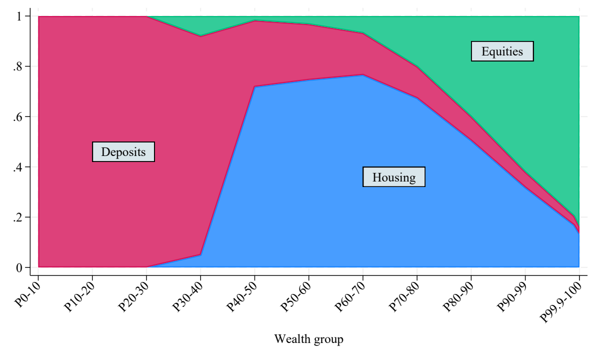
[40]See Garbinti, Goupille-Lebret, and Piketty (2021) for similar evidence from France, and Cao and Luo (2017) or Xavier (2024) for evidence based on U.S. data.

Figure 3: Portfolio composition and returns among wealth groups in 1984.

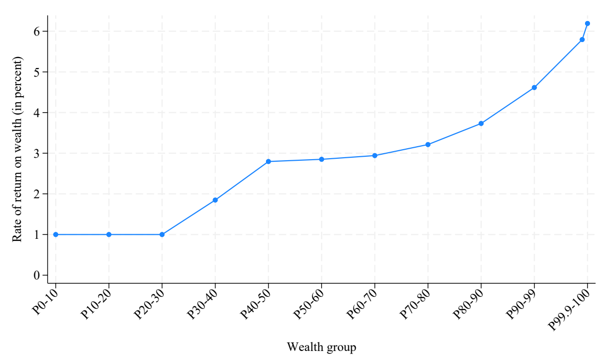
(a) Portfolio composition - data



(b) Portfolio composition - model



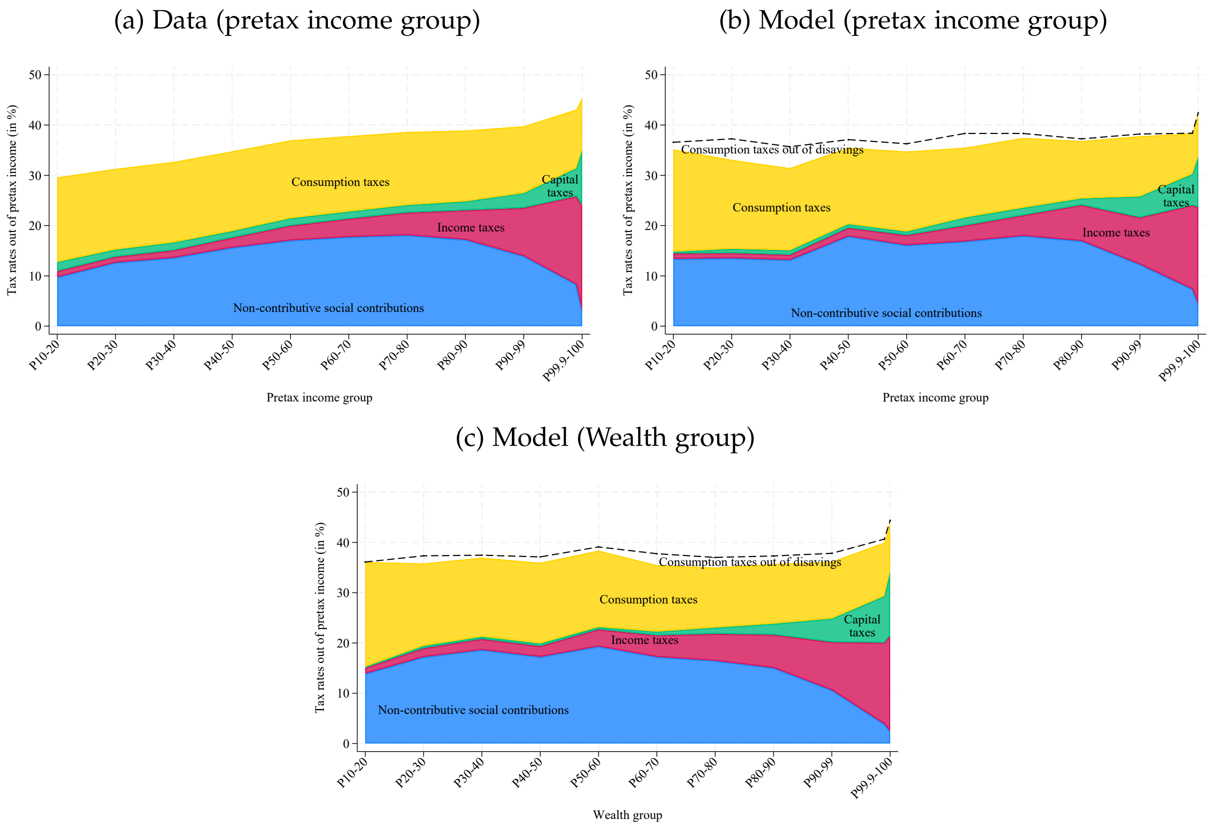
(c) Pretax rates of returns



Notes: Series from Panel (a) come from Garbinti, Goupille-Lebret, and Piketty (2021). In Panel (c), rates of returns are computed by weighting each asset-specific rate of returns (housing, equities, and deposits) by the proportion of each asset in the wealth of the group.

which carries the largest return (7.76%). The differential composition of portfolios explains that top wealth owners receive returns that exceed those of bottom wealth owners by more than 6 percentage points.

Figure 4: Taxes paid (in % of pretax income) by wealth or pretax income groups, France 1984.



Notes: Data from Panel (a) taken from Bozio et al. (2024).

Figure 4 reports the amount and composition of taxes paid by households ranked by income and wealth groups as a fraction of their pretax income. The consumption tax is regressive given that poorer households consume a larger fraction of their disposable income. Payroll taxes are also regressive at the top of the income distribution. Our results further show a strong progressivity of the income and wealth tax schedule. The latter is especially progressive at the very top because of large levels of wealth and because of large returns on wealth, driven by larger shares of equity in portfolios.

Overall, the model provides a close fit with the data on a large variety of dimensions. By design of our moment matching procedure, it fits the pretax income and wealth shares up to the top 1%, the aggregate composition of wealth, the aggregate wealth-income ratio and the labor share. It also fits non-targeted features of the data: the posttax income shares up to the top 1%, the composition of portfolios – our calibration procedure only targets the composition of aggregate portfolios, not their distribution – and increasing returns along the wealth distribution, and the composition of taxes paid along the pretax income distribution.

4.3 Dynamic Equilibrium

We now conduct dynamic simulations (second step of the solution) feeding a sequence of changes to exogenous variables from 1984 to 2019.

4.3.1 Exogenous variables

TFP and capital depreciation. First, we consider a time-varying depreciation rate of capital δ, derived using national accounts data, and a time-varying path for TFP, ξ in the model. The level of TFP is taken from the long-term productivity database of Bergeaud, Cette, and Lecat (2016). Since the model already features labor productivity growth in the steady-state at rate g_{ϱ}, we feed the model with log-deviations of TFP from an HP-filtered trend with a smoothing parameter of 5000. Both series are reported in Figure 7 along other exogenous variables.

Markups and entrepreneurial process. Second, as in Boar and Midrigan (2024) and Deb (2024), our conjecture is that rising market power may account for increasing income and wealth inequality because markups are the only source of income for entrepreneurs, who are at the top of the income and wealth distributions. We consider exogenous variations in aggregate markups between 1985 and 2016 based on the changes estimated by Bauer and Boussard (2020) as shown in Figure 7. In addition, we consider the time-varying dynamics of the entrepreneurial process (*i.e.* the changes in the $\mathcal{P}^e$ matrix and the vector of ω) estimated on French data, which implies the relative market shares and population dynamics for entrepreneurs reported in Figure 5.

Taxes and transfers. Third, for every year from 1984 to 2019, we introduce time-varying parameters in all taxes and transfers – whether proportional or progressive, and government spending. Indeed, changes in the level and progressivity of taxes and transfers may substantially affect income and wealth inequality dynamics. Figure 6 reports the evolution of our estimated parameters – level, progressivity and thresholds – for progressive taxes and transfers over time and Figure 7 the tax rates for proportional taxes and government spending.

Capital gains. Last, our dynamic simulations consider exogenous capital gains – cumulative changes in asset prices reported in Figure 7 – as a potential driver.[41] Asset prices affect households decisions through two channels in the model: (*i*) changes in the relative housing prices p^h alter the demand for housing services, the borrowing constraint and the conditions of homeownership more generally, and (*ii*) changes in asset prices – both housing and equity capital – change

[41] We use this reduced-form approach to abstract from modeling asset supply and offer a simplified representation of the equilibrium in asset markets – and especially the housing market.

Figure 5: Exogenous changes in the entrepreneurial process.

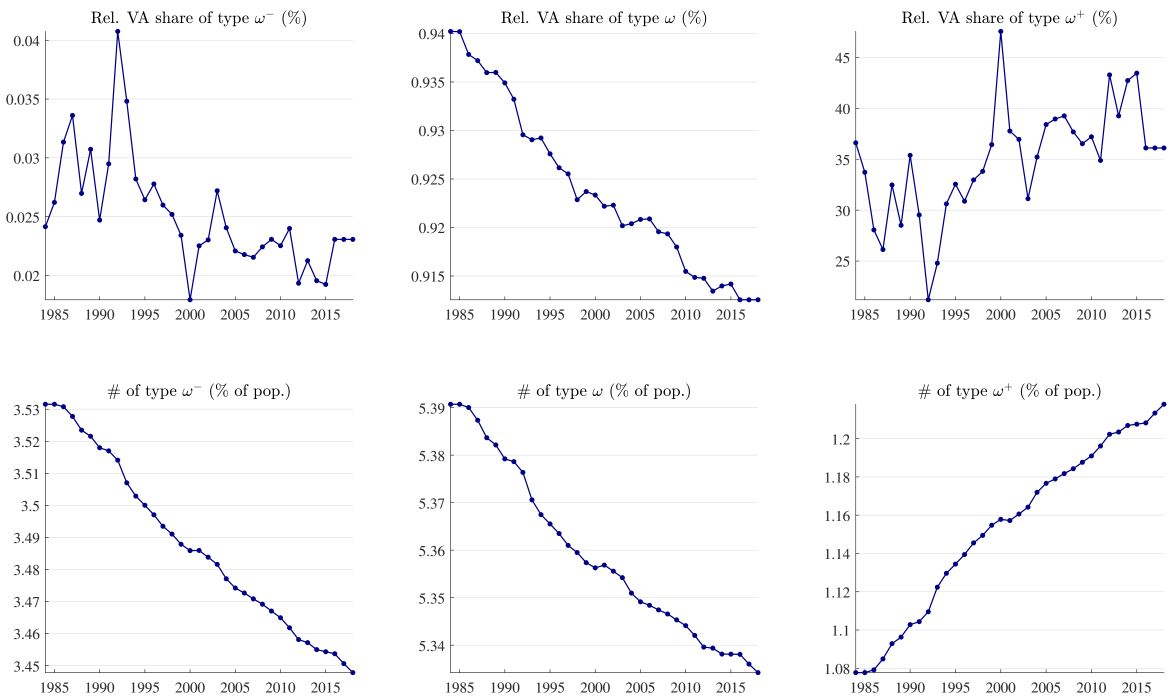
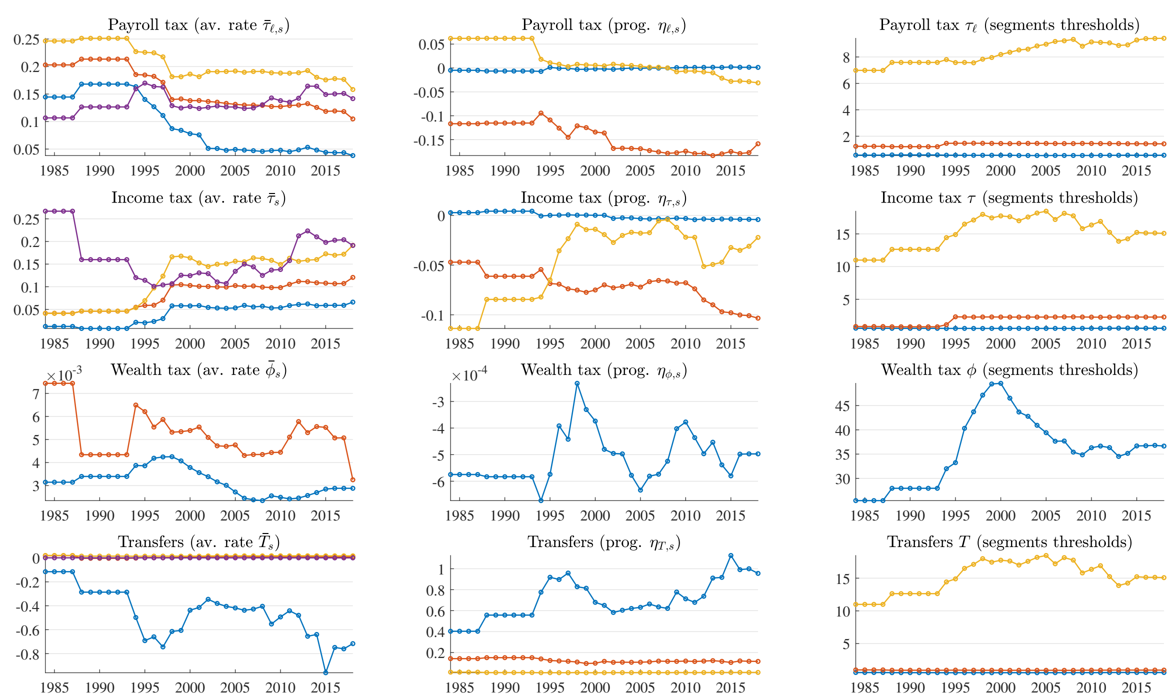
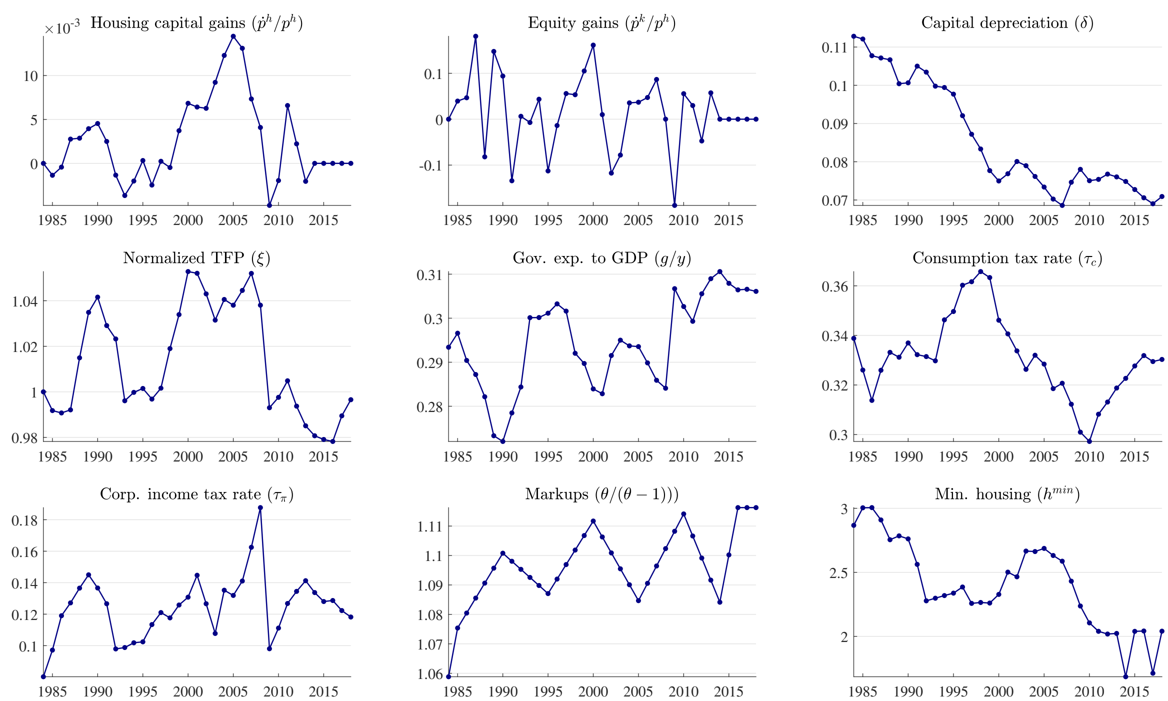


Figure 6: Exogenous changes in progressive taxes and transfer parameters.



the value of individual wealth and thus the wealth tax rate ϕ^j paid by households, which affects their savings decisions. We proceed as follows. First, a fraction (20%) of the observed changes in housing prices is taken into account by households when optimizing, reflecting the turnover of housing units. Second, we incorporate pure valuation effects, captured by Ξ^j in our model. We treat them as in Fagereng et al. (2019): assume $\Xi^j = 0$ in the optimization problem of households and reflate housing and equity capital holdings by the observed housing and equity capital gains $\dot{p}^h / p^h$ and $\dot{p}^k / p^k$ *after* optimization. This increases both the left-hand side ($\dot{a}^j$) and right-hand side (Ξ^j) of the budget constraint of each household. Since households partly take expected changes in housing prices into account in the dynamic simulations, this affects the homeownership rate. However, in the data, the homeownership rate remains quite stable, at around 60%. Therefore, in simulations with capital gains, we adjust the minimum housing size, $h^{\min}$, over time to keep the homeownership rate stable.

Figure 7: Exogenous variables



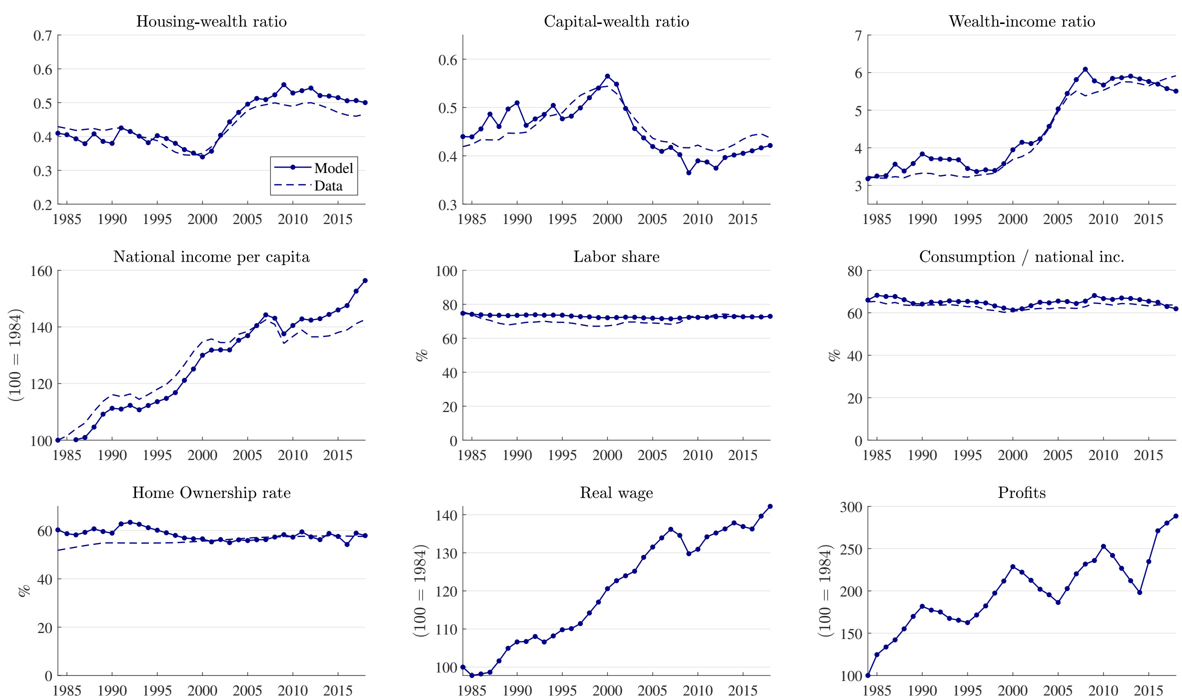
Solution method. Dynamic simulations are run using the finite difference method for continuous-time heterogeneous agent models of Achdou et al. (2022). Because the Hamilton-Jacobi-Bellman (HJB) equation is forward-looking, several current-period variables depend on their expected future path. We thus solve the model for an additional 30 years after 2018. Further, except for revaluation effects which are treated as unexpected shocks, the future paths of driving forces are known when solving the HJB equation, so that simulations are basically under perfect foresight. After 2018, when there are no data for exogenous variables anymore, the latter are assumed to remain equal at their 2018 values. Post-2019 capital gains are assumed to be zero, *i.e.* asset prices are stabilized at their 2018 levels for the later years.

4.3.2 Fit with the data

Let us start by looking at the performance of our simulated model in replicating aggregate features of the data.

The top panel of Figure 8 report the evolutions of the aggregate housing-wealth, capital-wealth and wealth-income ratios, as well as the national income per capita. The model accounts very well for the fall of the housing-wealth ratio from 1984 to 2000 and for its rise after 2000. An opposite movement – a rise until 2000 and then a fall – of the capital-wealth ratio is observed and well reproduced by the model. Further, the observed wealth-income ratio rises from 3.2 in 1984 to almost 6 in 2018, an overall increase that our model matches closely. Finally, the dynamics of the national income are also matched very closely, an additional indication of the excellent performance of our model simulations.

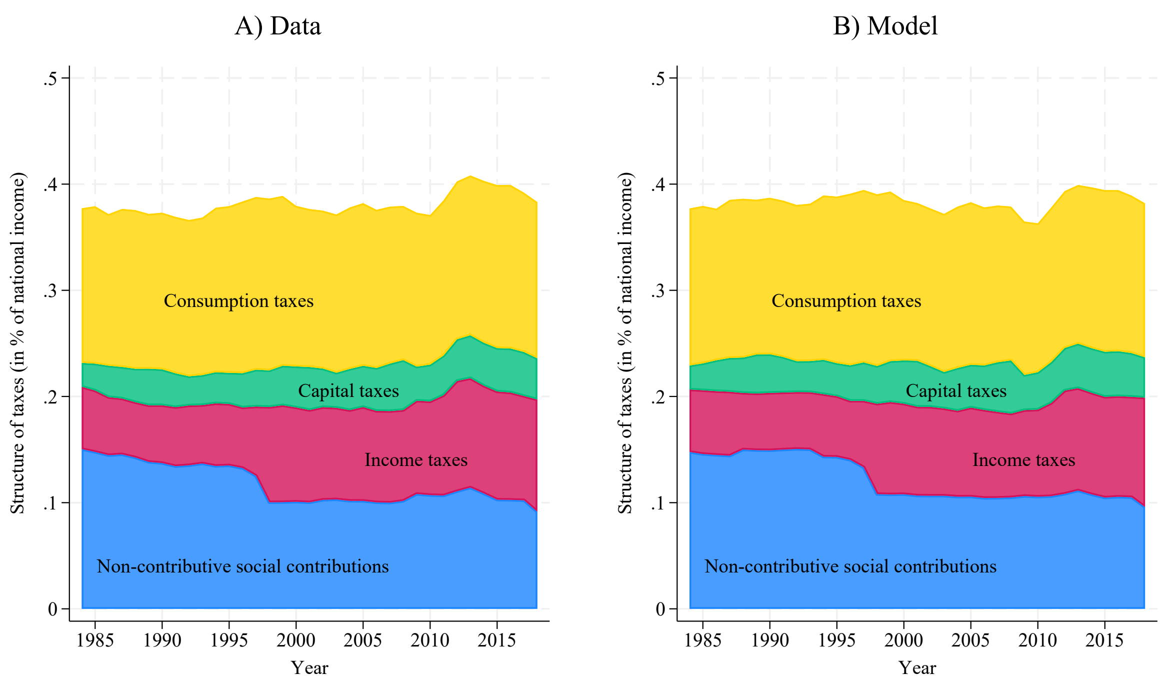
Figure 8: Macroeconomic variables



The middle and bottom panels of Figure 8 report the dynamics of the labor share, the consumption-income ratio, and the normalized levels of the average real wage and aggregate profits. The model simulations track the observed dynamics of the labor share and of the consumption-income ratio very well. For the labor share, note that the rise in profits is relatively neutral because 70% of profits are recorded in the model (and taxed) as labor income while the remaining 30% are treated as capital income. Finally, since our simulations are driven by a significant increase in markups, profits increase more than the average real wage over the period.

Figure 9 reports the simulated and observed decomposition of taxes in percentage of national income over time. The model reproduces almost perfectly the evolution of the aggregate tax structure and of the aggregate tax level.

Figure 9: Structure of taxes



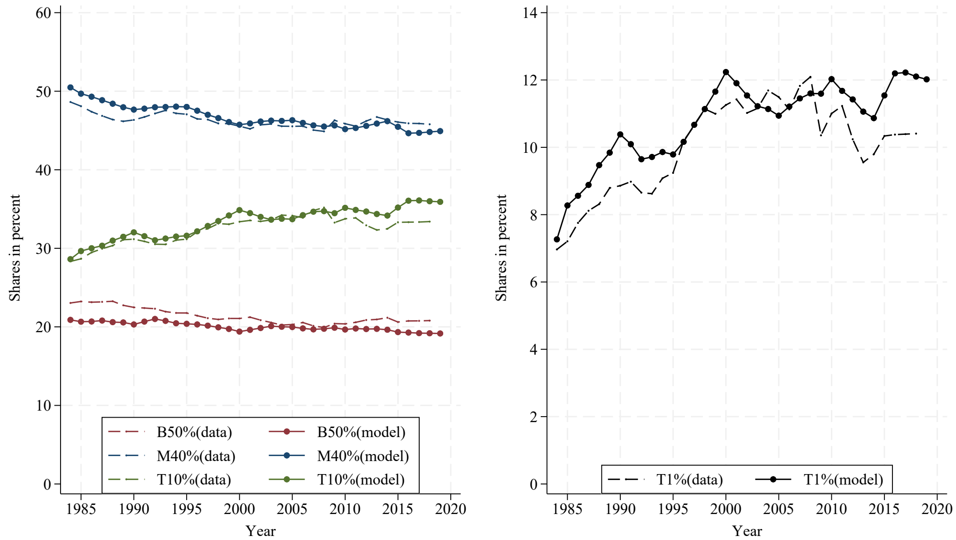
Finally, Figure 10 depicts the performance of our simulated model in reproducing inequality dynamics. The model fits very closely the evolution of pretax income (Panel A), post-tax income (Panel B), and wealth inequality (Panel C) for all groups (bottom 50%, middle 40%, top 10% and top 1%). For wealth inequality, the model is able to account for both the overall increasing pattern and the large short-term fluctuations around 2000. While the model fits almost perfectly the two extreme parts of the distributions (bottom 50% and top 1% wealth shares), it tends to slightly overestimate the top 10-1% wealth share (and therefore the top 10%) at the expense of the middle 40% wealth share.[42]

[42]We provide additional figures to assess the performance of our simulated model in Appendix E. Figure E.1 extends the comparison of portfolio composition to 2014, the last year covered in the data. Figure E.2 presents the evolution of pretax rates of return for different wealth groups – namely, the bottom 50%, the middle 40%, the top 10%, and the top 1% – comparing model predictions to the empirical estimates. The model is able to reproduce adequately the composition of household portfolios across the wealth distribution over time. While the level of pretax rates of returns may slightly differ between the model and the data, it captures well the increasing return on wealth along the wealth distribution.

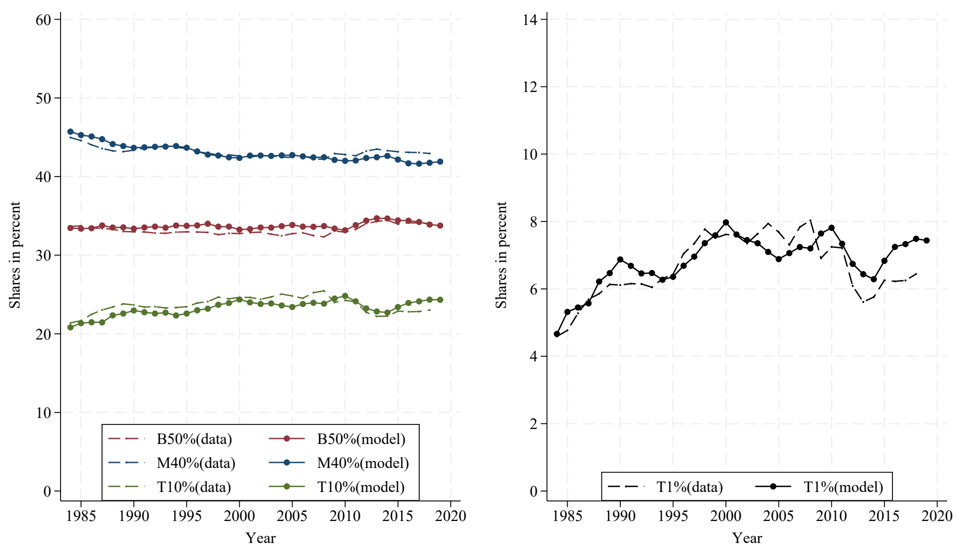
Figure 10 highlights two main facts regarding inequality dynamics: (*i*) a rise in income inequality driven mostly by a significant increase in the top 1% income share and (*ii*) a rise in wealth inequality driven by a significant increase in the top 10% and top 1% at the expense of the bottom 50% and middle 40% wealth shares. We provide a deeper understanding of the key forces and transmission mechanisms in the next section.

Figure 10: Inequality dynamics. Model vs. data

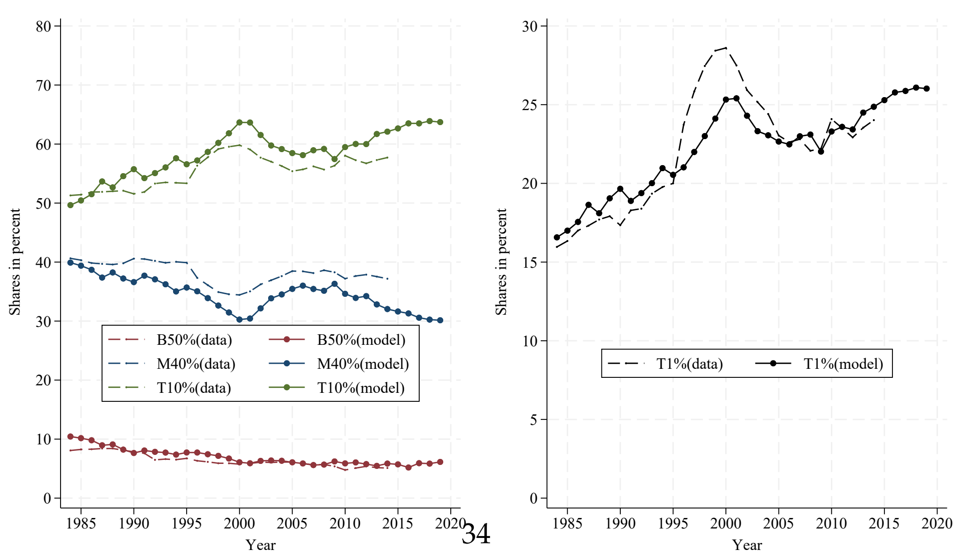
(a) Pretax income shares



(b) Post-tax income shares



(c) Wealth shares



5 Results

In this section, we conduct counterfactual analyses to shed light on how the different exogenous variables shape income and wealth inequality dynamics. We also propose a new method to identify the channels through which the different exogenous variables contribute to wealth inequality dynamics. In particular, the method allows us to distinguish mechanical effects from behavioral and general equilibrium effects.

To do so, we group exogenous variables into four groups: capital gains, taxes and transfers, markups, and other market forces (capital depreciation rate and TFP). We then run counterfactual simulations assuming that one or several groups of exogenous variables remain constant at their 1984 level throughout the 1984-2018 period. We compare the resulting income and wealth shares with our benchmark series to quantify the contributions of each group to the evolution of income and wealth inequalities.

Furthermore, for each counterfactual scenario, we propose a method to quantify the contribution of transmission channels to wealth inequality dynamics. Our method is based on a simple wealth accumulation equation that identifies all potential transmission channels: (i) aggregate pretax income dynamics, and the dynamics of inequality in (ii) pretax income, (iii) tax progressivity, (iv) saving rates, and (v) capital gains.

5.1 Counterfactual analyzes

We first investigate the impact of our exogenous variables on inequality by examining the evolution of the top 1%, top 10%, middle 40%, and bottom 50% income shares (Figure 11) and wealth shares (Figure 12) by counterfactual scenario.[43] The red curves represent the evolution of inequality in considering only changes in TFP and capital depreciation. The blue, purple, and orange curves incorporate either changes in taxation, markups, or capital gains in addition to changes in TFP and depreciation. The green curves combine changes in markups and taxation while holding capital gains constant. Finally, the black curves represent our baseline scenario with all exogenous variables together.

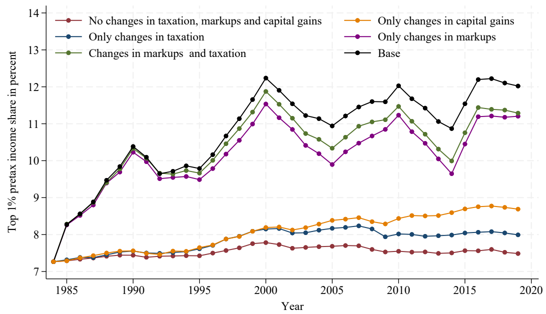
Considering only changes in TFP and capital depreciation (red curves), Figures 11 and 12 show that income and wealth inequality would have remained almost stable between 1984 and 2019. It suggests that these exogenous variables matter for the dynamics of aggregate variables but not for the dynamics of inequalities.

In contrast, our baseline scenario (black curves) shows a rise in income inequality, characterized by a strong increase in the top 1% income share (from 7% in 1984 to 12% in 2019),

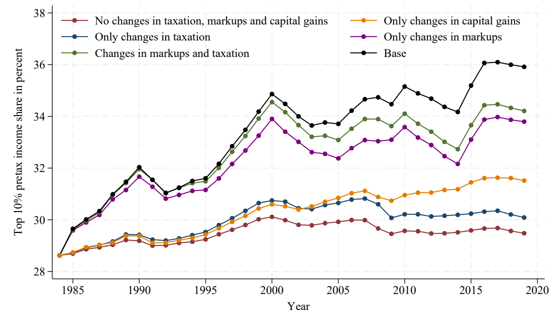
[43] Appendix Table E.1 provides complementary insights to the counterfactual analysis by showing how the different scenarios affect the growth rate of income (Panel A) and wealth (Panel B) for the full population and various income and wealth groups.

Figure 11: Counterfactual pretax income shares

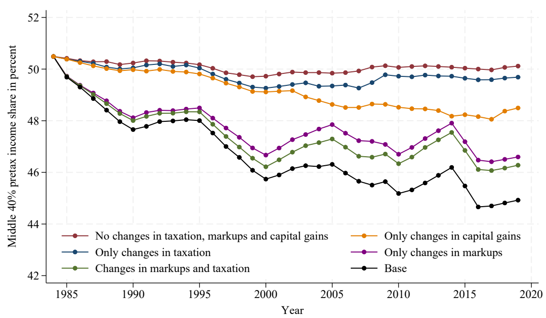
(a) Top 1% pretax income share



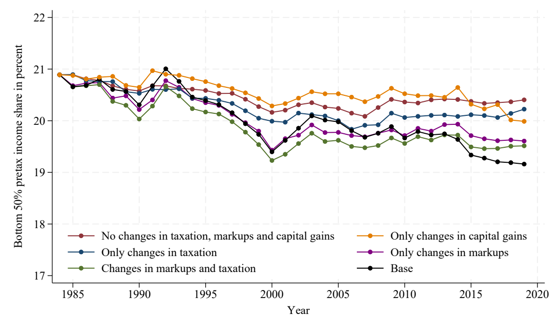
(b) Top 10% pretax income share



(c) Middle 40% pretax income share



(d) Bottom 50% pretax income share



compensated by a modest decline in the middle 40% and bottom 50% income shares. The counterfactual analysis highlights that: (*i*) changes in markups are the primary driver of the rise in income concentration, dramatically increasing the top 1% and top 10% income shares at the expense of the bottom 50% and middle 40% income shares (purple curves); (*ii*) changes in taxation (blue curves) and changes in capital gains (orange curves) also amplify income inequality but to a lesser extent; (*iii*) overall, changes in markups account for approximately 70% of the increase in the top 1% income share, compared to 15% for changes in capital gains and 10% for changes in taxation.

Turning to wealth inequality, Figure 12 shows that changes in markups, taxation, and capital gains all play key roles. However, the importance of these factors vary across wealth groups.

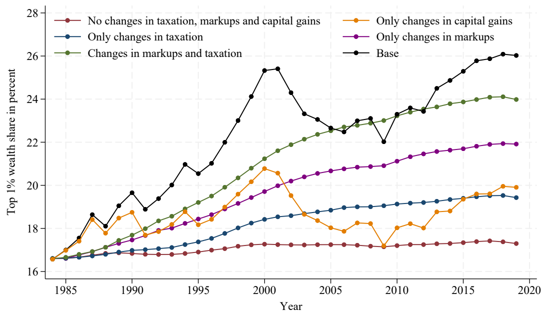
For the top 1%, the sharp increase in the wealth share from 16.5% in 1984 to 26% in 2019 is explained by all three factors: changes in markups account for 48% of the rise, compared to 22% for changes in taxation and 22% for changes in capital gains.

In contrast, the decline in the bottom 50% wealth share is almost entirely driven by changes in capital gains. Changes in taxation and markups exert small and opposing effects on the bottom 50% wealth share, largely offsetting each other.

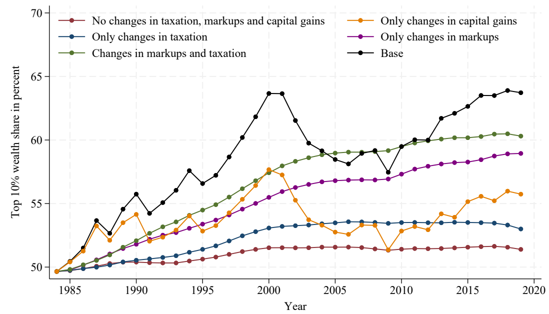
For the middle 40%, changes in taxation and markups are the primary long-term drivers of wealth share dynamics. Although capital gains induce substantial short-term fluctuations,

Figure 12: Counterfactual wealth shares

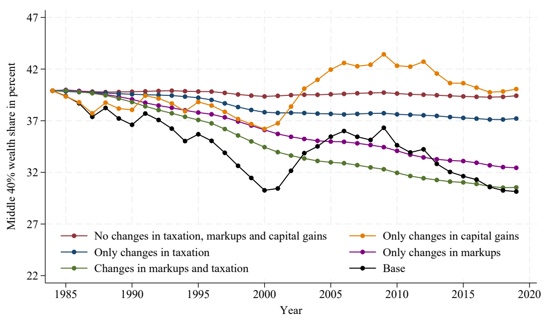
(a) Top 1% wealth share



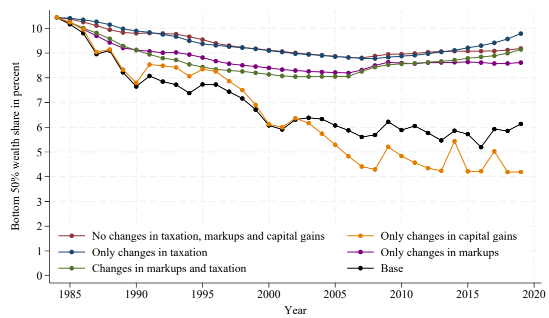
(b) Top 10% wealth share



(c) Middle 40% wealth share



(d) Bottom 50% wealth share



their long-term impact on the middle 40% wealth share is almost negligible. This finding is particularly striking given the disproportionate share of housing in the portfolios of households belonging to the middle 40%, and the significant rise in housing prices over the period. We will return to this point into more details in the next subsections.

5.2 Quantifying transmission channels: Method

While the counterfactual analysis above has highlighted the key roles of the different groups of exogenous variables in shaping wealth inequality dynamics, it remains silent about the underlying transmission mechanisms. For instance, rising markups redistribute income towards entrepreneurs at the top of the income distribution, but also lower wages and the return on capital. These movements may alter pretax income inequality but also the tax rates faced by individuals, and induce behavioral responses, such as changes in saving behaviors. The sign and strength of these responses are further shaped by the tax and transfer system, which can itself vary over time. Similarly, changes in capital gains can trigger strong behavioral responses beyond the mechanical effects stemming from the differential structure of portfolios across the wealth distribution.

To address these issues, we leverage a simple wealth accumulation equation that identifies the transmission channels driving wealth inequality dynamics. Specifically, wealth accumulation can be expressed as:

$$W_{it+1} = (1 + q_{it})(W_{it} + S_{it}) = (1 + q_{it})(W_{it} + s_{it}(1 - \tau_{it})sh^{Y}_{it}Y_t) \tag{32}$$

where W_{it} denotes the wealth owned by wealth group i at time t, $(1 + q_{it})$ is the rate of capital gains, and S_{it} represents savings. Savings can be further decomposed into four components: (*i*) the saving rate out of disposable income (s_{it}), (*ii*) the net-of-tax rate $(1 - \tau_{it})$, which accounts for both taxes and monetary transfers, (*iii*) the share of pretax income accruing to wealth group i (sh^{Y}_{it}), and (*iv*) aggregate pretax income (Y_t). Consequently, $(1 - \tau_{it})sh^{Y}_{it}Y_t$ corresponds to the disposable income of wealth group i. Incidentally, we define S_{it} and s_{it} as in Saez and Zucman (2016); Garbinti, Goupille-Lebret, and Piketty (2021), computing them as *synthetic* savings and *synthetic* saving rates that account for the observed evolution of wealth of group i from t to $t + 1$ given the observed values of the remaining variables (W_{it+1}, W_{it}, q_{it}, τ_{it}, sh^{Y}_{it} and Y_t).

Based on Equation (32), the evolution of the wealth share of group i can be written as:

$$sh^{W}_{it+1} = \frac{W_{it+1}}{W_{t+1}} = \frac{(1 + q_{it})}{(1 + q_t)} \cdot \frac{(W_{it} + s_{it}(1 - \tau_{it})sh^{Y}_{it}Y_t)}{(W_t + s_t(1 - \tau_t)Y_t)} \tag{33}$$

where sh^{W}_{it+1} denotes the wealth share of wealth group i at time $t + 1$ and q_t, s_t, and τ_t are the aggregate counterparts of q_{it}, s_{it}, and τ_{it}. Equation (33) highlights that wealth inequality dynamics result from five complementary transmission channels: (*i*) changes in pretax income inequality (sh^{Y}_{it}), (*ii*) changes in tax inequality (or tax progressivity, τ_{it} relative to τ_t), (*iii*) changes in saving rate inequality (s_{it} relative to s_t), (*iv*) changes in capital gains inequality (q_{it} relative to q_t), and (*v*) changes in aggregate pretax income (Y_t).

We apply this decomposition method to each of our counterfactual scenario. These scenarios are the same as those previously discussed: (1) no changes in taxation, markups, and capital gains; (2) changes in capital gains only; (3) changes in taxation only; (4) changes in markups only; and (5) changes in taxation and markups. Each counterfactual is then compared to the baseline scenario.

Our methodology proceeds in four steps for each counterfactual scenario. First, we fix all variables in Equation (32) at their 1984 levels for each group, *except* for aggregate pretax income. The resulting wealth shares isolate the contribution of aggregate pretax income to the evolution of wealth shares. Second, we allow each of the four transmission channels – saving rates, pretax income shares, tax rates, and rates of capital gains – to vary one at a time according to their simulated values, holding the others constant. This yields the first-order contribution of each channel. Third, we allow two channels to vary jointly and compute the resulting wealth shares. By subtracting the first-order effects, we isolate second-order (interaction) effects, which are then allocated across channels proportionally to their first-order contributions. Fourth, we repeat the procedure for triples of channels to obtain third-order contributions and, finally, for all four channels together to obtain fourth-order contributions. The total contribution of each channel is the sum of its first-, second-, third-, and fourth-order effects.

5.3 Quantifying transmission channels: Results

While the method described can be applied to decompose the wealth share evolution of any wealth group, we focus here on the top 1% wealth share, presented in Table 3, as it is the primary driver of wealth inequality dynamics over the period of study.[44] Table 3 quantifies the contribution of each transmission channel – pretax income inequality, tax progressivity, inequality in savings rates, and inequality in capital gains – to the changes in the top 1% wealth share under each counterfactual scenario. Figure 13 complements this table by illustrating the evolution of these transmission channels by counterfactual scenario.

Table 3: Transmission channels – Top 1% wealth share (1984-2019)

Counterfactual Scenarios	Top 1% Wealth Share Variation	Variations due to changes in: Pretax Income Inequality	Tax progressivity	Saving rate inequality	Capital gains inequality
Base: Changes in markups, taxation and capital gains	57%	15%	1%	74%	-32%
Changes in markups and taxation	45%	15%	1%	29%	0%
Changes in markups	32%	12%	0%	20%	0%
Changes in taxation	17%	5%	1%	11%	0%
Changes in capital gains	20%	6%	0%	37%	-22%
No changes in taxation, markups and capital gains	4%	3%	0%	2%	0%

Note: In the baseline scenario, the top 1% wealth share increases by 57% over the 1984-2019 period, of which 15 percentage points are attributed to changes in pretax income inequality.

Several key insights emerge from Table 3. First, the positive effect of changes in capital gains on the top 1% wealth share (+20%) results from two opposing transmissions channels (see fifth row of Table 3). On the one hand, changes in capital gains generate a negative mechanical effect due to asset price fluctuations (capital gains inequality), which lowers the top 1% wealth share (-22%). What accounts for the mechanical effect of capital gains? Panel (e) of Figure 13 shows the cumulative rate of capital gains by wealth group over time. Capital gains have been significantly more important for the middle 40% wealth group than for the top 1%, largely because of different asset price movements (e.g., housing prices have outpaced equity prices) and distinct portfolio compositions (e.g. deposits for the bottom 50%, mostly housing for the middle 40%, and equity for the top 1%, as shown in Panel (b) of Figure 3). On the other hand, changes in capital gains

[44] Tables E.2 to E.4 in Appendix E provide the quantification of the transmission channels for other wealth groups (Top 10%, Middle 40%, and Bottom 50%). A detailed table containing all first-, second- and third-order contributions is available upon request.

have also induced positive behavioral and general equilibrium effects on saving rate inequality (+37%), which contributed to more than offset the negative mechanical effect of capital gains inequality. Panel (c) and (d) of Figure 13 highlight this transmission channel, showing that changes in capital gains have a differential impact on saving rates across wealth groups–boosting the saving rate of the top 1% while reducing it for the rest of the population, thus increasing saving rate inequality. Note that Tables E.3 and E.4 in Appendix E present a consistent and complementary view of the impact of changes in capital gains on the middle 40% and bottom 50% wealth groups. For the middle 40%, the large and positive mechanical effect of capital gains is fully offset by negative behavioral and general equilibrium effects on saving rate inequality, leading to stability in the wealth share of this group. In contrast, the bottom 50% wealth share is strongly and negatively impacted by changes in capital gains, as both the mechanical effect on capital gains inequality and the behavioral effect on saving rate inequality work in the same negative direction.

Second, the impact of changes in taxation on the top 1% wealth share (+17%) is not driven by the mechanical effect of taxation (column 3 of Table 3)[45], but rather through its behavioral and general equilibrium effects on saving rate inequality (+11%, column 4) and, to a lesser extent, on pretax income inequality (+5%, column 2) (see fourth row of Table 3). This finding can be rationalized as follows: while changes in taxation have generally left the overall level of tax progressivity broadly unchanged (see Panel (b) of Figure 13)[46], shifts in the composition of taxes paid can influence savings behavior through changes in the after-tax return on savings ($(1-\tau^j)r^k - \phi$). For instance, when households in the bottom 50% pay less in social security taxes but more in income taxes, their after-tax return on savings decreases, leading to lower saving rates. Conversely, for households in the top 1%, a shift towards more corporate taxes and less income tax increases their after-tax return on savings, which in turn boosts their saving rate. These opposing movements combine to account for the rise in saving rate inequality induced by changes in taxation, as shown in Panel (c) of Figure 13.

Third, the impact of changes in markups on the top 1% wealth share (+32%) stems from both the mechanical effect on pretax income concentration (Panel (a) of Figure 13) and the increase in saving rate inequality (see third row of Table 3). The mechanical effect arises from the direct redistribution of several points of national income via profits towards the most talented entrepreneurs at the top, accompanied by a decline in factor payments at the bottom. This transfer leads to higher saving rates at the top and lower saving rates at the bottom, thereby magnifying the increase in the top 1% wealth share.

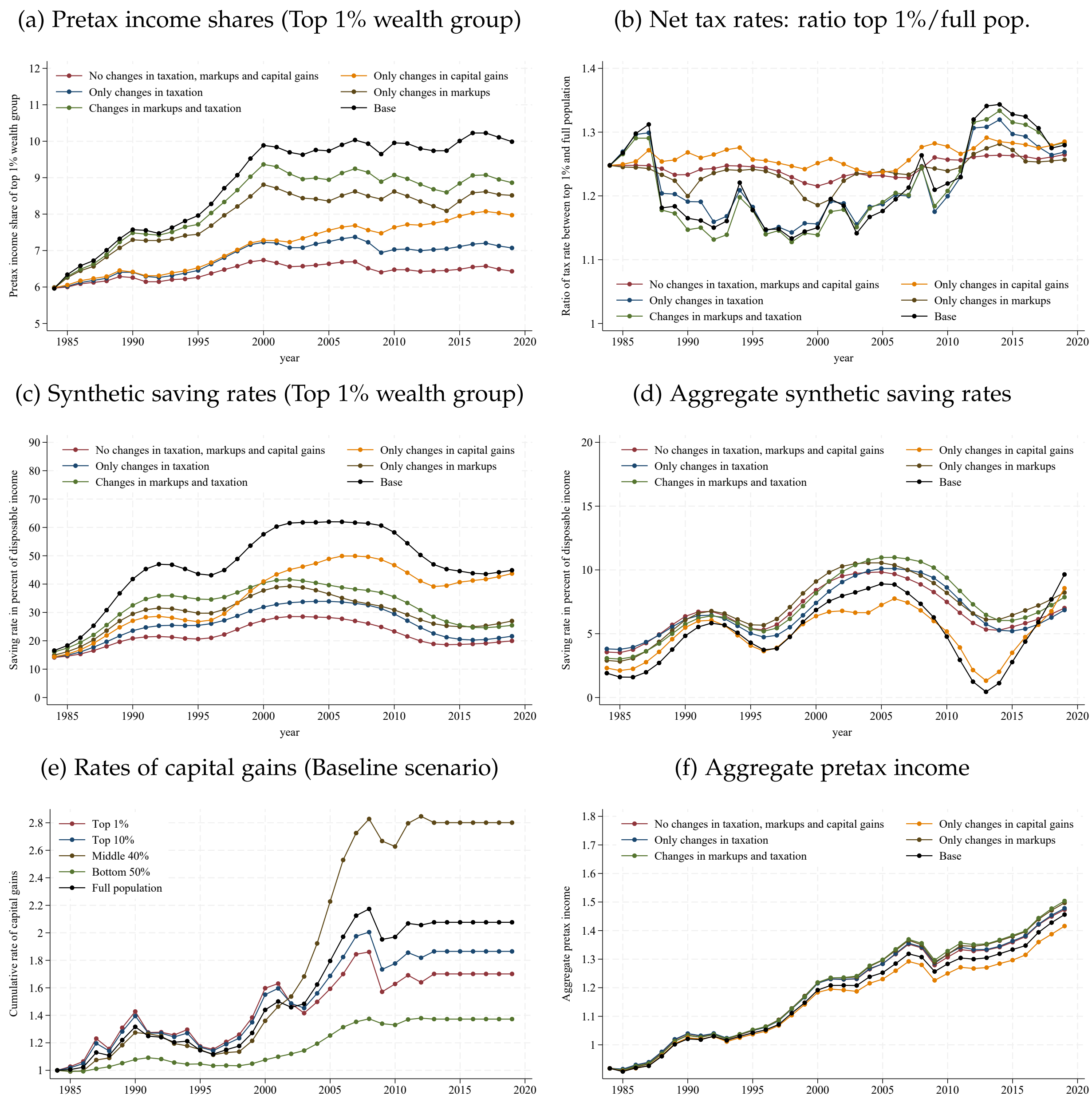
In summary, the increase in the top 1% wealth share from 1984 to 2019 is driven by three complementary forces, each affecting different transmission channels. Changes in taxation and markups increase wealth inequality by widening saving rate inequality and pretax income in-

[45]The mechanical effect of taxation refers to the impact of taxation on tax progressivity, that is the gap between pretax and disposable income inequality among wealth groups.

[46]Note that we consider tax progressivity by wealth group, rather than income group, in this analysis.

equality. Changes in capital gains also contribute to wealth inequality, but their effects on inequality are time-period-specific and ambiguous *ex-ante*. Specifically, Changes in capital gains produce (i) a mechanical effect whose sign depends on relative asset price movements and the wealth composition of the group considered, and (ii) behavioral and general equilibrium effects on saving rate inequality. The balance between the two may vary depending periods and wealth groups.

Figure 13: Mechanisms of wealth inequality for the top 1% wealth group by scenario



(a) Pretax income shares (Top 1% wealth group)

(b) Net tax rates: ratio top 1%/full pop.

(c) Synthetic saving rates (Top 1% wealth group)

(d) Aggregate synthetic saving rates

(e) Rates of capital gains (Baseline scenario)

(f) Aggregate pretax income

The first row of Table 3 aligns with previous empirical studies based on simple simulation exercises, which emphasize the pivotal role of asset prices, saving rate inequality, and pretax income inequality in the dynamics of wealth inequality (see Saez and Zucman (2016), Kuhn, Schularick, and Steins (2020), Martínez-Toledano (2020) and Garbinti, Goupille-Lebret, and Piketty (2021)).

However, our framework offers deeper insights and three key contributions to this literature. First, although the mechanical effects of housing capital gains tend to reduce top wealth shares, they are more than offset by behavioral and general equilibrium effects on saving rate inequality, particularly when interacted with changes in markups and taxes. Second, even when the mechanical effects of taxation are minimal, tax changes – both through changes in the degree of tax progressivity or in the composition of taxes paid – can exert a significant influence on wealth inequality dynamics by affecting saving rate inequality through behavioral and general equilibrium effects. Third, in the absence of changes in taxation, markups and capital gains, wealth inequality would have remained stable. Consequently, the main transmission channel of wealth inequality is the change in saving rate inequality, which only emerges in response to external changes in the environment (such as shifts in asset prices, taxation, and markups). More broadly, these findings underline the crucial role of endogenous saving decisions as a key transmission channel of wealth inequality.

6 Conclusion

Unifying microeconomics and macroeconomics remains an area of vast research potential. We build an original macroeconomic model with three assets (deposits, gross housing, and equity), labor-income and entrepreneurial risk, and a rich and realistic set of flat and progressive taxes and transfers.

Using newly available wealth and income inequality series and fiscal data, we calibrate our model and highlight its ability to fit the level and dynamics of wealth and income inequalities, the aggregate and distributional tax structure, the composition of wealth along the distribution, and key macroeconomic aggregates from 1984 to 2018.

We then propose a method that quantifies the contribution of various transmission channels to income and wealth inequality dynamics in a counterfactual analysis. We show the importance of *(i)* markups in explaining the dynamics of income inequality and of *(ii)* endogenous saving decisions in response to exogenous variables as a key driver of wealth inequality.

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A Concept of pretax income

This work relies extensively on the long-term series of pretax income, posttax income and wealth developed for France within the "Distributional National Accounts" project. The latter aims at combining national accounts, tax, and survey data in a comprehensive and consistent manner to build long-term series of inequalities that are unified over time and across countries, cover the entire distribution and are fully consistent with the national accounts.

Complete methodological details about the construction of these series are provided in Garbinti, Goupille-Lebret, and Piketty (2021) for the wealth series, and Bozio et al. (2024) for pretax and posttax income series, along with a wide set of tabulated series, data files and computer codes. A complete presentation of the concepts and the general methodology to construct "Distributional National Accounts" series is provided by Alvaredo et al. (2020).

In this Appendix, we present the concept of pretax income and discuss its implications for the model.

Pretax vs. factor national income Pretax income is our benchmark concept to study the distribution of income before government intervention. It is defined as the sum of all income flows going to labor and capital, after taking into account the operation of the pension and unemployment insurance systems, but before taking into account other taxes and transfers. This concept should be benchmarked against the definition of factor income, which is equal to the sum of all income flows going to labor and capital, before considering the operation of the pension and unemployment systems. The key difference between factor income and pretax income is the treatment of pensions, which are counted on a contribution basis for factor income and on a distribution basis for pretax income. In other words, pretax income includes pension and unemployment benefits, while it excludes contributive payroll taxes, *i.e.* the fraction of payroll taxes dedicated to the financing of the pension and unemployment systems.

The main limitation of factor income is that retired individuals typically have very small factor income in countries using pay-as-you pension systems. As a result, inequality of factor income tends to look artificially large in countries and time periods with an older population. In contrast, pretax income inequality will not be affected by aging population nor by the design of the pension system.[47] However, the limitation of the concept of pretax income is that it does not incorporate the redistribution carried out by the pension and UI systems over the life-cycle.

Using the concept of pretax income yields three main implications for our model that we now discuss.

The incidence of taxes Computing pretax income requires to assign taxes that are not directly paid by households (corporate taxes and payroll taxes) into their income using tax incidence assumptions. As pointed out by Saez and Zucman (2019), one need to distinguish current distributional analysis from tax reform distributional analysis. Current distributional analysis shows the current tax burden by income groups and should assign taxes on each economic factor without including behavioral responses. As such, taxes based on labor income (payroll taxes) should fall on the corresponding workers. Taxes based on wealth or capital income should fall on the owners of the corresponding assets.

Therefore, when we compute pretax income, we assign current payroll taxes and corporate taxes paid to the corresponding household income without incorporating any behavioral response (current distributional analysis). In contrast, we use our model and rely on a counterfactual analysis to study how changes in taxes affect the aggregates and the distributions of pretax income, posttax income and wealth relative to baseline through potential behavioral effects (direct, indirect, general equilibrium).

Pension and payroll taxes Because pretax income includes pension and unemployment benefits, the model should only include the fraction of payroll taxes that do not finance the pension and unemployment systems to avoid double counting. Indeed, if we include all payroll taxes in the model and reassign them to pretax income, pretax income will include pension and unemployment contributions but also the corresponding benefits. Disposable and posttax income will also be inconsistent as pension and unemployment contributions will be subtracted but the corresponding benefits will not be added when going from pretax to disposable and posttax income. For simplicity we just assume equilibrium between contributions and distributions of the pension and unemployment systems, and neglect the incidence of pension and payroll taxes.

B Modeling the tax and transfer system

This Appendix provides a brief overview of the French tax and transfer system and presents in details the methodology used to estimate the different tax parameters.

[47] Note that pretax income is broader but conceptually similar to what most tax administrations attempt to tax, as pensions and unemployment benefits are largely taxable, while contributions are largely tax deductible.

B.1 Overview of the French tax and transfer system

The French tax system includes a large variety of taxes that we can regroup into five categories depending on the relevant tax basis: (*i*) taxes borne by pretax labor income ("non-contributive social contributions"), (*ii*) by total income (pretax labor and capital income) that we thus call "income tax", (*iii*) by capital ("wealth taxes"), (*iv*) by corporate profits ("tax on corporate profits"), and (*v*) by consumption ("consumption taxes").

Government spending can be decomposed into three distinct categories: monetary transfers, in-kind transfers, and collective consumption expenditure. Monetary transfers amount to about 4% of national income and include various types of housing benefits, family benefits, and social benefits. In-kind transfers are all transfers that are not monetary (or quasi-monetary) and can be individualized. They correspond to individual goods and services produced directly or reimbursed by government. In-kind transfers make up to 20% of national income (including 12.5% for health and 6.5% for education expenditure). Collective consumption expenditure regroups all consumption services that benefit to the community in general and cannot be individualized (spending on defense, police, the justice system, public infrastructure, etc.). It amounts to 10% of national income.

B.2 Fitting the progressivity of taxes and transfers

The DINA series contain a full decomposition of taxes and transfers that we exploit to compute the different tax rates that are used in our model.

We assume the functional forms given by Equation (25). Our approach consists in estimating two parameters for each tax: a level parameter ($\overline{T}$, τ_ℓ, τ, ϕ) and a progressivity parameter η. We refine this approach in two ways. First, to describe the effective tax schedule as accurately as possible, we compute aside the average tax rate for the top 0.1% of the distribution of the tax basis. As we will see, it is particularly relevant for the progressive income tax. Second, to allow for more flexibility and for a better fit to the actual effective tax rates, we fit the functional form on different segments of the distribution. That is, we estimate potentially different level and progressivity parameters on several subsets of the distribution of tax rates along the tax base. We proceed identically for transfers. We detail the tax concepts and results below.

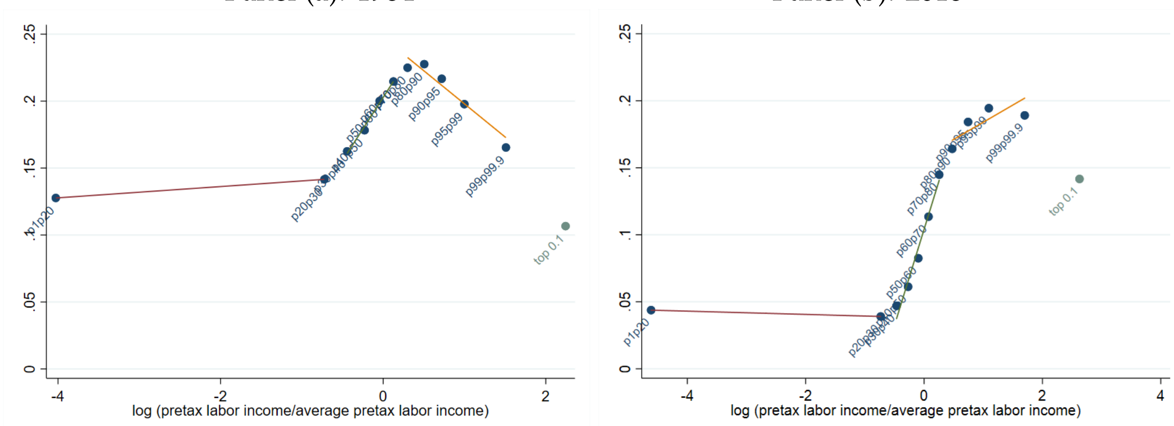
B.3 Taxes & their progressivity

We gather taxes depending on the relevant tax basis. We start from the detailed categories of taxes (presented in detail in Bozio et al. (2024)) and we classify them in 5 broad categories: non-contributive payroll taxes, income taxes, wealth taxes, tax on corporate profits, and consumption taxes.[48] Hereafter, for taxes and transfers, we present our method for the year 1984. A similar approach is used for all other years for which we have data (1988 and each year from 1994 onwards).

Payroll taxes τ_ℓ^j include all social security contributions that are not dedicated to the financing of the pension and unemployment systems as well as taxes on wages. Altogether, they make up to 11% of national income in 2018. They are applied to pretax labor income. For the different years for which we have data (1984, 1988 and each year from 1994), we estimate the different parameters on three segments of the distribution of pretax labor income (in addition to the average tax rate computed for the top 0.1%). Figure B.1 shows how we fit the distribution of the non-contributive SSC for the years 1984 and 2018. It illustrates that our flexible non-linear specification allows for an excellent fit of the distribution of tax rates and improves significantly our ability to model tax rates as close as possible as those observed in the data. This goodness of the fit is similar for all subsequent years for which we have data (1984, 1988 and all years after 1994). Comparing panels (a) and (b) shows the crucial importance of having time-varying parameters.

Figure B.1: Individual SSC contributions τ_ℓ^j (% pretax labor income)

Panel (a): 1984 Panel (b): 2018



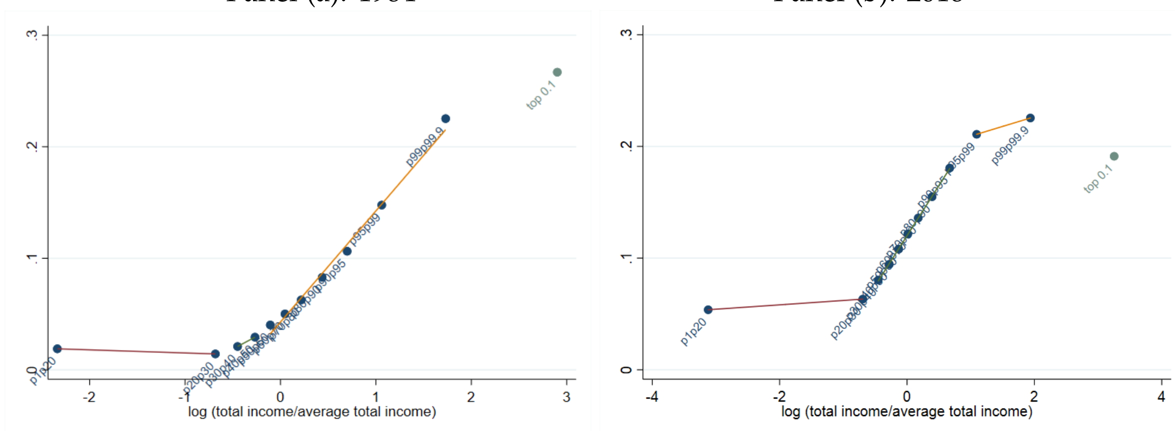
Income tax. We gather in the income tax τ^j taxes that are borne by total pretax income (labor and capital income, including profits). It thus includes both the income tax ("impôt sur le revenu des personnes physiques") and the "CSG" ("Contribution Sociale Généralisée", a flat tax) on capital and labor incomes. As for non-contributive SSC, we perform the estimation of the different level and progressivity parameters for three segments of the distribution of total pretax

[48] Note that we add pension and unemployment benefits to labor and capital incomes. Consequently, we do not add contributive payroll taxes to the analysis to avoid double-counting since these payroll taxes fund these benefits. In Garbinti, Goupille-Lebret, and Piketty (2018), another concept of income (factor income) is presented, where pension and unemployment benefits are not added to labor and capital incomes, and that allows to investigate the role of payroll taxes. One problem of that measure is that retired individuals typically have very small factor income in countries using pay-as-you pension systems such as France. As a result, inequality of factor income tends to rise mechanically with the fraction of old-age individuals in the population, which biases comparisons over time and across countries.

income. Figure B.2 shows the fit of the distribution of the income tax SSC for the years 1984 and 2018. Here again, it clearly shows that our specification provides a great fit of the distribution of the tax rates, a feature that is similar for all other years of our sample.

Figure B.2: Individual income tax rates τ^j (% total pretax income)

Panel (a): 1984 | Panel (b): 2018



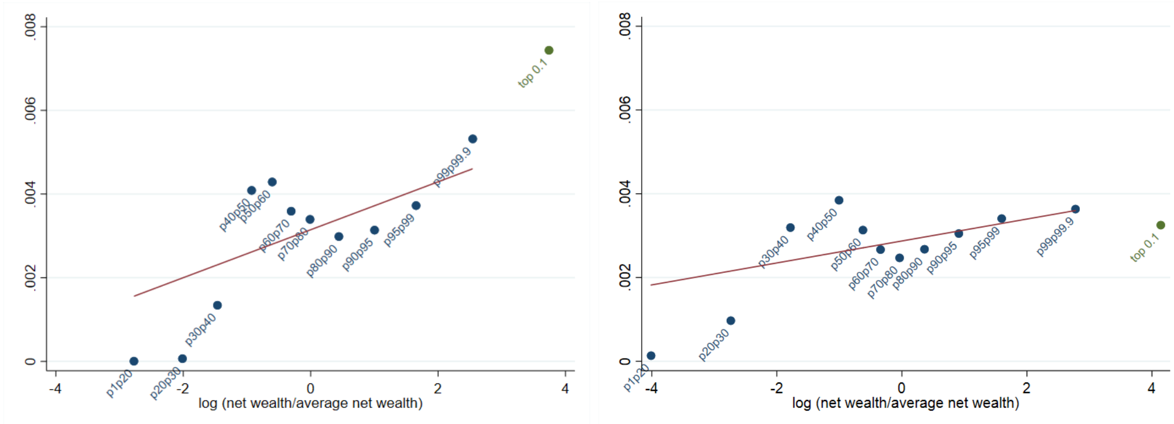
Wealth tax. The wealth tax ϕ^j includes all taxes borne by assets. This corresponds to the wealth tax, the property tax and the estate tax. Note that it applies to the *level* of wealth. Further, note that in France, there exists a "tax shelter" (bouclier fiscal) to insure that the total tax burden cannot exceed 60 to 70% (depending on the period) of total income. This mechanism has been set to avoid that wealth taxes lead to a tax burden deemed too high. We deduct this tax shelter from the wealth tax. Figure B.3 shows the fit of the wealth tax for 1984 and 2018. The tax rates appear aligned with a linear trend along the net wealth distribution, except for the bump observed from the 40th to the 60th percentiles. This is explained by the fact that property taxes apply to *gross* rather then *net* housing wealth. Here, we use the concept of *net* wealth (net of liabilities). It thus raises mechanically the tax rates for indebted individuals that are over-represented between the 40th and 60th percentiles of the net wealth distribution. In an alternative specification, we take into account this bump by allowing for non-linearity but this does not change our results. This is likely due to the fact that the magnitude of the gap between the bump and the rest of the surrounding tax rates is small. We thus opt for the simplest specification and choose a linear one (up to the top 0.1% which is still considered aside).

Tax on corporate profits. This tax directly applies to profits (Equation 2) and is a flat tax. We thus simply apply the same flat tax rate to firms profits. It is taken directly from the national accounts every year.

Consumption taxes. These taxes are borne by consumption (Equation 12). We consider here consumption taxes as a flat tax. This is not a significant departure from reality since the value added tax (VAT) represents the bulk of these taxes. Although the VAT has four different rates (ranging from 2.5 to 20%), the vast majority of goods are taxed at 20%. Consequently, as for the

Figure B.3: Individual capital tax rates ϕ^j (% net wealth)

Panel (a): 1984 Panel (b): 2018



tax on corporate profits, the value of this flat tax is taken directly from the national accounts every year.

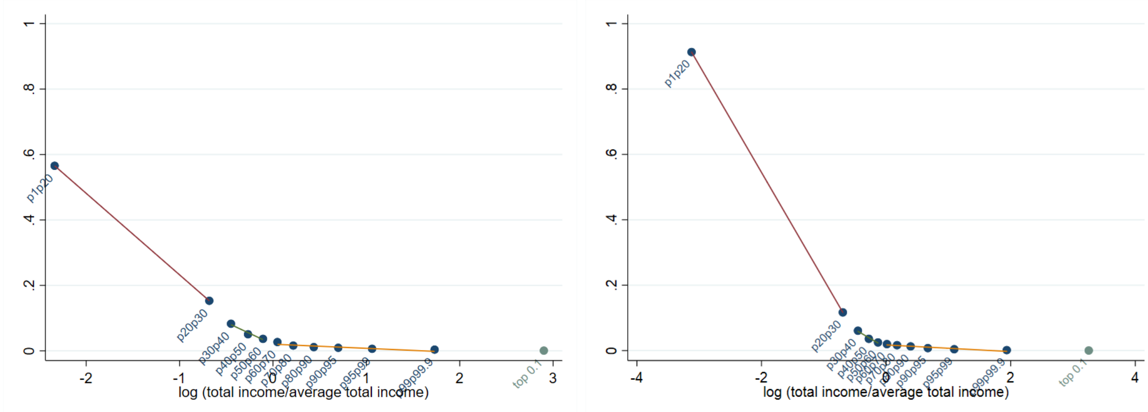
B.4 Individual transfers & their progressivity

Individual transfers (or monetary transfers) T^j represent about 4% of national income and include the various types of housing benefits, family benefits, and social benefits.[49] Here again, we perform the estimation of the level and progressivity parameters for three segments of the distribution of total pretax income. Figure B.4 shows how we fit the distribution of monetary transfers expressed as a percentage of pretax income for the years 1984 and 2018. Here, as for taxes, our non-linear specification allows for a very accurate representation of the transfers actually observed in the data over time.

[49]The housing benefits regroup "Allocation de Logement Familiale" (ALF), "Allocation de Logement Personnalisée" (APL), and "Allocation de logement sociale" (ALS). The family benefits include "Allocation Familiale" (AF), "Complément Familial" (CF), "Allocation Pour Jeune Enfant" (APJE), "Prestation d'Accueil du Jeune Enfant" (PAJE), "Allocation de Rentrée Scolaire" (ARS), "Allocation d'Education de l'Enfant Handicapé" (AEEH), and "Allocation de Soutien Familial" (ASF). The social benefits regroup "Revenue de Solidarité Active"/"Prime d'Activité" (RSA/PPA), "Allocation Adulte Handicapé" (AAH), and "Allocation de Solidarité aux Personnes Agées" (ASPA).

Figure B.4: Individual transfers T^j (% total pretax income, $Y^{pretax,j}$)

Panel (a): 1984 Panel (b): 2018



C Solution method

Our solution method is fully non-linear and takes advantage of the continuous-time formulation of the heterogeneous-agent problem solving the discretized Hamilton-Jacobi-Bellman and Kolmogorov forward equations. Our codes are freely adapted from those of Bence Bardoczy taken from the HACT project page maintained by Benjamin Moll: https://benjaminmoll.com/codes/.

C.1 Stationary equilibrium

The solution method uses an asset grid with 8 states (5 types of workers + 3 types entrepreneurs) and 501 grid points over a linear asset grid $a^j \in [0, 150]$. A state is thus a point on the $[501, 8]$ grid. The algorithm solving for the stationary distribution is the following.

Starting from initial guesses for the steady-state level of aggregate capital k, aggregate labor ℓ and tax schedules:

1. Compute output, y, rate of return on equity capital r^k, aggregate real wage w and firms' aggregate profits π
2. Given the income tax schedule τ^j, the consumption tax rate τ_c, the rate of return on housing $\bar{r}^h$ and the rate on deposits $\bar{r}^m$, compute the (household-specific) opportunity costs of housing R^{hj} and deposits R^{mj} and the individual price indices P^j_Λ
3. Given the labor tax schedule τ^j_ℓ, the productivity levels z^j and entrepreneurial profits π^j, compute individual labor income Φ^j_ℓ over the asset grid
4. Given r^k and entrepreneurial profits π^j, compute capital income Φ^j_k over the asset grid

5. Given the income tax schedule τ^j, the capital tax schedule ϕ^j and the transfer schedule T^j, compute arbitrable income consistently with the budget constraint: $\left(1-\tau^j\right)\left(\Phi^j_\ell+\Phi^j_k\right)-\left(\phi^j+g_\varrho\right)a^j+T^j$ over the asset grid

6. Given the transition matrix $\mathcal{M}$, solve the Hamilton-Jacobi-Bellman equation based on the utility function to determine the individual saving rules $\dot{a}^j$ and the expenditure rules Λ^j over the asset grid

7. Given Λ^j, P^j_Λ, R^{mj}, R^{hj} and τ_c compute the optimal rule for deposits m^{dj}, housing services s^j and the consumption of non-durable goods c^j over the asset grid

8. Given the minimum housing size and the borrowing constraint, determine the status of household j as renter ($\mathbb{1}_{h^j}=0$) or homeowner ($\mathbb{1}_{h^j}=1$), and the amount of housing owned h^j as well as housing debt d^j over the asset grid

9. Given the demand for deposit m^{dj} and housing owned h^j, compute holdings of capital $k^j=\mathbb{1}_{h^j}(a^j-(p^h h^j-d^j)-m^{dj})$ over the asset grid

10. Adjust $m^j=a^j-(p^h h^j-d^j)-k^j$ over the asset grid

11. Solve the discretized Kolmogorov forward equation to obtain the distribution of households Ω^j over the asset grid

12. Update the distributions of labor income Φ^j_ℓ, and capital income Φ^j_k and Υ^j_k and all the relevant measures of income over the asset grid

13. Update the progressive tax and transfer schedules τ^j_ℓ, τ^j, ϕ^j and T^j over the asset grid

14. Update aggregate labor $\ell=\int_j\Omega^j\left(1-\mathbb{1}_{e^j}\right)\left(w^j/w\right)\ell^j dj$ and update the average level of labor productivity that guarantees $\int_j\Omega^j\left(1-\mathbb{1}_{e^j}\right)w^j dj=w$

15. Compute the residual of capital market clearing condition as the difference between the sum of individual capital detention $\int_j\Omega^j k^j dj$ and the aggregate stock of capital k

16. Adjust aggregate capital k using the above residual and iterate from 1. until the residual of the capital market clearing condition is less than 0.1% of the aggregate capital stock.

Solving for the stationary equilibrium takes a few seconds.

C.2 Transition dynamics

The algorithm solving for the transitional dynamics is very similar to the one solving for the stationary distribution, and is based on updating the sequence of aggregate capital $\{k_t\}_{t=1}^{t=T}$, and all the relevant variables, given the path of exogenous variables

$$\left\{\theta_t,\delta_t,\xi_t,\dot{p}^h_t/p^h_t,p^h_t,g_t/y_t,\tau_{ct},\tau_{\pi t},h^{\min}_t,\Gamma_t\right\}_{t=1}^{t=T}$$

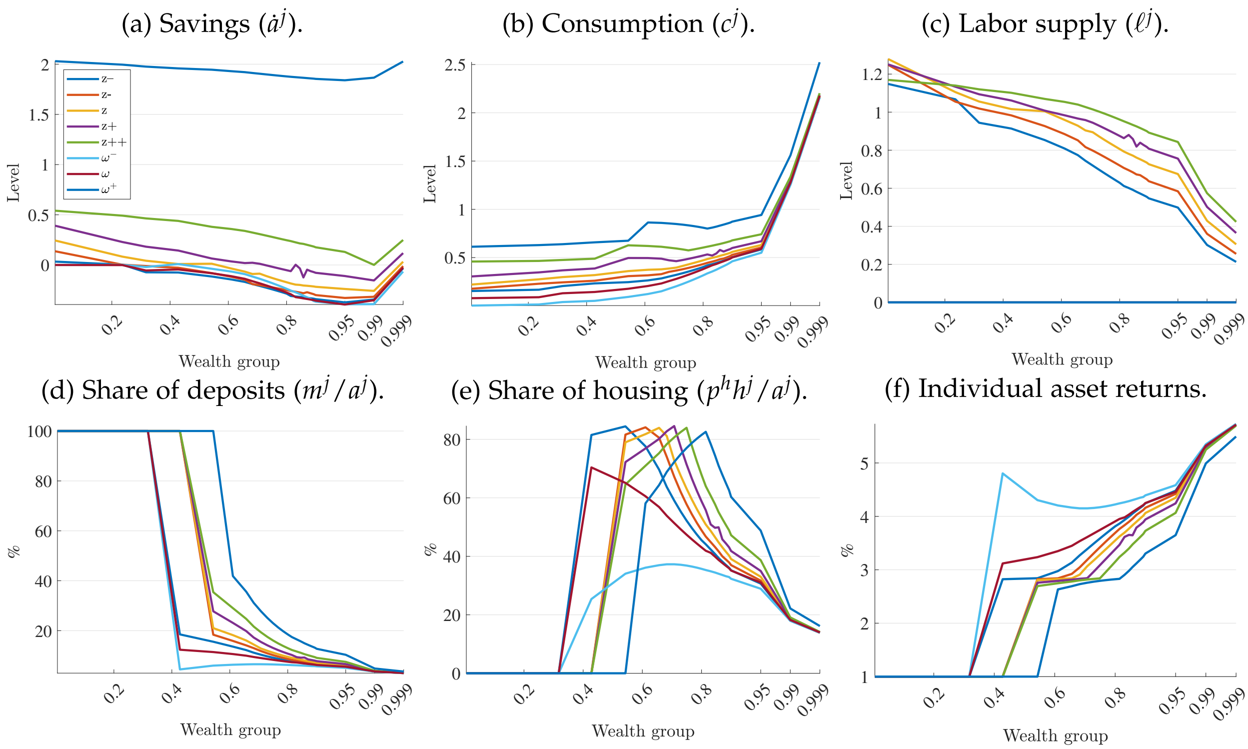
where Γ_t gathers all the parameters governing the progressive tax and transfer schedules. We start from the steady-state path of $\{k_t\}_{t=1}^{t=T} = k$ and update k_t using last iteration (time-varying) residuals until the maximum excess capital between $\{2 : T\}$ is strictly less than tolerance (0.1% of total capital stock). By definition, since the exogenous drivers are a surprise in the first period, errors at time $t = 1$ can not be brought to zero. Solving for the transition dynamics takes a few minutes depending on the exercise, nature of the exogenous drivers and length of the simulation.

D Policy Functions and Alternative Specifications

D.1 Policy Functions

The model generates the policy functions depicted in Figure D.1. Panel (a), (b) and (c) show the savings, consumption and labor supply schedules, Panel (d) and (e) the household-specific holdings of deposits and housing and Panel (f) the household-specific returns on wealth.

Figure D.1: Policy functions



Note: z^{--} stands for very low productivity workers, z^{-} for low, z for medium, z^{+} for higher, and z^{++} for very high productivity workers. Similarly, ω^{-} stands for low productivity entrepreneurs, ω for medium and ω^{+} for top entrepreneurs.

Panel (a) of Figure D.1 shows that top entrepreneurs are the largest savers in the model. First, these households receive large amounts of income. Second, given the low probability of becoming an entrepreneur and the relatively large probability of losing the status, a strong precautionary motive drives them to save a large fraction of their (large) disposable income. Workers also save to self-insure against earning risk, that is, the risk of transiting to lower levels of income. Hence, the second largest savers are the very high and high productivity workers. Saving rates are overall decreasing in wealth levels because once households have reached their target amount of precautionary saving, they stop saving, except for very high levels of wealth where the wealth-in-utility dimension kicks in. Workers with lower productivity (middle, low or very low) have overall negative savings, *i.e.* they use their existing wealth to sustain higher consumption taking into account the probability of upward income mobility.

Panel (c) shows that labor supply is driven both by a wealth effect – decreasing in the amount of wealth – and a substitution effect – increasing in the after-tax wage. At low levels of wealth, the wealth effect can be strong enough to overturn the substitution effect but the substitution effect dominates at larger levels of wealth. Panels (d) and (e) of Figure D.1 inform about the individual compositions of portfolios by types and wealth levels. They show that households at the bottom of the asset grid do not save enough to reach the threshold to become homeowners, and therefore keep their wealth in the form of liquid deposits. When households save enough to buy housing, they allocate almost all of their wealth to housing and then diversify their portfolios by holding capital. As a result of the varying composition of portfolios along the distribution of wealth, individual pretax returns are increasing in wealth (Panel (f)).

D.2 Alternative Specifications

We investigate the contribution of our assumptions to the results by reporting the distributions of income and wealth when we simplify or abstract from some of our assumptions. Table D.1 reports the baseline moments in the first column and the difference between the alternative distribution and the baseline in the remaining columns. In particular, it allows us to study the role of saving motives and of a progressive tax system in explaining the level of income and wealth inequality in France in 1984. Positive numbers indicate that the alternative overshoots the baseline moments while negative numbers signal undershooting.[50]

First, consider an alternative economy without markups assuming $\theta/(\theta-1)=1$ by imposing $\theta \to \infty$ and a zero probability of becoming an entrepreneur (Column (2) of Table D.1). Doing so drives aggregate profits and the total number of entrepreneurs to zero. It redistributes income and wealth from the top to the bottom of the distribution. The bottom 50% and middle 40% pretax income shares are larger (+1pp and +3pp respectively) than their baseline values, and the top 10% and 1% shares both shrink by 5pp. Because being an entrepreneur is risky and implies large precautionary savings, this movement is widely amplified for wealth shares: removing markups and entrepreneurs results in undershooting the top 10% and top 1% wealth shares by 16pp and 12pp, respectively. We conclude that the presence of markups and entrepreneurs in the baseline model is central to match top income and wealth shares.

What if utility does not depend on wealth and therefore one of the saving motives is shut down? Column (3) of Table D.1 reports the corresponding results. As expected, wealth in utility has little effects on the distribution of income but affects the distribution of wealth. The main operating channel is wealth in utility prevents the saving rate from decreasing too fast with

[50]Note that the parameter calibration remains constant across all alternative specifications. The purpose of this exercise is not to examine whether alternative models can match key empirical facts following re-calibration. Rather, it serves as a decomposition exercise aimed at isolating the contribution of each model feature to inequality in the baseline specification.

Table D.1: Alternative specifications

	Base.	Counterfactual (Δ with baseline level)					
		$\theta \to \infty$	$\beta = 0$	$\zeta \to \infty$	Flat tax	One tax	One asset
Pretax income							
Bottom 50%	0.21	+0.01	+0.01	-0.01	+0.00	+0.00	+0.02
Middle 40%	0.50	+0.03	-0.01	-0.01	-0.01	-0.01	+0.00
Top 10%	0.29	-0.05	-0.00	+0.02	+0.01	+0.01	-0.03
Top 1%	0.07	-0.05	-0.00	+0.00	+0.01	+0.01	-0.01
Posttax income							
Bottom 50%	0.33	+0.00	+0.01	-0.01	-0.03	-0.02	+0.02
Middle 40%	0.46	+0.02	-0.01	-0.01	-0.00	+0.00	-0.00
Top 10%	0.21	-0.03	-0.00	+0.01	+0.03	+0.02	-0.02
Top 1%	0.05	-0.03	-0.00	-0.00	+0.01	+0.01	-0.00
Wealth							
Bottom 50%	0.10	+0.05	+0.11	-0.02	-0.02	-0.03	+0.02
Middle 40%	0.40	+0.12	-0.09	-0.03	-0.06	-0.05	+0.03
Top 10%	0.50	-0.16	-0.01	+0.05	+0.09	+0.08	-0.05
Top 1%	0.17	-0.12	-0.06	+0.01	+0.07	+0.07	-0.02
Aggregate ratios							
$m/\mathcal{W}$	0.15	+0.00	+0.18	+0.00	+0.00	+0.02	-0.15
$h/\mathcal{W}$	0.41	+0.01	-0.16	-0.01	-0.00	-0.04	-0.41
$k/\mathcal{W}$	0.44	-0.01	-0.02	+0.01	+0.00	+0.02	+0.56
$\mathcal{W}/\mathcal{Y}^{pretax}$	3.18	+0.09	-1.49	-0.01	+0.42	+0.25	-1.63

Note: The table expresses the key moments targeted by our model. The first column refers to the baseline model and results, moments are expressed in levels. In the remaining columns, moments are expressed in difference from the baseline case. Column 2: no markups and no entrepreneurs ($p^w e \approx 0$). Column 3: no wealth-in-the-utility function. Column 4: inelastic labor supply. Column 5: all progressive taxes and transfers replaced by flat rates that equal the average rates paid in the baseline model. Column 6: all progressive taxes and corporate taxes replaced by a single progressive income tax, as usually done in macro models (unique level and progressivity parameters estimated from the data). Monetary transfers are rebated lump-sum. Column 7: one asset (capital) is considered: $k^j = a^j$ and $\chi = \kappa = 0$ in the utility function.

wealth. Its absence results in lower saving rates at the top of the wealth distribution and lowers the top 10% wealth share by 1pp and the top 1% wealth share by 6pp.[51]

Assuming an inelastic supply of labor by setting $\zeta \to \infty$ (Column (4) of Table D.1) slightly increases pretax income inequalities among workers: the bottom 50% and middle 40% shares of pretax income are 1pp lower, while the top 10% share is 1pp higher. The top 1% share of pretax income, mostly populated with top entrepreneurs, is unaffected. Because wealth effects are quantitatively important, we conclude that endogenous labor supply acts to reduce the dispersion of labor income. Movements in wealth shares are amplified: the bottom 50% and 40% wealth shares decline by 2pp and 3pp respectively with inelastic labor supply, while the top 10% wealth share is 5pp higher.

The next alternative answers a longstanding question: What is the effect of tax and transfer progressivity on pretax income inequality? Our alternative shows not much. However, the effects on wealth inequality are more significant. Column (5) of Table D.1 reports the results when we apply the (weighted) average tax or transfer rate to all households uniformly. Switching to a flat system of taxation leaves pretax income inequality almost unchanged but unsurprisingly raises posttax income inequality. A flat tax and transfer system has a more significant effect on wealth inequality: the bottom 50% and middle 40% wealth shares fall by 2pp and 6pp respectively, while the top 10% and top 1% wealth shares are 9pp and 7pp higher. These results are mostly driven by a flat taxation of capital, which favors wealth accumulation for top savers.

The two last alternative distributions highlight our contribution relative to standard macroeconomic models by respectively looking at a less granular tax schedule and at a model with capital as the only asset. In the former case, all progressive taxes – except transfers – are pooled with the corporate tax into a single income tax. A single average rate $\tau = 0.3075$ and a single progressivity parameter $\eta = -0.0589$ are estimated from French fiscal data in 1984. In the latter case, we make capital the only possible vehicle of savings by imposing $\chi = \kappa = 0$. With a single income tax including all the sources of taxation (Column (6) of Table D.1), the model fails to replicate the distribution of posttax income to some extent and wealth to a larger extent. Just as when tax rates are flat, a system with only one tax understates the progressivity of the French tax and transfer system and results in increased posttax income inequalities, and substantially larger wealth inequalities: the bottom 50% and middle 40% wealth shares are 3pp and 5pp lower, and the top 10% and top 1% wealth shares are 8pp and 7pp higher. Last, by definition, a one-asset model – abstracting from deposits and housing – can not capture the composition of portfolios. It also spectacularly fails to match the wealth-income ratio. Further, the returns on wealth become uniform along the wealth distribution. This makes households at the bottom of the income and wealth distributions richer in terms of income through higher returns on savings. The bottom

[51] The effect of removing entrepreneurs and markups on the top 1% wealth share is more than twice as large as the effect of removing the wealth-in-utility motive. This suggests that the rise in top income shares due to the presence of markups and entrepreneurs leads to increased top wealth shares, even in the absence of preferences for wealth. The wealth-in-utility motive amplifies these effects but is not a necessary condition for them to emerge.

50% pretax income shares is respectively 2pp above its baseline value while the top 10% and top 1% pretax income shares are 3pp and 1pp below, respectively. The effects on the distribution of wealth is further magnified: the one-asset model overshoots the bottom 50% and middle 40% wealth shares by 2pp and 3pp respectively, and undershoots the top 10% and top 1% wealth shares by 5pp and 2pp.

E Additional Tables and Figures

Table E.1: Average annual growth rate by scenario, 1984-2019

Group	(1) Income Shares in 1984	(2) Baseline	(3) Without changes in markups, taxation and capital gains	(4) Only changes in capital gains	(5) Only changes in taxation and markups	(6) Only changes in taxation	(7) Only changes in markups
Panel A: Pretax income							
Full Population	100%	1.3%	1.4%	1.2%	1.4%	1.4%	1.4%
Bottom 50%	21%	1.1%	1.3%	1.1%	1.2%	1.3%	1.2%
Middle 40%	50%	1.0%	1.3%	1.1%	1.2%	1.3%	1.2%
Top 10%	29%	2.0%	1.4%	1.5%	1.9%	1.5%	1.9%
Incl. Top 10-1%	21%	1.7%	1.4%	1.4%	1.6%	1.5%	1.6%
Incl. Top 1%	7%	2.8%	1.4%	1.8%	2.7%	1.6%	2.7%
Panel B: Wealth							
Full Population	100%	2.9%	1.5%	2.8%	1.6%	1.5%	1.6%
Bottom 50%	10%	1.4%	1.1%	0.2%	1.2%	1.3%	1.0%
Middle 40%	40%	2.1%	1.5%	2.9%	0.8%	1.3%	1.0%
Top 10%	50%	3.7%	1.6%	3.2%	2.2%	1.7%	2.1%
Incl. Top 10-1%	33%	3.3%	1.6%	3.1%	1.9%	1.5%	1.9%
Incl. Top 1%	17%	4.3%	1.6%	3.4%	2.7%	2.0%	2.4%
Aggregate Wealth-Income ratio		549%	331%	548%	337%	331%	337%

Note: This table reports the average annual growth rate of income (Panel A) and wealth (Panel B) for the full population and various income and wealth groups, across different counterfactual scenarios over the 1984–2019 period. When a group's average growth rate is lower (higher) than the aggregate growth rate, its share in total income or wealth declines (rises) over the period. On average, real income for the top 1% income group grows by 2.8% per year in the baseline scenario, compared to 1.3% for the full population.

Table E.2: Transmission channels – Top 10% wealth share (1984-2019)

Counterfactual Scenarios	Top 10% Wealth Share Variation	Variations due to changes in Pretax Income Inequality	Tax progressivity	Saving rate inequality	Capital gains inequality
Base: Changes in markups, taxation and capital gains	28%	4%	0%	42%	-18%
Changes in markups and taxation	21%	4%	0%	18%	0%
Changes in markups	19%	4%	0%	15%	0%
Changes in taxation	7%	2%	0%	5%	0%
Changes in capital gains	12%	2%	0%	22%	-11%
No changes in taxation, markups and capital gains	4%	1%	0%	3%	0%

Note: In the baseline scenario, the top 10% wealth share increases by 28% over the 1984-2019 period, of which 4 percentage points are attributed to changes in pretax income inequality.

Table E.3: Transmission channels – Middle 40% wealth share (1984-2019)

Counterfactual Scenarios	Middle 40% Wealth Share Variation	Variations due to changes in Pretax Income Inequality	Tax progressivity	Saving rate inequality	Capital gains inequality
Base: Changes in markups, taxation and capital gains	-24%	-5%	0%	-51%	32%
Changes in markups and taxation	-23%	-4%	0%	-20%	0%
Changes in markups	-19%	-4%	0%	-15%	0%
Changes in taxation	-7%	-2%	0%	-5%	0%
Changes in capital gains	0%	-3%	0%	-23%	25%
No changes in taxation, markups and capital gains	-1%	-1%	0%	0%	0%

Note: In the baseline scenario, the middle 40% wealth share decreases by 24% over the 1984-2019 period, of which -5 percentage points are attributed to changes in pretax income inequality.

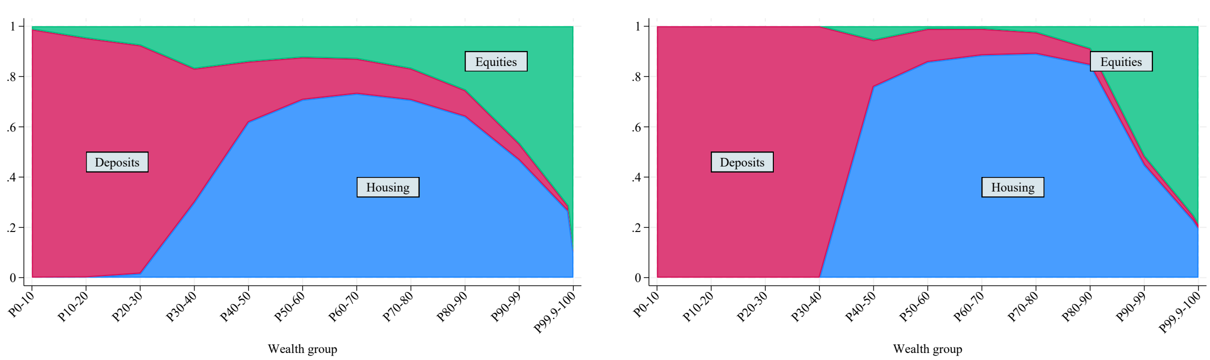
Table E.4: Transmission channels – Bottom 50% wealth share (1984-2019)

Counterfactual Scenarios	Bottom 50% Wealth Share Variation	Variations due to changes in			
		Pretax Income Inequality	Tax progressivity	Saving rate inequality	Capital gains inequality
Base: Changes in markups, taxation and capital gains	-41%	-2%	1%	-15%	-26%
Changes in markups and taxation	-12%	-5%	2%	-10%	0%
Changes in markups	-17%	-3%	0%	-15%	0%
Changes in taxation	-6%	-2%	1%	-6%	0%
Changes in capital gains	-60%	2%	0%	-29%	-33%
No changes in taxation, markups and capital gains	-12%	-1%	0%	-11%	0%

Note: In the baseline scenario, the bottom 50% wealth share decreases by 41% over the 1984-2019 period, of which -2 percentage points are attributed to changes in pretax income inequality.

Figure E.1: Portfolio composition in 2014.

(a) Portfolio composition - data (b) Portfolio composition - model

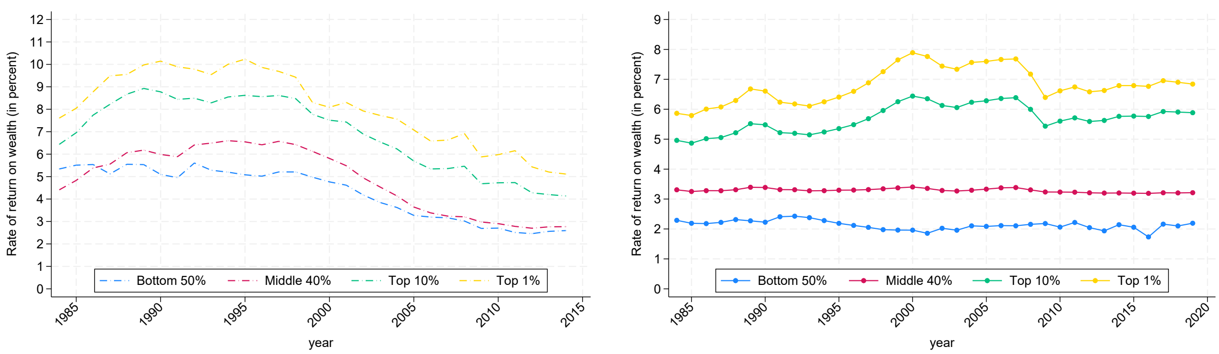


Notes: Series from Panel (a) come from Garbinti, Goupille-Lebret, and Piketty (2021).

Figure E.2: Evolution of rates of return by wealth group.

(a) Rates of return - data

(b) Rates of return - model



Notes: Series from Panel (a) come from Garbinti, Goupille-Lebret, and Piketty (2021).

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