Unpacking Rising Inequality

The Roles of Markups, Taxes, and Asset Prices

Stéphane Auray, Aurélien Eyquem,
Bertrand Garbinti, Jonathan Goupille-Lebret

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Introduction

Introduction

- Features of the model:
  - Link between firms' market power (captured by markups and top income shares)
  - Endogenous portfolio choices that generate heterogeneity in wealth composition
- Link markups and top income shares through entrepreneurial risk
- Features to match upper tails of distributions:
  - Introduce non-homothetic, wealth dependent preferences
  - Households can choose to rent or own housing, subject to minimum housing size requirements, and borrowing constraints.
- Granular representation of the French tax and transfer mechanism.

Model

Firms

Representative firm produces an intermediate good y^m under perfect competition.

$$y^m = \xi k^\alpha (\rho l)^{1-\alpha} \tag{1}$$

- ξ: measure of TFP
- ρ: measure of labour productivity that grows at rate g_ρ

Firm sells this intermediate good to retailer at price ϕ.

Associated after tax profits are:

$$(1 - \tau_\pi)(\phi \xi k^\alpha (\rho l)^{1-\alpha} - wl - \delta k) - r^k k \tag{2}$$

Firms

Maximising with respect to capital and labour gives:

$$\alpha \frac{\phi y^m}{k} = \frac{r^k}{1-\tau_\pi} \quad \text{and} \quad (1-\alpha)\frac{\phi y^m}{l} = w \tag{3}$$

Next, retailers differentiate these intermediate goods into different varieties, and assign different prices. There are continuum of retailers of size 1, indexed by i.

Price set by retailer for each variety of good:

$$p(i)$$

Demand for the respective variety:

$$y^d(i) = \left(\frac{p(i)}{p}\right)^{-\theta} y$$

Firms

The optimal price $p(i)$ solves:

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

Assuming symmetry across retailers, i.e.,

$$p(i) = p \quad \text{and} \quad y^d(i) = y = y^m$$

Optimal pricing condition gives:

$$\underbrace{\frac{\theta}{\theta - 1}}_{\substack{\text{Aggregate} \\ \text{Markup}}} \phi = 1 \tag{5}$$

Households

Continuum of heterogeneous households $j \in [0, 1]$

Two types of households: workers and entrepreneurs

Households keep switching types according to a two state Markov process representing entrepreneurial dynamics

- When households are workers: individual productivity is subject to idiosyncratic shocks
- When households are entrepreneurs: share of profits that they receive is subject to idiosyncratic shocks

Households

Workers:

Households supply l^j units of labour and receive real wage $w^j = we^{z^j}$, and z^j follows a log-normal Gaussian mixture process as in Ferrière et al. (2023)

Entrepreneurs:

Receive fraction of aggregate profits $\pi_j = \frac{w^j \pi}{e}$

Transitions:

The global transition matrix:

$$\mathcal{M} = \log \begin{bmatrix} (1 - p_{ew})\mathcal{P}^w & p_{ew}\mathcal{P}^{ew} \\ p_{we}\mathcal{P}^{we} & (1 - p_{we})\mathcal{P}^e \end{bmatrix}, \qquad (6)$$

Households

Capital income:

Household j can hold three more assets

- housing in quantity h_j
- deposits in quantity m^j
- equity capital k^j

Constant risk adjusted returns on holding deposits ($r^m = \bar{r}^m$) or housing ($r^h = \bar{r}^h$). Households can also borrow amount d^j, and there is a borrowing constraint given by $d^j \leq \varsigma p^h h^j$

Households

Total wealth of the household would become:

$$a^j = k^j + p^h h^j - d^j + m^j$$

Labour and capital incomes of household j is given by:

$$\Phi_l^j = (1 - \tau_l^j)(\omega^j (1 - \mathbf{1}_{e^j}) l^j + \mathbf{1}_{e^j} 0.7\pi^j) \tag{7}$$

$$\Upsilon_k^j = r^k k^j + \bar{r}^h p^h h^j + \bar{r}^m (m^j - d^j) + \mathbf{1}_{e^j}(1 - \tau_\pi) 0.3\pi^j \tag{8}$$

Households

Preferences:

$$\Lambda^j = (c^j)^{1-\kappa-\chi}(s^j)^{\kappa}(m^j)^{\chi} \tag{9}$$

Optimization problem:

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

$$\begin{aligned}
\text{s.t.} \quad & \text{budget:} \quad (1+\tau_c)c^j + \bar{r}^h p^h s^j + \Delta^j = (1-\tau^j)\left(\Phi^j_\ell + Y^j_k\right) - \phi^j a^j + T^j, \\
& \text{net wealth:} \quad a^j = k^j + p^h h^j - d^j + m^j, \qquad (10) \\
& \text{net savings:} \quad \Delta^j = \dot{k}^j + p^h \dot{h}^j - \dot{d}^j + \dot{m}^j + g_\rho a^j, \\
& \text{borrowing:} \quad m^j \geq 0, \; d^j \leq s^p h^j, \\
& \text{bounds:} \quad a^j \geq 0, \; k^j \geq 0, \; h^j \in [h^{\min}, \infty).
\end{aligned}$$

Household problem reformulation

This problem can be turned into a one-asset problem while preserving the endogenous composition of household portfolios.

Total wealth of the household is:

$$a^j = k^j + p^h h^j - d^j + m^j \tag{11}$$

Rewriting the budget constraint:

$$\dot{a}^j + g_\rho a^j + (1+\tau_c)c^j + \underbrace{R^{hj} s^j + R^{mj} m^j}_{P^{\Lambda_j}\Lambda^j} = (1-\tau^j)\left(\Phi^j_\ell + \Phi^j_k\right) - \phi^j a^j + \Xi^j + T^j \tag{12}$$

where P^{Λ_j} is the true price index associated with Λ_j

Household problem reformulation

Also,

$$R^{hj} = p^h((1-\mathbf{1}_{h^j})\bar{r}^h + \mathbf{1}_{h^j}[(1-\tau^j)((1-\varsigma)r^k + \varsigma\bar{r}^m) + \tau^j r^h]) \tag{13}$$

$$R^{mj} = (1-\tau^j)(r^k - \bar{r}^m) \tag{14}$$

$$\Phi^j_k = r^k a^j + \mathbf{1}_{e^j}(1-\tau_\pi)0.3\pi^j \tag{15}$$

This setup changes the household optimization problem to:

$$\begin{aligned} \max_{\Lambda^j, a^j, \ell^j} \quad & \mathbf{E}_0 \int_0^\infty e^{-\rho_j t} \left\{ \frac{(\Lambda^j)^{1-\gamma}}{1-\gamma} - \frac{(\ell^j)^{1+\zeta}}{1+\zeta} + \beta \log\left(\frac{a^j}{a} + \mu\right) \right\} dt \\ \text{s.t.} \quad & \dot{a}^j + P^{\Lambda^j}\Lambda^j = (1-\tau^j)\left(\Phi^j_\ell + \Phi^j_k\right) - (\phi^j + g_a)a^j + \Xi^j + T^j, \\ & a^j > 0. \end{aligned} \tag{16}$$

Household problem reformulation

This reformulation (dynamic problem) also solves for endogenous labour supply decisions of workers, that implies:

$$l^j = \left[\frac{(1-\tau^j)(1-\tau_l^j)(1-\mathbf{1}_{e^j})\omega^j}{P^{\Lambda j}\Lambda^j} \right] \tag{17}$$

Households' endogenous portfolio choice:

After solving the dynamic problem mentioned earlier, the static problem involved choosing composition of Λ^j s.t. the relative costs of the three expenditure categories:

$$\min_{c^j, s^j, m^j} \quad (1+\tau_c)c^j + R^{hj}s^j + R^{mj}m^j$$

$$\text{s.t.} \quad (c^j)^{1-\kappa-\chi}(s^j)^{\kappa}(m^j)^{\chi} = \Lambda^j$$

Household problem reformulation

The decision rules for housing services, financial services and non-durable goods consumption would then be:

$$m^{dj} = \chi P_\Lambda^j \Lambda^j / R^{mj}$$

$$s^j = \kappa P_\Lambda^j / R^{hj}$$

$$c^j = (1 - \kappa - \chi) P_\Lambda^j \Lambda^j / (1 + \tau_C)$$

with

$$P_\Lambda^j = \left(\frac{1 + \tau_c}{1 - \kappa - \chi} \right)^{1-\kappa-\chi} \left(\frac{R^{hj}}{\kappa} \right)^{\kappa} \left(\frac{R^{mj}}{\chi} \right)^{\chi} \tag{18}$$

Household's portfolio choices (decision)

Housing demand is bounded by below (given minimum size of housing units), upper bound is given by the borrowing constraint.

Homeownership would then be determined by:

$$h^j = \mathbf{1}_{h^j} \min\left\{ s^j, \frac{a^j - k^j - m^{dj}}{\xi p^h} \right\} \quad \text{and} \quad d^j = \xi p^h h^j \tag{19}$$

where

$$\mathbf{1}_{h^j} = \left(\frac{a^j - k^j - m^{dj}}{\xi p^h} > h^{\min} \right)$$

Assuming only homeowners can buy capital, their decision would be:

$$k^j = \mathbf{1}_{h^j} \max\{a^j - (p_h h^j - d^j) - m^{dj}, 0\} \tag{20}$$

Remaining positive amount of wealth not allocated to housing or capital is held in liquid form:

$$m^j = \max\{a^j - (p_h h^j - d^j) - k^j, 0\} \tag{21}$$

Tax and transfer mechanisms

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

$$\mathcal{T}^j = 1 - (1 - \bar{\mathcal{T}}_s) \left(\frac{\mathcal{B}^j}{\bar{\mathcal{B}}} \right)^{-\eta_s} \quad \text{for} \quad \mathcal{B}_{s-1} \leq \mathcal{B}^j \leq \mathcal{B}_s \tag{22}$$

for each type of transfer $\mathcal{T} \in \{\tau, \tau_I, \phi, T\}$

$\bar{\mathcal{B}}$ is the average value of the tax base in total population.

Government and market clearing

Government's budget constraint:

$$
\begin{aligned}
s_g Y + \underbrace{\int_j \Omega^j T^j \, dj}_{\text{Transfers}} + r^m m^s = \dot{m}^s + \underbrace{\int_j \Omega^j \tau_\ell^j \left(w^j (1 - \mathbf{1}_{e^j}) \ell^j + \mathbf{1}_{e^j} 0.7 \pi^j \right) dj}_{\text{Payroll tax}} \\
+ \underbrace{\int_j \Omega^j \phi^j a^j \, dj}_{\text{Capital tax}} + \tau_\pi \underbrace{\left(\frac{r^k}{1 - \tau_\pi} k + \int_j \Omega^j \mathbf{1}_{e^j} 0.3 \pi^j \, dj \right)}_{\text{Corporate tax}} \\
+ \tau_c \underbrace{\int_j \Omega^j c^j \, dj}_{\text{Consumption tax}} + \underbrace{\int_j \Omega^j \tau^j \left(\Phi_\ell^j + Y_k^j \right) dj}_{\text{Income tax}} .
\end{aligned}
\tag{23}
$$

Government and market clearing

Market clearing conditions of capital, labour, deposit/househing debt markets:

$$k = \int_j \Omega^j k^j dj \tag{24}$$

$$l = \int_j \Omega^j (1 - \mathbf{1}_{e^j})(\omega^j/\omega) l^j dj \tag{25}$$

$$m^s = m - d = \int_j \Omega^j (m^j - d^j) dj \tag{26}$$

Given housing demand, exogenous housing prices and return $\bar{r}^h$, there exists an implicit housing supply:

$$h^s = h = \int_j \Omega^j h^j dj \tag{27}$$

Final equations

Aggregate output:

$$y = \xi k^{\alpha}(\rho l)^{1-\alpha} \tag{28}$$

$$\omega = (1-\alpha)\frac{\theta-1}{\theta}\frac{y}{l} \tag{29}$$

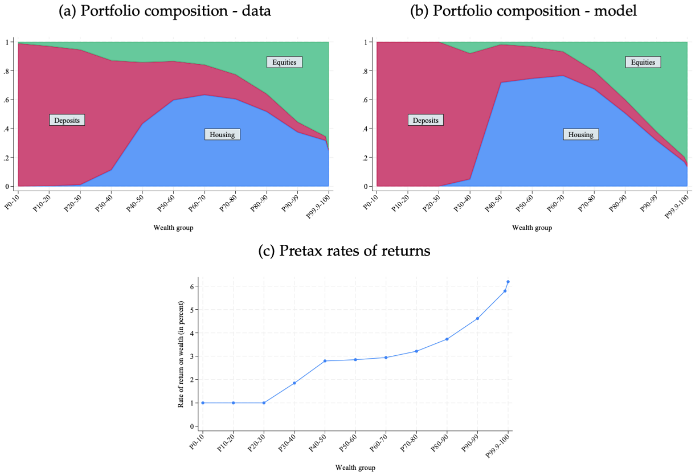
$$r^k = (1-\tau_\pi)\left(\alpha\frac{\theta-1}{\theta}\frac{y}{k} - \delta\right) \tag{30}$$

Results

Static Equilibrium

Static Equilibrium - Household portfolio choices

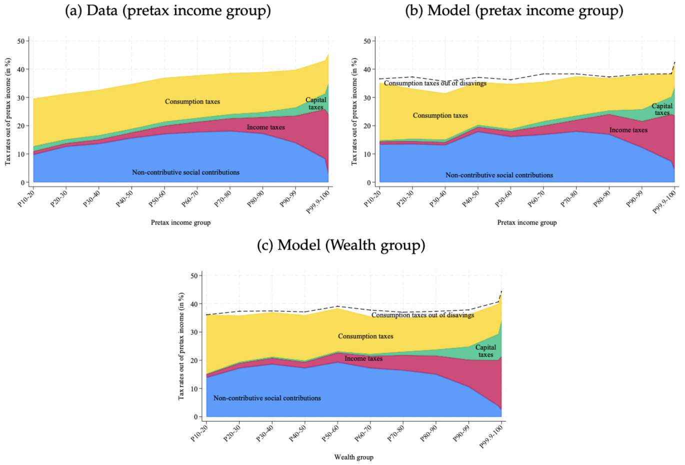
Figure 3: Portfolio composition and returns among wealth groups in 1984.



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.

Static Equilibrium - Household taxes

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

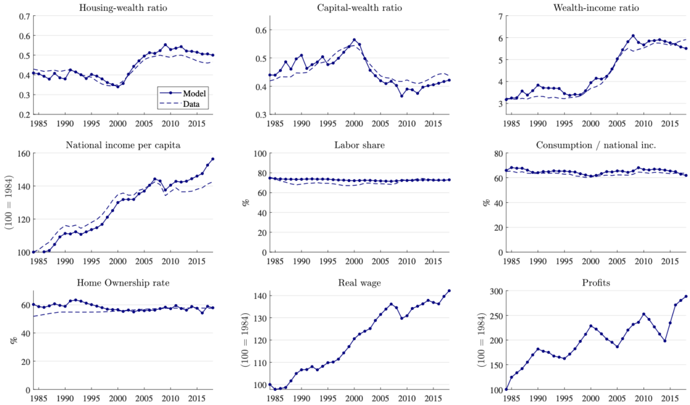


Notes: Data from Panel (a) taken from Bozio et al. (2024).

Dynamic Equilibrium

Dynamic equilibrium - macroeconomic variables

Figure 8: Macroeconomic variables



Dynamic equilibrium - macroeconomic variables

Figure 9: Structure of taxes