The Aging Hypothesis

A unified explanation for:

- rising market power
- rising inequality
- falling interest rates
- …. and more

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& U.S. Treasury

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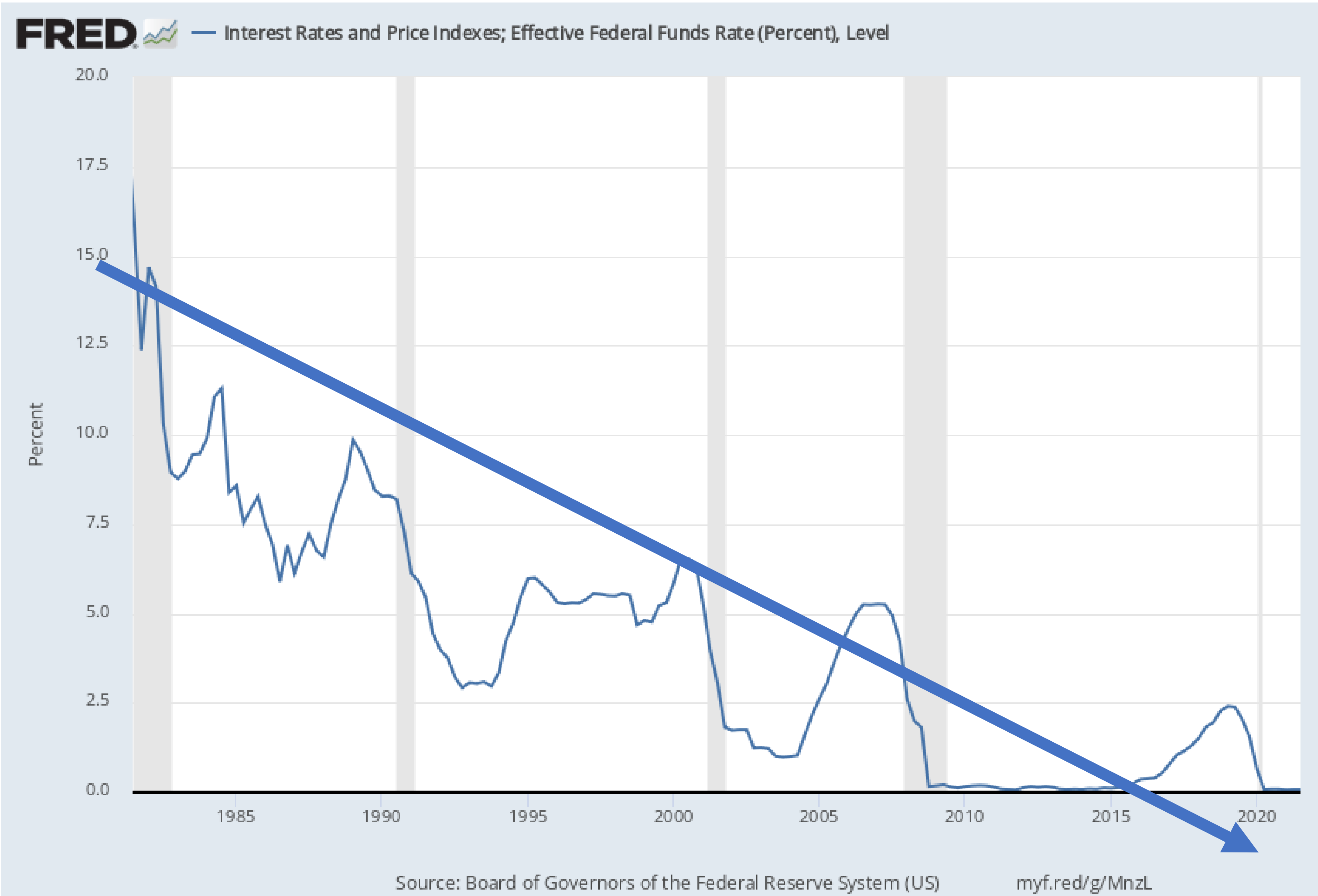
The Secular Stagnation Hypothesis

- Alwyn Hansen (1937)

- Summers (2014)
  - A permanent reduction in the natural rate of interest?

- Eggertsson and Mehrotra (2014)
  - Model permanent reduction in natural rate in OLG. Aging/inequality/falling productivity/global imbalances
  - Amend AD to allow for permanent slump

  → ***Need a simultaneous increase in markups***


FRED
Interest Rates and Price Indexes; Effective Federal Funds Rate (Percent), Level
20.0
17.5
15.0
12.5
10.0
7.5
5.0
2.5
0.0
Percent
1985
1990
1995
2000
2005
2010
2015
2020
Source: Board of Governors of the Federal Reserve System (US)
myf.red/g/MnzL

Three big trends in macro

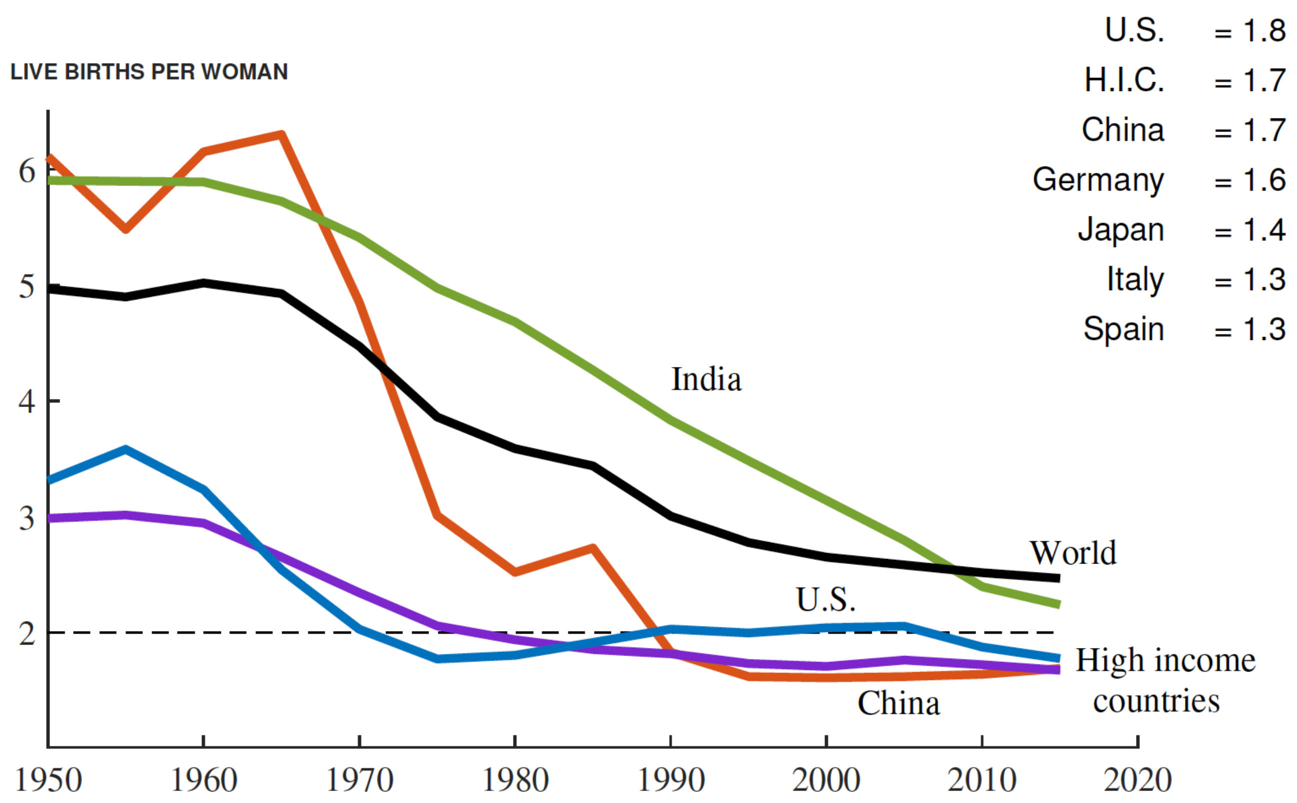
1. Fall in real interest rates
   - ZLB, sec stagnation, fall in growth
   - Meanwhile measured return on capital relatively constant
2. Rise in inequality
   - Rise of top 1 percent
   - Rise in wealth to output (without rise in investment), high Tobins Q
3. Rise in firms market power
   - Fall in business dynamisms → secular decline in firm entry
   - Fall in productivity
   - Fall in labor share and capital share

Is there a common cause?

- What do we even mean by “explanation”?
- Don’t want to push back the explanation one step
    - **Ates and Akcigit (2020)** and slowdown in “knowledge diffusion.”
    - ➢ Something that looks reasonably “slow moving”
    - ➢ Something reasonably independent of policy.

Charles Jones (2020): The End of Economic Growth? Unintended Consequences of Declining Population

The Total Fertility Rate (Live Births per Woman)



Aging

- Can aging account of all of these trends and sub-trends?

- Insight dating back to Bain (1954)
  - ❖Incumbant firms generate rents because consumers have accumulated preferences for their product.
  - ❖Brunnerberger, Jean-Pierrera and Gentzkow (AER,2012) show that older people less likely to switch products
  - ❖This evidence is extended and amplified by Bornstein (2018)

I. Aging and markups

A simple model

$$N_t = nN_{t-1}$$

$$M_t = N_t + N_{t-1}$$

The household

J products

$$U_t^* = \max_{c_t^y, c_{t+1}^o} u\left(c_t^y\left(j^*\right)\right) + \beta u\left(c_{t+1}^o\left(j^*\right)\right)$$

$$p_t\left(j^*\right) c_t(j^*) = I_t^y + d_t$$

$$p_{t+1}(j^*) c_{t+1}(j^*) = I_{t+1}^o - (1 + r_t) d_t$$

$$d_t \leq \bar{d}$$

$$c_t^y(j) \equiv e^{\frac{1}{\theta}\epsilon_t(j)} c_t(j)$$

Follows a Gumbel distribution as in Anderson, Depalma, Thisse (1987) and Bornstein (2018)

$$j_i^* = \arg \max_{j \epsilon (0,1)} \left(-\theta \ln p_j + \epsilon_t(j)\right)$$

Proposition 1 *If $J = 1$, the customer base of firm j from young people is:*

$$B_t^j = N_t \left(\frac{p_t(j)}{P_t}\right)^{-\theta}$$

where

$$P_t \equiv \left[\int_0^1 p_t(j)^{-\theta} dj\right]^{-\frac{1}{\theta}}$$

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Demand of the young

$$B_t^j \frac{I_t^y}{p_t(j)}$$

Firm demand function at time t

$$y_t(j) = \underbrace{B^j_{t-1} \frac{I^o_t}{p_t(j)}}_{\text{demand from existing customers}} + \underbrace{N_t\left(\frac{p_t(j)}{P_t}\right)^{-\theta} \frac{I^y_t}{p_t(j)}}_{\text{demand from new customers}}$$

The firms problem

$$V(B^j_{t-1}) = \max_{p_t(j)} \{(p_t(j) - w_t)y_t(j) + \lambda V(B^j_t)\}$$

s.t.

$$y_t(j) = \qquad B^j_{t-1}\frac{I^o_t}{p_t(j)} \qquad + \quad N_t(\frac{p_t(j)}{P_t})^{-\theta}\frac{I^y_t}{p_t(j)}$$

$$B^j_t = N_t(\frac{p_t(j)}{P_t})^{-\theta}$$

Markups

$$1 + \mu_t \equiv \frac{p_t}{w_t} = \underbrace{\frac{\theta + 1}{\theta} \frac{N_t I_t^y}{N_t(I_t^y + \lambda \frac{\mu_{t+1}}{1+\mu_{t+1}} I_{t+1}^o)}}_{\text{New Customers}} + \underbrace{\frac{N_{t-1} I_t^o}{N_t(I_t^y + \lambda \frac{\mu_{t+1}}{1+\mu_{t+1}} I_{t+1}^o)\theta}}_{\text{Existing Customers}}$$

Assumption:

$$\frac{I_t^o}{I_t^y} = \frac{1-\gamma}{\gamma}$$

Markups

$$1+\mu = \underbrace{\frac{1}{\theta n}\frac{1-\gamma}{\gamma+\lambda(1-\gamma)}}_{\textit{Existing Customer Base}} + \underbrace{\frac{\theta+1}{\theta}\frac{\gamma}{\gamma+\lambda(1-\gamma)}}_{\textit{New Customer Base}} + \underbrace{\frac{1-\gamma}{\frac{\gamma}{\lambda}+1-\gamma}}_{\textit{Future Customer Base}}$$

$$\frac{\partial \mu}{\partial n} = -\frac{1-\gamma}{\gamma+(1-\gamma)\lambda}\frac{1}{\theta n^2} < 0$$

Interest rates

$$u_c(c_t^y) = \beta(1 + r_t)E_t(c_{t+1}^o)$$

- No effect
- Eggertsson, Mehrotra and Robbins (2019) show the effect of aging in interest rate via relative demand and supply for savings.
- Is there feedback between ***markups and interest rates***?

So far….

…. simple meachanism for aging triggering rise in markups ***via the demand side***

…. no effect on interest rates

…. (could make interest rate fall via effect of aging on relative demand and supply for savings as in Eggertsson, Mehrotra and Robbins).

…. but can markups generate this fall instead?

The rise in markups

- Has moved ***hand in hand*** with

……

rise in ***inequality***

In Eggertsson, Mehrotra, Robbins (2019) we point out this channel might be relevant for interest rates *if rich save more*

II. Inequality and markups

Inequality

N_t

λ^w → $w_t \gamma 2L$ $I_t^{y,w}$

workers get wage

$(1-\lambda^w)$ → $(1-w_t)\gamma 2L$ $I_t^{y,c}$

Capitalists get the markup

Borrowing-Lending

$$I_t^{y,w} = \frac{w_t L_t}{\lambda^w} < I_t^{y,c} = \frac{y_t(p_t - w_t)}{p_t(1-\lambda^w)}$$

$$\lambda^w > \frac{1}{1+\mu_t}$$

Assume: the ***rich*** will save when young and ***poor*** will borrow up
to borrowing limit. (will show assumption under which this is true shortly

$$d_t^w = \bar{d}$$

Derivation of markups will remain the same

$$1+\mu_t = \frac{\theta+1}{\theta} + \frac{1}{\theta}\frac{1}{n}\frac{1-\gamma}{\gamma}$$

$$\frac{I_t^{y,w}}{P_t} = \frac{\gamma}{1+\mu_t} \qquad \frac{I_t^{y,c}}{P_t} = \gamma\frac{\mu_t}{1+\mu_t}$$

Straight forward mechanism through which increase in markups increases inequality

$$G_t = \lambda^w - \frac{1}{1+\mu_t} > 0$$

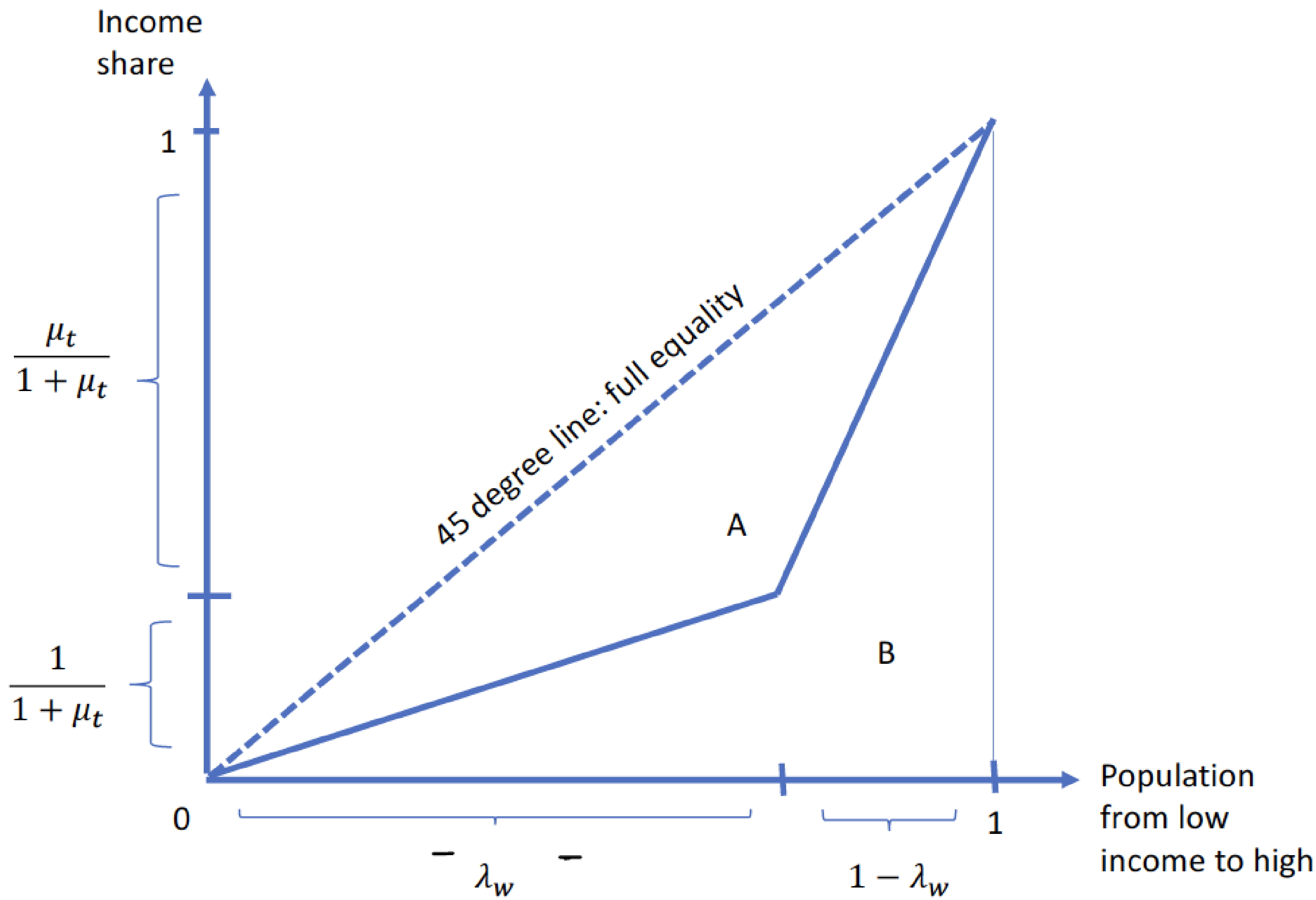
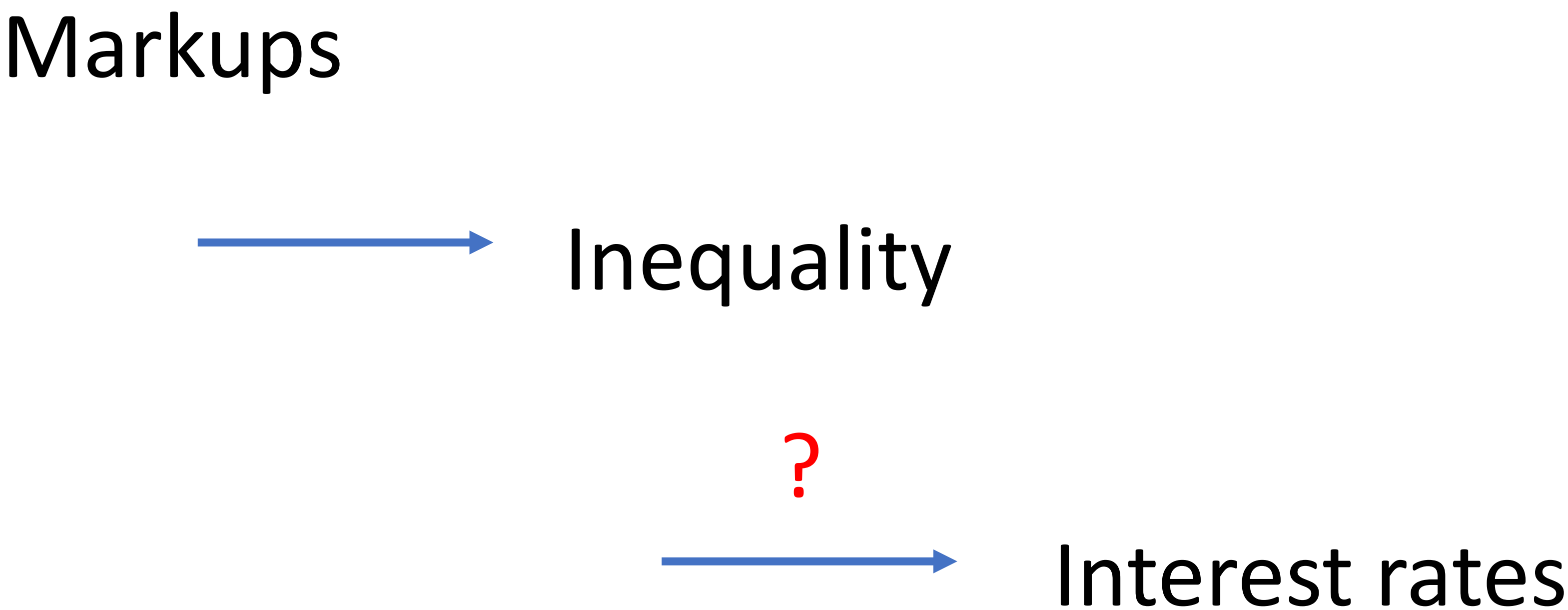


Figure 1: The Gini Coefficient

Markups, inequality and interest rates

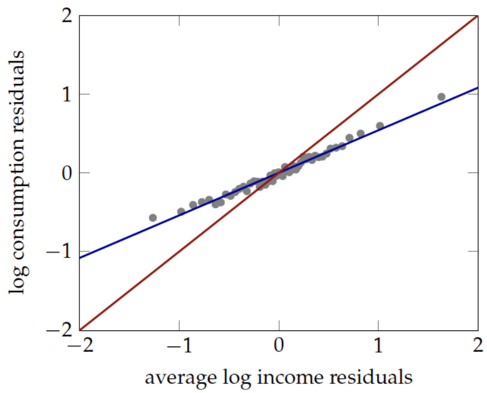

Markups
Inequality
?
Interest rates

The Rich Save More

Dynan, Skinner, Zeldes (2004): "Do the Rich Save More".

Ludwig Straub (2020): "Consumption, savings, and the distribution of permanent income".

Figure 3: Consumption and average income.



Note. The graph shows consumption and average income in logs for the baseline sample of PSID households. To construct it, log consumption is regressed on controls (year, age, household size, location) and 50 bins for average log income residuals. Log income residuals are obtained by partialing out year, age, and household size dummies and then averaged over a symmetric 9-year interval for each household ($T = 5$). The blue line is the estimated linear relationship with slope ϕ, the red line is the 45° line.

Rich *do* save more than poor

But why?

1. The increase in inequality is to some degree driven by increase in capital income
   - → Capital Income is more volatile
   - → Then "rich" people will save more because of insurance motive (alternative taxation motive).
2. Directly engineer preferences so that "rich save more".

Use addi-log preferences as suggested by Hauthakker (1960) and Straub (2020)

The ***curvature*** of the utility of consumption ***decreases*** with age

- Can be modeled via bequest motive

Example

$$\log c_t^y + \beta c_{t+1}^o$$

Consumption Euler Equation

$$\frac{1}{c_t^y} = \beta(1 + r_t)$$

Only rich determine the interest rate
--> poor are borrowing constrained:

$$c_t^{y,c} = \frac{\mu_t}{1+\mu_t}\frac{\gamma 2L}{1-\lambda^w} - \frac{\lambda^w}{1-\lambda^w}\bar{d}$$

$$1 + r_t = \beta^{-1}\frac{1}{c_t^{y,c}}$$

$\downarrow n$ $\quad \mu_t \uparrow$ $\quad c_t^{y,c} \uparrow$ $\quad \downarrow r_t$

Summary so far

- Aging of the population

→Rise of market power (more "captive" customers)

→The rise in rents → benefits the "top 1 percent"

→Increase in Inequality

→Fall in interest rate because rich save more

Other developments

Fall in labor share

Fall in productivity

Firm dynamics:

Should there not be an inflow of firms due to the increase in rents?

Aging and productivity

Obvious mechanism not covered:
Productivity depending on age distribution

Firms compete in price and quality of product

$$c_t^y(j) \equiv e^{\frac{1}{\theta}\epsilon_t(j)} \frac{c_t(j)}{q_t(j)}$$

$$j^* = \arg\max_{j\epsilon(0,J)} \{-\theta \ln p_t(j) + \theta \ln q_t(j) + \epsilon_t(j)\}$$

$$y_t(j) = \underbrace{N_{t-1} \frac{I_t^o}{p_t(j)}}_{\text{existing customer base}} + \underbrace{N_t \left(\frac{p_t(j)}{P_t}\right)^{-\theta} \left(\frac{q_t(j)}{Q_t}\right)^{\theta} \frac{I_t^y}{p_t(j)}}_{\text{new customers}}$$

$$Q_t \equiv [\int_0^1 q_t(j)^\theta dj]^{\frac{1}{\theta}}$$

$$w_t \phi\left(\frac{q_t(j)}{Q_t} - 1\right) M_t$$

Cost of increasing quality in terms of labor units

$$\phi\left(\frac{q_t(j)}{q_{t-1}} - 1\right) = \begin{cases} \phi_q\left(\frac{q_t(j)}{q_{t-1}} - 1\right) \text{ if } q_t(j) > q_{t-1} \text{ where } \phi_q \geq 0 \text{ is a coeffient} \\ 0 \text{ if } q_t(j) \leq q_t \end{cases}$$

$$\frac{Q_t}{Q_{t-1}} = \frac{1}{\phi_p} * \theta \frac{n}{1+n} \gamma * \{2 + \mu_t\}$$

Proposition 5

Aging reduces productivity if

$$\theta\{2+\mu\} > \frac{1+n}{n} \frac{1-\gamma}{\gamma}$$

Aging and firm entry/business dynamism

Higher markups

- So far: number of firms ***fixed***

- Shouldn't high markups create profit opportunities and encourage firms to enter?

- Efficient outcome?

- ***NO not necessarily if there are borrowing limits***

- ***Aging can lead to a FALL in entry***

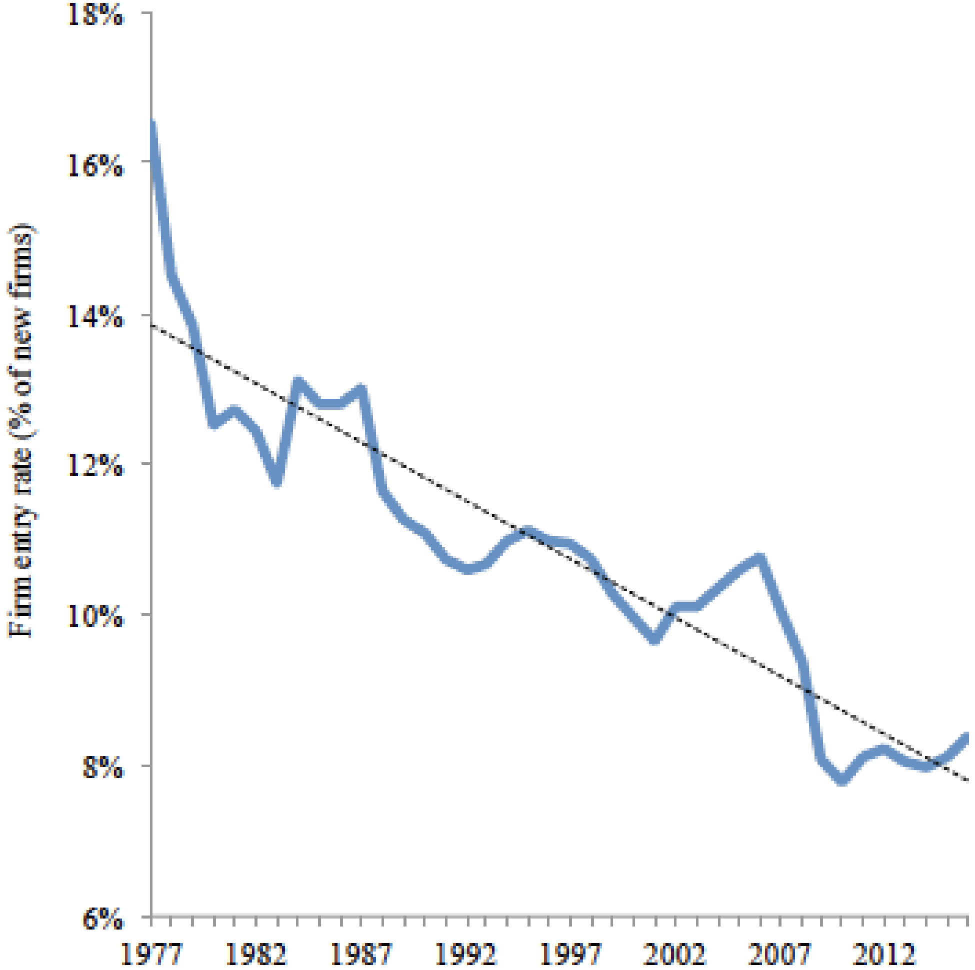


Figure 3: Firm entry rate

Free entry

- We now allow for a continuum of firms

$$J_t \qquad \delta$$

Incumbant

$$y_t^I(j) = B_{t-1}^j \frac{I_t^o}{p_t^I} + B_t^j \frac{I_t^y}{p_t(j)} \qquad B_t^j = \frac{N_t}{J_t}(\frac{p_t(j)}{P_t})^{-\theta}$$

Entrant

$$y_t^E(j) = B_t^j \frac{I_t^y}{p_t(j)}$$

Free entry

$$F_t = \sum_{t=0}^{\infty} R_{t,t+1}\{p_t(j)y_t(j) - w_t l_t(j)\}$$

Fixed cost

More reasonable?

$$F_t = p_t(j)y_t(j) - w_t l_t(j)$$

Free entry

- Consider an equilibrium in which ***J*** is constant. How does it depend on ***n***?

- Entry cost in a sector increases with population

→ fixed number of firms in a balanced growth path

→Then with smaller fraction of the population young

→ smaller customer base for entrants

→ lower entry

Results

- Can show that

$$1+\mu^I = \frac{\theta + 1 + \frac{1-\gamma}{\gamma}(\frac{1}{n} - \delta\lambda\theta)}{\theta - \delta\lambda\theta\frac{1-\gamma}{\gamma}}$$

$$1+\mu^E = \frac{\theta+1}{\theta}\frac{(\theta+1) + \frac{1-\gamma}{\gamma}\{\frac{1}{n} - \delta\lambda\theta\}}{(1-\tau) + \frac{1-\gamma}{\gamma}\lambda\delta(1+\frac{1-\gamma}{\gamma}\frac{1}{n})}$$

$$1+\mu^I > \quad 1+\mu^E$$

Key Results

$$\hat{\mu}^I = -(1-\gamma)\hat{n}$$

$$\hat{\mu}^E = -\frac{\theta}{\theta+1}\frac{1-\gamma}{\gamma}\lambda\delta(1+\mu)\hat{\mu}^I - \mu^*$$

Key result

- Aging increases markups and reduces entry.

$$\hat{J} = \frac{1}{2}\hat{n} + \frac{1}{1 - \frac{1}{2}\delta(1+\theta)\mu}\hat{\mu}^E$$

$\hat{n} \downarrow$ $\hat{J} \uparrow$

Free entry and productivity

- To the extent new entrants reflect "business dynamism" and enhanced productivity

→Possible spillover to productivity

Free entry and supply side

- Here we emphasized the demand side effect of reduction in entry with slowdown in productivity growth (smaller new customer base).

- Entrepreneurial activity associated with younger workers?

- Niklas Engbom (2019): “Firm and Worker Dynamics in an Aging Labor Market”

- Argues older worker less willing to switch job, lower entrepreneurial activity, etc.

--> Additional effect

Conclusion

- The demographic transition we are experiencing implies world population declining by 2050.
- May have fundamental implications for economics going forward
- The problem of secular stagnation “started” in Japan
  - →The fastest aging population in the world
- Once current “stagflation” episode over, back to where we were.

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Five puzzles

Eggertsson, Robbins, Wold (2017): Kaldor and Piketty's Facts: The Rise of Monopoly Power in the US

(P1) W/Y>> despite low S and low K/Y.

(P2) High Tobin's Q >> 1.

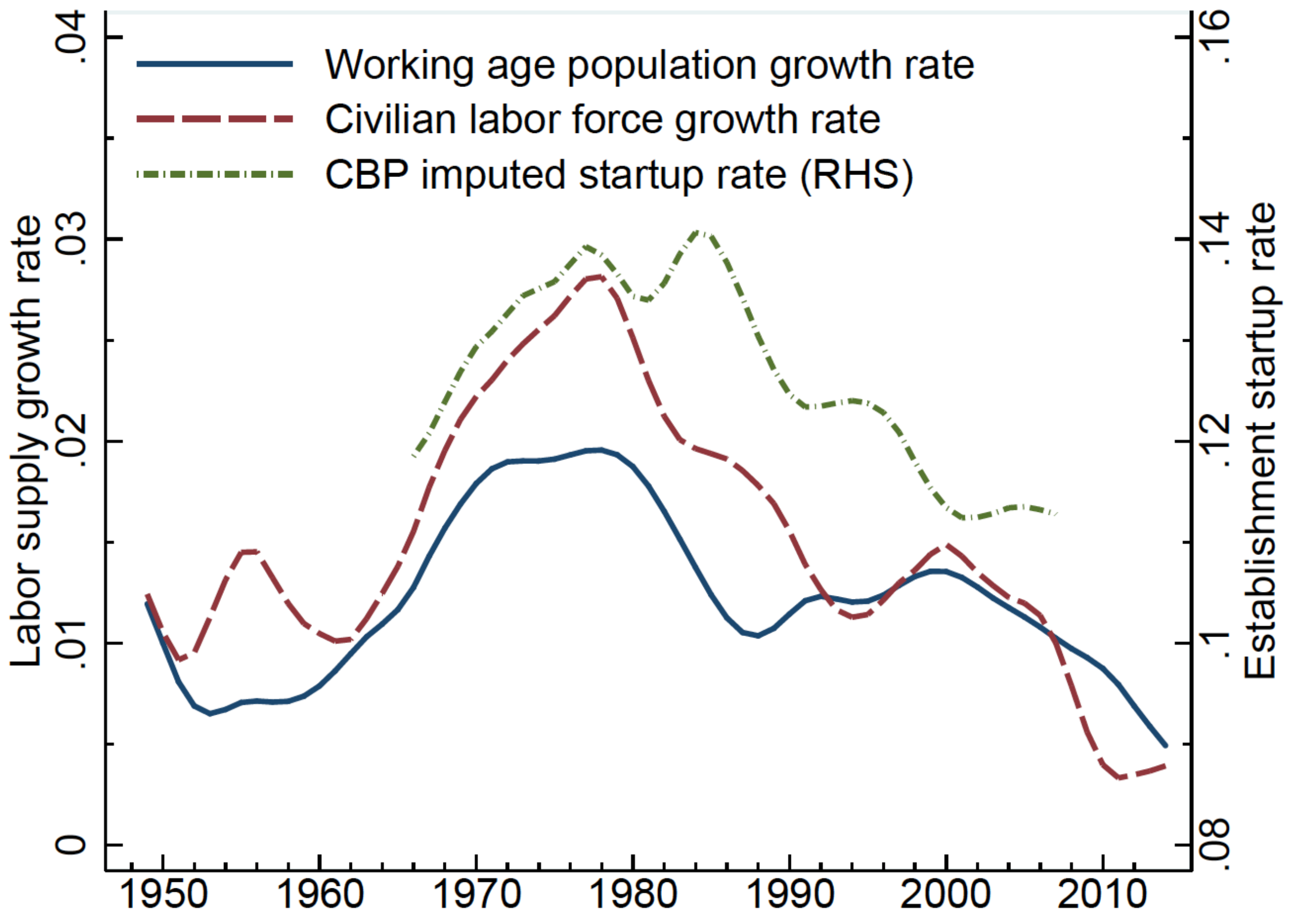
(P3) A decrease in r while measured return on capital constant.

(P4) A decrease in both the *labor share* and the *capital share*.

(P5) A decrease in I/Y despite low r and a high Q.

Driven by fall in ***interest rate*** and rise in ***markups***

Benjamin Pugsley, Fatih Karahan and Aysegul Sahin (2018): Demographic Origins of the Startup Deficit



Gideon Bornstein (2018): "Entry and Profits in an Aging Economy: The role of consumer Inertia.

Figure 4: Consumer Inertia by Different Age Groups