The Distribution of Wealth and the Marginal Propensity to Consume

Presentation: Inequality in Macroeconomics

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The Paper

- *The Distribution of Wealth and the Marginal Propensity to Consume* [3]
- Authors: Carroll, Slacalek, Tokuoka and White (2017, Quantitative Economics)
- Empirical estimates of the first year marginal propensity to consume (MPC) out of one-time income shocks generally large (0.2-0.6)
- In model without individual uncertainty way lower ($\approx$0.04)
- Even in Krusell-Smith model lower than empirical estimates

Model with realistic income dynamics can match empirical wealth distribution and MPC's.

Buffer Stock Saving

- In a world with income uncertainty, impatient but risk adverse agents have target wealth ('buffer stock') [1]
- **Impatience:** Want to consume now
- **Uncertainty:** Want to save to smooth consumption

⇒ Buffer stock as compromise

How to model income risk?

- Unemployment risk
- Income of working people has permanent and transitory component (Friedman)
- Krusell-Smith income not able to match microdata

Friedman Buffer Stock (FBS) income

$$y_t = W_t \cdot \underbrace{p_t}_{\text{permanent}} \cdot \underbrace{\xi_t}_{\text{transitory}} \tag{1}$$

$$p_t = p_{t-1} \cdot \psi_t, \quad \log(\psi_t) \sim N(-\sigma_\psi^2/2, \sigma_\psi^2) \tag{2}$$

$$\xi_t = \begin{cases} \mu & \text{with prob. } \Omega \text{ (unemployed)} \\ (1-\tau)l\theta_t & \text{else} \end{cases} \tag{3}$$

$$\log(\theta_t) \sim N(-\sigma_\theta^2/2, \sigma_\theta^2)$$

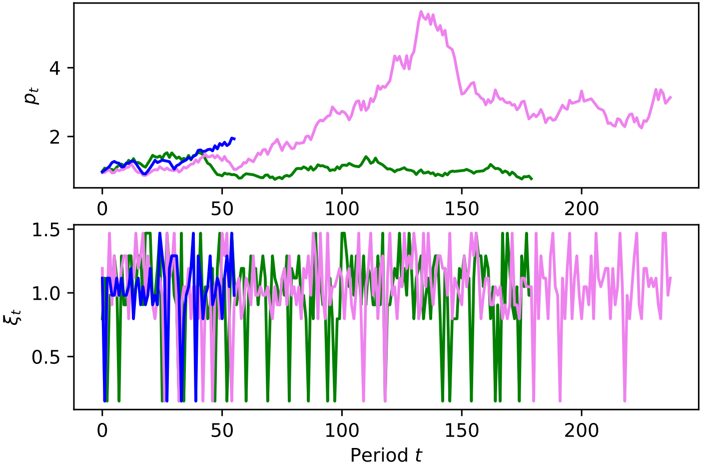
Death Impatience Condition

- The longer agents live (are simulated), the higher is the cross-sectional variance of (p_t)
- In order to have a steady state distribution of (p_t) in the model, agents must be able to die
- Baseline specification: Perpetual youth model (geometric distribution of death)

For target wealth to permanent income ratio we must have:

$$\frac{(1-\delta+r_t)^{(1-\rho)}\mathbb{E}_t[\psi^{-1}]\cancel{D}}{\Gamma} < 1. \tag{4}$$

Paths of Productivity Components



Problem of the Agent

$$\max_{(C_\tau)_{\tau=t}^{\infty} } \mathbb{E}_t \sum_{n=0}^{\infty} (\cancel{D}\beta)^n u(C_{t+n}), \tag{5}$$

subject to

$$\begin{aligned} A_t &= M_t - C_t \\ K_{t+1} &= A_t/\cancel{D} \\ M_{t+1} &= (1-\delta+r_{t+1})K_{t+1} + W_{t+1}p_{t+1}\xi_{t+1} \\ p_{t+1} &= p_t\psi_{t+1} \\ A_t &\geq 0 \end{aligned}$$

Assumption: $u(\bullet) = \bullet^{1-\rho}/(1-\rho)$
How to deal with the state-variable p_t?

Normalized Problem of the Agent

Divide every variable in t by $W_t \cdot p_t$! [2]

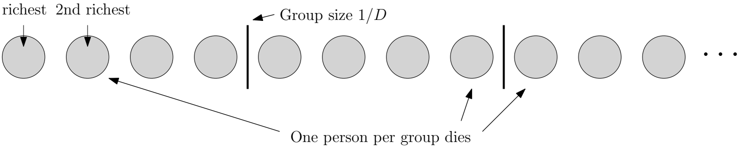
$$v(m_t) = \max_{c_t} \left\{ u(c_t) + \beta \cancel{D} \mathbb{E}_t \left[\left(\frac{W_{t+1}}{W_t} \right)^{1-\rho} \psi_{t+1}^{1-\rho} v(m_{t+1}) \right] \right\} \quad (6)$$

$$\begin{aligned} a_t &= m_t - c_t \\ k_{t+1} &= \frac{a_t W_t}{W_{t+1} \cancel{D} \psi_{t+1}} \\ m_{t+1} &= (1 - \delta + r_{t+1}) k_{t+1} + \xi_{t+1} \\ a_t &\geq 0 \end{aligned}$$

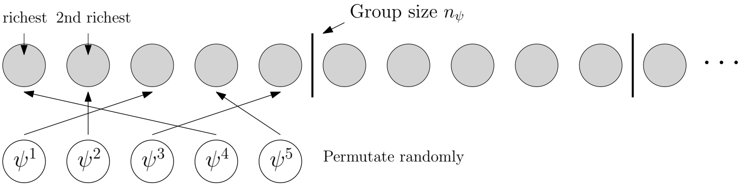
- Now m_t is only state variable
- Still costs: Interpolation is needed at every step in VFI
- Interaction of 3 random variables (u_t, ψ_t, θ_t)
- If (ψ_t) and (θ_t) are approximated by 8 states each, 72 times interpolation per Bellman evaluation

Reduce Simulation Error

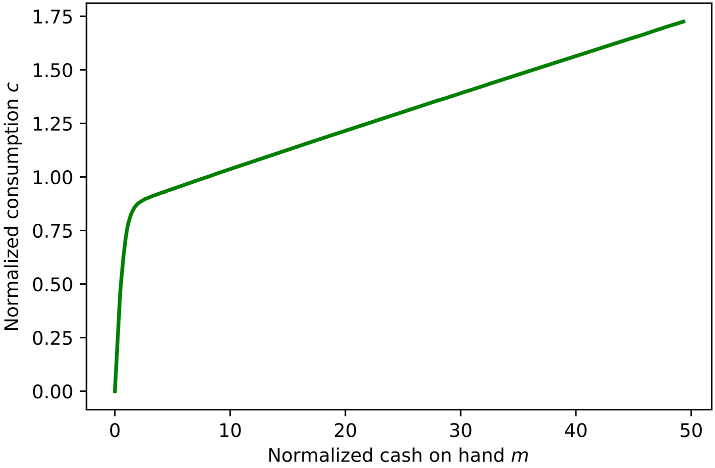
Simulate Death



Simulate Permanent Productivity Shocks

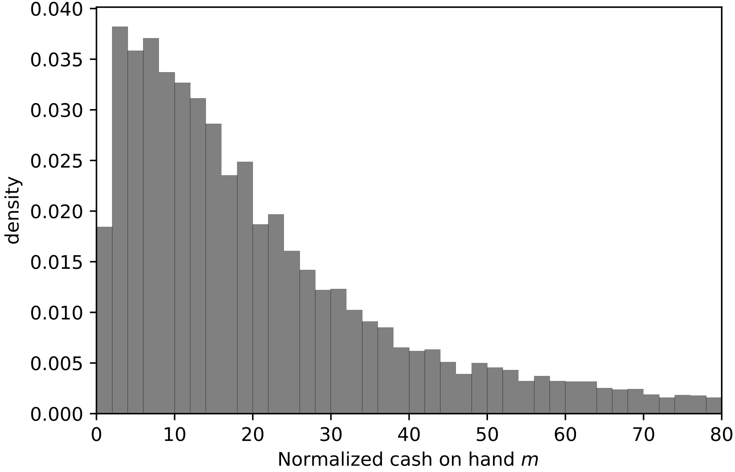


Consumption Function at the Steady State

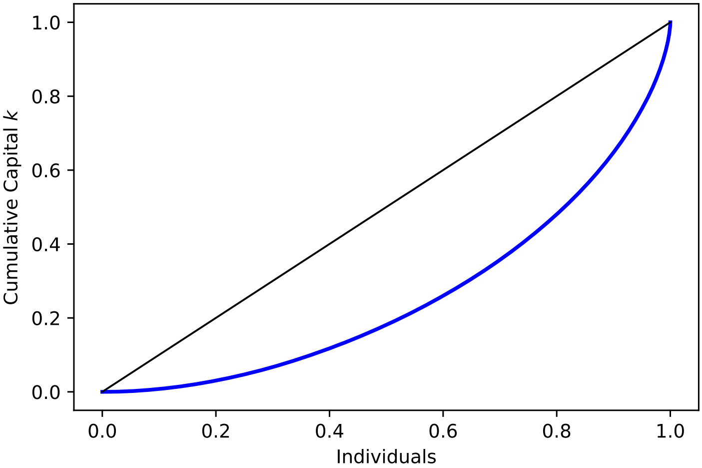


(Model is closed with $Y_t = K^{\alpha}(l(1-\Omega))^{1-\alpha}$.)

Distribution of Cash on Hand at the Steady State



Steady State Capital Distribution



Gini-Coefficient: 0.49, $r^{ss} = 0.0337$

Limits of the Basic Model

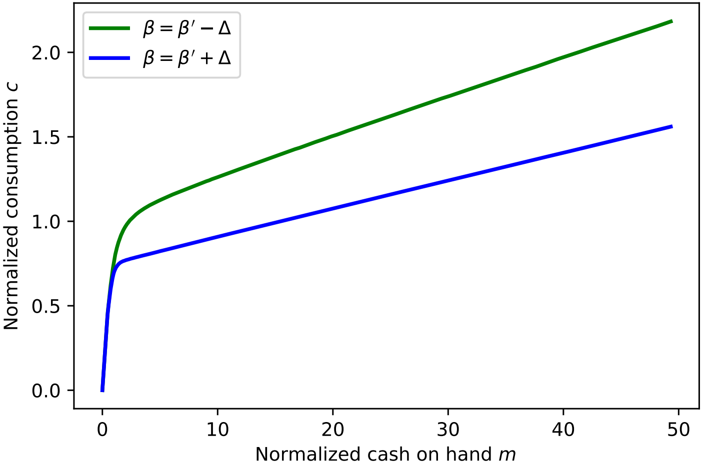
- The income process is calibrated to (permanent) income reported in the NY Fed Survey of Consumers
- The income distribution is matched well by the model
- In reality, wealth is more unequally distributed than income, in this model it is not!
- No surprise, since all agents share the same target wealth to permanent income ratio
- Obviously agents are not identical in reality

$\Rightarrow$ Additional to stochastic (ex-post) heterogeneity introduce structural (ex-ante) heterogeneity [4]

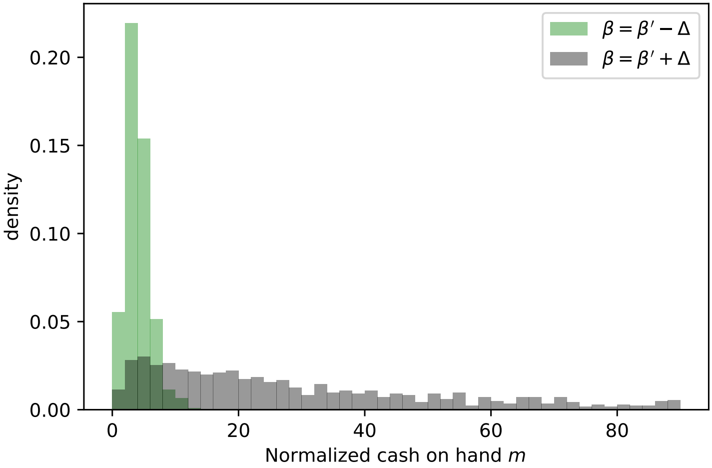
The β-dist model

- Agents differ in their discount factor β
- At the start $\beta \sim U[\beta' - \Delta, \beta' + \Delta]$
- $\{\beta', \Delta\} = \{0.9867, 0.0067\}$ calibrated to US wealth distr.
- Different β's should capture different preferences, life-cycle aspects, limited asset market participation

Consumption Function at the Steady State



Distribution of Cash on Hand at the Steady State



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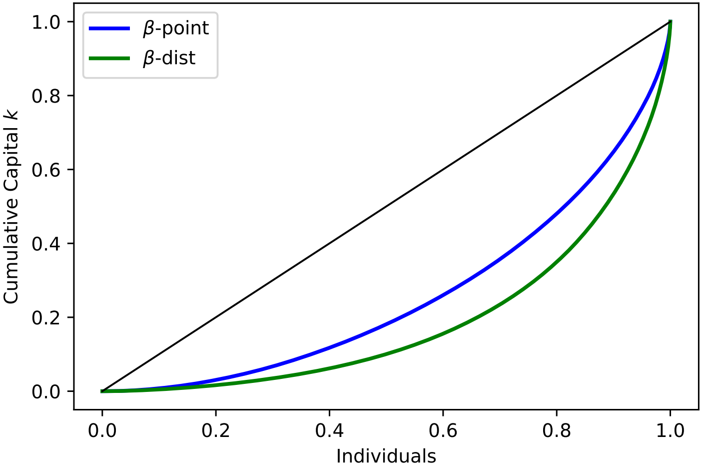


Gini-Coefficient: 0.62, $r^{ss} = 0.0357$ (β-point model)

Policy Experiment: Stimulus Check

- At $t = 0$, government gives every person 1 additional asset ($\approx 6.4\%$ of GDP)
- Financed by tax on future generations (100 year bonds)
- **By how much will consumption increase in the first year?**
- Carroll et al.: Extend Krusell-Smith model to include FBS
- They compute the annual MPC as $1 - (1 - \text{MPC}_{\text{quarterly}})^4$
- Aggregate shocks seem to be not too important

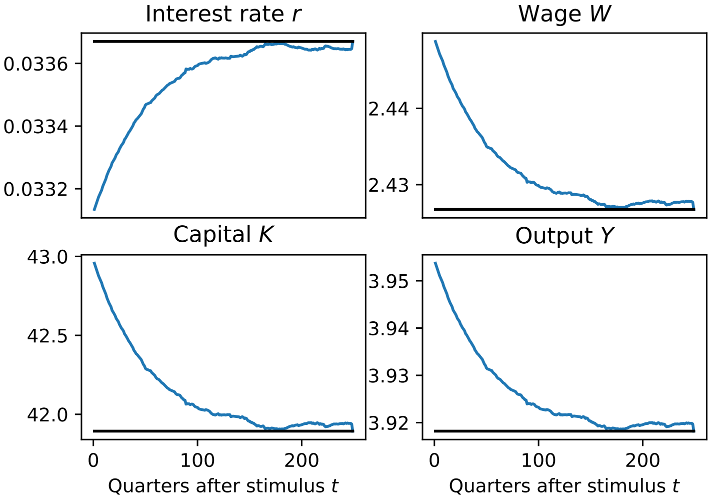
My Approach

- Solve transitional dynamics via shooting method
- $m_{i,0} = m_i^{ss} + 1/(W^{ss} p_i^{ss})$

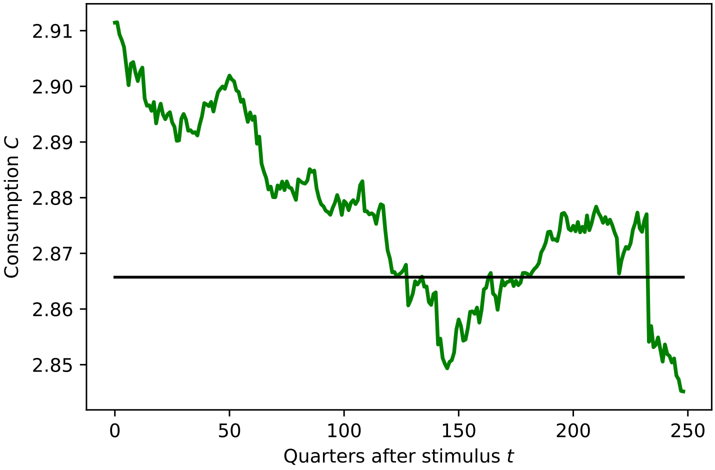
$$v_t(m_t) = \max_{c_t} \left\{ u(c_t) + \beta \cancel{\mathcal{D}} \mathbb{E}_t \left[\left(\frac{W_{t+1}}{W_t} \right)^{1-\rho} (\psi_{t+1})^{1-\rho} v_{t+1}(m_{t+1}) \right] \right\}$$

- $v_T(m) = v^{ss}(m)$
- For $(R_t)_{t=1}^T$ with $R_T = R^{ss}$ solve for consumption function
- Simulate dynamics to get $(R_t^{\text{implied}})_{t=1}^T$
- Move R-path towards implied path and repeat until convergence

Aggregate Dynamics after Stimulus

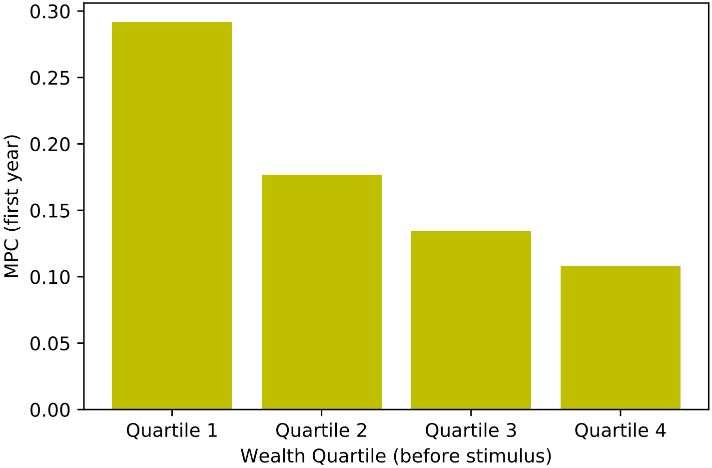


Consumption after Stimulus

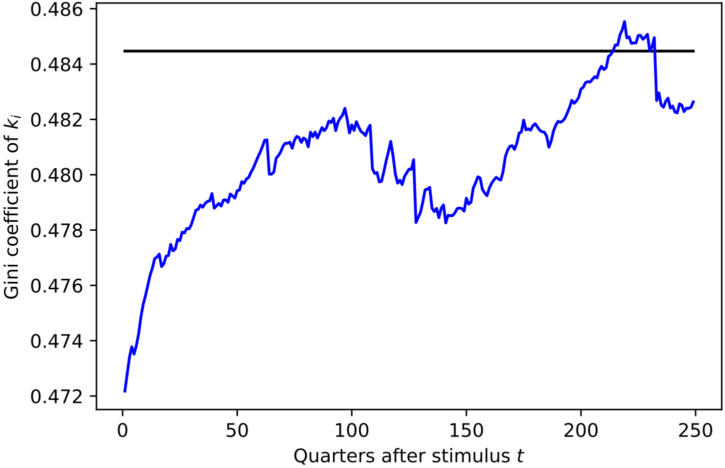


Implied annual MPC: 0.178

MPCs per (initial) Wealth Quantile



Path of Gini Coefficient



Additional Results of Carroll et al.

- MPCs counter-cyclical
- Aggregate state only of secondary relevance for MPC, individual state (wealth, employment) way more important for individual MPC
- β-dist model yields higher MPC than β-point model (low-β households have higher MPC *and* are pushed in steep policy function region)
- Matching liquid assets instead of net worth leads to higher Δ and way higher MPC
- Life-cycle model (no aggregate shocks) also leads to higher MPC
- Interesting: Life-cycle model demands higher Δ in calibration (recall growth impatience condition; capital explodes in PY-model for high β)

Thank you!

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