

Aggregate Implications of Microeconomic Consumption Behavior

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19th IMF Macro Modeling Conference
Armenia
September 2016

In a model with 'serious' heterogeneity:

- ➊ Fiscal Policy Can Be Much More Powerful than in RA model
 - ↳ Heterogeneity makes it easier to target specific groups
- ➋ Monetary Policy Mechanism Is Radically Different
 - ↳ Heterogeneity makes it easier to target specific groups
- ➌ Changes in *micro* Uncertainty Can Matter A Lot
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- ➍ New Tools ⇒ It's Not As Hard As You Think!
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- ① Fiscal Policy Can Be Much More Powerful than in RA model
 - \Rightarrow austerity has much bigger medium-term effects
- ② Monetary Policy Mechanism Is Radically Different
 - Effect of r mostly *not* about intertemporal substitution
 - QE works when it affects people with high MPC; otherwise, not
- ③ Changes in *micro* Uncertainty Can Matter A Lot
 - When Michigan $E_t[\Delta U_{t+1}] \uparrow$, $C \downarrow$
 - Explains Why Saving Rate \uparrow in Recessions
- ④ New Tools \Rightarrow It's Not As Hard As You Think!
 - Algorithmic Resources and toolKit: ARK!
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Micro Heterogeneity and Aggregate Consumption

Key Question: How Large Is ‘**the MPC**’ ($\equiv \kappa$)?

If households receive a surprise extra 1 unit of income,
how much will be spent over the next year?

Elements that interact to produce the answer:

- Households are heterogeneous *ex post* and *ex ante*
- Lots of HH's who do lots of C have little wealth
- c function is highly concave
- \Rightarrow Distributional issues matter for aggregate C
Giving 1 to the poor \neq giving 1 to the rich

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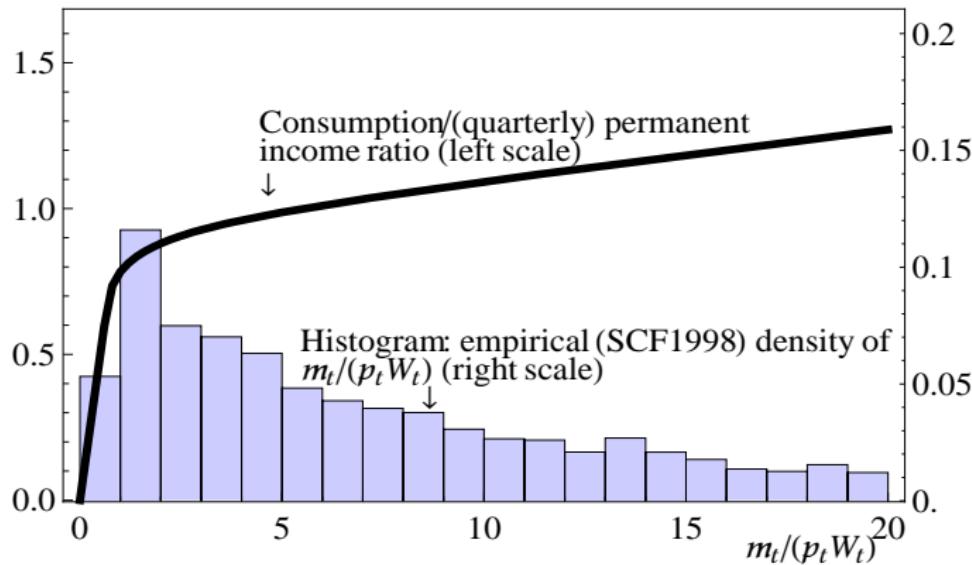
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Consumption Concavity and Wealth Heterogeneity



To-Do List

- ① Calibrate realistic income process
- ② Match empirical wealth distribution
- ③ Back out optimal c and $c'(m) = \kappa(m)$ out of transitory income
- ④ Is MPC in line with empirical estimates?

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Our (Micro) Income Process

Idiosyncratic (household) income process is logarithmic Friedman:

$$y_{t+1} = p_{t+1} \xi_{t+1} W$$

$$p_{t+1} = p_t \psi_{t+1}$$

p_t - permanent income

ψ_{t+1} - permanent income

$\mathbb{E}_t[\xi_{t+n}] = 1$ - transitory income

$\mathbb{E}_t[\psi_{t+n}] = 1$ - permanent shock

W - aggregate wage rate

Generates *ex post* dist'n of y that matches cross-section data

Unemployment and Unemployment Insurance

Modifications from Carroll (1992)

Transitory income ξ_t incorporates **unemployment insurance**:

$$\begin{aligned}\xi_t &= \mu \text{ with probability } u \\ &= (1 - \tau)\bar{\ell}\theta_t \text{ with probability } 1 - u\end{aligned}$$

μ is UI when unemployed

τ is the rate of tax collected for the unemployment benefits

Model Without Aggr Uncertainty: Decision Problem

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

s.t.

$$a_t = m_t - c_t$$

$$a_t \geq 0$$

$$k_{t+1} = a_t / (\mathbb{D}\psi_{t+1})$$

$$m_{t+1} = (\gamma + r)k_{t+1} + \xi_{t+1}$$

$$r = \alpha Z(K/\ell L)^{\alpha-1}$$

(State and control variables normalized by $p_t W$)

What Happens After Death?

- You are replaced by a new agent whose permanent income p is equal to the population mean
- Prevents dist'n of p from spreading out, so long as

$$\partial \mathbb{E}[\psi^2] < 1$$

which holds for our parameterization (next slide)

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Parameter Values

- $\beta, \rho, \alpha, \delta, \bar{\ell}, \mu$, and u taken from JEDC special volume
- Main new parameter values:

Description	Param	Value	Source
Prob of Death per Quarter	D	0.00625	Life span of 40 years
Variance of Log ψ_t	σ_ψ^2	$0.016 * 4/11$	Carroll (1992); SCF DeBacker et al. (2013)
Variance of Log θ_t	σ_θ^2	0.010×4	Carroll (1992)

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Variants of Our Model—Four Dimensions

① Discount Factor β

- ‘ β -Point’ model: Single discount factor
- ‘ β -Dist’ model: Uniformly distributed discount factor

② Aggregate Shocks

- (No)
- Krusell–Smith
- Friedman/Buffer Stock

③ Empirical Wealth Variable to Match

- Net Worth
- Liquid Financial Assets

④ Life Cycle

- Perpetual Youth (*a la* Blanchard)
- Overlapping Generations

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Estimation of β -Point and β -Dist

' β -Point' model

- 'Estimate' single $\hat{\beta}$ by matching the capital-output ratio

' β -Dist' model—Heterogenous Impatience

- Assume uniformly distributed β across households
- Estimate the band $[\bar{\beta} - \nabla, \bar{\beta} + \nabla]$ by minimizing distance between model (w) and data (ω) net worth held by the top 20, 40, 60, 80%

$$\min_{\{\bar{\beta}, \nabla\}} \sum_{i=20,40,60,80} (w_i - \omega_i)^2,$$

s.t. aggregate net worth-output ratio matches the steady-state value from the perfect foresight model

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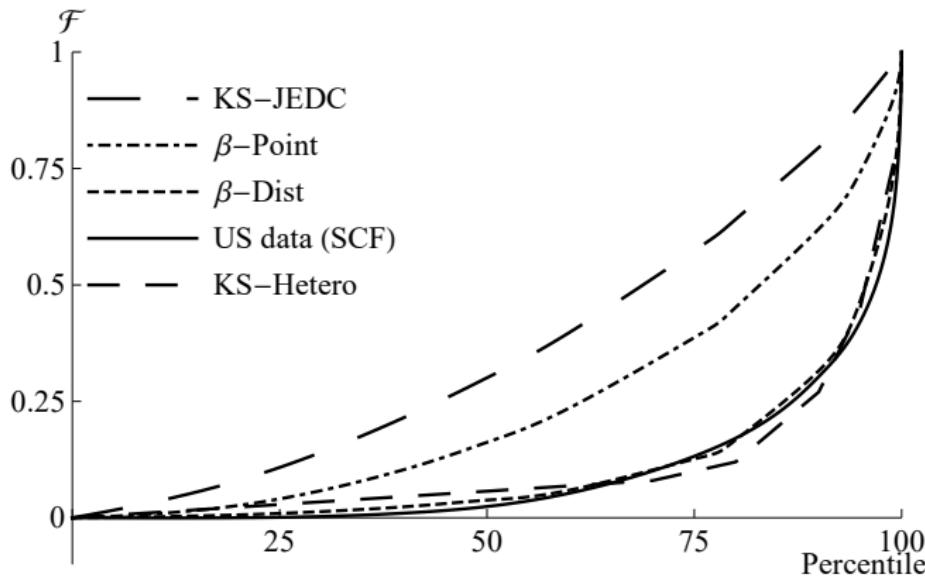
Alternatives to β Heterogeneity

Perfect foresight ‘impatience’ condition is:

$$\left(\frac{(\beta R D)^{1/\rho}}{\Gamma} \right) < 1 \quad (1)$$

‘Target’ m will depend on *degree of impatience*: $1 - \left(\frac{(\beta R D)^{1/\rho}}{\Gamma} \right)$
 \Rightarrow heterogeneity in *beliefs* about Γ, R, D generate similar results

Results: Wealth Distribution

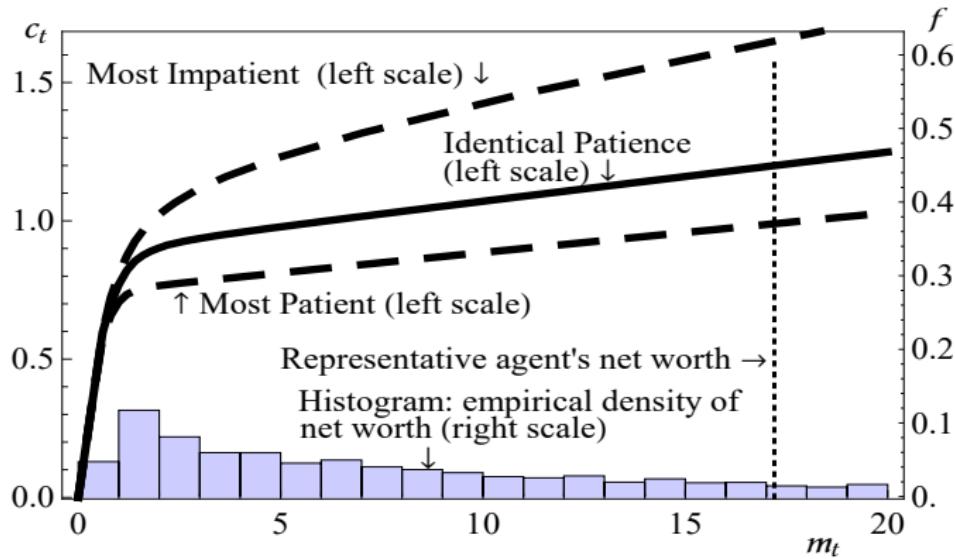


Results: Wealth Distribution

Micro Income Process						
	Friedman/Buffer Stock	KS-JEDC	KS-Orig \diamond			
	Point Discount Factor ‡	Uniformly Distributed Discount Factors *	Our solution	Hetero		
	β -Point	β -Dist				
Top 1%	10.1	26.7	2.6	3.0	24.0	29.6
Top 20%	54.8	83.3	35.9	35.0	88.0	79.5
Top 40%	76.4	94.	60.1			92.9
Top 60%	89.6	97.6	78.5			98.7
Top 80%	97.4	99.4	92.			100.4

Notes: $\ddagger : \dot{\beta} = 0.9894$. $* : (\dot{\beta}, \nabla) = (0.9867, 0.0067)$. Bold points are targeted. $K_t/Y_t = 10.3$.

Marginal Propensity to Consume and Net Worth



Empirical Estimates of MPC: $\sim 0.2\text{--}0.6$

Friedman (1963) estimated $\kappa = 1/3$

Authors	Consumption Measure				Event/Sample
	Nondurables	Durables	Total PCE	Horizon	
Blundell et al. (2008b) [‡]	0.05				Estimation Sample: 1980–92
Coronado et al. (2005)			0.36	1 Year	2003 Tax Cut
Hausman (2012)			0.6–0.75	1 Year	1936 Veterans' Bonus
Johnson et al. (2009)	~ 0.25			3 Months	2003 Child Tax Credit
Lusardi (1996) [‡]	0.2–0.5				Estimation Sample: 1980–87
Parker (1999)	0.2			3 Months	Estimation Sample: 1980–93
Parker et al. (2011)	0.12–0.30		0.50–0.90	3 Months	2008 Economic Stimulus
Sahm et al. (2009)			$\sim 1/3$	1 Year	2008 Economic Stimulus
Shapiro and Slemrod (2009)			$\sim 1/3$	1 Year	2008 Economic Stimulus
Souleles (1999)	0.045–0.09	0.29–0.54	0.34–0.64	3 Months	Estimation Sample: 1980–91
Souleles (2002)	0.6–0.9			1 Year	The Reagan Tax Cuts of the Early 1980s

Notes: [‡]: elasticity.

Model Results: MPC (in Annual Terms)

	Micro Income Process		
	Friedman/Buffer Stock	KS-JEDC	
	β -Point	β -Dist	Our solution
Overall average	0.1	0.23	0.05
By wealth/permanent income ratio			
Top 1%	0.07	0.05	0.04
Top 20%	0.07	0.06	0.04
Top 40%	0.07	0.08	0.04
Top 60%	0.07	0.12	0.04
Bottom 1/2	0.13	0.35	0.05
By employment status			
Employed	0.09	0.2	0.05
Unemployed	0.22	0.54	0.06

Notes: Annual MPC is calculated by $1 - (1 - \text{quarterly MPC})^4$.

Typology of Our Models—Four Dimensions

① Discount Factor β

- 'B-Point' model: Single discount factor
- 'B-Dist' model: Uniformly distributed discount factor

② Aggregate Shocks

- (No)
- Krusell-Smith
- Friedman/Buffer Stock

③ Empirical Wealth Variable to Match

- Net Worth
- Liquid Financial Assets

④ Life Cycle

- Perpetual Youth (a la Blanchard)
- Overlapping Generations

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Results: MPC Is Stable Over the Business Cycle

There Is Such a Thing as 'the MPC':

Model: β -Dist	Krusell-Smith (KS)			Friedman/Buffer Stock (FBS)		
	Scenario	Base	Recessn	Expsn	Base	Large Bad Perm Shock
Overall average	0.23	0.25	0.21	0.20	0.20	0.21
By wealth/permanent income ratio						
Top 1%	0.05	0.05	0.05	0.05	0.05	0.05
Top 10%	0.06	0.06	0.06	0.06	0.06	0.06
Top 20%	0.06	0.06	0.06	0.06	0.06	0.06
Top 40%	0.08	0.08	0.08	0.06	0.06	0.06
Top 50%	0.09	0.10	0.09	0.06	0.06	0.09
Top 60%	0.12	0.12	0.11	0.09	0.09	0.09
Bottom 50%	0.35	0.38	0.32	0.32	0.32	0.32
By employment status						
Employed	0.20	0.20	0.20	0.19	0.19	0.19
Unemployed	0.54	0.56	0.51	0.41	0.41	0.41

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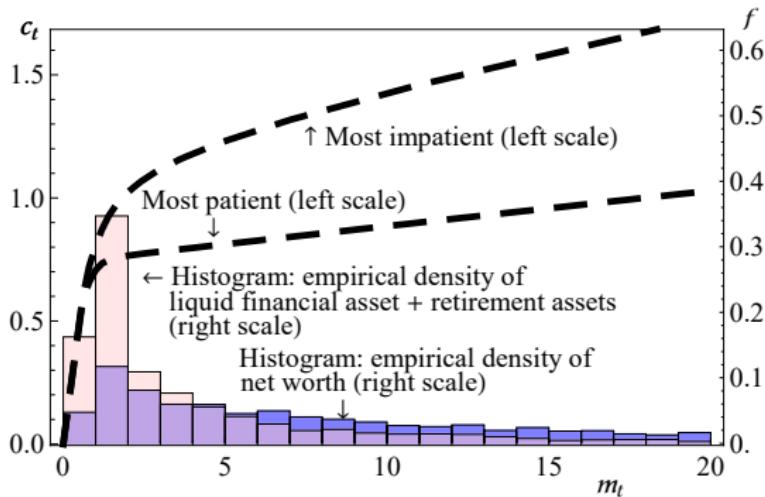
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Dimension 3: Matching Net Worth vs. Liquid Assets



Liquid Assets \equiv transaction accounts, CDs, bonds, stocks, mutual funds

Match Net Worth vs. Liquid Financial Assets

- Buffer stock saving driven by accumulation of **liquidity**
- May make more sense to match liquid (and retirement) assets (Hall (2011), Kaplan and Violante (2014))
- Aggregate MPC Increases Substantially: $0.23 \uparrow 0.44$

	β -Dist	
	Net Worth	Liq Fin and Ret Assets
Overall average	0.23	0.44
By wealth/permanent income ratio		
Top 1%	0.05	0.12
Top 20%	0.06	0.13
Top 40%	0.08	0.2
Top 60%	0.12	0.28
Bottom 1/2	0.35	0.59

Notes: Annual MPC is calculated by $1 - (1 - \text{quarterly MPC})^4$.

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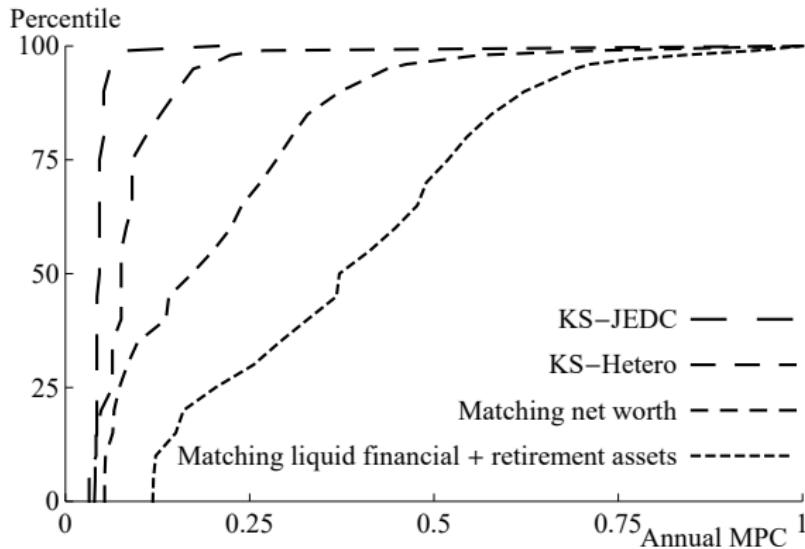
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Distribution of MPCs

Wealth heterogeneity translates into heterogeneity in MPCs



Dimension 4: Overlapping Generations

Realistic Life-Cycle Model

- Three education levels: $e \in \{D, HS, C\}$
- Age/education-specific income profiles

$$\begin{aligned}y_t &= \xi_t p_t = (1 - \tau) \theta_t p_t, \\p_t &= \psi_t \bar{\psi}_{es} p_{t-1}\end{aligned}$$

- Age-specific variances of income shocks
- Transitory unemployment shock with prob u
- Household-specific mortality D_{es}

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Household Decision Problem

$$v_{es}(m_t) = \max_{c_t} u(c_t) + \beta D_{es} \mathbb{E}_t \left[\psi_{t+1}^{1-\rho} v_{es+1}(m_{t+1}) \right]$$

s.t.

$$a_t = m_t - c_t,$$

$$k_{t+1} = a_t / \psi_{t+1},$$

$$m_{t+1} = (\bar{\gamma} + r) k_{t+1} + \xi_{t+1},$$

$$a_t \geq 0$$

Macro Dynamics

- Population growth N , technological progress Γ
- Tax rate to finance social security and unemployment benefits:

$$\tau = \tau_{SS} + \tau_U$$

$$\bullet \quad TSS = \frac{\sum_{e \in \{D, HS, C\}} \left[\theta_e \bar{p}_{e0} \sum_{t=164}^{384} \left(((1+\Gamma)(1+N))^{-t} \prod_{s=0}^t (\bar{\psi}_{es} \varnothing_{es}) \right) \right]}{\sum_{e \in \{D, HS, C\}} \left[\theta_e \bar{p}_{e0} \sum_{t=0}^{163} \left(((1+\Gamma)(1+N))^{-t} \prod_{s=0}^t (\bar{\psi}_{es} \varnothing_{es}) \right) \right]}$$

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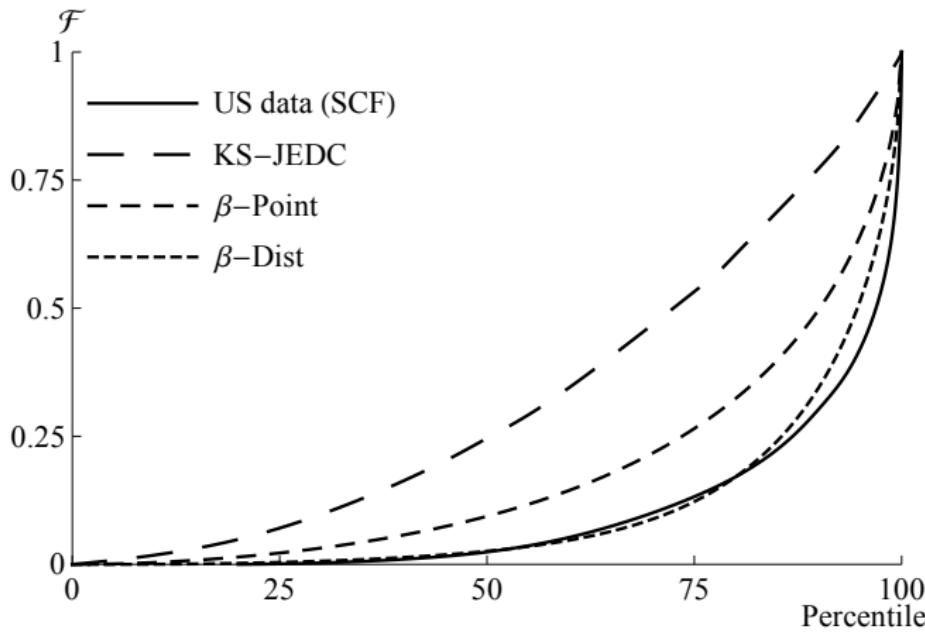
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Calibration

Description	Parameter	Value
Coefficient of relative risk aversion	ρ	1
Effective interest rate	$(r - \delta)$	0.01
Population growth rate	N	0.0025
Technological growth rate	Γ	0.0037
Rate of high school dropouts	θ_D	0.11
Rate of high school graduates	θ_{HS}	0.55
Rate of college graduates	θ_C	0.34
Average initial permanent income, dropout	\bar{P}_{D0}	5000
Average initial permanent income, high school	\bar{P}_{HS0}	7500
Average initial permanent income, college	\bar{P}_{C0}	12000
Unemployment insurance payment	μ	0.15
Unemployment rate	u	0.07
Labor income tax rate	τ	0.0942

Results: Wealth Distribution



Results: MPC (in Annual Terms)

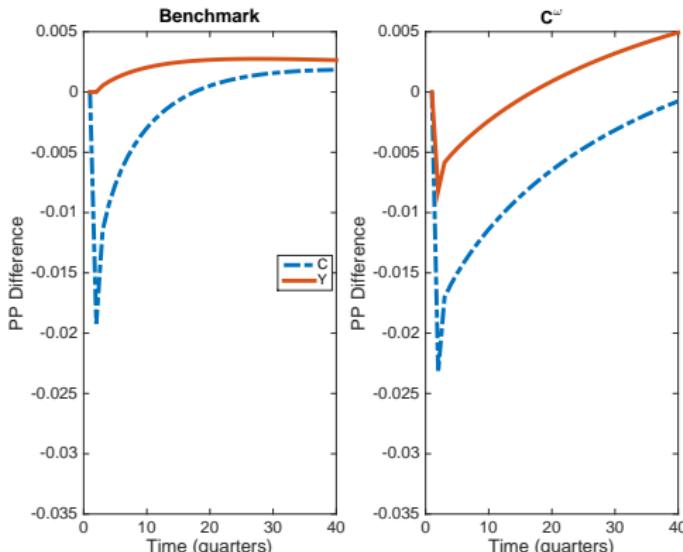
Wealth Measure	Micro Income Process		Life-Cycle Model		
	KS-JEDC Our solution NW	FBS β -Dist NW	β -Point NW	β -Dist NW	β -Dist Liquid
Overall average	0.05	0.23	0.11	0.29	0.42
By wealth/permanent income ratio					
Top 1%	0.04	0.05	0.08	0.07	0.07
Top 20%	0.04	0.06	0.09	0.07	0.07
Top 40%	0.04	0.08	0.08	0.07	0.11
Top 60%	0.04	0.12	0.08	0.10	0.20
Bottom 1/2	0.05	0.35	0.13	0.49	0.70
By employment status					
Employed	0.05	0.2	0.10	0.28	0.42
Unemployed	0.06	0.54	0.13	0.39	0.56

Notes: Annual MPC is calculated by $1 - (1 - \text{quarterly MPC})^4$.

Macro Handbook Model Like Ours, But With Multipliers

'KMP': Krueger, Mitman, and Perri (2016)

Effect of mean-preserving spread in unemployment risk:



Other Results from KMP (Macro Handbook Paper)

- Unemployment Insurance Has Big Macro Stabilization Role
- Huge Heterogeneity in Cost of Business Cycles Across HH's

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 - Wealth Distribution
- The model produces more plausible implications about:
 - Aggregate MPC
 - Distribution of MPC Across Households
- Can address questions like
 - Design of effective fiscal stimulus packages
 - Role of Uncertainty in C collapse
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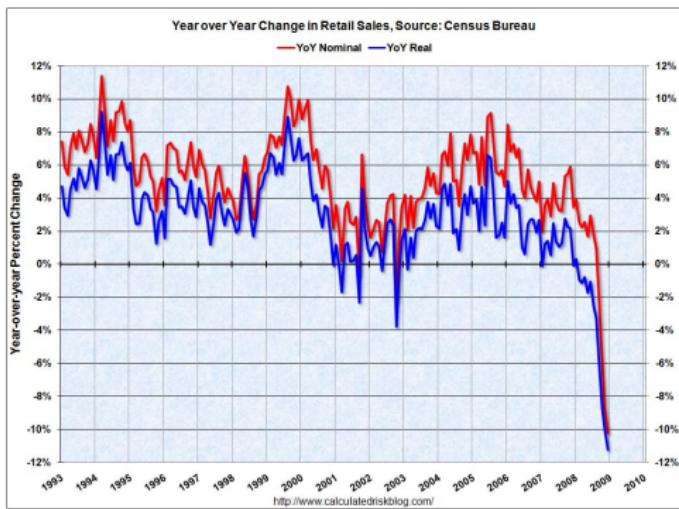
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What About Pre-1979 Macro?

Keynesian **multipliers** should be big in liquidity trap

Crudest Keynesian Model:

- $Y = C + I + G$ and $C = (Y - T)\kappa$

• $I = \alpha(Y - T) + \beta(r)$ and $r = \gamma(Y - T)$

• $G = G_0$ and $T = T_0$ constant

• $\kappa > 1$ and $\alpha < 1$ and $\beta > 0$ and $\gamma < 0$

• $r = \gamma(Y - T) < 0$ and $r \rightarrow -\infty$ as $Y \rightarrow T$

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In RANK models, log-linearized Euler equation captures almost everything (~ 95 percent) of effect of monetary policy on C dynamics:

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Why? When central bank makes r_{t+1} go up,

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Source: J. Campbell & R. Shiller (1991)

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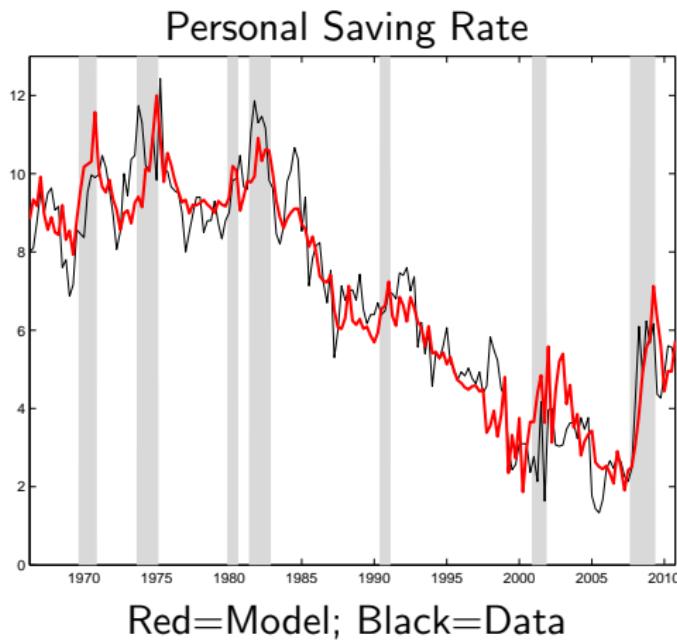
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