The Distribution of Wealth and the Marginal Propensity to Consume

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“Serious” Microfoundations $\Rightarrow$ High MPC

**Defining ‘the MPC’ ($\equiv \kappa$)?**

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

**Elements that interact with each other to produce the result:**

- Households are heterogeneous
- Wealth is unevenly distributed
- $c$ function is highly concave
- $\Rightarrow$ Distributional issues matter for aggregate $C$
  Giving 1 to the poor $\neq$ giving 1 to the rich
Consumption Concavity and Wealth Heterogeneity

Motivation
Model Without Aggregate Shock
Two Specifications of Aggregate Shock
Matching Net Worth vs Liquid Assets
Life Cycle Model
References

The MPC
Theory and Evidence
Essential Consumption Microfoundations
Friedman (1957)

Carroll, Slacalek, Tokuoka and White
Wealth and MPC
Nobody trying to make a forecast in 2008–2010 would ask:

- Big ‘stimulus’ tax cuts
- Keynesian multipliers should be big in liquidity trap
- Crude Keynesianism: Transitory tax cut multiplier is $1/(1 - \kappa) - 1$
  - If $\kappa = 0.75$ then multiplier is $4 - 1 = 3$
  - Some micro estimates of $\kappa$ are this large
  - If $\kappa = 0.05$ then multiplier is only $\approx 0.05$
  - This is about the size of $\kappa$ in Rep Agent and KS models
Why Worry About the MPC ($\equiv \kappa$)?

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  - This is about the size of $\kappa$ in Rep Agent and KS models
Since Friedman’s (1957) PIH:

- $c$ chosen optimally:
  - Goal: smooth $c \text{ in light of beliefs about } y \text{ fluctuations}$
- Single most important thing to get right is income dynamics!
- With smooth $c$, income dynamics drive everything!
  - Saving/dissaving: Depends on whether $E[\Delta y] \uparrow$ or $E[\Delta y] \downarrow$
  - Wealth distribution depends on integration of saving
- Cardinal sin: Assume crazy income dynamics
  - Throws out the defining core of the intellectual framework
Our Goal: “Serious” Microfoundations

Requires three changes to well-known Krusell–Smith (1998) model:

1. Sensible microeconomic income process: Friedman
2. Finite lifetimes: Blanchard
3. Match wealth distribution
   - Here, achieved by preference heterogeneity
   - View it as a proxy for many kinds of heterogeneity
     - Age
     - Optimism/Pessimism about Growth
     - Risk aversion
     - Rate of Return
     - …
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     - …

References
- The MPC
- Theory and Evidence
- Essential Consumption Microfoundations
- Friedman (1957)
Our Question:

Does a model that matches micro facts about income dynamics and wealth distribution give different (and more plausible) answers than KS to macroeconomic questions (say, about the response of consumption to fiscal ‘stimulus’)?
Friedman (1957): Permanent Income Hypothesis

\[ Y_t = P_t + T_t \]
\[ C_t = P_t \]

Progress since then

- **Micro data**: Friedman description of income shocks works well
- **Math**: Friedman’s words well describe optimal solution to dynamic stochastic optimization problem of impatient consumers with geometric discounting under CRRA utility with uninsurable idiosyncratic risk calibrated using these micro income dynamics (!)
Our (Micro) Income Process

Idiosyncratic (household) income process is logarithmic Friedman:

\[ y_{t+1} = p_{t+1} \xi_{t+1} W \]
\[ p_{t+1} = p_t \psi_{t+1} \]

\( p_t = \text{permanent income} \)
\( \xi_t = \text{transitory income} \)
\( \psi_{t+1} = \text{permanent shock} \)
\( W = \text{aggregate wage rate} \)
Further Details of Income Process

Modifications from Carroll (1992)

Transitory income $\xi_t$ incorporates unemployment insurance:

$$\xi_t = \mu \text{ with probability } u$$

$$= (1 - \tau)\bar{\ell}\theta_t \text{ with probability } 1 - u$$

$\mu$ is UI when unemployed

$\tau$ is the rate of tax collected for the unemployment benefits
Model Without Aggr Uncertainty: Decision Problem

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

s.t.

\[ a_t = m_t - c_t \]
\[ a_t \geq 0 \]
\[ k_{t+1} = a_t / (\psi_{t+1}) \]
\[ m_{t+1} = (1 + r)k_{t+1} + \xi_{t+1} \]
\[ r = \alpha Z(K/\bar{\ell}L)^{\alpha-1} \]

(State and control variables normalized by \( p_t W \))
What Happens After Death?

- You are replaced by a new agent whose permanent income is equal to the population mean.
- Prevents the population distribution of permanent income from spreading out.
What Happens After Death?

- You are replaced by a new agent whose permanent income is equal to the population mean.
- Prevents the population distribution of permanent income from spreading out.
Ergodic Distribution of Permanent Income

Exists, if death eliminates permanent shocks:

$$\mathcal{D}\mathbb{E}[\psi^2] < 1.$$ 

Holds.

Population mean of $p^2$:

$$\mathbb{M}[p^2] = \frac{D}{1 - \mathcal{D}\mathbb{E}[\psi^2]}$$
Parameter Values

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

<table>
<thead>
<tr>
<th>Description</th>
<th>Param</th>
<th>Value</th>
<th>Source</th>
</tr>
</thead>
<tbody>
<tr>
<td>Prob of Death per Quarter</td>
<td>$D$</td>
<td>0.00625</td>
<td>Life span of 40 years</td>
</tr>
<tr>
<td>Variance of Log $\psi_t$</td>
<td>$\sigma_{\psi}^2$</td>
<td>0.016/4</td>
<td>Carroll (1992); SCF</td>
</tr>
<tr>
<td>Variance of Log $\theta_t$</td>
<td>$\sigma_{\theta}^2$</td>
<td>0.010 $\times$ 4</td>
<td>DeBacker et al. (2013)</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Carroll (1992)</td>
</tr>
</tbody>
</table>
## Annual Income, Earnings, or Wage Variances

<table>
<thead>
<tr>
<th></th>
<th>$\sigma^2_\psi$</th>
<th>$\sigma^2_\xi$</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Our parameters</strong></td>
<td>0.016</td>
<td>0.010</td>
</tr>
<tr>
<td><strong>Carroll (1992)</strong></td>
<td>0.016</td>
<td>0.010</td>
</tr>
<tr>
<td><strong>Storesletten, Telmer, and Yaron (2004)</strong></td>
<td>0.008–0.026</td>
<td>0.316</td>
</tr>
<tr>
<td><strong>Meghir and Pistaferri (2004)</strong>*</td>
<td>0.031</td>
<td>0.032</td>
</tr>
<tr>
<td><strong>Low, Meghir, and Pistaferri (2010)</strong></td>
<td>0.011</td>
<td>—</td>
</tr>
<tr>
<td><strong>Blundell, Pistaferri, and Preston (2008)</strong>*</td>
<td>0.010–0.030</td>
<td>0.029–0.055</td>
</tr>
<tr>
<td><strong>DeBacker, Heim, Panousi, Ramnath, and Vidangos (2013)</strong></td>
<td>0.007–0.010</td>
<td>0.15–0.20</td>
</tr>
<tr>
<td><strong>Implied by KS-JEDC</strong></td>
<td>0.</td>
<td>0.038</td>
</tr>
<tr>
<td><strong>Implied by Castaneda et al. (2003)</strong></td>
<td>0.03</td>
<td>0.006</td>
</tr>
</tbody>
</table>

*Meghir and Pistaferri (2004) and Blundell, Pistaferri, and Preston (2008) assume that the transitory component is serially correlated (an MA process), and report the variance of a subelement of the transitory component. $\sigma^2_\xi$ for these articles are calculated using their MA estimates.
**Motivation**

Model Without Aggregate Shock
Two Specifications of Aggregate Shock
Matching Net Worth vs Liquid Assets
Life Cycle Model

**References**

Income Process
Decision Problem
There Is an Ergodic Distribution of Permanent Income
Parameter Values
Annual Income Variances

**Our Strategy**

Results: Marginal Propensity to Consume

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**Typology of Our Models—Four Dimensions**

1. **Discount Factor $\beta$**
   - ‘$\beta$-Point’ model: Single discount factor
   - ‘$\beta$-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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Carroll, Slacalek, Tokuoka and White
Wealth and MPC
Dimension 1: Estimation of $\beta$-Point and $\beta$-Dist

**'β-Point' model**
- ‘Estimate’ single $\hat{\beta}$ by matching the capital–output ratio

**'β-Dist' model—Heterogenous Impatience**
- Assume uniformly distributed $\beta$ across households
- Estimate the band $[\hat{\beta} - \nabla, \hat{\beta} + \nabla]$ by minimizing distance between model ($w$) and data ($\omega$) net worth held by the top 20, 40, 60, 80%

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

s.t. aggregate net worth–output ratio matches the steady-state value from the perfect foresight model
Results: Wealth Distribution

- KS–JEDC
- β–Point
- β–Dist
- US data (SCF)
- KS–Hetero

Carroll, Slacalek, Tokuoka and White

Wealth and MPC
### Results: Wealth Distribution

<table>
<thead>
<tr>
<th>Micro Income Process</th>
<th>Friedman/Buffer Stock</th>
<th>KS-JEDC</th>
<th>KS-Orig</th>
<th>U.S. Data</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Point Discount Factor†</td>
<td>Uniformly Distributed Discount Factors*</td>
<td>Our solution</td>
<td>Hetero</td>
</tr>
<tr>
<td><strong>β-Point</strong></td>
<td><strong>β-Dist</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Top 1%</td>
<td>10.1</td>
<td>26.7</td>
<td>2.6</td>
<td>3.0</td>
</tr>
<tr>
<td>Top 20%</td>
<td>54.8</td>
<td>83.3</td>
<td>35.9</td>
<td>35.0</td>
</tr>
<tr>
<td>Top 40%</td>
<td>76.4</td>
<td>94.0</td>
<td>60.1</td>
<td></td>
</tr>
<tr>
<td>Top 60%</td>
<td>89.6</td>
<td>97.6</td>
<td>78.5</td>
<td></td>
</tr>
<tr>
<td>Top 80%</td>
<td>97.4</td>
<td>99.4</td>
<td>92.0</td>
<td></td>
</tr>
</tbody>
</table>

### Notes:
- †: $\beta = 0.9894$.
- *: $(\beta, \nabla) = (0.9867, 0.0067)$. Bold points are targeted.
- $\kappa_t / Y_t = 10.3$.
Marginal Propensity to Consume & Net Worth

Most Impatient (left scale) ↓
Identical Patience (left scale) ↓
Most Patient (left scale)
Rep agent's ratio of M to (quarterly) perm income →
Histogram: empirical density of net worth (right scale)
## Results: MPC (in Annual Terms)

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

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

Carroll, Slacalek, Tokuoka and White (2019). Wealth and MPC.
Estimates of MPC in the Data: $\sim 0.2–0.6$

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

Notes: ‡: elasticity.

References
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<table>
<thead>
<tr>
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<td></td>
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</tr>
<tr>
<td></td>
<td><strong>Aggregate Shocks</strong></td>
</tr>
<tr>
<td>2</td>
<td>(No)</td>
</tr>
<tr>
<td></td>
<td>- Krusell–Smith</td>
</tr>
<tr>
<td></td>
<td>- Friedman/Buffer Stock</td>
</tr>
<tr>
<td></td>
<td><strong>Empirical Wealth Variable to Match</strong></td>
</tr>
<tr>
<td>3</td>
<td>- Net Worth</td>
</tr>
<tr>
<td></td>
<td>- Liquid Financial Assets</td>
</tr>
<tr>
<td></td>
<td><strong>Life Cycle</strong></td>
</tr>
<tr>
<td>4</td>
<td>- Perpetual Youth (a la Blanchard)</td>
</tr>
<tr>
<td></td>
<td>- Overlapping Generations</td>
</tr>
</tbody>
</table>
Dimension 2.a: Adding KS Aggregate Shocks

Model with KS Aggregate Shocks: Assumptions

- Only two aggregate states (good or bad)
- Aggregate productivity $Z_t = 1 \pm \Delta Z$
- Unemployment rate $u$ depends on the state ($u^g$ or $u^b$)

Parameter values for aggregate shocks from Krusell and Smith (1998)

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>$\Delta Z$</td>
<td>0.01</td>
</tr>
<tr>
<td>$u^g$</td>
<td>0.04</td>
</tr>
<tr>
<td>$u^b$</td>
<td>0.10</td>
</tr>
<tr>
<td>Agg transition probability</td>
<td>0.125</td>
</tr>
</tbody>
</table>
Friedman/Buffer Stock Shocks

- **Motivation:**
  More plausible and tractable aggregate process, also simpler

- Eliminates ‘good’ and ‘bad’ aggregate state

- Aggregate production function: \( K_t^\alpha (L_t)^{1-\alpha} \)
  - \( L_t = P_t \Xi_t \)
  - \( P_t \) is aggregate permanent productivity
  - \( P_{t+1} = P_t \Psi_{t+1} \)
  - \( \Xi_t \) is the aggregate transitory shock.

- Parameter values estimated from U.S. data:

<table>
<thead>
<tr>
<th>Description</th>
<th>Parameter</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Variance of Log ( \Psi_t )</td>
<td>( \sigma_{\Psi}^2 )</td>
<td>0.00004</td>
</tr>
<tr>
<td>Variance of Log ( \Xi_t )</td>
<td>( \sigma_{\Xi}^2 )</td>
<td>0.00001</td>
</tr>
</tbody>
</table>
Dimension 2.b: Adding FBS Aggregate Shocks

Friedman/Buffer Stock Shocks

- **Motivation:** More plausible and tractable aggregate process, also simpler
- Eliminates ‘good’ and ‘bad’ aggregate state
- Aggregate production function: \( K_t^\alpha (L_t)^{1-\alpha} \)
  - \( L_t = P_t \Xi_t \)
  - \( P_t \) is aggregate permanent productivity
  - \( P_{t+1} = P_t \Psi_{t+1} \)
  - \( \Xi_t \) is the aggregate transitory shock.
- Parameter values estimated from U.S. data:

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<tbody>
<tr>
<td>Variance of Log ( \Psi_t )</td>
<td>( \sigma^2_{\Psi} )</td>
<td>0.00004</td>
</tr>
<tr>
<td>Variance of Log ( \Xi_t )</td>
<td>( \sigma^2_{\Xi} )</td>
<td>0.00001</td>
</tr>
</tbody>
</table>
Results

Our/FBS model

- A few times faster than solving KS model
- The results are similar to those under KS aggregate shocks
Results: MPC Over the Business Cycle

<table>
<thead>
<tr>
<th>Model: $\beta$-Dist</th>
<th>Krusell–Smith (KS)</th>
<th>Friedman/Buffer Stock (FBS)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Base</td>
<td>Recssn</td>
</tr>
<tr>
<td>Overall average</td>
<td>0.23</td>
<td>0.25</td>
</tr>
<tr>
<td>By wealth/permanent income ratio</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Top 1%</td>
<td>0.05</td>
<td>0.05</td>
</tr>
<tr>
<td>Top 10%</td>
<td>0.06</td>
<td>0.06</td>
</tr>
<tr>
<td>Top 20%</td>
<td>0.06</td>
<td>0.06</td>
</tr>
<tr>
<td>Top 40%</td>
<td>0.08</td>
<td>0.08</td>
</tr>
<tr>
<td>Top 50%</td>
<td>0.09</td>
<td>0.10</td>
</tr>
<tr>
<td>Top 60%</td>
<td>0.12</td>
<td>0.12</td>
</tr>
<tr>
<td>Bottom 50%</td>
<td>0.35</td>
<td>0.38</td>
</tr>
<tr>
<td>By employment status</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Employed</td>
<td>0.20</td>
<td>0.20</td>
</tr>
<tr>
<td>Unemployed</td>
<td>0.54</td>
<td>0.56</td>
</tr>
</tbody>
</table>
Results: MPC Over the Business Cycle

**Krusell–Smith**
- Aggregate and idiosyncratic shocks positively correlated
- Higher MPC during recessions, especially for the unemployed

**Friedman/Buffer Stock**
- Shocks uncorrelated
- MPC essentially doesn’t vary over BC
Typology of Our Models—Four Dimensions

1. **Discount Factor $\beta$**
   - ‘$\beta$-Point’ model: Single discount factor
   - ‘$\beta$-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

References

Krusell–Smith
Permanent/Transitory Aggregate Shocks

Krusell–Smith
Typology of Our Models—Four Dimensions

Carroll, Slacalek, Tokuoka and White
Wealth and MPC
Dimension 3: Matching Net Worth vs. Liquid Financial (and Retirement) 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: $0.23 \uparrow 0.43$

<table>
<thead>
<tr>
<th></th>
<th>Net Worth</th>
<th>Liq Fin and Ret Assets</th>
</tr>
</thead>
<tbody>
<tr>
<td>Overall average</td>
<td>0.23</td>
<td>0.44</td>
</tr>
<tr>
<td>By wealth/permanent income ratio</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Top 1%</td>
<td>0.05</td>
<td>0.12</td>
</tr>
<tr>
<td>Top 20%</td>
<td>0.06</td>
<td>0.13</td>
</tr>
<tr>
<td>Top 40%</td>
<td>0.08</td>
<td>0.2</td>
</tr>
<tr>
<td>Top 60%</td>
<td>0.12</td>
<td>0.28</td>
</tr>
<tr>
<td>Bottom 1/2</td>
<td>0.35</td>
<td>0.59</td>
</tr>
</tbody>
</table>

Notes: Annual MPC is calculated by $1 - (1 - \frac{1}{4}) \times \text{quarterly MPC}$.
Wealth heterogeneity translates into heterogeneity in MPCs.
### Typology of Our Models—Four Dimensions

1. **Discount Factor $\beta$**
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   - (No)
   - Krusell–Smith
   - Friedman/Buffer Stock

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   - Liquid Financial Assets

4. **Life Cycle**
   - Perpetual Youth (a la Blanchard)
   - Overlapping Generations
Dimension 4: Overlapping Generations

Realistic Life-Cycle Model

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

\[
y_t = \xi_t \rho_t = (1 - \tau) \theta_t \rho_t,
\]
\[
\rho_t = \psi_t \psi_{es} \rho_{t-1}
\]

- Age-specific variances of income shocks
- Transitory unemployment shock with prob \( u \)
- Household-specific mortality \( D_{es} \)
Household Decision Problem

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

s.t.

\[ a_t = m_t - c_t, \]

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

\[ m_{t+1} = (\ell + r) k_{t+1} + \xi_{t+1}, \]

\[ a_t \geq 0 \]
Population growth $N$, technological progress $\Gamma$

Tax rate to finance social security and unemployment benefits:

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

$$\tau_{SS} = \frac{\sum_{e \in \{D, HS, C\}} \theta e \bar{P}_e \sum_{t=164}^{384} \left( (1+\Gamma)(1+N) \right)^{-t} \prod_{s=0}^{t} (\psi_{es} D_{es}) }{\sum_{e \in \{D, HS, C\}} \theta e \bar{P}_e \sum_{t=0}^{163} \left( (1+\Gamma)(1+N) \right)^{-t} \prod_{s=0}^{t} (\psi_{es} D_{es}) }$$

$$\tau_U = \mu \mu$$
## Calibration

<table>
<thead>
<tr>
<th>Description</th>
<th>Parameter</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Coefficient of relative risk aversion</td>
<td>$\rho$</td>
<td>1</td>
</tr>
<tr>
<td>Effective interest rate</td>
<td>$(r - \delta)$</td>
<td>0.01</td>
</tr>
<tr>
<td>Population growth rate</td>
<td>$N$</td>
<td>0.0025</td>
</tr>
<tr>
<td>Technological growth rate</td>
<td>$\Gamma$</td>
<td>0.0037</td>
</tr>
<tr>
<td>Rate of high school dropouts</td>
<td>$\theta_D$</td>
<td>0.11</td>
</tr>
<tr>
<td>Rate of high school graduates</td>
<td>$\theta_{HS}$</td>
<td>0.55</td>
</tr>
<tr>
<td>Rate of college graduates</td>
<td>$\theta_C$</td>
<td>0.34</td>
</tr>
<tr>
<td>Average initial permanent income, dropout</td>
<td>$\bar{p}_{D0}$</td>
<td>5000</td>
</tr>
<tr>
<td>Average initial permanent income, high school</td>
<td>$\bar{p}_{HS0}$</td>
<td>7500</td>
</tr>
<tr>
<td>Average initial permanent income, college</td>
<td>$\bar{p}_{C0}$</td>
<td>12000</td>
</tr>
<tr>
<td>Unemployment insurance payment</td>
<td>$\mu$</td>
<td>0.15</td>
</tr>
<tr>
<td>Unemployment rate</td>
<td>$u$</td>
<td>0.07</td>
</tr>
<tr>
<td>Labor income tax rate</td>
<td>$\tau$</td>
<td>0.0942</td>
</tr>
</tbody>
</table>
Results: Wealth Distribution

- US data (SCF)
- KS–JEDC
- β–Point
- β–Dist

Carroll, Slacalek, Tokuoka and White
Wealth and MPC
## Results: MPC (in Annual Terms)

<table>
<thead>
<tr>
<th>Wealth Measure</th>
<th>Micro Income Process</th>
<th>Life-Cycle Model</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>KS-JEDC</td>
<td>FBS</td>
</tr>
<tr>
<td>Overall average</td>
<td>Our solution</td>
<td>β-Dist</td>
</tr>
<tr>
<td>NW</td>
<td>NW</td>
<td>NW</td>
</tr>
<tr>
<td>0.05</td>
<td>0.23</td>
<td>0.11</td>
</tr>
<tr>
<td>By wealth/permanent income ratio</td>
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<td></td>
</tr>
<tr>
<td>Top 1%</td>
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<td>0.05</td>
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<td>Top 20%</td>
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</tr>
<tr>
<td>Bottom 1/2</td>
<td>0.05</td>
<td>0.35</td>
</tr>
<tr>
<td>By employment status</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Employed</td>
<td>0.05</td>
<td>0.20</td>
</tr>
<tr>
<td>Unemployed</td>
<td>0.06</td>
<td>0.54</td>
</tr>
</tbody>
</table>

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

- Initial drop in MPC: Build-up of buffer stock
- Rise while rapid income growth, fall before retirement, then increasing mortality risk

Carroll, Slacalek, Tokuoka and White

Wealth and MPC
Conclusions

• Definition of “serious” microfoundations: Model that matches
  • Income Dynamics
  • Wealth Distribution

• The model produces more plausible implications about:
  • Aggregate MPC
  • Distribution of MPC Across Households

• Version with more plausible aggregate specification is simpler, faster, better in every way!
References I


