A Model of the Consumption Response to Fiscal Stimulus Payments

Greg Kaplan
University of Pennsylvania

Gianluca Violante
New York University, CEPR, and NBER

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Fiscal stimulus payments (a.k.a. tax rebates)

Frequently used instrument to stimulate spending during recessions
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1. **2001**: Under *Economic Growth and Tax Relief Reconciliation Act*, taxpayers entitled to rebate of up to $300 per adult. Total = $38b
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1. **2001**: Under *Economic Growth and Tax Relief Reconciliation Act*, taxpayers entitled to rebate of up to $300 per adult. Total = $38$b

2. **2008**: *Economic Stimulus Act* provided most households with payments of $300-$600 per adult and $300 per child. Total = $79$b

3. **2009**: *American Recovery and Reinvestment Act* provided refundable tax credit up to $400 per adult ("Making Work Pay")
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3. **2009**: *American Recovery and Reinvestment Act* provided refundable tax credit up to $400 per adult (“Making Work Pay”)

Typically: anticipated, temporary, (almost) lump-sum, small
Households **spend about 20%-40% of their stimulus payment in the quarter they receive it in nondurable goods**

Fact and motivation

Households spend about 20%-40% of their stimulus payment in the quarter they receive it in nondurable goods


Violation of the LC-PIH which predicts:

1. Response to temporary income shock is small
2. Response to anticipated income change is zero
Fact and motivation

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Modigliani-Steindel: unless consumers are constrained or impatient
Goal and questions

Build a structural model to study the consumption response to fiscal stimulus payments (no ‘behavioral’ biases)

JPS (2006): “without knowing the full structural model underlying the results, we cannot conclude that future tax rebates will have the same effect"

• What model features account for large response?

• How does the state of the economy affect the size of response?

• How does this fiscal instrument compare to alternatives?
Preview of idea and results

• Baumol-Tobin model of money-demand integrated within life cycle, incomplete markets framework → two assets:

1. liquid asset

2. illiquid asset with higher return but s.t. transaction cost
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Wealthy hand-to-mouth (constrained) agents
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**Wealthy hand-to-mouth** (constrained) agents

- Model’s consumption response to tax rebate is **15% – 27%**
Outline of the talk

1. Micro evidence on consumption response to FSP

2. Life-cycle model with two assets and transaction cost

3. Evidence on households’ holding of liquid and illiquid wealth

4. Results I: consumption response to FSP in the model

5. Results II: other model’s implications
THE MICRO EVIDENCE
The 2001 tax rebate

EGTRRA of 2001 cut lowest tax rate ($\leq 12,000$) from 15% to 10%

Checks corresponding to an “advance refund” for 2001 sent to 92 millions taxpayers between July-September
The 2001 tax rebate

EGTRRA of 2001 cut lowest tax rate ($\leq 12,000) from 15% to 10%

Checks corresponding to an “advance refund” for 2001 sent to 92 millions taxpayers between July-September

Three key features of this tax rebate:

1. **anticipated**: EGTRRA enacted in May

2. **lump-sum**: $600 for married couples ($300 for singles)

3. **randomized timing**: checks mailed out by last 2 digits of SSN
Measuring the response to tax rebates

The CEX added a special module to its quarterly interview in second half of 2001 asking whether rebate was received, when, and how much
Measuring the response to tax rebates

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\[ C_{i,t+1} - C_{i,t} = \sum_s \beta_{0s} month_{s,i} + \beta'_1 X_{i,t} + \beta_2 Rebate_{i,t+1} + u_{i,t+1} \]

\[ X_{i,t}: \text{age, change in } \# \text{ of adults, change in } \# \text{ of children} \]
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\[ X_{i,t} : \text{age, change in \# of adults, change in \# of children} \]

\[ \beta_2 \equiv \text{fraction of rebate check spent in the same quarter it was received (net of response of the control group)} \]

... not exactly a MPC out of the rebate

Kaplan-Violante, "A Model of the Consumption Response to Fiscal Stimulus Payments"
Measuring the response to tax rebates

Estimates of Rebate Coefficient $\hat{\beta}_2$

<table>
<thead>
<tr>
<th></th>
<th>Strictly Nondurable</th>
<th>Nondurable</th>
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</thead>
<tbody>
<tr>
<td><strong>2001 Tax Rebates</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>JPS 2006, 2SLS ($N = 13,066$)</td>
<td>0.202 (0.112)</td>
<td>0.375 (0.136)</td>
</tr>
<tr>
<td>MS 2011, 2SLS ($N = 13,066$)</td>
<td></td>
<td>0.385 (0.120)</td>
</tr>
<tr>
<td>MS 2011, IVQR ($N = 13,066$)</td>
<td></td>
<td>0.244 (0.057)</td>
</tr>
<tr>
<td><strong>2003 Child Tax Credit</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>JPS 2009, 2SLS ($N = 15,069$)</td>
<td>0.020 (0.098)</td>
<td>0.232 (0.124)</td>
</tr>
<tr>
<td><strong>2008 Fiscal Stimulus Payments</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>PSJM 2011, 2SLS ($N = 11,239$)</td>
<td>0.207 (0.087)</td>
<td>0.252 (0.103)</td>
</tr>
</tbody>
</table>

$\hat{\beta}_2$ ranges between 20% and 40% for non-durable consumption
THE MODEL
Model

Demographics: households work until age $J^{work}$ and then live, as retirees, until age $J$

Preferences: $\sum_{j=0}^{J} \beta^j c_{ij}^{1-\gamma} - 1$

Earnings: heterogeneous age-earnings profiles

$\log y_{ij} = \chi_j + \alpha_i + \phi_i \cdot j + z_{ij}$

where $z_{ij}$ is i.i.d. component interpreted as measurement error

Uncertainty: no aggregate or idiosyncratic risk
Model (contd.)

Two Assets: 1) liquid asset $m_{ij} \geq 0$ with return $R^m \equiv \frac{1}{q^m}$

2) illiquid asset $a_{ij} \geq 0$ with return $R^a \equiv \frac{1}{q^a} > R^m$

Transactions cost: households must pay $\kappa$ to deposit into or withdraw from illiquid account

Government: satisfies intertemporal budget constraint

$$G + \sum_{j=J^w+1}^{J} \int p(Y_{J^w}) \, d\mu_j + \left( \frac{1}{q^a} - 1 \right) B = \tau^c \sum_{j=1}^{J} \int c_j \, d\mu_j + \sum_{j=1}^{J} \int T(y_j, a_j, m_j) \, d\mu_j$$
Problem of the working household (no adjustment)

State vector: \( s_j = (m_j, a_j, Y_j, \alpha, \psi) \)
Problem of the working household (no adjustment)

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\[
V_j^0 (s_j) = \max_{c_j, m_{j+1}} u(c_j) + \beta \max \{ V_{j+1}^0 (s_{j+1}), V_{j+1}^1 (s_{j+1}) \}
\]

subject to:

\[
q^m m_{j+1} + (1 + \tau^c) c_j = y_j - \mathcal{T}(y_j, a_j, m_j) + m_j
\]
\[
q^a a_{j+1} = a_j
\]
\[
m_{j+1} \geq 0
\]
\[
y_{ij} = \exp (\chi_j + \alpha_i + \psi_{ij})
\]
\[
Y_{j+1} = (j Y_j + y_j) / (j + 1)
\]
Problem of the working household (adjustment)

\[ V_{j+1}^1 (s_j) = \max_{c_j, m_{j+1}, a_{j+1}} u(c_j) + \beta \max \{ V_{j+1}^0 (s_{j+1}), V_{j+1}^1 (s_{j+1}) \} \]

subject to:

\[ q^m m_{j+1} + q^a a_{j+1} + (1 + \tau^c) c_j = y_j - \mathcal{T}(y_j, a_j, m_j) + m_j + a_j - \kappa \]

\[ m_{j+1} \geq 0 \]

\[ a_{j+1} \geq 0 \]

\[ y_{ij} = \exp(\chi_{ij} + \alpha_i + \psi_{ij}) \]

\[ Y_{j+1} = (jY_j + y_j) / (j + 1) \]
Example of two-asset economy
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Kaplan-Volante, "A Model of the Consumption Response to Fiscal Stimulus Payments"
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Kaplan-Violante, "A Model of the Consumption Response to Fiscal Stimulus Payments"
A wealthy hand-to-mouth household

Consumes the rebate check and does not respond to the news

Cochrane (1989): small welfare gain of smoothing vs $\kappa$
Parametrization (quarterly model)

- **Demographics**: $J_{work} = 35$ years and $J = 55$ years

- **Preferences**: $\gamma = 1$ (log utility)

- **Earnings**: heterogeneity in age profiles to match level and growth of earnings inequality over the life cycle

- **Government**: expenditures, debt, tax system and SS system reproduce the key features of US counterpart in 2001
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- **Set** $\{R^m, R^a, \kappa, \beta\}$ based on micro data on household portfolios

Kaplan-Violante, "A Model of the Consumption Response to Fiscal Stimulus Payments"
SCF EVIDENCE ON LIQUID AND ILLIQUID WEALTH

Kaplan-Volante, "A Model of the Consumption Response to Fiscal Stimulus Payments"
Liquid and illiquid wealth in SCF 2001

- **Sample:** all households 25+, except top 2% of distribution of net worth in order to make SCF and CEX samples comparable
Liquid and illiquid wealth in SCF 2001

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- **Liquid assets**: checking, savings, money market, and call accounts net of revolving credit card balances (6%)

- **Illiquid assets**: net worth minus liquid assets (94%)
  - housing wealth net of all secured debt (38%)
  - retirement accounts (25%)
  - directly held mutual funds (stocks and bonds) (15%)
  - vehicles net of installment loans (7%)

Kaplan-Violante, "A Model of the Consumption Response to Fiscal Stimulus Payments"
### Liquid and illiquid wealth in SCF 2001

<table>
<thead>
<tr>
<th></th>
<th>Mean</th>
<th>25th pct</th>
<th>50th pct</th>
<th>75th pct</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Net worth</strong></td>
<td>219,387</td>
<td>16,600</td>
<td>86,650</td>
<td>255,000</td>
</tr>
<tr>
<td><strong>Liquid wealth</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Liquid assets</td>
<td>15,412</td>
<td>710</td>
<td>3,200</td>
<td>11,700</td>
</tr>
<tr>
<td>Revolving CC debt</td>
<td>1,390</td>
<td>0</td>
<td>0</td>
<td>450</td>
</tr>
<tr>
<td><strong>Illiquid wealth</strong></td>
<td>205,365</td>
<td>14,600</td>
<td>80,000</td>
<td>235,850</td>
</tr>
<tr>
<td>Housing net of mortgages</td>
<td>85,885</td>
<td>0</td>
<td>39,000</td>
<td>109,000</td>
</tr>
<tr>
<td>Retirement accounts</td>
<td>43,304</td>
<td>0</td>
<td>1,000</td>
<td>32,000</td>
</tr>
<tr>
<td>Directly held MF, stocks, bonds, and T-Bills</td>
<td>33,139</td>
<td>0</td>
<td>0</td>
<td>3,800</td>
</tr>
<tr>
<td>Vehicles net of loans</td>
<td>15,063</td>
<td>4,100</td>
<td>11,100</td>
<td>21,100</td>
</tr>
<tr>
<td>Life Insurance</td>
<td>8,668</td>
<td>0</td>
<td>0</td>
<td>1,000</td>
</tr>
<tr>
<td>CDs</td>
<td>5,449</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>Saving Bonds</td>
<td>1,121</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
</tbody>
</table>
Calibration of asset returns

1. Construct average returns by asset class from 1967-2006:
   - **Checking accounts**: zero nominal return
   - **Money market and savings accounts**: 3 month T-bills
   - **Equity**: CRSP value-weighted portfolio incl dividends
   - **Bonds**: 3 month T-bills
   - **Certificates of deposit**: FRB database
   - **Housing**: NIPA data adjusted for flow of consumption services

2. From observed portfolios in SCF, construct household-specific returns on liquid and illiquid wealth

3. Use resulting cross-sectional mean return (12% and 2.9%)
Calibration (contd.)

- **Asset Returns:**
  - **Illiquid return** After tax real return $r = 6.9\%$
    - (12.0\% nominal, 3\% inflation, 16.5\% tax)
  - **Liquid return** After tax real return $r^m = -0.8\%$
    - (2.9\% nominal, 3\% inflation, 24\% tax)

- **Discount Factor $\beta$:** Match median illiquid wealth of $80,000$

- **Transactions Cost $\kappa$:** Match median illiquid wealth of $2,400$

Kaplan-Violante, "A Model of the Consumption Response to Fiscal Stimulus Payments"
Estimates of hand-to-mouth households

39% ‘constrained’ in liquid wealth, compared with 11% in net worth

Estimates of hand-to-mouth households

27% wealthy hand-to-mouth households in the SCF

Kaplan-Violante, "A Model of the Consumption Response to Fiscal Stimulus Payments"
Tax rebate experiment

- In quarter $t = 0$, govt announces all households will receive a tax rebate of $500$ paid out at either $t = 0$ (group A) or $t = 1$ (group B).

- After 10 years, permanent rise in flat earnings tax.
Rebate coefficient in the model

Rebate coefficient rising with $\kappa$ (3.7% in one-asset model)

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Rebate coefficient in the model

Action entirely from constrained agents

Kaplan-Violante, "A Model of the Consumption Response to Fiscal Stimulus Payments"
Rebate coefficient in the model

Median liquid wealth close to SCF for $\kappa \geq $500

Kaplan-Violante, "A Model of the Consumption Response to Fiscal Stimulus Payments"
Rebate coefficients in 2001 environment

Two key features of economic environment in 2001

1. Bush tax cuts (EGTRRA)
   - Unexpected tax reform announced in 2001:Q2 (with rebate), takes effect gradually from 2002:Q1
   - No sunset in 2011

2. Mild 2001-02 recession
   - Unexpected 1.5% decline in earnings, over 3 quarters
   - Followed by 8 quarter recovery
Rebate coefficients in 2001 environment

Tax reform and recession exacerbate liquidity constraints

Kaplan-Violante, "A Model of the Consumption Response to Fiscal Stimulus Payments"
2001 rebate with tax reform & recession ($\kappa = 500$)

Aggregate ND consumption rises by half pct point for two quarters

Effect is very short lived

Kaplan-Violante, "A Model of the Consumption Response to Fiscal Stimulus Payments"
Heterogeneity in rebate coefficients (Misra-Surico)

1. Distribution of consumption responses is bimodal

2. High income households at both end of the distribution
Heterogeneity in rebate coefficients (Misra-Surico)

1. Distribution of consumption responses is **bimodal**

2. High income households at both end of the distribution
Size-asymmetry of responses (Hsieh)

Same households who have large MPC out of 2001 rebate do not respond to (larger) distributions of the Alaskan Permanent Fund.
Size-asymmetry of responses (Hsieh)

Same households who have large MPC out of 2001 rebate do not respond to (larger) distributions of the Alaskan Permanent Fund

Larger rebate $\Rightarrow$ more adjustment $\Rightarrow$ lower consumption response

Kaplan-Violante, "A Model of the Consumption Response to Fiscal Stimulus Payments"
ROBUSTNESS
For reasonable borrowing rates, findings are robust

Kaplan-Violante, "A Model of the Consumption Response to Fiscal Stimulus Payments"
Idiosyncratic risk

If shocks are permanent, findings are robust

Kaplan-Violante, "A Model of the Consumption Response to Fiscal Stimulus Payments"
Conclusions

• Novel mechanism to generate a large fraction of households with illiquid assets and no liquid wealth → wealthy constrained
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- Model capable of responses to fiscal stimulus payments that are: 1) large, 2) bimodal, 3) size-asymmetric

  ... while being consistent with liquid/illiquid wealth distributions
Conclusions

• Novel mechanism to generate a large fraction of households with illiquid assets and no liquid wealth → **wealthy constrained**

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... while being consistent with liquid/illiquid wealth distributions

• **Extensions:**
  
  ▶ durable consumption flow from part of illiquid assets
  
  ▶ automatic deposit/withdrawal into/from illiquid account
  
  ▶ counterfactual “stimulus policies” and welfare analysis
Consumption dynamics: no adjustment phase

- **Case I**: Positive liquid assets \( (m_{t+1} > 0) \)

\[
\frac{1}{c_t} = \beta \frac{1}{c_{t+1}}
\]

Consumption falls at rate \( \beta < 1 \)
Consumption dynamics: no adjustment phase

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\frac{1}{c_t} = \beta \frac{1}{c_{t+1}}
\]

Consumption falls at rate \(\beta < 1\)

- **Case II:** No liquid assets \((m_{t+1} = 0)\)

\[c_t = y_t\]

**Borrowing constrained** so consumption equals income
Consumption dynamics: adjustment while working

- **Case III:** Date of adjustment \((m_{t+1} = 0)\)

\[
\frac{1}{c_t} = \beta \frac{1}{c_{t+1}} + \lambda_t^{m_{t+1}}
\]

Always optimal to deposit entire cash holdings so \(m_{t+1} = 0\)

Consumption has an “upward jump” between \(t\) and \(t + 1\).

Between two adjustment dates, \(t\) and \(t + j\)

\[
\frac{1}{c_t} = [\beta(1 + r)]^j \frac{1}{c_{t+1}}
\]

Consumption grows at rate \(\beta(1 + r) > 1\)