A Model of the Consumption Response to Fiscal Stimulus Payments

Greg Kaplan  
University of Pennsylvania

Gianluca Violante  
NYU, CEPR, NBER

The University of Chicago Booth School of Business

November 14th, 2011
Fiscal stimulus payments (a.k.a. tax rebates)

Direct cash transfers from government to households

In general are small, anticipated, temporary, (almost) lump-sum
Fiscal stimulus payments (a.k.a. tax rebates)

Direct cash transfers from government to households

In general are small, anticipated, temporary, (almost) lump-sum


2. **2008**: *Economic Stimulus Act* provided most households with payments of $300-$600 per adult and $300 per child.
Fiscal stimulus payments (a.k.a. tax rebates)

Direct cash transfers from government to households

In general are small, anticipated, temporary, (almost) lump-sum


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

3. **2001**: *Economic Growth and Tax Relief Reconciliation Act* entitled taxpayers to rebate of up to $300 per adult.
   Total payout was $38b: 8% of quarterly G, or 1.7% of quarterly Y.
Households spend about 20-40% of their stimulus payment on non-durable consumption in the quarter they receive it

Households **spend about 20-40%** of their stimulus payment on **non-durable consumption** in the quarter they receive it


**Sharp violation** of standard life-cycle model which predicts:

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

Unless **borrowing constraints** are binding
Build a structural model to study consumption response to stimulus payments
Build a structural model to study consumption response to stimulus payments

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

Model generates wealthy hand-to-mouth households
Consistent with SCF data
Preview of idea and results

- Build a **structural model** to study consumption response to stimulus payments

- **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**

- Model generates **wealthy hand-to-mouth** households
  Consistent with **SCF data**

- Model’s consumption response to tax rebate is **15% – 30%**
Outline of the talk

1. Micro evidence on consumption response to FSP

2. Lifecycle model with two assets and transaction costs

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

4. Results I: consumption response to FSP in model

5. Results II: other model implications
Evidence on consumption response to FSP

Lifecycle model with two assets

SCF evidence on liquid and illiquid wealth

Quantitative analysis

Additional Slides
The 2001 tax rebate

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

Checks (typically $300 or $600) corresponding to “advance refund” for 2001 sent to 92 million taxpayers between Jul-Sep
The 2001 tax rebate

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

Checks (typically $300 or $600) corresponding to “advance refund” for 2001 sent to 92 million taxpayers between Jul-Sep

Three key features of this tax rebate:

1. anticipated (at least for some): EGTRRA enacted in May
2. lump-sum: fixed amount per adult
3. randomized timing: checks mailed out by last 2 digits of SSN
Measuring the response to tax rebates

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

CEX added special module to quarterly interview in second half of 2001 asking whether rebate was received, when, and how much

\[ C_{i,t+1} - C_{i,t} = \sum_s \beta_0 s \text{month}_{s,i} + \beta'_1 X_{i,t} + \beta_2 \text{Rebate}_{i,t+1} + u_{i,t+1} \]

\[ X_{i,t}: \text{age, change in \# of adults, change in \# of children} \]
Measuring the response to tax rebates

CEX added special module to quarterly interview in second half of 2001 asking whether rebate was received, when, and how much

\[ C_{i,t+1} - C_{i,t} = \sum_s \beta_0 s \text{month}_{s,i} + \beta'_1 X_{i,t} + \beta_2 \text{Rebate}_{i,t+1} + u_{i,t+1} \]

\( X_{i,t} \): age, change in # of adults, change in # of children

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

\( \ldots \text{not a MPC out of the rebate} \)
Measuring the response to tax rebates

<table>
<thead>
<tr>
<th>Study</th>
<th>Strictly Nondurable</th>
<th>Nondurable</th>
</tr>
</thead>
<tbody>
<tr>
<td>JPS 2006, 2SLS (N = 13,066)</td>
<td>0.202 (0.112)</td>
<td>0.375 (0.136)</td>
</tr>
<tr>
<td>H 2008, 2SLS (N = 12,710)</td>
<td>0.242 (0.106)</td>
<td></td>
</tr>
<tr>
<td>MS 2011, IVQR (N = 13,066)</td>
<td>0.244 (0.057)</td>
<td></td>
</tr>
</tbody>
</table>

- $\hat{\beta}_2$ ranges between 20% and 40% for non-durable consumption
- More recent estimates put weight on lower end of range

**Strictly Nondurable**: food, utilities, household operations, public transportation and gas, alcohol and tobacco and miscellaneous goods

**Nondurable**: strictly nondurable plus apparel goods and services, reading materials and out-of-pocket health care expenditures
Outline

Evidence on consumption response to FSP

Lifecycle model with two assets

SCF evidence on liquid and illiquid wealth

Quantitative analysis

Additional Slides
Model

Demographics: household $i$ works for $J^{work}$ periods
lives as retiree for $J^{ret}$ periods

Preferences: $E_0 \sum_{j=0}^{J} \beta^j \frac{c_{ij}^{1-\gamma} - 1}{1-\gamma}$

Earnings: idiosyncratic household earnings risk

$log y_{ij} = \chi_j + z_{ij} + u_{ij}$

$z_{ij}$ is unit root, $u_{ij}$ is i.i.d. interpreted as measurement error

No aggregate uncertainty
Model

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: fixed money, utility or time cost $\kappa$ for each deposit into or withdrawal from illiquid account

Government: taxes income progressively, consumption linearly, runs a progressive SS system, and spends

respects intertemporal budget constraint
Model

\[ V_j(a_j, m_j, z_j) = \max \left\{ V_j^N(a_j, m_j, z_j), V_j^A(a_j + m_j - \kappa^f, z_j) \right\} \]
$$V_j(a_j, m_j, z_j) = \max \left\{ V_j^N(a_j, m_j, z_j), V_j^A(a_j + m_j, z_j) - \kappa^u \right\}$$
Model

\[ V_j(a_j, m_j, z_j) = \max \left\{ V_j^N(a_j, m_j, z_j), V_j^A(a_j + m_j - \kappa^y y_j, z_j) \right\} \]
Model

\[ V_j(a_j, m_j, z_j) = \max \{ V_j^N(a_j, m_j, z_j), \, V_j^A(a_j + m_j - \kappa^f_x) \} \]

\[ V_j^N(a_j, m_j, z_j) = \max_{c_j, m_{j+1}} \{ u(c_j) + \beta \mathbb{E} V_{j+1}(a_{j+1}, m_{j+1}, z_{j+1}) \} \]

subject to

\[ c_j + q^m m_{j+1} \leq m_j + y_j(z_j) - \mathcal{T}(y_j, a_j, m_j, c_j) \]
\[ q^a a_{j+1} = a_j \]
\[ m_{j+1} \geq 0 \]

\[ V_j^A(x_j, z_j) = \max_{c_j, a_{j+1}, m_{j+1}} \{ u(c_j) + \beta \mathbb{E} V_{j+1}(a_{j+1}, m_{j+1}, z_{j+1}) \} \]

subject to

\[ c_j + q^a a_{j+1} + q^m m_{j+1} \leq x_j + y_j(z_j) - \mathcal{T}(y_j, a_j, m_j, c_j) \]
\[ a_{j+1} \geq 0, \, m_{j+1} \geq 0 \]
Example of two-asset economy
Example of two-asset economy
Example of two-asset economy

[Euler Equations]
Example of two-asset economy

[Euler Equations]
Example of two-asset economy

[Euler Equations]
Example of two-asset economy

[Euler Equations]
Example of two-asset economy

[Graph showing consumption levels for different scenarios: Income, Consumption (1 asset, high R), Consumption (1 asset, low R), Consumption (2 assets).]

[Euler Equations]
A wealthy hand-to-mouth household

Agent features endogenous hand to mouth behavior
Agent features **endogenous hand to mouth** behavior

Consumes the rebate check and does not respond to the news

Small welfare gain of smoothing vs $\kappa$ and $R^a - R^m$

Cochrane (1989)
Parametrization (quarterly model)

- **Demographics:** $J^{work} = 38$ years (22-59) 
  $J^{ret} = 20$ years (60-79)

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

- **Earnings:** Method of moments estimator to match level and growth of earnings inequality over the life cycle

- **Government:** expenditures, debt, tax system and SS system reproduce key features of US counterpart in 2001
Parametrization (quarterly model)

- **Demographics:** \( J_{\text{work}} = 38 \text{ years (22-59)} \)  
  \( J_{\text{ret}} = 20 \text{ years (60-79)} \)

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

- **Earnings:** Method of moments estimator to match level and growth of earnings inequality over the life cycle

- **Government:** expenditures, debt, tax system and SS system reproduce key features of US counterpart in 2001

- **Set** \( \{ R^m, R^a, \kappa, \beta \} \) from micro data on household portfolios
Evidence on consumption response to FSP

Lifecycle model with two assets

SCF evidence on liquid and illiquid wealth

Quantitative analysis

Additional Slides
Liquid and illiquid wealth in SCF 2001

- **Sample:** all households 22+, except top 5% of distribution of net worth, to make SCF and CEX samples comparable
Liquid and illiquid wealth in SCF 2001

- **Sample:** all households 22+, except top 5% of distribution of net worth, to make SCF and CEX samples comparable

- **Liquid assets:** checking, savings, money market, directly held mutual funds, stocks and bonds and call accounts net of revolving debt on credit card balances ($2,700)

- **Iliquid assets:** net worth minus liquid assets ($70,000)
  - housing net of mortgages and other secured debt ($31,000)
  - vehicles net of installment loans ($11,000)
  - retirement accounts ($950)
Liquid and illiquid wealth over the lifecycle

Median liquid wealth: $2,700. Median illiquid wealth: $70,000

30% ‘hand to mouth’ in liquid wealth, vis-a-vis 6% in net worth
Liquid and illiquid wealth over the lifecycle

- Median liquid wealth: $2,700. Median illiquid wealth: $70,000
- 30% ‘hand to mouth’ in liquid wealth, vis-a-vis 6% in net worth
Calibration (cont’d)

- **Assets Returns:**
  - Illiquid asset: After-tax real return $r^a = 6.2\%$
  - Liquid asset: After-tax real return $r^m = -1.1\%$

- **Discount Factor $\beta$:** Match median illiquid wealth of $70,000 $\Rightarrow 0.953$ (annualized)

- **Transactions Cost $\kappa$:** Broadly consistent with median liquid wealth, fractions of hand-to-mouth households, and frequency of adjustment $\Rightarrow$ $500 - $1,000

[details of returns calibration]
Evidence on consumption response to FSP

Lifecycle model with two assets

SCF evidence on liquid and illiquid wealth

Quantitative analysis

Additional Slides
Tax rebate experiment

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

- After 10 years, permanent additional proportional earnings tax
Tax rebate experiment

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

- After 10 years, permanent additional proportional earnings tax

- 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
  2. Mild 2001-02 recession
     - Unexpected 1.5% decline in earnings, over 3 quarters, followed by 8 quarter recovery
Rebate coefficient in the model

- Rebate coefficient rising with $\kappa$ (2% in one-asset model)
Rebate coefficient in the model

- Rebate coefficient rising with $\kappa$ (2% in one-asset model)
- Tax reform and recession exacerbate liquidity constraints
Rebate coefficient in the model

- Rebate coefficient rising with $\kappa$ (2% in one-asset model)
- Tax reform and recession exacerbate liquidity constraints
Rebate coef rising with fraction of hand-to-mouth households
MPC across households

► Action entirely from hand-to-mouth households
Further implications and extensions

- Timing and anticipation [go to surprise]
- Heterogeneity in rebate coefficients [go to heterogeneity]
- Size asymmetry of responses [go to size]
- Lifecycle properties [go to lifecycle]
- Aggregate consumption response [go to aggregate response]
- Allowing for credit [go to borrowing]
- Utility costs and time costs [go to transactions cost]
- Alternative model for idiosyncratic risk [go to idiosyncratic]
- Frequency of adjustment [go to adjustment]
Conclusions

- Baumol-Tobin model of money demand integrated into a lifecycle incomplete markets framework

- Generates *wealthy hand-to-mouth* consumers
  Microfoundation for Campbell-Mankiw spender-saver model

- Model capable of responses to fiscal stimulus payments that are: (i) large; (ii) bimodal; and (iii) size-asymmetric
  
  ...while being consistent with liquid/illiquid distributions
Outline

Evidence on consumption response to FSP

Lifecycle model with two assets

SCF evidence on liquid and illiquid wealth

Quantitative analysis

Additional Slides
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

- **Case I:** Positive liquid assets \((m_{t+1} > 0)\)
  
  \[
  \frac{1}{c_t} = \beta \frac{1}{c_{t+1}}
  \]

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

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

  \[
  c_t = y_t
  \]

  Borrowing constrained so consumption equals income
Consumption dynamics: adjustment in work

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

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

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 \( t + j \)

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

Consumption grows at rate at least \( \beta(1 + r) \)
Hand-to-mouth agents in data and model

Fraction with Liquid Wealth $\leq 0$

Fraction with Liquid Wealth $\leq 0$ and Illiquid Wealth $> 0$
Size-asymmetry of responses (Hsieh, 2003)

Same households who have large MPC out of small income tax refunds do not respond to larger distributions from Alaskan Permanent Fund.
Same households who have large MPC out of small income tax refunds do not respond to larger distributions from Alaskan Permanent Fund.

- Larger rebate ⇒ more adjustment ⇒ lower consumption response
Heterogeneity in rebate coefficients

Misra & Surico (2011):

1. Distribution of consumption responses is bimodal
2. High income households at both ends of distribution
Heterogeneity in rebate coefficients

Misra & Surico (2011):

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

2. High income households at both ends of distribution
Correlation with earnings and liquid wealth

Mean Rebate Coefficient vs. Tercile of Earnings Distribution

Mean Rebate Coefficient vs. Tercile of Liquid Wealth Distribution
Correlation with earnings and liquid wealth

Empirical evidence:

1. JPS and Misra-Surico: low $m$ not significant

2. Borda-Parker and Souleles: low $m/y$ significant
Idiosyncratic earnings risk

- If HIP instead of permanent shocks, then findings are robust
Alternate specification of transactions cost

![Graph showing the relationship between Rebate Coefficient and Transactions Cost (%). The graph includes two lines: one for Utility Cost (% of consumption) and another for Time Cost (% of earnings). The x-axis represents Transactions Cost (%), while the y-axis shows Rebate Coefficient.]
Tax reform and recession

[diagram showing rebate coefficient (%)]

- No tax reform, No recession
- Tax reform, No recession
- Tax reform, With recession
Around 40% of rebate outlays are spent in first year

ND consumption up by 0.5% compared to counterfactual
Credit means ability to hold negative amounts of the liquid asset by paying a rate $R^b > R^m$ on balances.
Credit

Credit means ability to hold **negative amounts of the liquid asset** by paying a rate $R^b > R^m$ on balances.

Two conjectures for why credit may reduce rebate coefficients:

(1) Low liquid wealth households are no longer constrained: consumption is interior $\rightarrow$ smaller MPC out of the rebate.
Credit

Credit means ability to hold negative amounts of the liquid asset by paying a rate $R^b > R^m$ on balances.

Two conjectures for why credit may reduce rebate coefficients:

(1) Low liquid wealth households are no longer constrained: consumption is interior $\rightarrow$ smaller MPC out of the rebate

(2) Group B borrows upon announcement and consumes as much as group A $\rightarrow$ smaller rebate coefficient
Conjecture (1): fewer constrained, small MPC

- Since $R^b > R^m$, households still face a corner at $m = 0$ which is potentially binding for many
Conjecture (1): fewer constrained, small MPC

Since $R^b > R^m$, households still face a corner at $m = 0$ which is potentially binding for many

![Graph showing the relationship between Fixed Cost ($\text{Fixed Cost}$) and Marginal Propensity to Consume (%) for different Borrowing Wedges: No Borrowing, Borrowing Wedge = 0.25, and Borrowing Wedge = 0.10. The graph illustrates how the marginal propensity to consume changes with different fixed costs.]
Conjecture (2): group B borrows upon news

1. Expensive credit: many in group B prefer waiting
2. Cheaper credit: true, but still significant amplification
Conjecture (2): group B borrows upon news

1. **Expensive credit:** many in group B prefer waiting
2. **Cheaper credit:** true, but still significant amplification

![Graph showing the relationship between Rebate Coefficient and Fixed Cost with different borrowing wedges. The graph illustrates that as the fixed cost increases, the rebate coefficient also increases, with different lines representing different borrowing wedges.](image-url)
Fraction of agents adjusting in the model

[Graph showing the fraction of agents adjusting in the model as a function of fixed cost.]

[Return]
Distribution of liquid wealth in data and model

Data (SCF 2001)

Model

[return]
# Liquid and illiquid wealth in SCF 2001

<table>
<thead>
<tr>
<th></th>
<th>50th pct</th>
<th>Mean</th>
<th>Fraction Positive</th>
<th>After-Tax Real Return</th>
</tr>
</thead>
<tbody>
<tr>
<td>Earnings + benefits (22-59)</td>
<td>41,000</td>
<td>52,696</td>
<td>–</td>
<td>–</td>
</tr>
<tr>
<td>Net worth</td>
<td>77,100</td>
<td>164,463</td>
<td>0.95</td>
<td>5.5</td>
</tr>
<tr>
<td>Net liquid wealth</td>
<td>2,700</td>
<td>30,531</td>
<td>0.77</td>
<td>-1.1</td>
</tr>
<tr>
<td>Cash, checking, saving, MM</td>
<td>1,880</td>
<td>12,026</td>
<td>0.87</td>
<td>-2.0</td>
</tr>
<tr>
<td>MF, stocks, bonds, T-Bills</td>
<td>0</td>
<td>19,920</td>
<td>0.28</td>
<td>4.1</td>
</tr>
<tr>
<td>Revolving credit card debt</td>
<td>0</td>
<td>1,415</td>
<td>0.33</td>
<td>–</td>
</tr>
<tr>
<td>Net illiquid wealth</td>
<td>70,000</td>
<td>133,932</td>
<td>0.93</td>
<td>6.2</td>
</tr>
<tr>
<td>Housing net of mortgages</td>
<td>31,000</td>
<td>72,585</td>
<td>0.68</td>
<td>7.1</td>
</tr>
<tr>
<td>Vehicles net of loans</td>
<td>11,000</td>
<td>14,562</td>
<td>0.86</td>
<td>5.8</td>
</tr>
<tr>
<td>Retirement accounts</td>
<td>950</td>
<td>34,431</td>
<td>0.53</td>
<td>4.5×1.35</td>
</tr>
<tr>
<td>Life insurance</td>
<td>0</td>
<td>7,734</td>
<td>0.27</td>
<td>0.5</td>
</tr>
<tr>
<td>Certificates of deposit</td>
<td>0</td>
<td>3,805</td>
<td>0.14</td>
<td>1.3</td>
</tr>
<tr>
<td>Saving bonds</td>
<td>0</td>
<td>815</td>
<td>0.17</td>
<td>0.5</td>
</tr>
</tbody>
</table>
Calibration of asset returns

1. Construct average returns by asset class from 1960-2009:
   - **Checking accounts**: zero nominal return
   - **Money market and savings accounts**: 3 month treasury bills
   - **Stocks**: CRSP value-weighted portfolio incl dividends
   - **Bonds**: 3 month treasury bills
   - **Housing**: NIPA data adjusted for flow of consumption services
   - **Vehicles**: User cost approach
   - **Retirement accounts**: Return $\times 1.35$ (employer contribution)
   - **Certificates of deposit**: Federal Reserve Board database

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

3. Use resulting cross-sectional mean return
Equivalence of lifecycle profiles

**One-asset model**

**Two-asset model**

[Graphs showing the equivalence of lifecycle profiles between one-asset and two-asset models, highlighting age, income, consumption, and wealth profiles along with variance log income and consumption across different ages.]