Fiscal Multipliers and Financial Crises

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Fiscal policy response to the 2008 financial crisis

- “Conventional” fiscal stimulus
  1. Govt purchases (Drautzburg & Uhlig ’11; Conley & Dupor ’13)
  2. Transfers to households (Oh & Reis ’12; Parker et al. ’13; Kaplan & Violante ’14)

- Financial sector interventions
  3. Equity injections (Blinder & Zandi ’10; Philippon & Schnabl ’13)
  4. Credit guarantees (Philippon & Skreta ’12; Lucas ’16)

Large debate on the effectiveness and composition of the response

This paper:

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Approach and Results

1. Structural model of fiscal policy
   - Potential stabilization roles for each of the tools
   - State dependent effects of shocks and policies

2. Quantitative Exercise
   - Calibrated model + data on fiscal policy response
   - Estimate structural shocks given policy response
   - Study counterfactuals
     - Crisis and Great Recession without fiscal response

3. Results:
   - Aggregate consumption falls by 50% more without policy response
   - Transfers and equity injections most important
   - Fiscal multipliers extremely state dependent
   - New transmission channels for fiscal policy
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Nominal Rigidities $\implies$ Government purchases
Incomplete Markets $\implies$ Transfers
(Frictional) Financial Sector $\implies$ Bank Recaps.
Credit Risk & Default $\implies$ Credit Guarantees
Impulse and Propagation

- Aggregate shocks:
  1. TFP $A_t$
  2. Financial shock $\sigma_t$

$$\text{Household Default Rate}_t = f(LTV_t, \sigma_t^+)$$

- Financial shock: defaults $\uparrow$
  1. Bank equity $\downarrow$
  2. If bank constraint binds $\Rightarrow$ spreads rise, lending falls
  3. Disposable income for borrowers $\downarrow$
  4. If borrower constraint binds $\Rightarrow$ aggregate consumption $\downarrow$

Shock transmission depends on bank leverage and household leverage
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Shock transmission depends on bank leverage and household leverage
State Dependence: Financial Shock with Low Leverage

- GDP
- Cons. Borrower
- Value of the Bank
- Bank Cost of Funds
State Dependence: Financial Shock with High Leverage

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- Cons. Borrower
- Value of the Bank
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Quantitative Exercise

1. Calibrate model to U.S. pre-crisis
   - Match moments on household and bank balance sheets

2. Use data to estimate sequences of structural shocks
   - $\{A_t, \sigma_t\}_{t=2000Q1}^{T=2015Q4}$

   - $Y^T \equiv$ Observed Macro Variables $^T = \{C_t, \text{spread}_t\}_t$

   - $\Omega^T \equiv$ Observed Fiscal Policy Response $^T = \{G_t, T^b_t, s^k_t, s^d_t\}_t$

3. What $\{\hat{A}_t, \hat{\sigma}_t\}_t^T$ make the model match $Y^T$ given $\Omega^T$?

4. Use estimated $\{\hat{A}_t, \hat{\sigma}_t\}_t^T$ to study counterfactual paths for $\Omega^T$
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Main Counterfactual: No Fiscal Policy

Consumption

Lending Spread

% dev. from trend

Data

Counterfactual

2007Q1 2008Q3 2013Q4

0 50 100 150 200 250

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Time Series for Fiscal Multipliers

GDP Multiplier, Purchases

GDP Multiplier, Transfers

GDP Multiplier, Recaps

GDP Multiplier, Guarantees
Two channels:

1. Borrower Constraint $\Rightarrow$ standard MPC channel

2. Borrower Const. $+$ Bank Const. $\Rightarrow$ new channel
   - Transfers $\Rightarrow$ house prices $\uparrow$ (only when borrowers are constrained)
   - Default rates fall, banks post fewer losses
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   - Disposable income $\uparrow$

New channel active when both constraints bind
State Dependent Multipliers: Mechanism

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Conclusion

This Paper

• Analysis of fiscal policy response to the Great Recession
• Structural Model + Data

Contribution

• Conventional stimulus and financial sector interventions
  • Important for normative analysis
  • Quantitative evaluation
• New transmission channels for fiscal policy
  • Household-bank balance sheet interactions
  • State dependent effects
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Borrowers: Debt and Default

- Face value $B_{t-1}^b$,
- Fraction $\gamma$ matures every period
- Family construct (Landvoigt, 2015)

1. Borrower enters period with states
   \[ h_{t-1}, B_{t-1}^b \]

2. Continuum of members $i \in [0, 1]$, each with
   \[ h_{t-1}, B_{t-1}^b, \nu_t(i) \]
   where $\nu_t(i) \sim F_t^b \in [0, \infty)$

3. Each member $i$ can:
   3.1 Repay maturing debt $\gamma B_{t-1}^b$, and keep houses worth $\nu_t(i)p_t h_{t-1}$
   or
   3.2 Default on maturing debt, lose collateral
Borrower Family Problem

\[ V^b_t(B^b_{t-1}, h_{t-1}) = \max_{c^b_t, n^b_t, h_t, B^b_t, \iota(\nu)} \left\{ u(c^b_t, n^b_t) + \xi^b \log(h_t) + \beta \mathbb{E}_t V^b_{t+1} \right\} \]

subject to budget constraint

\[
c^b_t + \frac{\gamma B^b_{t-1}}{\Pi_t} \int [1 - \iota(\nu)] dF^b_t(\nu) + p^b_t h_t \leq \left\{ \begin{array}{l}
\text{debt repayment} \\
\text{house purchase}
\end{array} \right. \\
(1 - \tau) w^b_t n^b_t + Q^b_{t} B^b_{t,\text{new}} + p^b_t h_{t-1} \int \nu [1 - \gamma \iota(\nu)] dF^b_t(\nu) - T_t + T^b_t \leq \left\{ \begin{array}{l}
\text{new debt} \\
\text{sale of non-forecl. houses} \\
\text{Transfers}
\end{array} \right.
\]

and borrowing constraint

\[ B^b_{t,\text{new}} \leq m p^b_t h_t \]
Borrower Default

Default iff $\nu \leq \nu^*_t$,

$$\nu^*_t = \frac{B^b_{t-1}}{\Pi_t p_t h_{t-1}} \approx \text{Loan-to-Value}$$

- $F^b_t = \text{Beta}(1, \sigma^b_t)$
- $\sigma^b_t \sim \text{two-state Markov}$
- Mean preserving spread

Lenders earn (per unit of debt)

$$Z^{\text{loans}}_t = (1 - \gamma)Q^b_t + \gamma \left\{ 1 - F^b_t(\nu^*_t) + \left(1 - \lambda^b_t\right) \int_0^{\nu^*_t} \nu \frac{p_t h_{t-1}}{B^b_{t-1}/\Pi_t} dF^b_t \right\}$$
Financial Intermediaries

- Fixed income portfolios, maturity transformation, risky deposits
- Fraction $1 - \theta$ of earnings paid out as dividends every period
- Invest in loan securities $b_t$, raise deposits $d_t$

Problem for intermediary $j \in [0, 1]$ with current earnings $e_{j,t}$

$$V_t^k(e_{j,t}) = \max_{b_{j,t}, d_{j,t}} \left\{ (1 - \theta)e_{j,t} + \mathbb{E}_t \left[ \Lambda^s_{t,t+1} \max \{0, V_{t+1}^k(e_{j,t+1})\} \right] \right\}$$

subject to

flow of funds: $Q_b^b b_{j,t} = \theta e_{j,t}(1 + s_t^k) + Q_d^d d_{j,t}$

capital req.: $\kappa Q_b^b b_{j,t} \leq \mathbb{E}_t \left[ \Lambda^s_{t,t+1} \max \{0, V_{t+1}^k(e_{j,t+1})\} \right]$

LoM earnings: $e_{j,t+1} = u_{j,t+1} Z_{t+1}^{loans} \frac{b_{j,t}}{\Pi_{t+1}} - \frac{d_{j,t}}{\Pi_{t+1}}$
Financial Intermediaries

- \( u_{j,t} \sim F^d \subseteq [u, \bar{u}] \)
- Default iff 
  \[ u_{j,t} < u^*_t \equiv \frac{d_{j,t-1}}{Z^\text{loans}_t b_{j,t-1}} \approx \text{Leverage} \]
- Aggregation \( \Rightarrow \) representative bank
  \[ \int_{[0,1]} \mathbb{E}_t \left[ \frac{\Lambda^s_{t,t+1}}{\Pi_{t+1}} \max \{ 0, V^k_{t+1}(e_{j,t+1}) \} \right] dj \equiv \Phi_t \theta E_t \]
- Spreads reflect Credit Risk + Current + Future binding constraints
- Long-term debt \( \Rightarrow \) Pecuniary Externalities \( \Rightarrow \) Financial Accelerator
- Payoff per unit of deposits,

\[
Z_{t}^{\text{deposits}} = s_{t}^{d} + (1-s_{t}^{d}) \begin{cases} 
& 1 - F^d(u^*_t) + (1 - \lambda^d) \int_{0}^{u^*_t} u \frac{Z^\text{loans}_t B^b_{t-1}}{D_{t-1}} dF^d \text{ repaid} \\
\text{guaranteed} & \text{liquidated}
\end{cases}
\]
Closing the Model

Standard DSGE model w/ nominal rigidities

- Producers $\rightarrow$ Phillips Curve
- Savers $\rightarrow$ Euler Equation (IS)
- Housing in fixed supply, $h_t = 1$
- Central Bank $\rightarrow$ Taylor Rule

\[
\frac{1}{Q_t} = \frac{1}{\bar{Q}} \left[ \frac{\Pi_t}{\Pi} \right]^{\phi_\pi} \left[ \frac{Y_t}{Y} \right]^{\phi_y}
\]

- Aggregate resource constraint,

\[
C_t + G_t + \text{DWL Default}_t = A_t N_t \left[ 1 - d(\Pi_t) \right]
= Y_t \quad \text{Menu Costs}
\]
Fiscal Authority

Budget constraint,

\[ \tau Y_t + T_t + Q_t B_t^g - \bar{G} - \frac{B_{t-1}^g}{\Pi_t} = \text{Net Cost from Discretionary Measures}_t \]

Standard Surplus

Fiscal rule for taxes,

\[ T_t = \phi_\tau \log \left( \frac{B_{t-1}^g}{\bar{B}^g} \right) \]

Net Cost from Discretionary Measures,

\[ (G_t - \bar{G}) + \chi T_t^b + s_t^k \theta E_t + s_t^d \frac{D_{t-1}}{\Pi_t} \times (1 - \text{Recovery Rate}_t) \]
Calibration

1. **Crises**

\[ \sigma_t^b = [\sigma_t^{b,\text{normal}}, \sigma_t^{b,\text{crisis}} ] \]

and

\[ \mathbf{P}^\sigma = \begin{bmatrix} .995 & .005 \\ .2 & .8 \end{bmatrix} \]

2. **Households**

<table>
<thead>
<tr>
<th>Target</th>
<th>Target Parameter</th>
<th>Parameter</th>
</tr>
</thead>
<tbody>
<tr>
<td>Fraction Borrowers</td>
<td>Parker et al. (2013)</td>
<td>( \chi = 0.475 )</td>
</tr>
<tr>
<td>Avg. Maturity</td>
<td>5 years</td>
<td>( \gamma = 1/20 )</td>
</tr>
<tr>
<td>Max LTV Ratio</td>
<td>80%</td>
<td>( m = 0.0383 )</td>
</tr>
<tr>
<td>Debt/GDP</td>
<td>80%</td>
<td>( \xi = 0.1565 )</td>
</tr>
<tr>
<td>Avg. Delinquency Rate</td>
<td>2%</td>
<td>( \sigma_t^{b,\text{normal}} = 8.205 )</td>
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</table>

3. **Banks**

\[
F^d(u) = \frac{u^\sigma - u^\sigma}{\bar{u}^\sigma - u^\sigma}
\]

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<td>Book Leverage</td>
<td>10</td>
<td>( \kappa = 0.1 )</td>
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<tr>
<td>Payout Rate</td>
<td>15%</td>
<td>( \theta = 0.85 )</td>
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<tr>
<td>Avg. Lending Spread</td>
<td>2%</td>
<td>( \varpi = 0.0105 )</td>
</tr>
<tr>
<td>CDS-Implied Def. Prob.</td>
<td>2% in recessions</td>
<td>( u = 0.88, \sigma^d = 1.5 )</td>
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Smoothing Shocks

TFP

% Deviation from SS

2000Q1  2008Q3  2015Q4

Credit Risk Shock

% Deviation from SS

2000Q1  2008Q3  2015Q4