Fiscal Multipliers and Financial Crises

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49th Konstanz Seminar
Reichenau, May 2018

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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:

1. How important was the fiscal policy response?
2. Which tools were the most important?
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 twice as much w/o policy
   - Transfers and equity injections most important
   - Fiscal multipliers extremely state dependent
   - New transmission channels for fiscal policy
Nominal Rigidities $\implies$ Government purchases

Incomplete Markets $\implies$ Transfers

(Frictional) Financial Sector $\implies$ Bank Recaps.

Credit Risk & Default $\implies$ Credit Guarantees
Model: Key Ingredients

Borrowers

1. Borrow in long-term debt $B_t^b$, purchase houses $h_t$
2. Family construct $i \in [0, 1]$, housing quality shocks $\nu(i) \sim F_t$
3. Fraction of borrowers $m$ has to move every period
   3.1 Prepay debt + sell house if $B_{t-1}^b \leq p_t^h \nu_t(i) h_{t-1}$, or
   3.2 Default + lose house
4. New borrowing subject to LTV constraint

$$B_t^{b,\text{new}} \leq \theta^{\text{LTV}} p_t^h h_t$$

Banks

1. Invest in mortgages, financed w/ deposits and retained earnings
2. Subject to iid shock on portfolio return, default if $V_t \leq 0$
3. Market leverage constraint

$$\kappa Q_t^b B_t^b \leq V_t$$
Impulse and Propagation

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

  Household Default Rate$_t = f(LTV_t, \sigma_t)$

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

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

[Graphs showing changes in GDP, Consumer Borrower, House Price, and Bank Cost of Funds over quarters after a crisis.]
State Dependence: Financial Shock with High Leverage

**GDP**

**Cons. Borrower**

**House Price**

**Bank Cost of Funds**

- **Low lev.**
- **Hi lev.**
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
   \[
   \{A_t, \sigma_t\}_{t=2000Q1}^{T=2015Q4}
   \]
   - \(Y^T \equiv \text{Observed Macro Variables}^T = \{C_t, \text{spread}_t\}_t^T\)
   - \(\Omega^T \equiv \text{Observed Fiscal Policy Response}^T = \{G_t, T^b_t, x^k_t, s^d_t\}_t^T\)

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 \(\Omega^T\)
Fiscal Policy Data

- **G**: ARRA ’09 contracts, Medicaid and Education spending

- **T**: ESA ’08 tax rebates, HERA ’08 tax credits + NSP + Cash for Clunkers, ARRA ’09 social transfers + tax cuts, TARP ’08 housing programs (MHA, HHF, FHA-Refi)

- **x**: TARP ’08 equity injection programs (CPP, CDCI, PPIP, AIG, BofA/Citi), auto bailout (AIFP, ASSP), GSE bailout (PSI)

- **s**: TARP ’08 credit guarantees (TABSLF, BofA/Citi), TLGP ’08 credit guarantees
Main Counterfactual: No Fiscal Policy
Policy Decomposition

Aggregate Consumption

% deviation from trend/SS

2007Q1 2008Q3 2012Q4

-8 -6 -4 -2 0 2 4

Data
No Purchases
No Transfers
No Bank Recaps
No Guarantees
Time Series for Fiscal Multipliers

GDP Multiplier, Purchases

GDP Multiplier, Transfers

GDP Multiplier, Recaps

GDP Multiplier, Guarantees
State Dependent Multipliers: Mechanism

Two channels:

1. Borrower Constraint $\Rightarrow$ standard MPC channel

2. Borrower Const. $+$ Bank Const. $\Rightarrow$ new channel

- Transfers $\Rightarrow$ house prices ↑ (only when borrowers are constrained)
- Default rates fall, banks post fewer losses
- Lending ↑, spreads ↓ (only when banks are constrained)
- Disposable income ↑

New channel active when both constraints bind
Conclusion

This Paper

- Analysis of fiscal policy response to the Great Recession
- Structural Model + Data
- BANK + MONK

Contribution

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

- Face value $B_{t-1}^b$, coupon rate $\gamma$
- 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 agent $i$ has to move with prob. $m$, she can:
   3.1 Prepay if $B_{t-1}^b \leq \nu_t(i)p_t^h h_{t-1}$, sell house
   3.2 Default, lose collateral
Borrower Family Problem

\[ V_t^b(B_{t-1}^b, h_{t-1}) = \max_{c_t^b, n_t^b, h_t, B_t^b, \iota(\nu)} \left\{ u(c_t^b, n_t^b) + \xi^b \log(h_t) + \beta \mathbb{E}_t V_{t+1}^b \right\} \]

subject to budget constraint

\[ c_t^b + \gamma \frac{B_{t-1}^b}{\Pi_t} \int (1 - m) + m[1 - \iota(\nu)]dF_t^b(\nu) + p_t h_t \leq (1 - \tau_t)w_t n_t^b + mQ_t B_t^{b,\text{new}} + p_t h_{t-1} \int (1 - m)\nu + m\nu[1 - \iota(\nu)]dF_t^b(\nu) + T_t^b \]

and borrowing constraint

\[ B_t^{b,\text{new}} \leq \theta^{\text{max ltv}} p_t h_t \]

\(\triangleright\) Back
Borrower Default

Default iff \( \nu \leq \nu^*_t \),

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

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

Lenders earn (per unit of debt)

\[
Z^{\text{loans}}_t = (1 - m)[\gamma + (1 - \gamma) Q^b_t] + m
\]

\[
\begin{aligned}
&1 - F^b_t(\nu^*_t) + (1 - \lambda^b) \int_0^{\nu^*_t} \nu p_t h_{t-1} - 1 / \Pi_t \ dF^b_t \\
&\text{not moving} \\
&\text{movers repay} \\
&\text{default}
\end{aligned}
\]
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 $e_{j,t}$

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

current mkt value

subject to

flow of funds: $Q^b_t b_{j,t} = [\theta e_{j,t}(1 + x^k_t) - \text{Govt Payments}_t] + Q^d_t d_{j,t}$

capital req.: $\kappa Q^b_t b_{j,t} \leq \mathbb{E}_t \left[ \Lambda^s_{t,t+1} \max \{0, V^k_{t+1}(e_{j,t+1})\} \right]$

LoM earnings: $e_{j,t+1} = (u_{j,t+1} Z^\text{loans}_{t+1} b_{j,t} - d_{j,t}) / \Pi_{t+1}$
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
  \[ \int_{[0,1]} \mathbb{E}_t \left[ \Lambda^{s}_{t,t+1} \prod_{t+1} \max \{0, V^k_{t+1}(e_{j,t+1})\} \right] \, dj \equiv \Phi_t \theta E_t \]
- Spreads reflect Credit Risk + Current + Future binding constraints
- Long-term debt \( \Rightarrow \) Pecuniary Externalities \( \Rightarrow \) Financial Accelerator
- Payoff per unit of deposits,

\[
Z^{\text{deposits}}_t = s^d_t + (1-s^d_t) \begin{cases} 
1 - F^d(u_t^*) + (1 - \lambda^d) \int_0^{u_t^*} u Z^\text{loans}_t \frac{B^b_{t-1}}{D_{t-1}} \, dF^d \\
\text{guaranteed} & \text{repaid} & \text{liquidated}
\end{cases}
\]
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

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

- Aggregate resource constraint,

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

Budget constraint,

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

Standard Surplus

Fiscal rule for taxes,

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

Net Cost from Discretionary Measures:

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

1. **Crises**

\[ \sigma^b_t = [\sigma^b_{t,\text{normal}}, \sigma^b_{t,\text{crisis}}]^T \quad \text{and} \quad P^\sigma = \begin{bmatrix} .995 & .005 \\ .15 & .85 \end{bmatrix} \]

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 = 0.45 )</td>
</tr>
<tr>
<td>Debt Maturity</td>
<td>PTI of 30%</td>
<td>( \gamma = 0.035 )</td>
</tr>
<tr>
<td>Max LTV Ratio</td>
<td>85%</td>
<td>( m = 0.0871 )</td>
</tr>
<tr>
<td>Debt/GDP</td>
<td>80%</td>
<td>( \xi = 0.0945 )</td>
</tr>
<tr>
<td>Ann. Delinquency Rate</td>
<td>2%</td>
<td>( \sigma^b_{t,\text{normal}} = 3.819 )</td>
</tr>
</tbody>
</table>

3. **Banks**

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

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<tr>
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</tr>
</thead>
<tbody>
<tr>
<td>Book Leverage</td>
<td>10</td>
<td>( \kappa = 0.1 )</td>
</tr>
<tr>
<td>Payout Rate</td>
<td>15%</td>
<td>( \theta = 0.90 )</td>
</tr>
<tr>
<td>Avg. Lending Spread</td>
<td>2%</td>
<td>( \varpi = 0.0120 )</td>
</tr>
<tr>
<td>CDS-Implied Def. Prob.</td>
<td>2% in recessions</td>
<td>( u = 0.91, \sigma^d = 1 )</td>
</tr>
</tbody>
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Smoothed Shocks

TFP

2000Q1  2008Q3  2015Q4

% Deviation from SS

Credit Risk Shock

2000Q1  2008Q3  2015Q4

% Deviation from SS