Fiscal Multipliers and Financial Crises

Miguel Faria-e-Castro
Federal Reserve Bank of St. Louis

49th Konstanz Seminar
Reichenau, May 2018

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. <u>How important</u> was the fiscal policy response?
2. <u>Which tools</u> 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

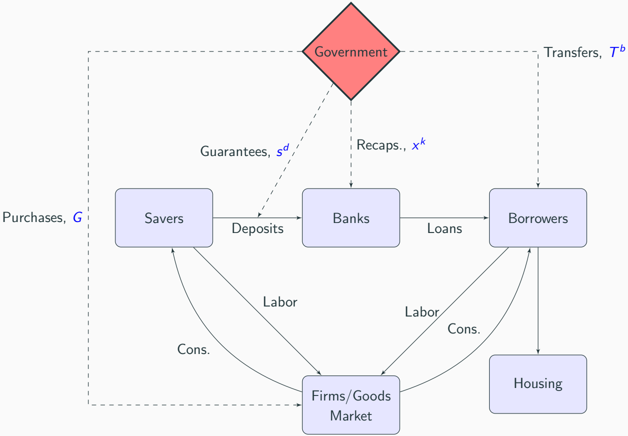
Model

Nominal Rigidities $\Longrightarrow$ Government purchases

Incomplete Markets $\Longrightarrow$ Transfers

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

Credit Risk & Default $\Longrightarrow$ Credit Guarantees



Model: Key Ingredients

Borrowers ▸ Detail

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

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

Banks ▸ Detail

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

$$\kappa Q_t^b B_t^b \leq V_t$$

▸ Government ▸ Rest of the Model

Impulse and Propagation

- Aggregate shocks:
  1. TFP A_t
  2. Financial shock σ_t

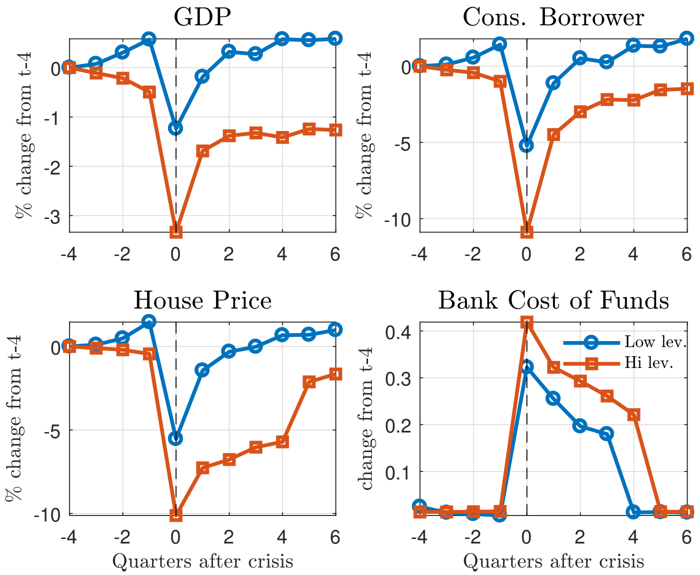
$$\text{Household Default Rate}_t = f(\overset{+}{\text{LTV}}_t, \overset{+}{\sigma}_t)$$

- 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

State Dependence: Financial Shock with Low Leverage

State Dependence: Financial Shock with High Leverage



Quantitative Exercise

1. Calibrate model to U.S. pre-crisis
   - Match moments on household and bank balance sheets ▸ Calibration
2. Use data to estimate sequences of structural shocks

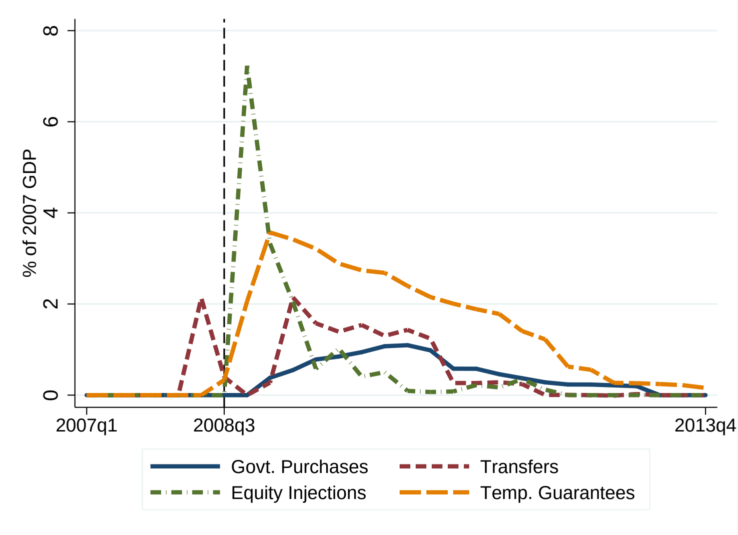
$$\{A_t, \sigma_t\}_{t=2000Q1}^{T=2015Q4}$$

   - $Y^T \equiv \text{Observed Macro Variables}^T = \{C_t, \text{spread}_t\}_t^T$
   - $\Omega^T \equiv \text{Observed Fiscal Policy Response}^T = \left\{G_t, T_t^b, x_t^k, s_t^d\right\}_t^T$
3. What $\left\{\hat{A}_t, \hat{\sigma}_t\right\}_t^T$ make the model match Y^T <u>given</u> Ω^T?
4. Use estimated $\left\{\hat{A}_t, \hat{\sigma}_t\right\}_t^T$ to study counterfactual paths for Ω^T

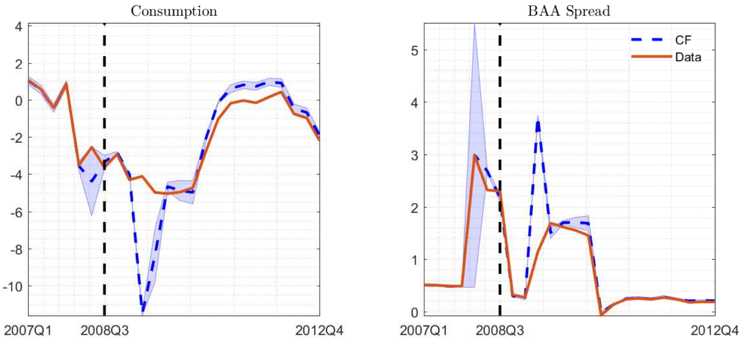
Fiscal Policy Data

- G_t: ARRA '09 contracts, Medicaid and Education spending
- T_t^b: 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_t^k: TARP '08 equity injection programs (CPP, CDCI, PPIP, AIG, BofA/Citi), auto bailout (AIFP, ASSP), GSE bailout (PSI)
- s_t^d: TARP '08 credit guarantees (TABSLF, BofA/Citi), TLGP '08 credit guarantees

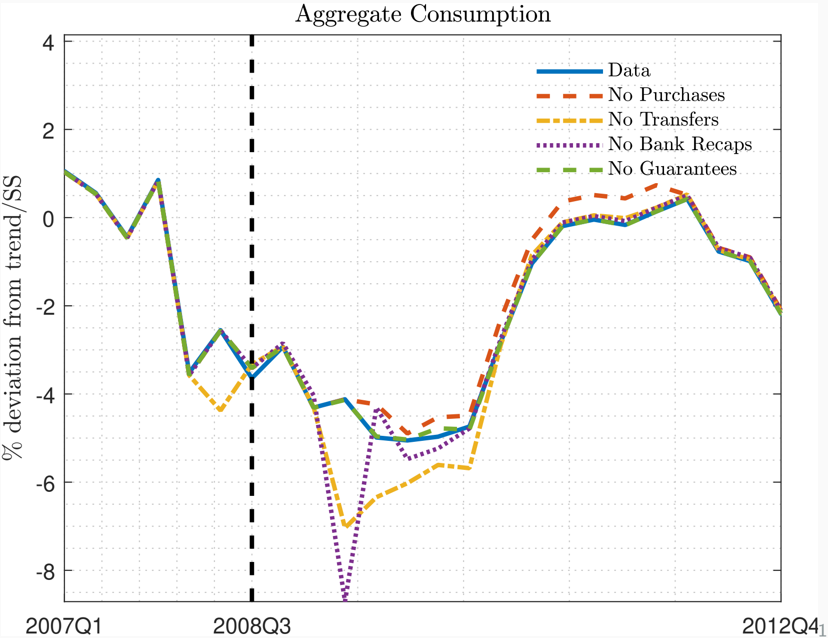
Fiscal Policy Response Data



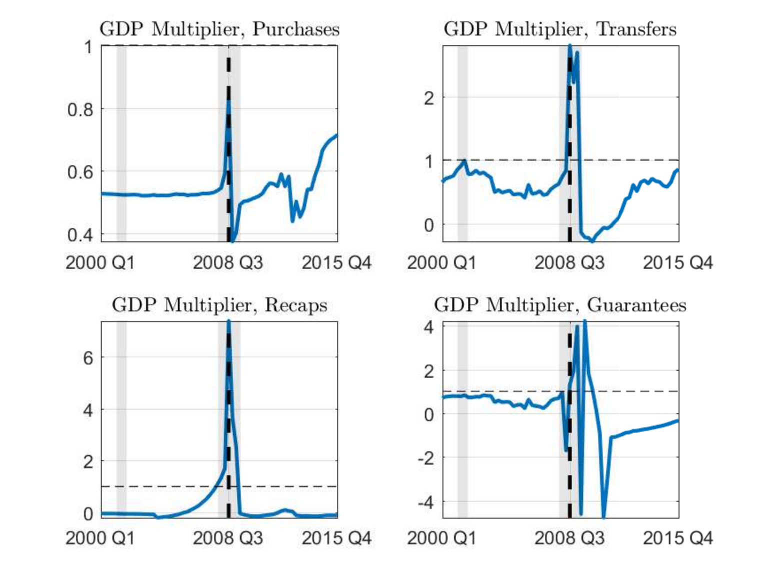
Main Counterfactual: No Fiscal Policy



Policy Decomposition



Time Series for Fiscal Multipliers



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 $\uparrow$ (only when borrowers are constrained)
   - Default rates fall, banks post fewer losses
   - Lending $\uparrow$, spreads $\downarrow$ (only when banks are constrained)
   - Disposable income $\uparrow$

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 <u>and</u> 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^b_{t-1}, coupon rate γ
- Family construct (Landvoigt, 2015)

1. Borrower enters period with states

$$h_{t-1}, B^b_{t-1}$$

2. Continuum of members $i \in [0,1]$, each with

$$h_{t-1}, B^b_{t-1}, \nu_t(i)$$

   where $\nu_t(i) \sim F^b_t \in [0, \infty)$

3. Each agent i has to move with prob. m, she can:
   3.1 Prepay if $B^b_{t-1} \leq \nu_t(i) p^h_t h_{t-1}$, sell house

   or

   3.2 Default, lose collateral

Back

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

$$c_t^b + \underbrace{\gamma \frac{B_{t-1}^b}{\Pi_t} \int (1-\mathrm{m}) + \mathrm{m}[1-\iota(\nu)] \mathrm{d}F_t^b(\nu)}_{\text{debt repayment}} + \underbrace{p_t h_t}_{\text{house purchase}} \leq$$

$$(1-\tau_t) w_t n_t^b + \underbrace{\mathrm{m} Q_t^b B_t^{b,\text{new}}}_{\text{new debt}} + \underbrace{p_t h_{t-1} \int (1-\mathrm{m})\nu + \mathrm{m}\nu[1-\iota(\nu)] \mathrm{d}F_t^b(\nu)}_{\text{sale of non-foreclosed houses}} + \underbrace{T_t^b}_{\text{Transfe}}$$

and borrowing constraint

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

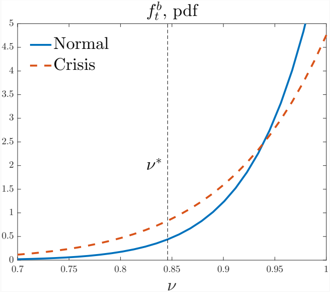
Back

Borrower Default

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

$$\nu_t^* = \frac{B_{t-1}^b}{\Pi_t p_t h_{t-1}} \simeq \text{Loan-to-Value}$$

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



Lenders earn (per unit of debt)

$$Z_t^{\text{loans}} = \underbrace{(1-\mathrm{m})[\gamma + (1-\gamma)Q_t^b]}_{\text{not moving}} + \mathrm{m}\left\{ \underbrace{1 - F_t^b(\nu_t^*)}_{\text{movers repay}} + \underbrace{\overbrace{(1-\lambda^b)}^{\text{Resource Cost}} \int_0^{\nu_t^*} \nu \frac{p_t h_{t-1}}{B_{t-1}^b / \Pi_t} \mathrm{d}F_t^b} \right\}$$

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 $e_{j,t}$

$$\underbrace{V_t^k(e_{j,t})}_{\text{current mkt value}} = \max_{b_{j,t},d_{j,t}} \left\{ \underbrace{(1-\theta)e_{j,t}}_{\text{dividend}} + \underbrace{\mathbb{E}_t\left[\Lambda^s_{t,t+1}\max\left\{0, V^k_{t+1}(e_{j,t+1})\right\}\right]}_{\text{ex-dividend value}} \right\}$$

subject to

$$\begin{aligned}
\text{flow of funds} : Q^b_t b_{j,t} &= \left[\theta e_{j,t}(1+x^k_t) - \text{Govt Payments}_t\right] + Q^d_t d_{j,t} \\
\text{capital req.} : \kappa Q^b_t b_{j,t} &\leq \mathbb{E}_t\left[\Lambda^s_{t,t+1}\max\left\{0, V^k_{t+1}(e_{j,t+1})\right\}\right] \\
\text{LoM earnings} : e_{j,t+1} &= (u_{j,t+1}Z^{\text{loans}}_{t+1}b_{j,t} - d_{j,t})/\Pi_{t+1}
\end{aligned}$$

Back

Financial Intermediaries

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

$$Z_t^{\text{deposits}} = \underbrace{s_t^d}_{\text{guaranteed}} + (1-s_t^d) \left\{ \underbrace{1 - F^d(u_t^*)}_{\text{repaid}} + \underbrace{(1-\lambda^d) \int_0^{u_t^*} u \frac{Z_t^{\text{loans}} B^b_{t-1}}{D_{t-1}} \mathrm{d}F^d}_{\text{liquidated}} \right\}$$

Back

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,

$$C_t + G_t + \text{DWL Default}_t = \underbrace{A_t N_t}_{=Y_t} \underbrace{[1 - d(\Pi_t)]}_{\text{Menu Costs}}$$

Back

Fiscal Authority

Budget constraint,

$$\underbrace{\tau_t Y_t + Q_t B_t^g - \bar{G} - \frac{B_{t-1}^g}{\Pi_t}}_{\text{Standard Surplus}} = \text{Net Cost from Discretionary Measures}_t$$

Fiscal rule for taxes,

$$\tau_t = \bar{\tau}\left(\frac{B_{t-1}^g}{\bar{B}^g}\right)^{\phi_\tau}$$

Net Cost from Discretionary Measures:

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

▸ Back

Calibration

1. *Crises*

$$\sigma_t^b = [\sigma_t^{b,\text{normal}}, \sigma_t^{b,\text{crisis}}]^T \qquad \text{and} \qquad \mathbf{P}^\sigma = \begin{bmatrix} .995 & .005 \\ .15 & .85 \end{bmatrix}$$

2. *Households*

Target	Target	Parameter
Fraction Borrowers	Parker et al. (2013)	$\chi = 0.45$
Debt Maturity	PTI of 30%	$\gamma = 0.035$
Max LTV Ratio	85%	$\underline{m} = 0.0871$
Debt/GDP	80%	$\xi = 0.0945$
Ann. Delinquency Rate	2%	$\sigma^{b,\text{normal}} = 3.819$

3. *Banks*

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

Target	Target	Parameter
Book Leverage	10	$\kappa = 0.1$
Payout Rate	15%	$\theta = 0.90$
Avg. Lending Spread	2%	$\varpi = 0.0120$
CDS-Implied Def. Prob.	2% in recessions	$\underline{u} = 0.91, \sigma^d = 1$

Smoothed Shocks