Fiscal Multipliers in Recessions

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Overview

- Popular policy prescription: Fiscal expansion during recessions as a means of stimulating economic activity
- Example: The recent Great Recession
Overview

- Are fiscal multipliers large? (> 1)
- Does their size depend on the state of the economy? (state dependent)
Empirical Evidence
Problems with the identification of fiscal shocks
In favor of large, state dependent multipliers

- Auerbach and Gorodnichenko [2012]
  1. Regime switching SVAR’s
  2. Multipliers: $< 1$ during expansions and $>> 1$ during recessions

- Bachmann and Sims [2012]: Similar results

- Riera-Crichton, Vegh and Vuletin [2014]
  1. Condition on both the state of the business cycle and the sign/size of the fiscal intervention
  2. Fiscal expansions in recessions are much more expansionary than fiscal expansions in booms

- Nakamura and Steinsson [2014]
  1. REGIONAL fiscal multipliers
  2. The effects of government spending are substantial but also much higher during periods of high slackness (high unemployment) in comparison to other times
Empirical Evidence Cont’ed
No such properties

- Ramey and Zubairy [2012]
  1. Longer time sample and a news based identification scheme
  2. Small multipliers, absence of any state dependence

- Brückner and Tuladhar [2011]
  1. Japanese REGIONAL data
  2. Small multipliers, absence of any state dependence
The empirical literature seems unsettled and is still evolving.

It needs theoretical guidance in its search for state dependence.

Valuable to explore if and how standard models can produce such effects.
Overview: Theory

**Theory**

Standard models (RBS and NK) have difficulty producing large, state dependent multipliers

- **Large multipliers:**
  1. Deep habit models, Ravn et al [2012]

- **Large and state dependent**
  1. Zero lower bound models, Eggertsson [2010] and Christiano et al. [2011]
  2. Results questioned by Cogan at al [2010], Erceg and Linde [2010], Bachmann, Berg and Sims [2014], Dupor and Li [2014]
Our contribution: Produce, large, cyclically variable multipliers in a model with financial frictions

Add countercyclical variation in bank intermediation costs to the banking model of Curdia and Woodford [2009, 2010]

This makes the spread between the bank deposit rate and the bank loan rate fluctuate countercyclically

It creates a financial accelerator that is stronger in recessions than in expansions
The mechanism

- The onset of a recession exacerbates the financial friction, inhibiting borrowing
- A fiscal stimulus expands output and decreases the spread
- This in turn encourages more borrowing and spending
- This further expands the economy and decreases the spread again, encouraging more borrowing
- The process repeats itself
- The same accelerator is present in an expansion; however, during good times, the spread is lower to begin with, and the accelerator is correspondingly weaker
The model relies on Curdia and Woodford

Two types of agents: High (impatient, $b$) and low (patient, $s$) marginal utility

Type changes randomly over time

The patient save while the impatient borrow

Presence of a financial friction $\implies$ Spread between the saving and the borrowing rate

Ricardian equivalence does not hold $\implies$ Public debt matters

The rest of the model is standard: Monopolistic competition + calvo prices + Taylor rule.
Households

- Details regarding household types
- 2 classes of agents, $\tau = \{b, s\}$ of size $\pi_b$ (resp. $\pi_s$)
- Evolution of household type

![Diagram of household types]

$\delta$

$1 - \delta$

$\pi_b$

$\pi_s$
Households

- Household $i$’s preferences:

$$
\mathbb{E}_t \sum_{s=0}^{\infty} \beta^s \left[ u^{\tau_t+s(i)}(c^{\tau_t+s(i)}(i); \xi_{t+s}) - \int_0^1 v(h^{\tau_t+s(i)}(j); \xi_{t+s}) \, dj \right]
$$

where $\tau_t(i) \in \{b, s\}$ indicates household type in period $t$.

- A critical assumption: marginal utility of consumption of type $b$ agents is larger than that of type $s$ agents for any consumption level

$$
u^b_c(c, \xi) > \nu^s_c(c, \xi)
$$

- Agents $b$ are relatively impatient.
Households can deposit funds at /borrow from financial intermediaries.

- Deposits pay a nominal interest rate, $i^d_{t-1}$
- Loans pay an interest rate $i^b_{t-1}$ ($i^b > i^d$)

Type switching $\implies$ Infinite ♡ histories

Assumption: When selected to redraw a type, agents visit an insurance agency which wipes out debts and distributes assets equally. Departing agents of the same type are identical.

Distribution of types does not matter: Simplifies aggregation
Firms: Standard New Keynesian Setting

- Final good: \( y_t = \left( \int_0^1 y_t(j)^{\theta-1} \, dj \right)^{\frac{\theta}{\theta-1}} \)
- Intermediate goods: \( y_t(j) = x_t h_t(j)^{\frac{1}{\varphi}} \) with \( \varphi \geq 1 \)
- Calvo price setting
Banks

- Collect deposits, $d_t$, make loans, $b_t$, to the households
- When making loans, $b_t$, banks face a resource cost, $C(b_t, \tilde{y}_t)$ where
  \[
  \tilde{y}_t = \frac{y_t - y^*}{y^*}
  \]
- $C_b(\cdot, \cdot) > 0$, $C_{bb}(\cdot, \cdot) > 0$
- $C_{\tilde{y}}(\cdot, \cdot) < 0$: Intermediation costs are higher in recessions
- Mishkin, 2001: Cyclicality of firm net worth, of household liquidity etc. induces countercyclical variation in moral hazard and adverse selection problems.
- Gromb and Vayanos, 2011: When the wealth of financial intermediaries decreases, intermediation becomes less effective (more costly) because of margin constraints. Spreads increase.
Banks select amount of loans that maximizes

\[ D^I_t = P_t(d_t - b_t - C(b_t, \tilde{y}_t)) \]

The revenues from lending, \((1 + i^b_t)b_t\), have to finance the payments on deposits, \((1 + i^d_t)d_t\)

\[ (1 + i^d_t)d_t = (1 + i^b_t)b_t \]

Define \(\omega_t\) as the spread: \(1 + i^b_t = (1 + \omega_t)(1 + i^d_t)\)

Profits

\[ \omega_t b_t - C(b_t, \tilde{y}_t) \]

The spread satisfies

\[ \omega_t = C_b(b_t, \tilde{y}_t) \]
The government

- Government spending follows an exogenous, AR(1) process
- With "active" fiscal policy, govt spending responds by 1%
- Increases in government spending are initially bond financed, but lump sum taxes increase over time to stabilize public debt
- Monetary policy follows a standard interest rate rule
The key equation in the model

\[ i_b^t - i_d^t = \xi_{\psi,t} \eta b_t^{\eta-1} \exp(-\alpha \tilde{y}_t) \]  

(1)

The key parameter in the model: \( \alpha = 0.23 \).

CALIBRATION

- Set it so the model can reproduce cyclicality in spreads, a corporate bond rate –AAA or BAA– minus a money market rate – federal funds rate or Treasury bill rate

- Generate initial expansion (recession) of 1.16% (average deviation from HP-trend) by some shock. Solve model for \( b \). Search for \( \alpha \) that produces a spread of 1.65% for expansions and 2.8% for recessions (the average, corresponding AAA – TBR spreads over 1960-2008)
Estimation

\[ \hat{\omega}_t = \theta_b \hat{b}_t - \theta_y \hat{y}_t + u_t \]

- Output is measured by real GDP. The output gap uses HP–filtered output.
- Loans correspond to total loans at commercial banks.
- Spread equation estimated using a variety of instruments for the output gap: real price of oil, fiscal variables (the growth rate in defense spending, the Ramey estimate of exogenous changes in government spending and the Forni and Gambetti measure of fiscal news shocks), etc.
- The elasticities are

\[ \eta - 1 = \theta_b \quad (2) \]
\[ \alpha = \theta_y \quad (3) \]
<table>
<thead>
<tr>
<th></th>
<th>AAA-FFR</th>
<th>BAA-FFR</th>
<th>AAA-TBILL</th>
<th>BAA-TBILL</th>
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<tbody>
<tr>
<td></td>
<td>(I)</td>
<td>(II)</td>
<td>(I)</td>
<td>(II)</td>
</tr>
<tr>
<td>$\eta$</td>
<td>0.01</td>
<td>1.45</td>
<td>1.01</td>
<td>2.06</td>
</tr>
<tr>
<td></td>
<td>(0.69)</td>
<td>(0.58)</td>
<td>(0.56)</td>
<td>(0.49)</td>
</tr>
<tr>
<td>$\alpha$</td>
<td>32.88</td>
<td>28.69</td>
<td>25.05</td>
<td>23.23</td>
</tr>
<tr>
<td></td>
<td>(4.47)</td>
<td>(3.72)</td>
<td>(3.59)</td>
<td>(3.13)</td>
</tr>
</tbody>
</table>

Table: IV Regressions of the spread
Empirical evidence that fiscal policy has a disproportionate effect on spreads during recessions?

Empirical evidence that size of multipliers varies with credit markets "tightness"

Ferraresi et al [2014]: TVARS. Multipliers are large when spreads are large
Figure: Spreads and Government Expenditure

Note: Dark points expansions; light points mark contractions (HP filter)
We also test for significance of differences in fiscal multipliers in the two credit regimes employing the bootstrap distribution obtained from the simulated impulse response functions. More precisely, we test the null hypothesis that the multipliers in the ‘ordinary’ credit regime are higher than or equal to those computed within the ‘tight’ regime resorting to standard t-tests.

The multipliers associated with the TV AR model for the period 1984–2010 reveal strong differences in the effects of fiscal policies under the two credit regimes. In periods when the BAA spread is accelerating, the multipliers are at least more than two times bigger than those associated with the ‘peaceful’ corporate bond market regime. More precisely, in the ‘tight’ credit regime, fiscal policies appear to have strong effects on output dynamics: the impact multiplier is 2.26, rising to 4.16 after five quarters. Conversely, in the ‘normal’ credit regime, only the impact multipliers are not lower than one. Note that according to the performed t-tests, the multipliers resulting from the two credit regimes are always significantly different between them.
Multiplier:

\[
M_h^z(\xi_x) = \frac{\sum_{i=0}^{h} (z_{t+i}(\xi_x, g) - z_{t+i}(\xi_x))}{\sum_{i=0}^{h} (g_{t+i} - g^*)}
\]
The main result

Figure: Output Multipliers (Benchmark Experiment)
The key channel: No crowding out of \( C \)

**Figure :** Consumption Multipliers (Benchmark Experiment)

- **Cumulative Multiplier (Borrowers' consumption)**
- **Cumulative Multiplier (Savers' consumption)**
- **Cumulative Multiplier (Aggregate Consumption)**

- **Boom, Average, Recession**
Sensitivity of multipliers to

- The source of the business cycle
- The cyclicality of financial intermediation costs
  1. Replacing the output gap with an employment gap or a profits gap
  2. Other measures of the output gap: Flexible, efficient
  3. CRITICAL: Output gap must be sensitive to fiscal policy
- Debt vs tax finance of government spending. Former gives stronger output effects
- The size of the fiscal shock
- Amplitude of the business cycle
Sensitivity of multipliers to

- The conduct of monetary policy (strictness of inflation targeting)
  - More aggressive reaction of policy to inflation lowers the size of the multiplier
- The measure of the output gap in the monetary policy equation. It matters for the effectiveness of fiscal policy
  - More counter-cyclically variable gaps increase the size of the multiplier
- The degree of price rigidity: A non-monotone relationship
- The size of the steady state spread
Conclusions

- Cyclicality in financial frictions induces state dependence on fiscal multipliers
- Multipliers during recessions can significantly exceed unity
- Nominal aspects (monetary policy reactions, price rigidity) matter much for the effectiveness of fiscal policy (size of multiplier)
Figure: Output Multipliers (Balanced Budget)

- **Boom**, **Average**, **Recession**
Figure: Output Multipliers: Size of Fiscal Shock

[Graph showing output multipliers for fiscal stimuli in different time periods: 1 quarter and 1 year. The graph indicates the multiplier values under boom and recession conditions.]
Figure: Multipliers and Monetary Policy ($\kappa_\pi$)

Reaction to Inflation ($\kappa_\pi$ with $\kappa_y = 0$)

- __Boom__, __Recession__
Figure: Multipliers: Degree of Nominal Rigidity

- **Multiplier (1 Quarter)**
  - Nominal Rigidity 0.2 0.4 0.6 0.8 1
  - Multipliers: 0.5, 1, 1.5, 2, 2.5

- **Multiplier (1 Year)**
  - Nominal Rigidity 0.2 0.4 0.6 0.8 1
  - Multipliers: 0.5, 0.6, 0.7, 0.8, 0.9, 1

-- **Boom**
-- **Recession**
Figure: Multipliers: Size of Premium ($\omega^*$)

<table>
<thead>
<tr>
<th>Multiplier (1 Quarter)</th>
<th>Multiplier (1 Year)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Annualized Premium (in percent)</td>
<td></td>
</tr>
<tr>
<td>1.6</td>
<td>0.6</td>
</tr>
<tr>
<td>1.8</td>
<td>0.7</td>
</tr>
<tr>
<td>2.0</td>
<td>0.8</td>
</tr>
<tr>
<td>2.2</td>
<td>0.9</td>
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Boom, Recession
### Table: Parameters

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Value</th>
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</thead>
<tbody>
<tr>
<td><strong>Household</strong></td>
<td></td>
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<tr>
<td>Discount Factor</td>
<td>$\beta$ 0.9874</td>
</tr>
<tr>
<td>Intertemporal Elasticity (Borrowers)</td>
<td>$\sigma_b$ 12.2209</td>
</tr>
<tr>
<td>Intertemporal Elasticity (Savers)</td>
<td>$\sigma_s$ 2.4442</td>
</tr>
<tr>
<td>Inverse Frisch Labor Elasticity</td>
<td>$\nu$ 0.1048</td>
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<tr>
<td>Disutility of Labor Parameter (Borrowers)</td>
<td>$\psi_b$ 1.1492</td>
</tr>
<tr>
<td>Disutility of Labor Parameter (Savers)</td>
<td>$\psi_s$ 0.9439</td>
</tr>
<tr>
<td>Probability of Drawing Borrowers type</td>
<td>$\pi_b$ 0.5000</td>
</tr>
<tr>
<td>Probability of Keeping Type</td>
<td>$\delta$ 0.9750</td>
</tr>
<tr>
<td>Debt Share</td>
<td>$b^<em>/y^</em>$ 4 $\times$ 0.8</td>
</tr>
<tr>
<td>Preference Shock (Average, Borrowers)</td>
<td>$\log(\xi_b^*)$ 8.0133</td>
</tr>
<tr>
<td>Preference Shock (Average, Savers)</td>
<td>$\log(\xi_s^*)$ 0.8123</td>
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<tr>
<td><strong>Production</strong></td>
<td></td>
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<tr>
<td>Elasticity of Substitution between Goods</td>
<td>$\theta$ 7.6667</td>
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<tr>
<td>Inverse Labor Elasticity</td>
<td>$1/\varphi$ 0.7500</td>
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<td><strong>Financial Costs</strong></td>
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<td>Elasticity of Loans</td>
<td>$\eta$ 5.000</td>
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<td>Output Gap (deviation from SS) Elasticity</td>
<td>$\alpha$ 23.0000</td>
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<tr>
<td>Constant</td>
<td>$\xi_\psi$ 1.2720e-06</td>
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<tr>
<td><strong>Nominal Aspects</strong></td>
<td></td>
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<tr>
<td>Annual Premium (Gross)</td>
<td>$(1 + \omega)^4$ 1.0200</td>
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<td>Degree of Nominal Rigidities</td>
<td>$\gamma$ 0.6667</td>
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<tr>
<td>Persistence (Taylor Rule)</td>
<td>$\rho_i$ 0.8000</td>
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<tr>
<td>Reaction to Inflation (Taylor Rule)</td>
<td>$\kappa_\pi$ 1.5000</td>
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<tr>
<td>Reaction to Output Gap –deviation from SS– (Taylor Rule)</td>
<td>$\kappa_y$ 0.0500</td>
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<td><strong>Shocks</strong></td>
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<td>Government Shock (Persistence)</td>
<td>$\rho_g$ 0.9700</td>
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<td>Government Share</td>
<td>$g^<em>/y^</em>$ 0.2000</td>
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<td>Persistence (Other shocks: $x$)</td>
<td>$\rho_x$ 0.9500</td>
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<td>Debt feedback</td>
<td>$\varrho$ 0.0200</td>
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