Fiscal Multipliers in Recessions

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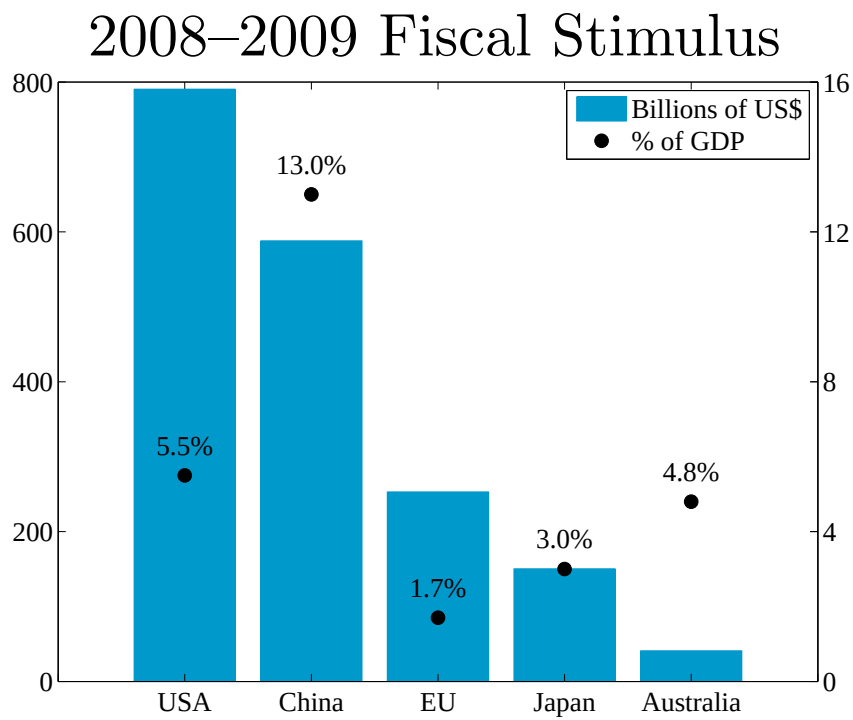
Motivation

Policy Practice

- Standard policy practice: Fiscal expansions during recessions as a means of stimulating economic activity.
- Example: The recent Great Recession.



Motivation

Standard Theory

- Standard business cycle models do not support such practices.
  - An increase in government spending raises households' future tax burden.
  - Negative wealth effect: Private savings increase, private consumption decreases, curtailing the expansion of aggregate demand.

  $\Longrightarrow$ Output fiscal multipliers are small, at best making it to around unity.
- The models do not imply asymmetric effects over the business cycle: Fiscal policy is **ineffective** even during very **severe downturns**.
- The criticism levelled at the Obama administration's stimulus plan had a sound theoretical basis.

Theory cont'ed

- Large body of research on "non-Ricardian equivalence" aiming at "killing" the negative wealth effect and producing large multipliers.
- Prominent examples:
  1. Financial frictions
  2. Finite lifetimes with no bequest motives
  3. Confusion about shocks (Canzoneri et al., 2008).

  None has succeeded in producing sufficiently large multipliers.

Motivation

Empirical evidence

- Until recently, the existing empirical evidence aligned with standard theory
- Estimated fiscal multipliers were small, often negative. At best around unity
- In light of theory and evidence, policy practices are puzzling!

Diversion: The empirical difficulty of estimating multipliers

Motivation

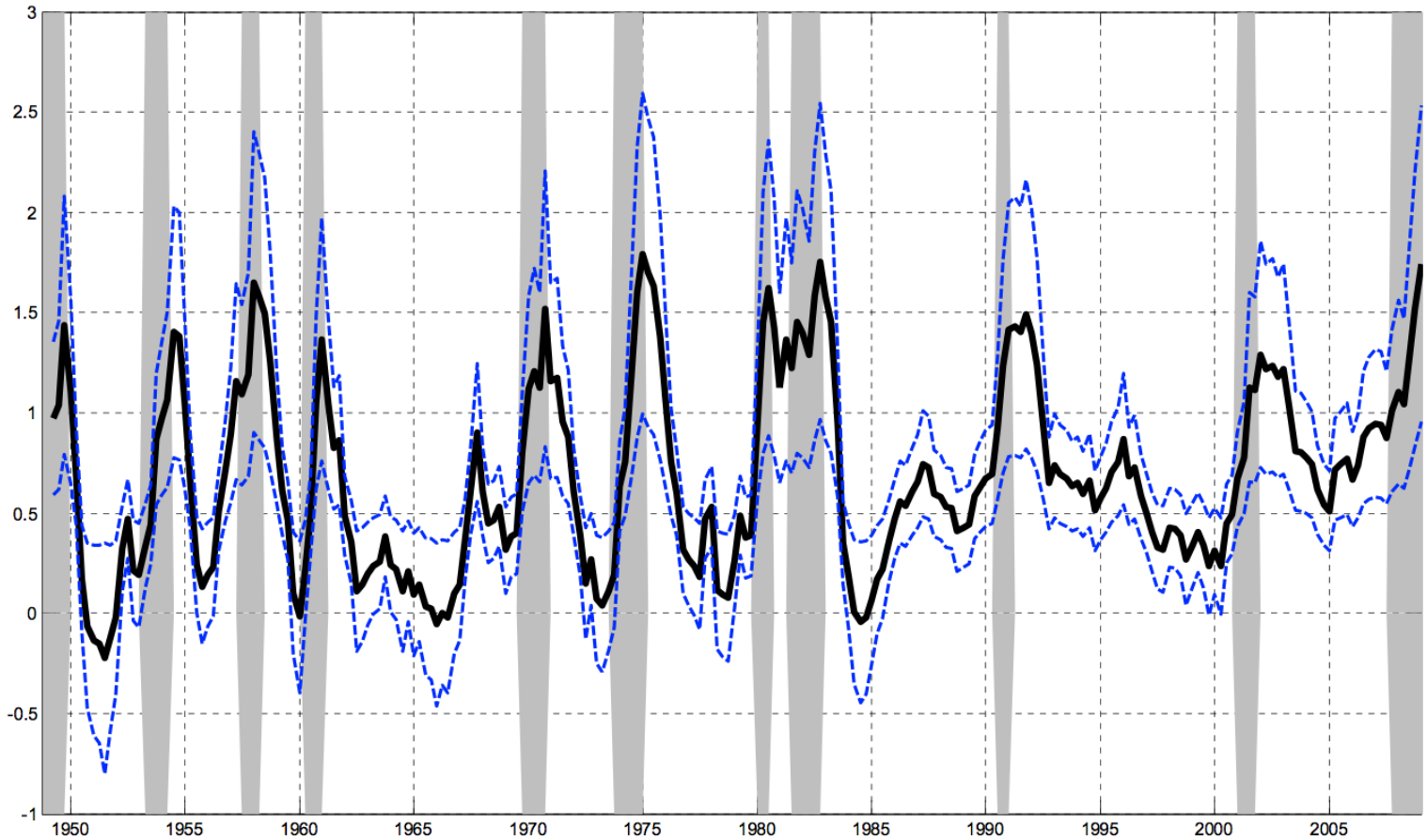
More recent empirical evidence

- Multipliers seem to be quite large in recessions: $\mu_g^R > 2$
- and low in expansions: $\mu_g^E < 1$
  Auerbach and Gorodnichenko (2010, 2011)

$\Longrightarrow$ The data seem to be kind to Keynes and the widely followed fiscal policy practices during recessions.

- In light of this evidence and the policy practices it is theory that is puzzling!

Empirical Evidence



Source: Auerbach and Gorodnichenko (2010)

Empirical Evidence

Total Spending

	$\max\{y_h\}$	
	Value	Std. dev.
Linear	1.00	0.32
Expansion	0.57	0.12
Recession	2.48	0.28

Source: Auerbach and Gorodnichenko (2010)

Empirical Evidence

	$\max\{y_h\}$	
	Value	Std. dev.
Defense spending		
Linear	1.16	0.52
Expansion	0.80	0.22
Recession	3.56	0.74
Consumption spending		
Linear	1.21	0.27
Expansion	0.17	0.13
Recession	2.11	0.54
Investment spending		
Linear	2.12	0.68
Expansion	3.02	0.25
Recession	2.85	0.36

Source: Auerbach and Gorodnichenko (2010)

A Challenge for Standard models

Low multipliers

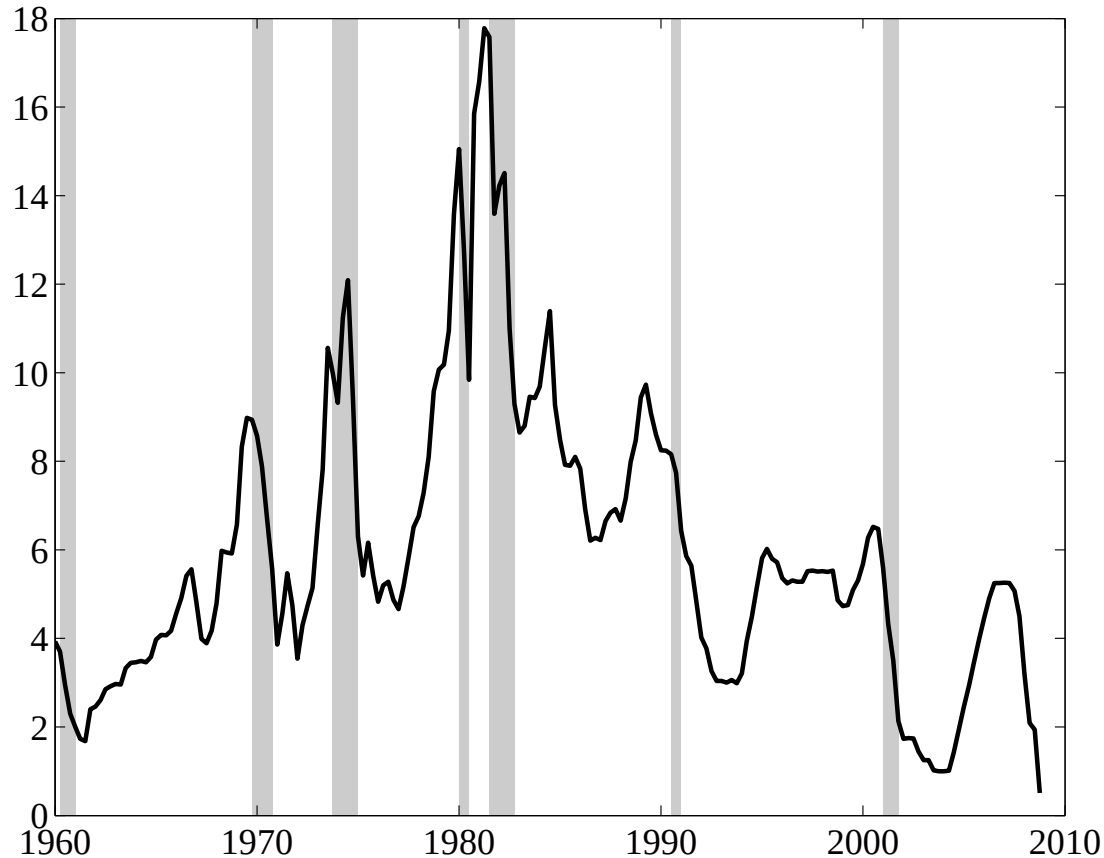
- These empirical results are also problematic for New-Keynesian models.
- Cogan et al. [2010] compute multipliers in the Smets Wouters [2007] model.
- Independent of
  1. The experiment (transitory, permanent, Obama fiscal stimulus . . .)
  2. The specification (zero bound, rule of thumb consumers,. . .)

  the maximum multiplier is about 1.
- Consumption and investment multipliers are negative.

A Challenge for Standard models

No asymmetries over the business cycle

- Cogan et al. [2010] investigate the size of multipliers in recession
- Use a 6.5% output gap + endogenous zero–bound
- No effect on output multipliers; if anything, slightly smaller
- Zero–bound (Christiano, Eichenbaum, Rebelo, 2009): Multiplier $\gg 1$ when $R \sim 0$
- Ercerg–Lindé, 2010: Not so clear. Depends very much on the particular details of the model
- Furthermore, no evidence for $R = 0$


18
16
14
12
10
8
6
4
2
0
1960
1970
1980
1990
2000
2010

- **What** do we do in this paper?
- Construct a model that can generate:
  1. Cyclically asymmetric fiscal multipliers
  2. Large multipliers (greater than unity) during recessions and small (less than unity) during expansions
- **How**: Use a model with financial frictions (based on Curdia and Woodford), that are more severe during recessions.

Intuition

- During a recession, financial frictions worsen.
- An increase in government expenditures ameliorates the business cycle and mitigates these frictions.
- Crates a positive wealth effect for "credit constrained" households and for aggregate economy.
- Can generate a large multiplier.
- Negative wealth effects dominate in booms making multipliers small.
- This scenario is robust to a number of variations in the model.

Roadmap

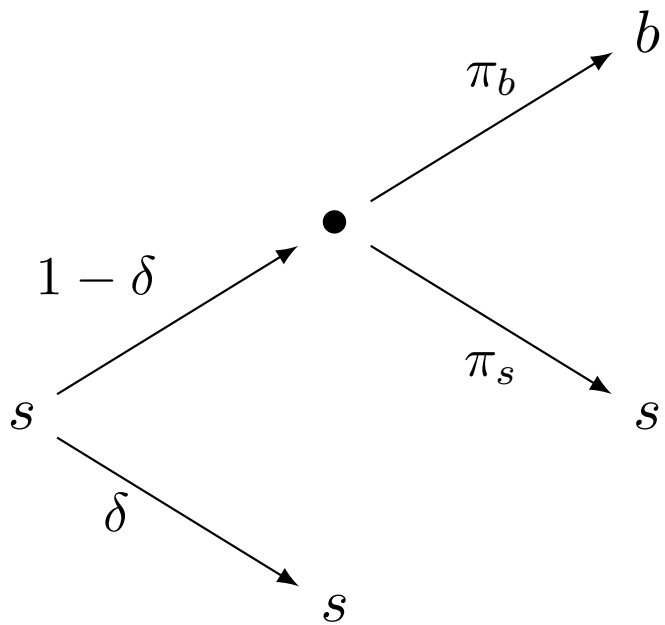
1. The Model: An extension of Curdia and Woodford
2. Calibration: Financial frictions
3. Main results: Large multipliers + Asymmetries
4. Robustness Analysis

A Model with Financial Frictions

- 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 $\Longrightarrow$ Spread between the saving and the borrowing rate.
- Ricardian equivalence does not hold $\Longrightarrow$ 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 π_b (resp. π_s)
- Evolution of household type



Households

- Household i's preferences:

$$\mathbb{E}_t \sum_{s=0}^{\infty} \beta^s \left[u^{\tau_{t+s}(i)}(c_{t+s}^{\tau_{t+s}(i)}(i); \xi_{t+s}) - \int_0^1 v(h_{t+s}^{\tau_{t+s}(i)}(j); \xi_{t+s}) \mathrm{d}j \right]$$

  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

$$u_c^b(c, \xi) > u_c^s(c, \xi)$$

- 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 $\Longrightarrow$ Infinite $\sharp$ 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: $y_t = \left(\int_0^1 y_t(j)^{\frac{\theta-1}{\theta}} \mathrm{d}j \right)^{\frac{\theta}{\theta-1}}$
- Intermediate goods: $y_t(j) = x_t h_t(j)^{\frac{1}{\varphi}}$ with $\varphi \geqslant 1$
- 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, $C(b_t, \widetilde{y}_t)$ where

$$\widetilde{y}_t = \frac{y_t - y^\star}{y^\star}$$

- $C_b(\cdot,\cdot) > 0$, $C_{bb}(\cdot,\cdot) > 0$
- $C_{\widetilde{y}}(\cdot,\cdot) < 0$: 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

$$D_t^{\mathrm{I}} = P_t(d_t - b_t - C(b_t, \widetilde{y}_t))$$

- The revenues from lending, $(1 + i_t^b)b_t$, have to finance the payments on deposits, $(1 + i_t^d)d_t$

$$(1 + i_t^d)d_t = (1 + i_t^b)b_t$$

- Define ω_t as the spread: $1 + i_t^b = (1 + \omega_t)(1 + i_t^d)$
- Profits

$$\omega_t b_t - C(b_t, \widetilde{y}_t)$$

- The spread satisfies

$$\omega_t = C_b(b_t, \widetilde{y}_t)$$

Calibration

- Use values (and functional forms) from Curdia and Woodford

▸ Parameters

- Differences from Curdia and Woodford
  1. Allow for endogenous debt: Requires lump sum transfers that stabilize debt: $T_t = -\varrho(b_t^g - b^{g\star})$ ($\varrho = 0.02$).
  2. Extend the form of the financial cost

$$C(b_t, \widetilde{y}_t; \xi_{\varphi,t}) = \exp(\xi_{\varphi,t}) b_t^{\eta} \exp(-\alpha \widetilde{y}_t)$$

where $\widetilde{y}_t \equiv (y_t - y^\star)/y^\star$

Calibration

- Use results from regressions:

$$\widehat{\omega}_t = cst + (\theta_b - 1)\widehat{b}_t - \theta_y \widehat{y}_t + \sum_{i=1}^{\ell} \gamma_i \widehat{\omega}_{t-i}$$

  where $\widehat{x}_t = (x_t - x^\star)/x^\star$.
- Output and total loans are linearly detrended.
- Long–run elasticities are obtained as

$$\eta_x = \frac{\theta_x}{1 - \sum_{i=1}^{\ell} \gamma_i}$$

Calibration

1960Q1–2008Q4	AAA–FFR	BAA–FFR	AAA–TBILL	BAA-TBILL
η	5.60	7.23	6.46	7.88
	(4.94)	(3.79)	(3.99)	(3.56)
α	37.45	30.90	24.39	23.11
	(15.29)	(11.33)	(11.81)	(9.82)
Lags	2	2	4	4
$\overline{R}^2$	0.82	0.83	0.85	0.86
D.W.	1.95	1.90	1.96	1.89
1982Q3–2008Q4	AAA–FFR	BAA–FFR	AAA–TBILL	BAA-TBILL
η	3.86	6.77	4.34	6.25
	(3.20)	(4.30)	(3.16)	(3.31)
α	24.90	27.99	18.15	21.21
	(12.08)	(13.19)	(9.40)	(9.67)
Lags	2	2	2	2
$\overline{R}^2$	0.89	0.89	0.89	0.89
D.W.	2.08	1.96	2.17	1.898

Calibration

- Set the mean of ξ_φ s.t. annual premium is 2%
- Set $\eta = 6.5$ and $\alpha = 23$:

Amplitude	Recession	Expansion
1.0%	2.6%	1.5%
2.5%	3.8%	0.9%

Cumulative Multipliers

- $\mu_h^z(x)$: Cumulative multiplier of z at horizon h after a shock to x

$$\mu_h^z(x) = \frac{\sum_{i=0}^{h}(z_{t+i}(x,g) - z_{t+i}(x))}{\sum_{i=0}^{h}(g_{t+i} - g^\star)}$$

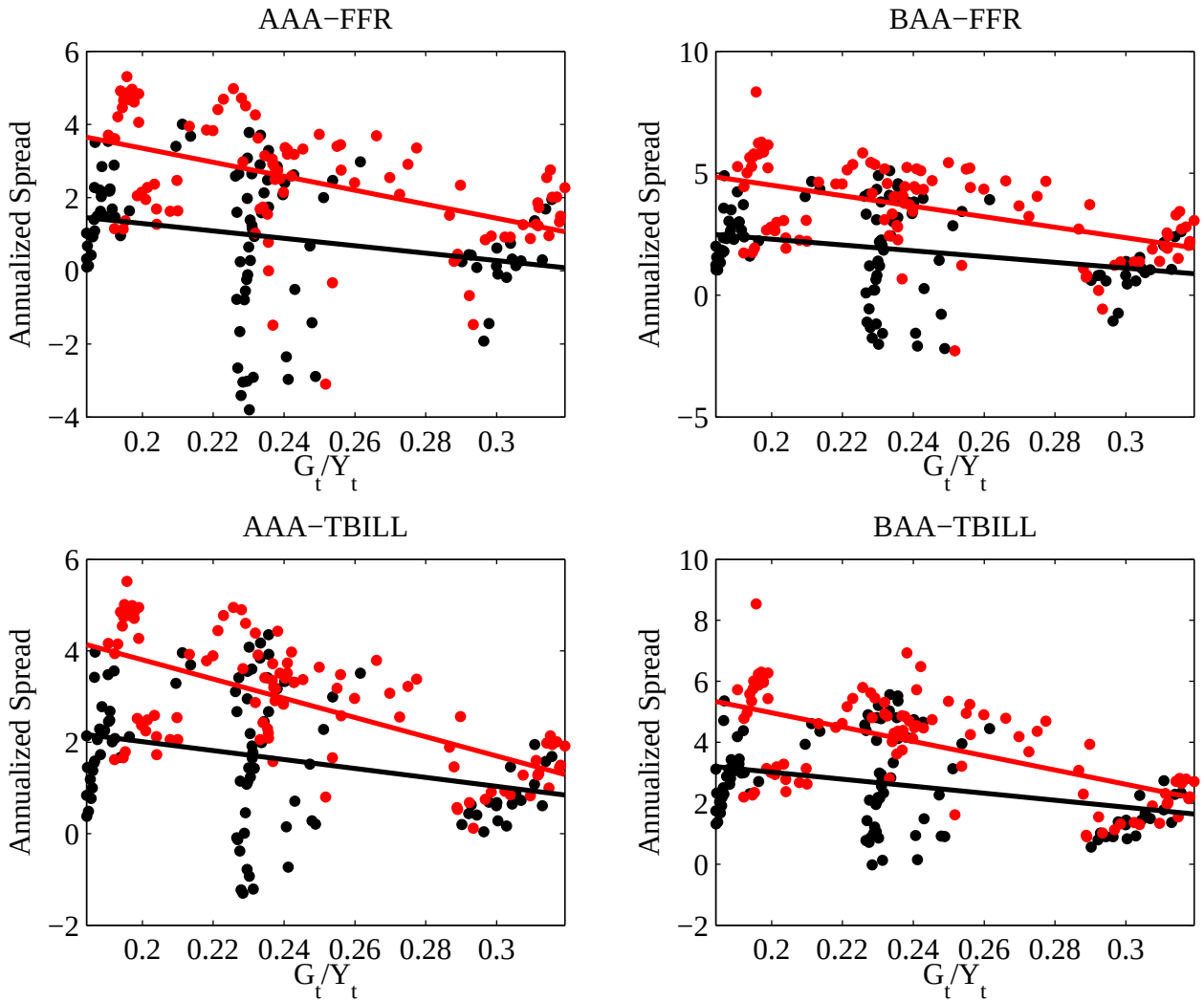
Typical Experiment

- Positive (negative) shock to the financial cost
  - Makes bank lending more (less) costly
  - Increases (decreases) the premium ($r_t^b \gg r_t^d$)
  - Triggers a recession (expansion)
- Size of the shock set s.t. 2.5% recession (expansion)
- Then 1% positive shock on government expenditures
- Preserve non–linearities in the model (Non–linear solution method)

Output Multipliers: Mechanism

- An increase in G has a negative wealth effect
- Agents increase hours worked
- Higher output decreases the spread
- Lower spread has a positive wealth effect on the borrower
- If the total wealth effect on the borrower is positive and it exceeds the negative wealth effect on the saver, aggregate consumption increases
- Multiplier exceeds unity

FIGURE: Spread–Government Expenditures Correlation

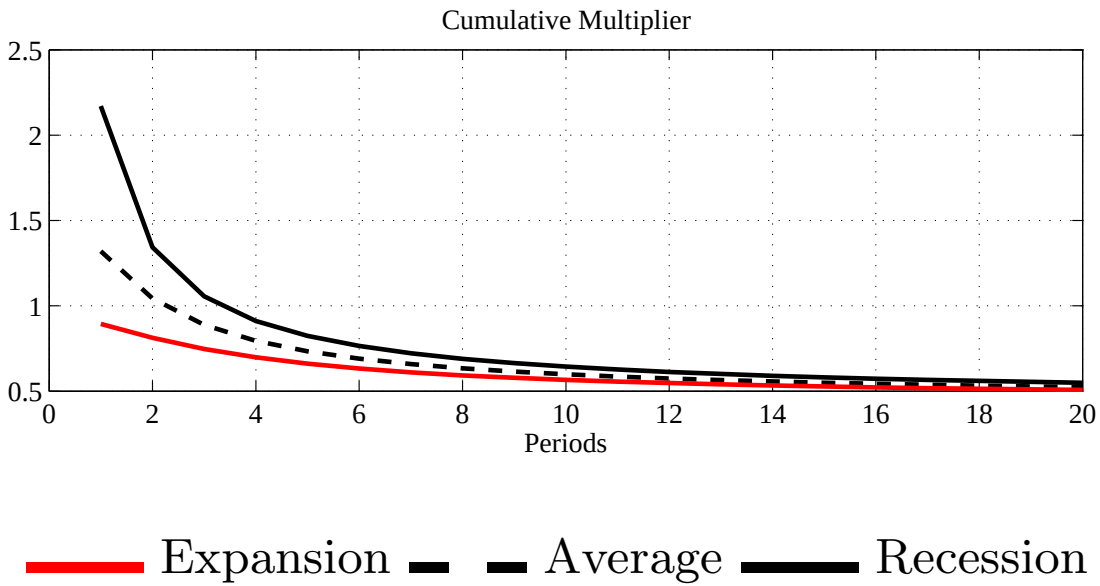


Note: Dark plain line (marks): Booms, Red plain line (marks): Recession. A "recession" is identified with periods during which the cyclical component of output (obtained from the HP filter) is negative. Period: 1960Q1-2008Q1.

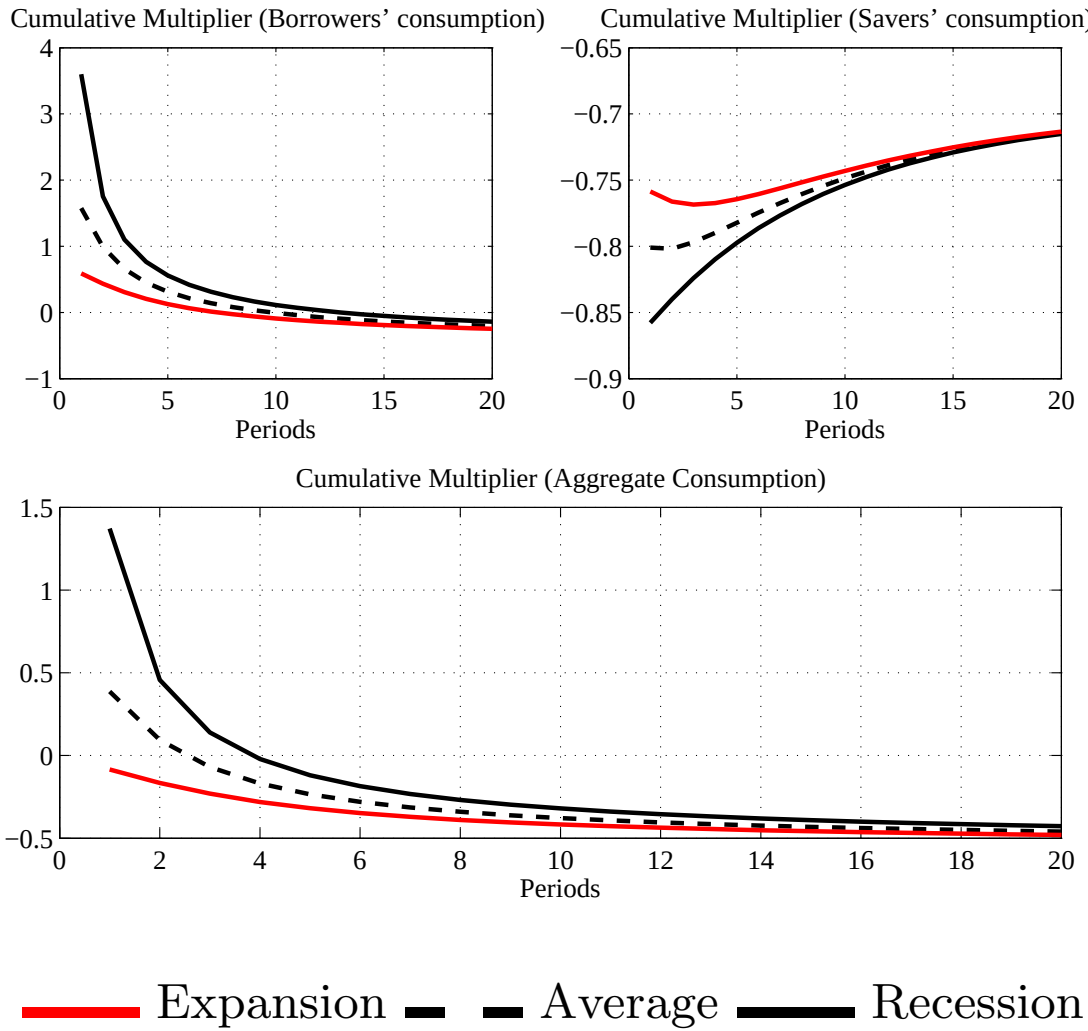
TABLE: Correlation Spread–Share of Government Spending

	AAA-FFR	BAA-FFR	AAA-TBILL	BAA-TBILL
Boom	-0.2244	-0.2631	-0.2795	-0.3136
Recession	-0.4888	-0.5041	-0.6493	-0.6017

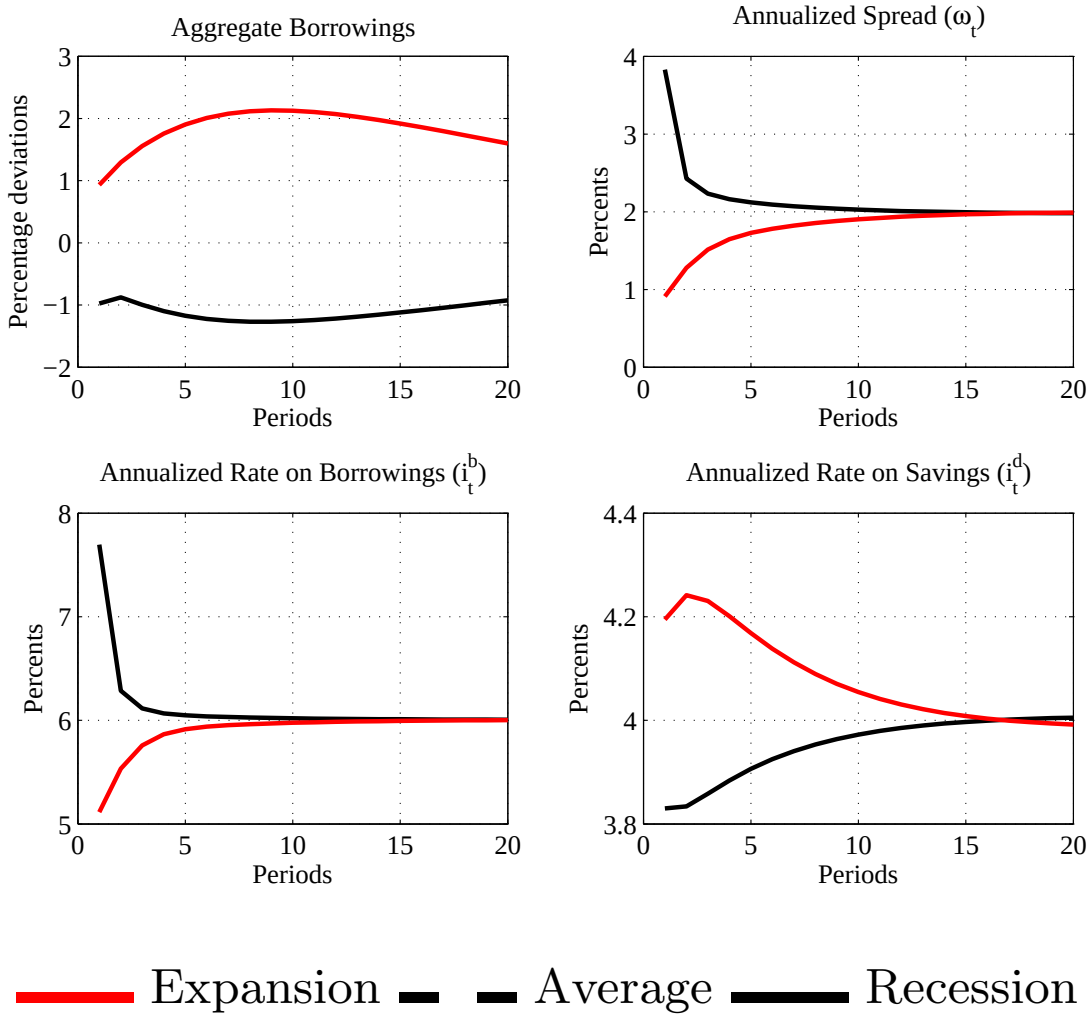
Output Multipliers



Consumption Multipliers



Mechanism


Aggregate Borrowings
Percentage deviations
Periods
Annualized Spread (ω_t)
Percents
Periods
Annualized Rate on Borrowings (i^b_t)
Percents
Periods
Annualized Rate on Savings (i^d_t)
Percents
Periods
Expansion
Average
Recession

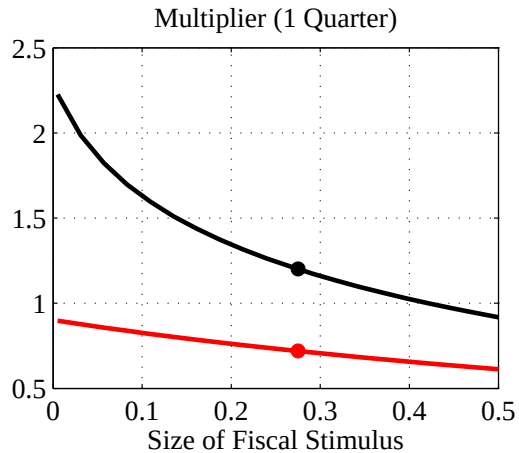
Output Multipliers

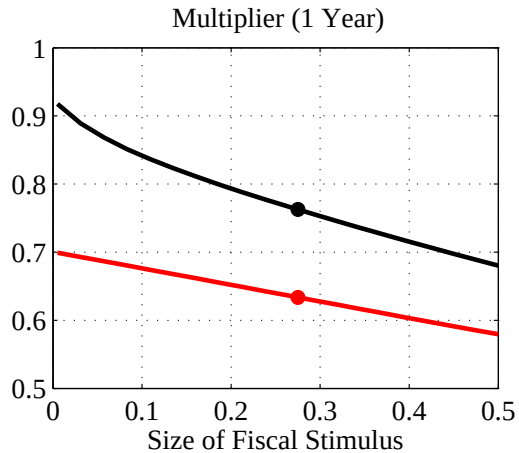
The model

- Possesses the type of asymmetries in multipliers found in the data
- Matches the size of the multipliers reported in empirical evidence
- Does not require a zero–bound effect

The size of the fiscal intervention

Too much spending can be a bad thing for fiscal effectiveness



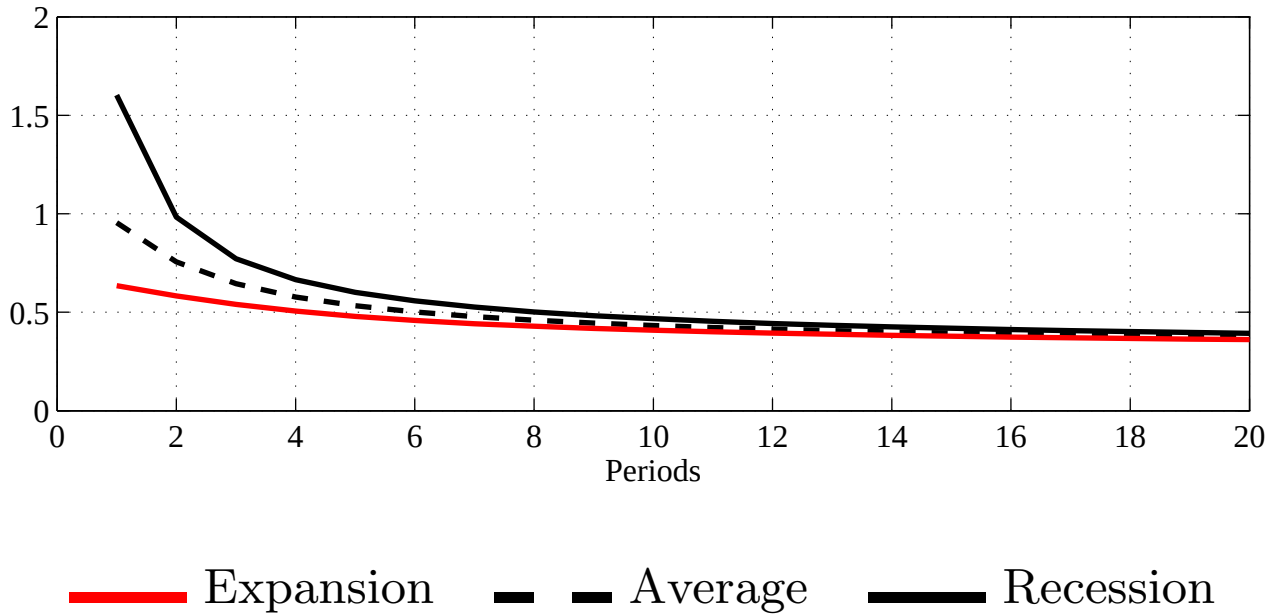


Expansion

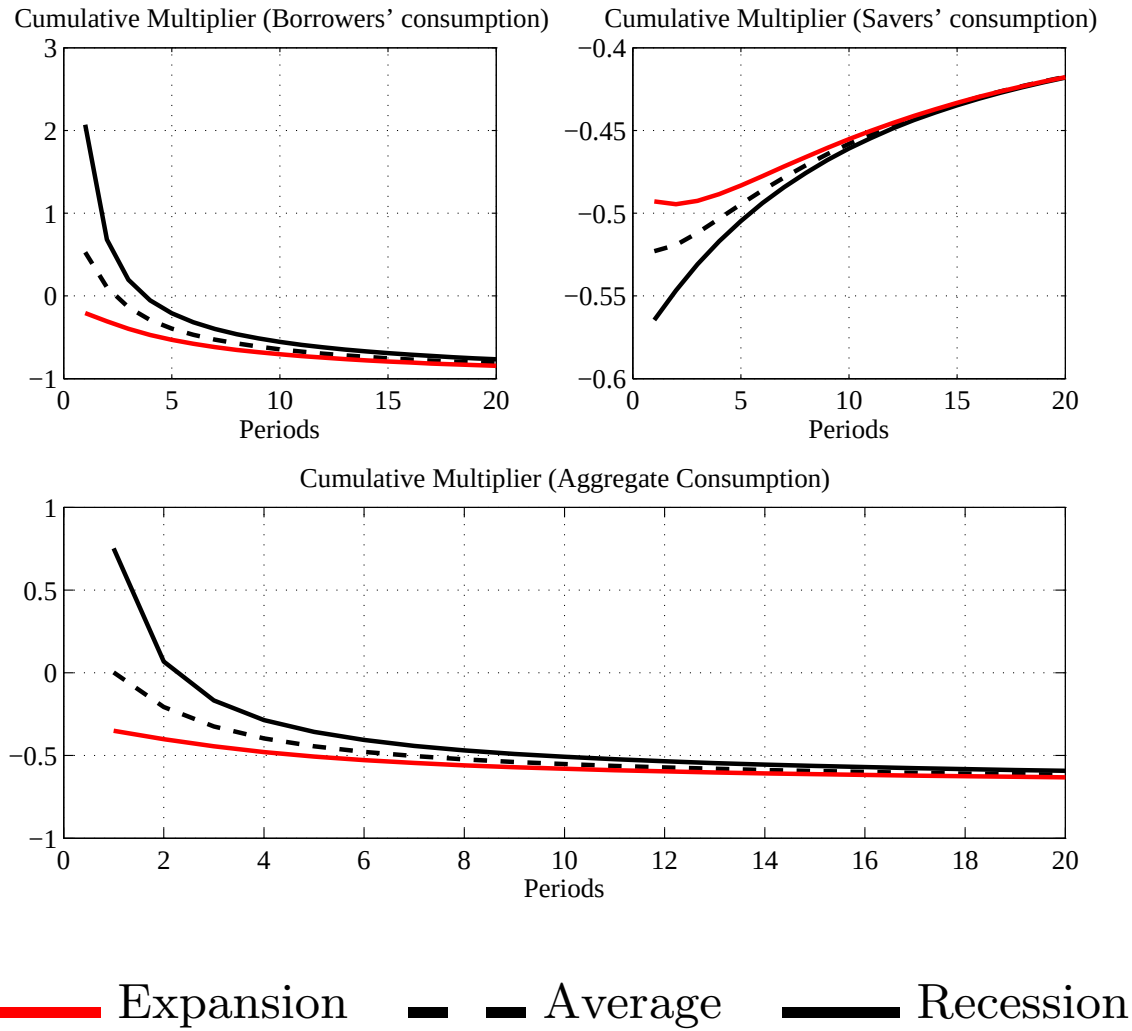
Recession

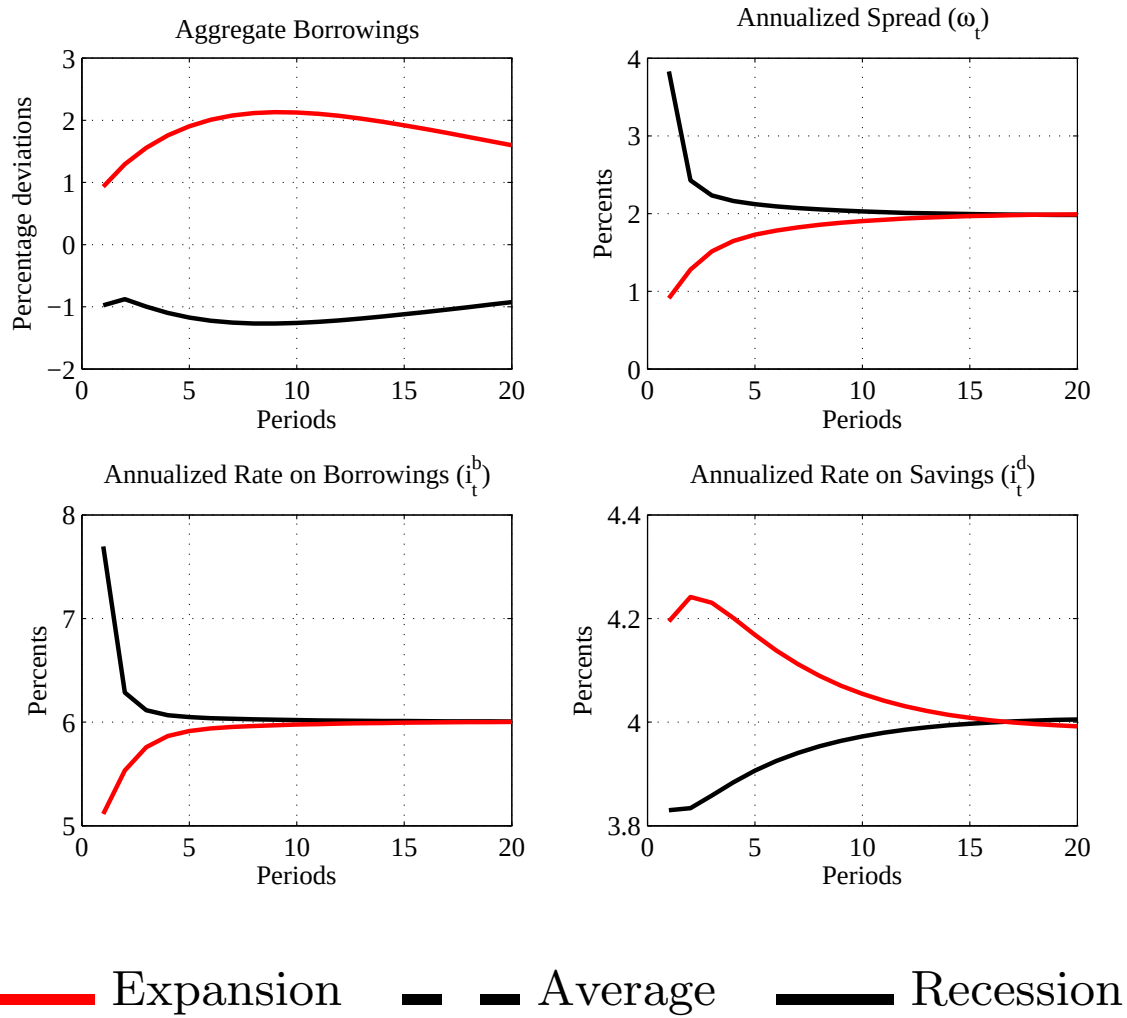
Sensitivity analysis

Tax vs Debt finance: Balanced budget



Consumption Multipliers




Aggregate Borrowings
Percentage deviations
Periods
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Percents
Periods
Annualized Rate on Borrowings (i_t^b)
Percents
Periods
Annualized Rate on Savings (i_t^d)
Percents
Periods
Expansion
Average
Recession

Sensitivity

Source of the cycle

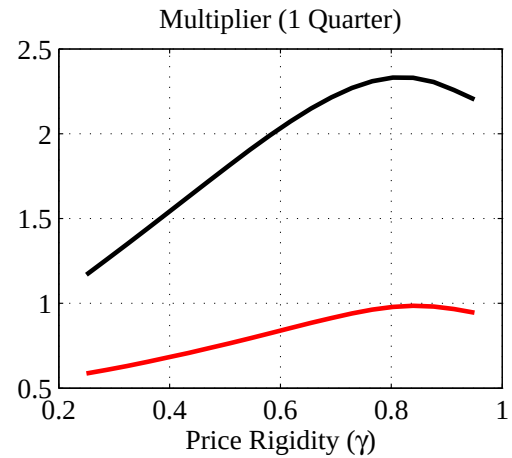
Table: Multipliers: Sensitivity to the Source of the Business Cycle

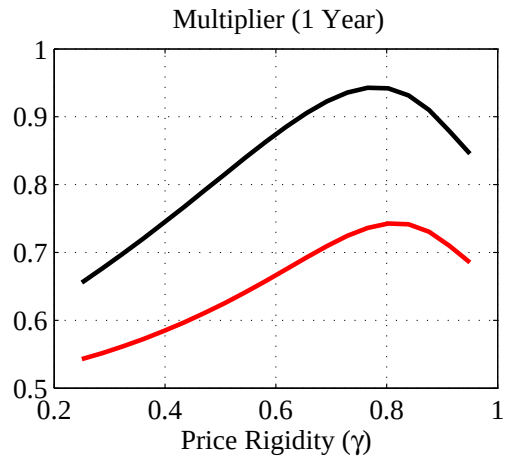
Shock	1 Quarter		1 Year		2 Years		5 Years	
	E	R	E	R	E	R	E	R
$\xi^b_{c,t}$	1.02	1.86	0.73	0.87	0.61	0.67	0.51	0.54
$\xi^s_{c,t}$	0.95	2.00	0.70	0.90	0.59	0.68	0.51	0.55
$\xi_{h,t}$	0.94	1.94	0.69	0.90	0.59	0.68	0.51	0.55
$\xi_{\Psi,t}$	0.89	2.17	0.70	0.91	0.59	0.69	0.51	0.55
$\xi_{y,t}$	0.94	1.94	0.69	0.90	0.59	0.68	0.51	0.55
$\xi_{i,t}$	1.06	1.85	0.76	0.86	0.62	0.67	0.51	0.54

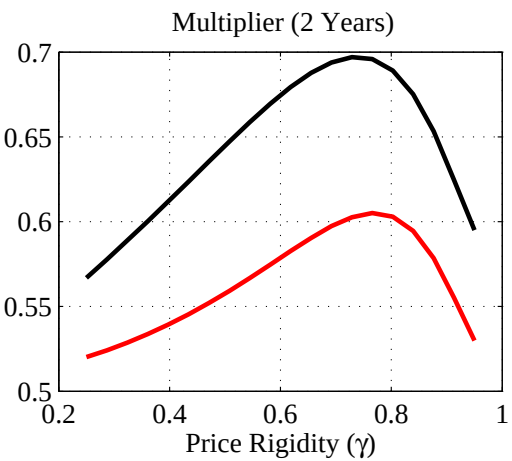
Note: The table reports the cumulative multipliers of output obtained in a 2.5% expansion (E) and in a 2.5% recession (R) generated by each of the considered shock.

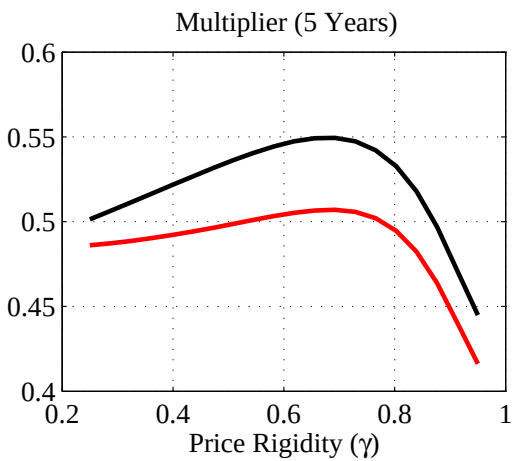
Sensitivity

Degree of Nominal Rigidity









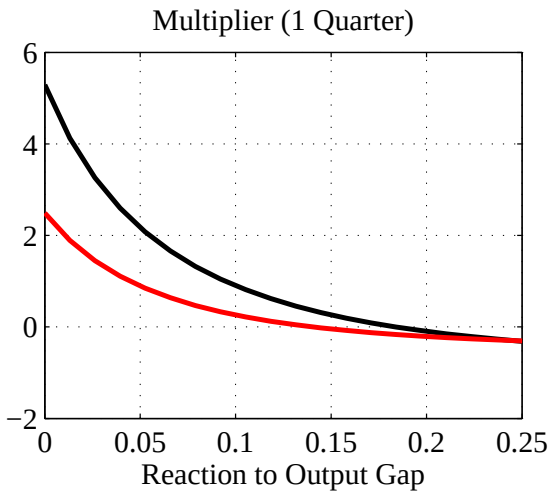
Expansion

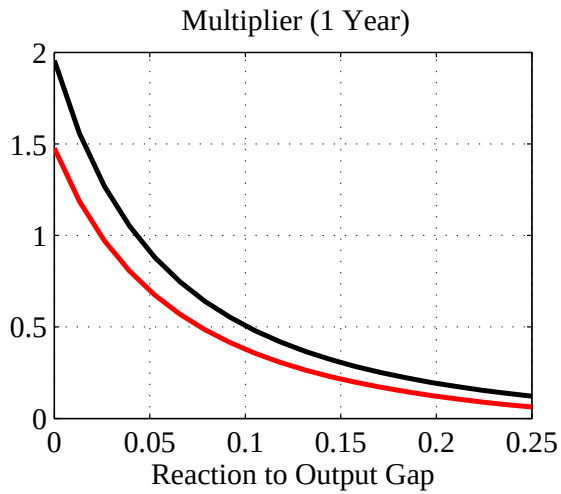
Recession

Sensitivity

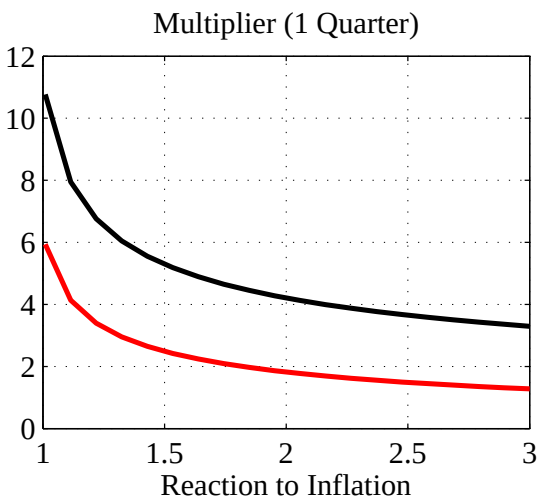
Multipliers and the Conduct of Monetary Policy

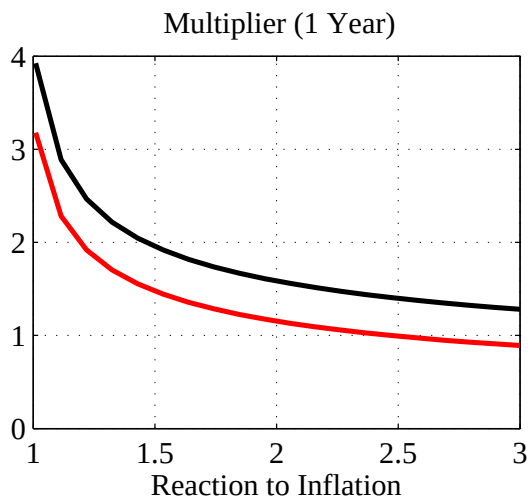
(a) Reaction to Output Gap (κ_y)





(b) Reaction to Inflation (κ_π)





Sensitivity

Role of Financial Frictions

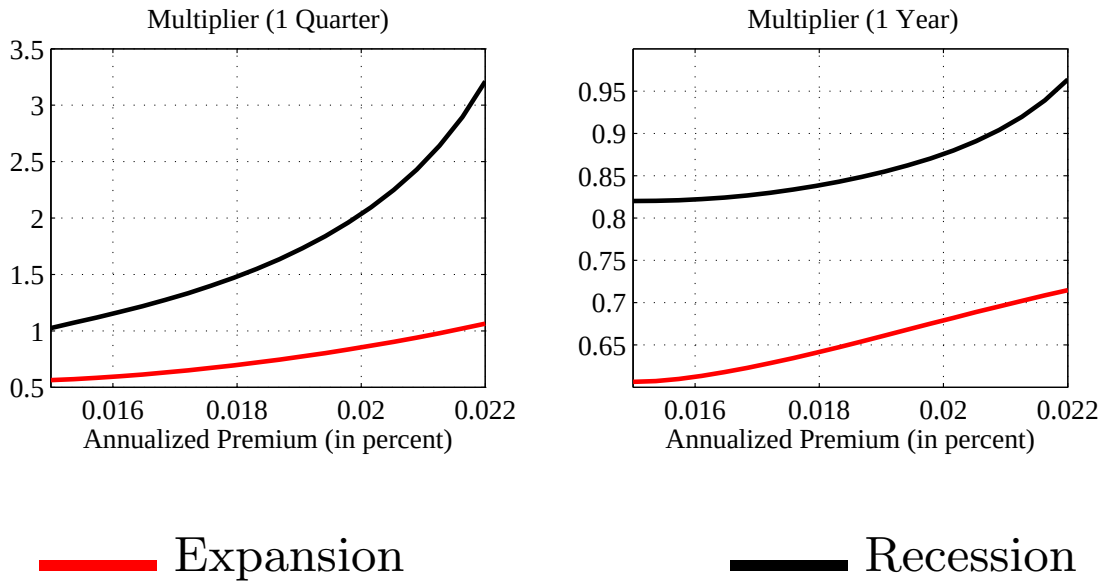
- Key to the result: financial frictions

$$\omega_t = C'(b_t) = \eta \exp(\xi_{\varphi,t}) b_t^{\eta-1} \exp(-\alpha \widetilde{y}_t)$$

- Investigate
  1. Role of the size of the distortion: $\omega^\star$ (*i.e.* $\xi_\varphi^\star$)
  2. Role of cyclical friction : α

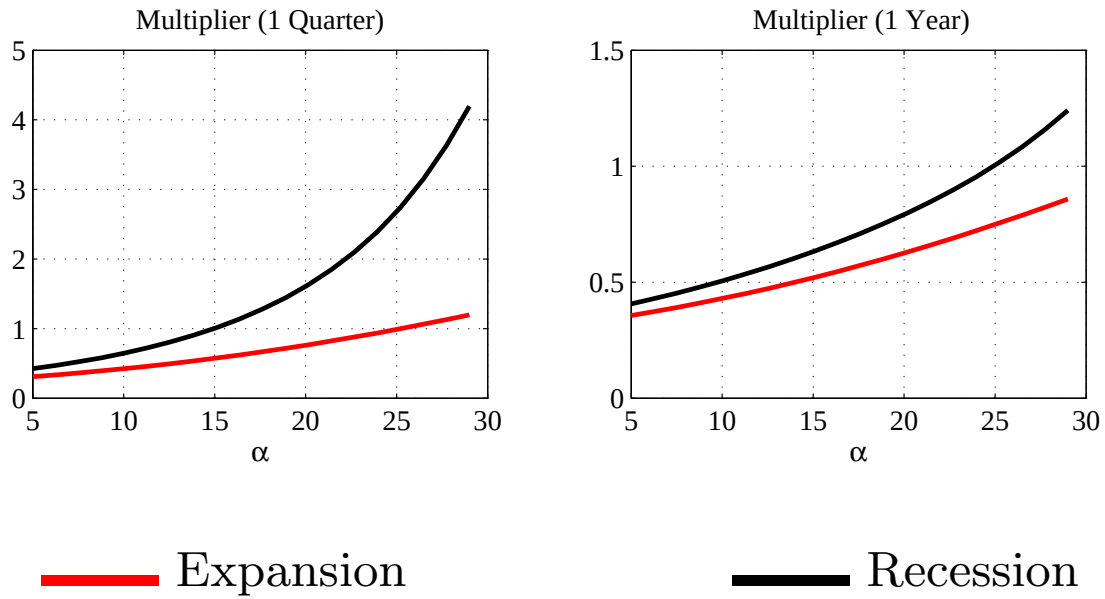
Sensitivity

Size of Premium



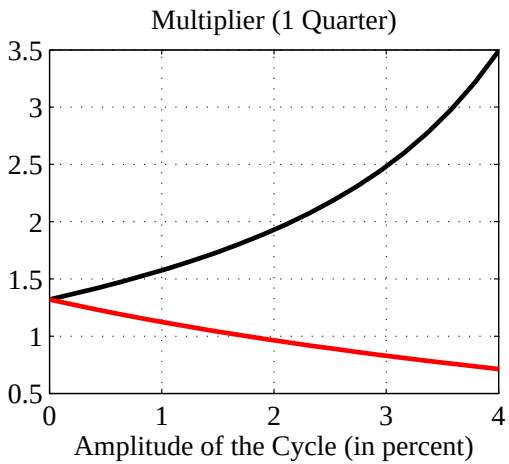
Sensitivity

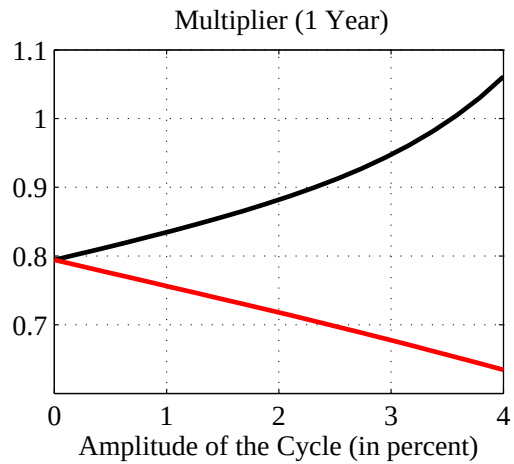
The role of the cyclicality in the financial friction



Sensitivity

Amplitude of the Cycle





Expansion

Recession

Concluding Remarks

- *Policy practice*: Countercyclical fiscal policy
- *Empirical evidence*: Multipliers are larger (> 1) in recessions than in booms
- *Theory*: Existing models have difficulty generating large and asymmetric multipliers
- We have provided a model that can do this
- Key element: Countecyclical financial frictions
- Financial frictions can be –indirectly– relaxed by fiscal policy
- Extra mileage from violation of Ricardian Equivalence

THANKS !

Appendix

Parameter		Value
Household		
Discount Factor	β	0.9874
Intertemp. Elasticity (Borrowers)	σ_b	12.2209
Intertemp. Elasticity (savers)	σ_s	2.4442
Inverse Frischian Labor Elasticity	ν	0.1048
Disutility of Labor param. (Borrowers)	ψ_b	1.1492
Disutility of Labor param. (Savers)	ψ_s	0.9439
Probability of Drawing Borrowers type	π_b	0.5000
Probability of Keeping Type	δ	0.9750
Share of Borrowings	b/y	4×0.8
Preference Shock (Average, Borrowers)	$\overline{\xi}_c^b$	8.0133
Preference Shock (Average, Savers)	$\overline{\xi}_c^s$	0.8123

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Appendix

Parameter		Value
Production		
Elasticity of Subst. btw. goods	θ	7.6667
Inverse labor Elasticity	$1/\varphi$	0.7500
Nominal Aspects		
Annual Premium (Gross)	$(1+\omega)^4$	1.0200
Degree of Nominal Rigidities	γ	0.6667
Persistence (Taylor Rule)	ρ_i	0.8000
Reaction to Inflation (Taylor Rule)	κ_π	1.5000
Reaction to Output (Taylor Rule)	κ_y	0.0500

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Appendix

Parameter		Value
Financial Costs		
Borrowing Elasticity	η	6.5000
Output Gap Elasticity	α	23.0000
Constant	$\overline{\Xi}$	1.2720e-06
Shocks		
Government Shock (Persistence)	ρ_g	0.9700
Government Share	g/y	0.2000
Persistence (Other shocks: x)	ρ_x	0.9500
Debt feedback	ϱ	0.0200

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