

Monetary Policy under Multiple Financing Constraints

Ander Perez-Orive ¹

Yannick Timmer¹

Alejandro van der Ghote ²

¹Federal Reserve Board

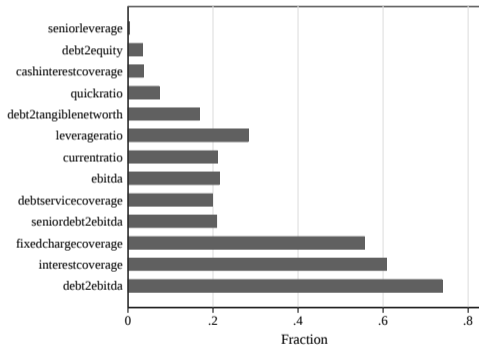
²European Central Bank

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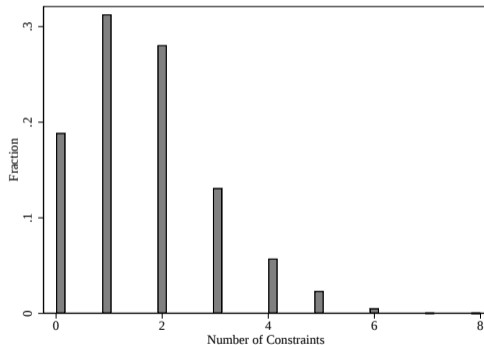
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Firms face multiple financing constraints

Most common debt covenants for firms



Density of # "tight" debt covenants across firms



Subject of study & Key findings

→ Paper studies implications of multiple tight debt covenants / binding financing constraints for transmission of monetary policy

Key findings:

1. Investment of firms with multiple binding financing constraints responds more aggressively to monetary tightening than to monetary easing
2. Investment of firms with single binding or with slack financing constraint responds instead roughly symmetrically
3. The larger the number of binding financing constraints, the stronger the asymmetry in investment response

Strong support for key findings in empirical analysis

In medium-scale New Keynesian economy enriched with multiple occasionally binding financing constraints findings significantly influence response of aggregate investment

Related literature

- ▶ **Anatomy of Financing Constraints**

Greenwald (2019); Lian and Ma (2021); Ivashina et al. (2022); Drechsel (2023); Chava and Roberts (2008)

- ▶ **Financial Frictions and Firm Heterogeneity**

Jeenas (2019); Ottonello and Winberry (2020); Cloyne et al. (2023)

- ▶ **Asymmetry in Monetary Transmission**

Tenreyro and Thwaites (2016); Barnichon et al. (2017); Angrist et al. (2018); Debortoli et al. (2020); Jordà et al. (2020); Barnichon et al. (2022)

Theory

A simple model of firm investment with multiple financing constraints

- ▶ A competitive firm that lives for two periods $t \in \{0, 1\}$
- ▶ **Technology:** Firm produces output good $y_t = F(k_t)$ using physical capital k_t
- ▶ **Financing:** $k_1 = n_0 + b_1$, with *multiple* ($J > 1$) restrictions on debt b_1 :

$$b_1 \leq \tilde{G}_j(k_1; R) \Rightarrow k_1 \leq G_j(n_0; R), \text{ with } j \in \{1, 2, \dots, J\},$$

where R is gross interest rate

! Key assumptions:

1. Multiple financing constraints can be binding
2. Financing constraints can feature different sensitivities to interest rate

Financially constrained firm: Responses of borrowing and investment

Proposition 1. (source of asymmetry)

- a. If firm faces multiple binding financing constraints, borrowing and investment respond more aggressively to marginal increase in interest rate than to marginal decrease
- b. If firm faces single binding financing constraint, the responses are instead symmetric

Financially constrained firm: Responses of borrowing and investment

Proposition 1. (source of asymmetry)

- a. If firm faces multiple binding financing constraints, borrowing and investment respond more aggressively to marginal increase in interest rate than to marginal decrease
- b. If firm faces single binding financing constraint, the responses are instead symmetric

Proof. If firm is financially constrained, then

$$\left| \lim_{h \rightarrow 0^+} \frac{\hat{k}_1(n_0; R+h) - \hat{k}_1(n_0; R)}{h} \right| = \max_{j \in B(n_0)} \left\{ \left| \frac{\partial}{\partial R} G_j(n_0; R) \right| \right\}, \quad (1)$$

and

$$\left| \lim_{h \rightarrow 0^-} \frac{\hat{k}_1(n_0; R+h) - \hat{k}_1(n_0; R)}{h} \right| = \min_{j \in B(n_0)} \left\{ \left| \frac{\partial}{\partial R} G_j(n_0; R) \right| \right\}, \quad (2)$$

where $\hat{k}_1(\cdot; \cdot)$ is the constrained optimal investment and $B(\cdot)$ is the set of binding financing constraints.

Firm with multiple binding financing constraints: Additional results

Proposition 2. (strength of asymmetry)

The larger the number of binding financing constraints, the stronger the asymmetry in the responses of borrowing and investment

Proposition 3. (binding status of financing constraints)

Financing constraints with higher sensitivity to interest rate tend to be binding after rate-increase but slack after rate-decrease

Proofs. Follow directly as corollary from Proposition 1

Financially unconstrained firm: Response of investment

Proposition 4. (symmetry under slack financing constraints)

If firm faces no binding financing constraint, borrowing (if any) and investment respond symmetrically to marginal changes in interest rate

Proof. If firm is financially unconstrained, then

$$\left| \frac{\partial}{\partial R} k_1 (R) \right| = - \frac{\frac{1}{R} [F' [k_1 (R)] + (1 - \delta)]}{F'' [k_1 (R)]} , \quad (3)$$

where unconstrained optimal investment $k_1 (\cdot) \leq \min_j \{G_j (\cdot, \cdot)\}$ is characterized by

$$1 = \frac{1}{R} [F' [k_1 (R)] + (1 - \delta)] . \quad (4)$$

Summary: Testable implications

1. For firms facing multiple binding financing constraints borrowing and investment respond more aggressively to monetary tightening than to monetary easing shocks
2. For firms facing either a single binding financing constraint or slack financing constraints borrowing and investment respond instead roughly symmetrically
3. The larger the number of binding financing constraints, the stronger the asymmetry in the responses of borrowing and reinvestment

Empirical Analysis

Data

- ▶ Firm-level balance sheet data
 - ▶ Compustat sample, U.S. nonfinancial firms, quarterly between 1995 and 2022
- ▶ Balance sheet / Income statement -based constraints
 - ▶ Data from Dealscan on covenants
 - ▶ Banks write legally binding financial covenants in loans to non-financial firms
- ▶ Market-based constraint
 - ▶ Firm-level financial constraints: distance to default (D2D)
 - ▶ Merton (1974) model: firm's equity as call option on assets (strike price=debt)
 - ▶ CRSP (daily stock price data) combined with Compustat
- ▶ Monetary policy shocks from Miranda-Agrippino and Ricco (2021)
 - ▶ High-frequency changes in 2Y US Treasury yields around policy announcements
 - ▶ Abstract from new information from Fed regarding economy
 - ▶ Separate policy shocks in two types: "loosening" and "tightening"
(similar average size between types and independence w.r.t. economic cycle)

Definition of multiple binding financing constraints

Binding financing constraints \equiv # Tight debt covenants + $1_{\{\text{Close to default}\}}$

Tight debt covenant \rightarrow Closer than 2 standard deviations away from violating covenant

Close to default \rightarrow Distance to default $<$ 2 standard deviations

Illustrative example of tight debt covenant: ICR (EBITDA/Interest Payments)

Current Value: 3

Covenant: > 1

\Rightarrow Distance to Covenant: 2

Firm-level standard deviation of ICR: 4

\Rightarrow Std distance to covenant: $0.5 \left(\frac{2}{4}\right)$

Empirical strategy

Local projections:

$$\begin{aligned}\Delta_{h+1} \log Y_{i,t+h} = & \beta_{c,u}^h (\text{Contr. MP Shock}_t * \text{Unconstrained}_{i,t}) + \beta_{a,u}^h (\text{Acc. MP Shock}_t * \text{Unconstrained}_{i,t}) \\ & \beta_{c,s}^h (\text{Contr. MP Shock}_t * \text{Single Constraint}_{i,t}) + \beta_{a,s}^h (\text{Acc. MP Shock}_t * \text{Single Constraint}_{i,t}) \\ & \beta_{c,m}^h (\text{Contr. MP Shock}_t * \text{Mul. Constraint}_{i,t}) + \beta_{a,m}^h (\text{Acc. MP Shock}_t * \text{Mul. Constraint}_{i,t}) \\ & + \mathbf{X}'\gamma + \epsilon_{i,t}\end{aligned}$$

where

$Y_{i,t+h}$ → either external financing (i.e., borrowing) or investment

Contr. MP Shock → contractionary monetary policy shock

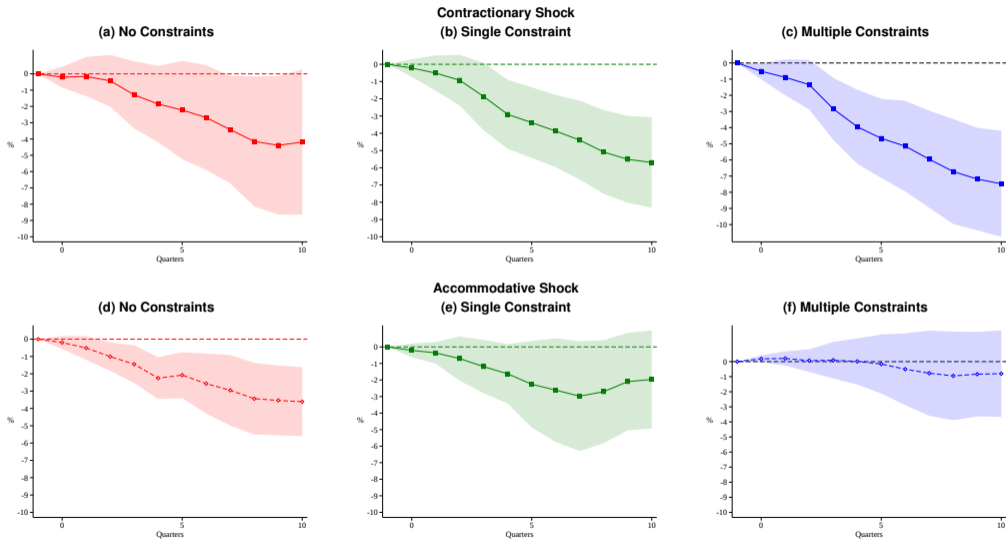
Acc. MP Shock → accommodative monetary policy shock

Unconstrained → dummy if firm faces no binding financing constraint

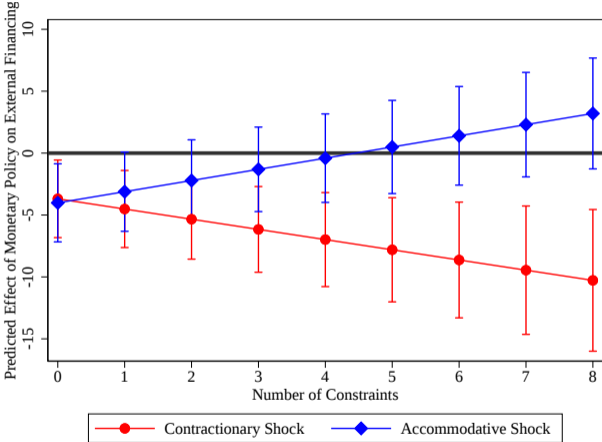
Single Constraint → dummy if firm faces a single binding financing constraint

Mul. Constraint → dummy if firm faces multiple binding financing constraints

Response of external financing to monetary policy shock



Strength of asymmetry in responses



Responses of external financing and investment (8th quarter)

(a) External Financing

	$\Delta_8 ExFin_{i,t+7}$			
	(1)	(2)	(3)	(4)
Contr. Shock \times Single Constraint	-1.521 (1.203)	-0.697 (1.152)	-0.170 (0.676)	-0.293 (0.738)
Contr. Shock \times Mult. Constraint	-3.361*** (1.196)	-2.640** (1.141)	-2.044*** (0.751)	-1.748*** (0.654)
Acc. Shock \times Single Constraint	0.709 (1.282)	-0.054 (1.037)	0.962*** (0.323)	1.131*** (0.374)
Acc. Shock \times Mult. Constraint	2.963*** (1.073)	2.144*** (0.773)	2.053*** (0.504)	2.339*** (0.491)
R-squared	0.030	0.030	0.338	0.041
N	106,881	106,881	106,707	100,060
Time FE	✓	✓	✓	✓
Firm FE			✓	
Firm Controls				✓
Macro Controls		✓	✓	✓

(b) Investment

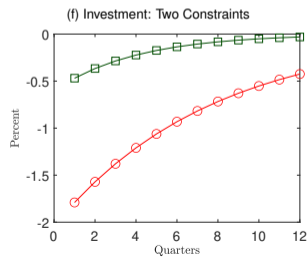
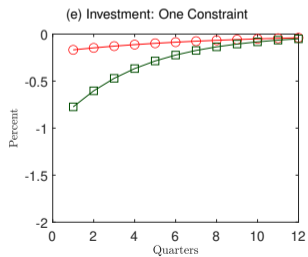
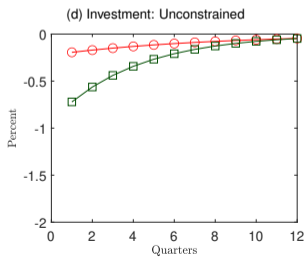
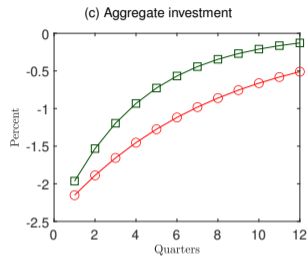
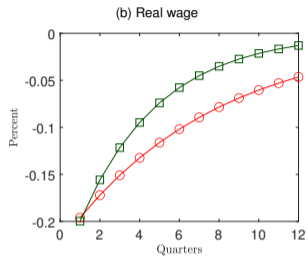
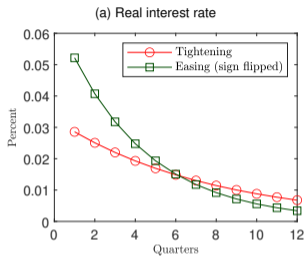
	$\Delta_8 Capital_{i,t+7}$			
	(1)	(2)	(3)	(4)
Contr. Shock \times Single Constraint	-1.762** (0.726)	-0.764 (0.558)	-0.364 (0.336)	-0.642* (0.417)
Contr. Shock \times Mult. Constraint	-2.227*** (0.842)	-1.353** (0.657)	-0.873* (0.523)	-0.966** (0.473)
Acc. Shock \times Single Constraint	1.520 (1.154)	0.615 (0.904)	0.498 (0.537)	1.252*** (0.459)
Acc. Shock \times Mult. Constraint	2.399** (1.136)	1.542* (0.866)	1.141+ (0.689)	1.757*** (0.516)
R-squared	0.054	0.054	0.358	0.061
N	111,673	111,673	111,523	101,129
Time FE	✓	✓	✓	✓
Firm FE			✓	
Firm Controls				✓
Macro Controls		✓	✓	✓

Quantitative Analysis

Model environment: Key elements

- ▶ Medium-scale New Keynesian macroeconomic model with multiple occasionally binding financing constraints
- ▶ Firms face two constraints (one earnings-based, the other asset-based) and must respect both
- ▶ Heterogeneity in exit rates (or more generally, discount rates) leads to distribution of firm net worth and concentration of firms in region where both constraints are tight

Response to monetary policy shock



Conclusion

- ▶ Firms face multiple financing constraints
- ▶ Firms with multiple binding financing constraints respond more aggressively to monetary tightening than to monetary easing
- ▶ Firms with single binding or with slack financing constraint respond symmetrically
- ▶ The larger the number of binding financing constraints, the stronger the asymmetry in investment responses
- ▶ Financing constraints with higher sensitivity to monetary policy tend to be binding after tightening but slack after easing

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