Chapter 19: Credit Market Frictions

Graduate Macroeconomics Slides

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Outline

Motivation

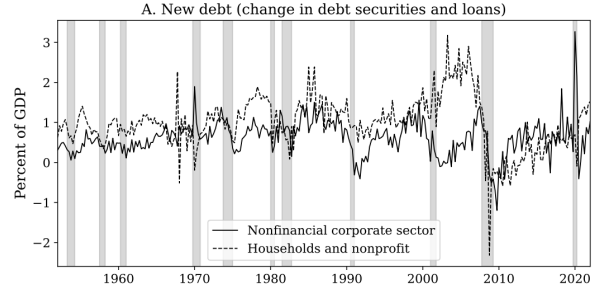
- The 2008 financial crisis exposed limitations in mainstream macroeconomic models that assumed frictionless financial markets.
- Notable papers including (Bernanke and Gertler, 1989) and (Kiyotaki and Moore, 1997) highlighted the impact of financial (credit) frictions on macroeconomic dynamics.
- Historically, the role of financial markets in major events such as the Great Depression (e.g., (Calomiris, 1993), (Bernanke, 2024)) was sometimes underemphasized.
- This chapter incorporates financial frictions into a standard neoclassical growth framework and examines their macroeconomic implications.

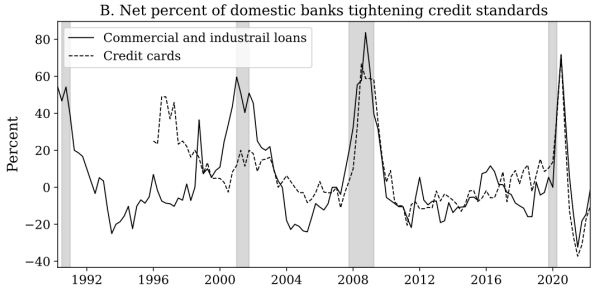
Key Questions

- Why do real and financial variables co-move so strongly over the business cycle?
- Are financial frictions simply propagating real shocks or can they themselves be a *source* of macroeconomic fluctuations?
- How can we model these frictions in an analytically tractable but empirically relevant way?

Pro-Cyclical Credit Flows

- Credit market liabilities (both household and business sector) typically expand during economic expansions and contract during recessions.
- **Figure 19.1 (Panel A)**:
  - Growth of household and business debt in the US strongly correlates with GDP growth.
  - 2008 crisis saw a sharp drop in credit growth.
- **Figure 19.1 (Panel B)**:
  - Bank loan officers report *tightening* of credit standards in recessions.
  - Lending *conditions* vary in a pro-cyclical manner.


A. New debt (change in debt securities and loans)
Percent of GDP
3
2
1
0
−1
−2
1960
1970
1980
1990
2000
2010
2020
Nonfinancial corporate sector
Households and nonprofit


B. Net percent of domestic banks tightening credit standards
Percent
80
60
40
20
0
−20
−40
1992
1996
2000
2004
2008
2012
2016
2020
Commercial and industrail loans
Credit cards

Credit Spreads and Unemployment

- **Figure 19.2 (Panel A)**:
  - Corporate bond spreads (Baa vs. Treasury) rise prior to recessions.
  - Reflects risk re-pricing and perceived borrower risk.
- **Figure 19.2 (Panel B)**:
  - Negative co-movement between new private-sector debt and unemployment rate.
  - Strengthens the case that tighter credit is associated with rising unemployment.

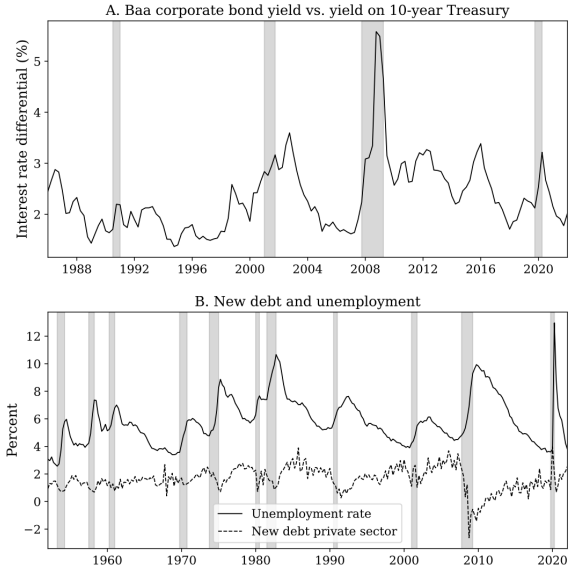


Figure 19.2: **Panel A**: Interest rate differential between U.S. corporate

Causal Channels

Three scenarios for real-financial interactions:

1. **Real activity causes changes in credit flows.**
   - Recession leads to lower consumption/investment, hence less borrowing.
2. **Financial frictions propagate non-financial shocks.**
   - E.g., a negative productivity shock erodes collateral, lowering credit capacity.
   - Amplifies or dampens initial shocks.
3. **Financial shocks as a direct source of fluctuations.**
   - Restrictive credit markets induce cutbacks in real activity.

This chapter focuses on modeling frameworks for capturing cases (2) and (3).

What Are Financial Frictions?

- **Definition**: Costs, constraints, or missing markets limiting the ability of agents to borrow, lend, or insure against risks.
- **Necessary conditions**:
  1. Some markets are *incomplete* or missing.
  2. Agents differ in some dimension (*heterogeneity*) that creates the need to trade.
- If markets were complete, Modigliani-Miller irrelevance results would apply, rendering the source of financing unimportant to real decisions.

Types of Market Incompleteness

Exogenous Incompleteness

- Assumption: Only non-contingent debt is available (fixed repayment).
- Often implemented by placing an *exogenous borrowing limit*.

Endogenous Incompleteness

- Financial contracts are limited by incentive constraints (information asymmetry, moral hazard, limited enforcement).
- E.g., (Bernanke and Gertler, 1989) (costly state verification), (Kiyotaki and Moore, 1997) (limited enforcement with collateral).

Heterogeneity and Self-Financing

- **Heterogeneous Agents**: Borrowers vs. lenders, high vs. low productivity, different discount factors, etc.
- Borrowing constraints matter if some agents are persistently constrained.
- Mechanisms preventing *self-financing*:
  - Finite horizons or overlapping generations.
  - Differing levels of *time preference*.
  - Tax benefits of debt or "convenience yields."
- Common outcome: Constrained agents maintain high leverage; unconstrained agents are net lenders.

Baseline Neoclassical Framework

- Representative household with preferences:

$$\sum_{t=0}^{\infty} \beta^t \, u\big(C_t, L_t\big).$$

- Firms produce using a production function $F(K_t, L_t)$ and accumulate capital.
- In the *complete markets* case, the source of funding (debt vs. equity) is irrelevant (Modigliani-Miller).
- We now *break* this irrelevance by introducing:
  1. A **tax advantage** to debt.
  2. A **borrowing limit** (collateral constraint).
  3. A **dividend adjustment cost**.

Firm Optimization with Frictions

Firm faces:

$$\max_{\{d_t,\, k_{t+1},\, b_{t+1},\, l_t\}} \sum_{t=0}^{\infty} m_t\, d_t$$

Subject to:

Budget Constraint:
$$F(z_t, k_t, l_t) - w_t l_t + \frac{b_{t+1}}{R_t} = b_t + k_{t+1} - (1-\delta)k_t + \varphi(d_t),$$

Borrowing Constraint:
$$\frac{b_{t+1}}{\widetilde{R}_t} \;\leq\; \xi\, p_t\, k_{t+1},$$

$$\varphi(d_t) \;=\; d_t + \kappa\left(d_t - \phi\right)^2,$$

where $\widetilde{R}_t = \frac{R_t}{(1+\tau)}$ represents the effective interest cost.

Interpretation of Constraints

- **Tax Advantage (τ):**

$$\widetilde{R}_t = \frac{R_t}{1+\tau}, \quad \tau > 0 \implies \widetilde{R}_t < R_t.$$

- **Collateral Constraint ($\xi\, p_t\, k_{t+1}$):**
  - Firms can borrow only a fraction ξ of the next period capital's market value $p_t k_{t+1}$.
  - Captures limited enforcement or secured borrowing with capital as collateral.
- **Dividend Adjustment Cost (κ):**
  - Raising equity or significantly cutting dividends is costly.
  - Creates a *pecking order* favoring debt over equity but *discouraging* large changes in dividend policies.

First-Order Conditions

- **Labor:**

$$F_L(z_t, k_t, l_t) \;=\; w_t.$$

- **Capital:**

$$\text{Expected Return} = \text{Effective Cost} - (\text{Collateral Value Term}),$$

$$\underbrace{E_t\left[m_{t+1}\left(F_K(z_{t+1}, k_{t+1}, l_{t+1}) + (1-\delta)\right)\right]}_{\text{discounted MPK+resale}} = \underbrace{(1+\mu_t\,\xi)}_{\text{wedge}}\, p_t,$$

  where μ_t is the multiplier on the borrowing constraint.

- **Debt:**

$$(1-\mu_t)(1+\tau) \;=\; \frac{1}{E_t[m_{t+1}]},$$

  in a simplified setup. If $\tau > 0$, the constraint tends to bind ($\mu_t > 0$).

Two-Period Model Setup

- Periods $t = 0, 1$ with no uncertainty (for simplicity).
- Period 0: Firms choose $k_1,\ b_1,\ l_0,\ d_0$ subject to constraints.
- Period 1: Production occurs with $F(z_1, k_1, l_1)$ and all capital is consumed or scrapped ($k_2 = 0$).
- Collateral constraint:

$$\frac{b_1}{(1+\tau)} \ \leq \ \xi\, p\, k_1.$$

- Dividend cost:

$$\varphi(d_0) \ = \ d_0 + \kappa\,(d_0 - \phi)^2.$$

Insights from the Two-Period Model

- **Positive Productivity Shock** (z_0, z_1 both increase):
  - Firms desire to invest more in k_1.
  - Must partly rely on *equity* (cut current dividends), raising the cost of investing.
  - $\Longrightarrow$ **Investment can be dampened** compared to frictionless case.
- **Financial Shock** (ξ changes):
  - Tighter constraint ($\downarrow \xi$) reduces k_1 and next period output.
  - Relaxed constraint ($\uparrow \xi$) *may or may not* increase k_1 substantially, as firms might not fully utilize new borrowing capacity (precaution or costs of large dividend changes).

Asymmetric Effects of Financial Shocks

- **Positive shock:** $\xi \uparrow$
  - If previously unconstrained, no change in borrowing or investment.
  - If previously constrained, can expand credit and investment (but possibly gradually).
- **Negative shock:** $\xi \downarrow$
  - If previously unconstrained, might remain unconstrained unless shock is large.
  - If constrained, forced to reduce debt (big drop in k_1 or dividends).
  - $\Longrightarrow$ Potentially sharper real contraction than the expansion in the positive-shock scenario.

Role of Asset Prices

- In many models (Bernanke et al., 1999), (Kiyotaki and Moore, 1997)), p_t (price of capital) rises in expansions and falls in contractions.
- Changes in p_t affect collateral value $\xi\, p_t\, k_{t+1}$:
  - **Boom:** Higher $p_t \implies$ easier borrowing, reinforcing capital accumulation (a *positive feedback loop*).
  - **Bust:** Lower $p_t \implies$ net worth collapses faster, reducing borrowing capacity and forcing deeper cuts.
- This *financial accelerator* mechanism is key to understanding "amplified" business cycles.

Working Capital Constraint

- Firms may need to finance **wage payments** in advance:

$$w_t\, l_t \;+\; \frac{b_{t+1}}{R_t} \;\leq\; \xi\, p_t\, k_{t+1}.$$

- This *directly* links credit constraints to labor demand:

$$F_L(z_t, k_t, l_t) \;=\; (1+\mu_t)\, w_t \quad \text{(if binding)}.$$

- Tighter constraints $\Longrightarrow$ $\mu_t > 0$ $\Longrightarrow$ effective *markup* on w_t, reducing labor demand and output.
- $\Longrightarrow$ Credit frictions matter not only for investment but also for **employment** fluctuations.

Calibration Overview

- Quarterly model with standard RBC parameters:

$$\beta = 0.983, \quad \alpha = 0.36, \quad \text{etc.}$$

- $\tau = 0.281$: approximate effective corporate tax rate in the US.
- κ: chosen to match empirical volatility of dividend payouts.
- ξ: follows a Markov chain capturing variation in borrowing limits, matched to average corporate debt-to-capital ratio and its volatility.
- Productivity z_t: also Markov, matched to RBC Solow residual persistence and volatility.

Simulation Results: Productivity Shock

Stylized simulation: A persistent positive productivity shock at time 0.

- Debt, output, and labor move together, but the multiplier μ_t drops in the boom (less tight credit).
- Result: Procyclical debt and output, consistent with data patterns.

Simulation Results: Financial Shock

Stylized simulation: An increase vs. decrease in ξ.

- Positive shock ($\xi \uparrow$): Modest credit expansion and moderate output growth.
- Negative shock ($\xi \downarrow$): Sharp contraction in credit $\implies$ large drop in output.
- Asymmetry arises from precautionary and/or binding constraints.

Table 19.1: Parameter values.

Parameters	Description	Values
β	Discount factor	0.983
ν	Utility parameter	0.412
α	Capital share in production	0.360
τ	Benefit of debt	0.281
κ	Dividends' cost	0.500
p	Price of capital	1.000
z	Productivity and transition probabilities	$\begin{pmatrix} 0.183 \\ 0.185 \\ 0.187 \end{pmatrix}, \begin{bmatrix} 0.900 & 0.075 & 0.025 \\ 0.050 & 0.900 & 0.050 \\ 0.025 & 0.075 & 0.900 \end{bmatrix}$
ξ	Debt limit and transition probabilities	$\begin{pmatrix} 0.450 \\ 0.500 \\ 0.550 \end{pmatrix}, \begin{bmatrix} 0.900 & 0.075 & 0.025 \\ 0.050 & 0.900 & 0.050 \\ 0.025 & 0.075 & 0.900 \end{bmatrix}$

Simulation Exercise

- The economy is hit by two exogenous processes: a productivity level $z \in \{0.183, 0.185, 0.187\}$ and a financial tightness variable $\xi \in \{0.450, 0.500, 0.550\}$, with agents forming expectations from the Markov structure.
- We start from the stochastic steady state at the mean realizations $(z, \xi) = (0.185, 0.500)$, and at $t{=}0$ we engineer one discrete "switch" to study dynamic responses.
- Borrowing is subject to a constraint with Lagrange multiplier $\mu_t \geq 0$; the constraint is binding throughout the productivity experiments ($\mu_t > 0$ at all t).
- Two counterfactuals are run: (i) a productivity boom $z : 0.185 \to 0.187$ (and symmetrically a contraction $z : 0.185 \to 0.183$) holding $\xi = 0.500$, and (ii) a credit boom $\xi : 0.500 \to 0.550$ (and symmetrically a tightening $\xi : 0.500 \to 0.450$) holding $z = 0.185$.

Productivity shocks: dynamic responses and facts

- A positive productivity switch raises output immediately and persistently, while debt rises only modestly; the mirror image holds for a negative switch.
- The multiplier μ_t moves countercyclically with productivity: it falls in booms and rises in contractions, which is consistent with countercyclical credit spreads and tighter lending standards in downturns (cf. the facts summarized around their Figs. 19.1–19.2).
- The small debt response relative to output contrasts with the data, where debt often moves more than activity; this gap highlights the importance of financial shocks for matching credit facts.

Productivity switch

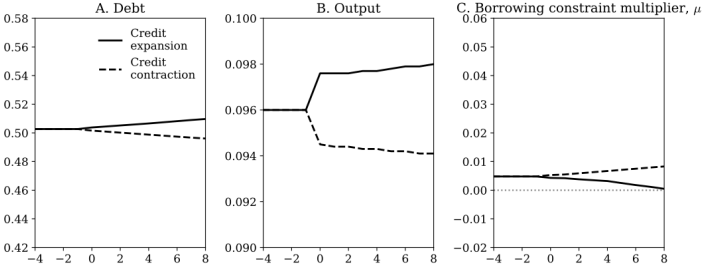


Figure 19.3: Response of debt, output, and borrowing constraint multiplier to a persistent productivity shock.

Financial shocks: asymmetric quantity and tightness effects

- A positive financial shock (credit expansion $\xi: 0.500 \rightarrow 0.550$) generates a gradual and persistent increase in debt with only a mild, hump-shaped rise in output.
- A negative financial shock (credit tightening $\xi: 0.500 \rightarrow 0.450$) induces a sharp fall in debt and a large, abrupt output contraction that is not very persistent.
- After a credit expansion the constraint becomes slack ($\mu_t \rightarrow 0$), whereas after a tightening μ_t spikes, tracking the surge in effective financial tightness.

Financial switch

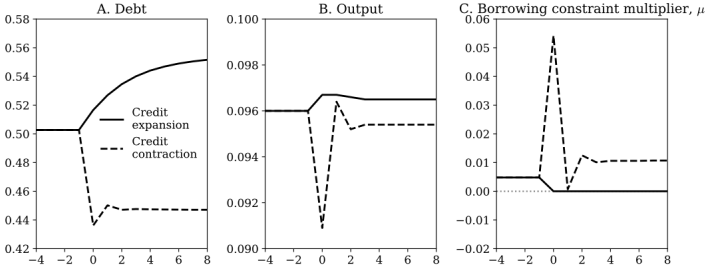


Figure 19.4: Response of debt, output, and borrowing constraint multiplier to a persistent financial shock.

Mechanism for the asymmetry

- When ξ jumps up, firms anticipate the possibility of reversal, so the shadow value of relaxing the constraint tomorrow implies a *precautionary* motive not to immediately hit the new limit; formally, the Euler equation for liabilities weighs $U_{c,t}$ against $U_{c,t+1}$ under a binding-constraint wedge μ_t.
- When ξ falls, the constraint tightens and firms must restore feasibility either by reducing labor and investment (to shrink external financing needs) or by raising equity via lower dividends; both margins are costly, so the optimal combination causes a large, sudden drop in debt and output.
- In the productivity experiments the constraint remains binding ($\mu_t > 0$), which keeps debt co-moving with output but with a smaller amplitude because the effective borrowing limit does not relax.

External validation and key takeaways

- The simulated credit dynamics match broad empirical regularities: credit booms are not necessarily paired with outsized real growth, while sudden credit stops produce sharp contractions (Reinhart and Rogoff, 2009; Schularick and Taylor, 2012).
- The model reproduces procyclical debt and countercyclical measures of financial tightness (spreads, lending standards $\leftrightarrow \mu_t$).
- **Bottom line:** Productivity shocks mainly move output, whereas financial shocks mainly move debt and do so *asymmetrically*; capturing this asymmetry is crucial for business-cycle credit facts and for policy counterfactuals.

Discussion Points

- **Amplification vs. Dampening**:
  - If equity issuance is still viable (albeit costly), frictions can *dampen* or *amplify* shocks depending on model specifics.
- **Big Role for Asset Prices**:
  - Endogenous p_t typically creates stronger amplification (financial accelerator).
- **Labor Wedge with Working Capital**:
  - Tighter credit directly reduces labor demand, making financial frictions more potent for output fluctuations.
- **Asymmetry in Booms vs. Busts**:
  - Credit expansions might be gradual, but reversals can be abrupt and severe.

Policy Implications

- **Macroprudential Policy**:
  - Limiting excessive leverage during expansions to prevent sharp busts.
- **Lender of Last Resort / Unconventional Monetary Policy**:
  - Easing credit constraints in crises to mitigate adverse feedback loops.
- **Tax Policy**:
  - Debt bias in corporate tax codes can affect average leverage, influencing how frequently constraints bind.

Conclusion

- Financial market frictions are **non-negligible** and can significantly shape macroeconomic dynamics.
- They can generate procyclical credit flows, amplify or dampen shocks, and produce sharp recessions upon negative credit events.
- Key elements:
  - Collateral constraints,
  - Debt-equity wedges,
  - Working capital requirements.
- Extending the *standard* neoclassical model with simple financial frictions captures many qualitative stylized facts of modern financial crises.

References I

Bernanke, B. and Gertler, M. (1989). Agency costs, net worth, and business fluctuations. *American Economic Review*, 79(1):14–31.

Bernanke, B., Gertler, M., and Gilchrist, S. (1999). The financial accelerator in a quantitative business cycle framework. In Taylor, J. B. and Woodford, M., editors, *Handbook of Macroeconomics*, volume 1C, pages 1341–1396. Elsevier Science: North Holland.

Bernanke, B. S. (2024). *Essays on the great depression*. Princeton University Press.

Calomiris, C. W. (1993). Financial factors in the great depression. *Journal of Economic Perspectives*, 7(2):61–85.

Kiyotaki, N. and Moore, J. H. (1997). Credit cycles. *Journal of Political Economy*, 105(2):211–248.

Reinhart, C. M. and Rogoff, K. S. (2009). *This Time is Different: Eight Centuries of Financial Folly*. Princeton University Press, Princeton, New Jersey.

Schularick, M. and Taylor, A. M. (2012). Credit booms gone bust: Monetary policy, leverage cycles and financial crises, 1870-2008. *American Economic Review*, 102(2):1029–1061.

Thank you!

Questions or comments?

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