Econ 702 Macroeconomics I

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Spring 2020

Lecture 26: Financial Frictions

Outline

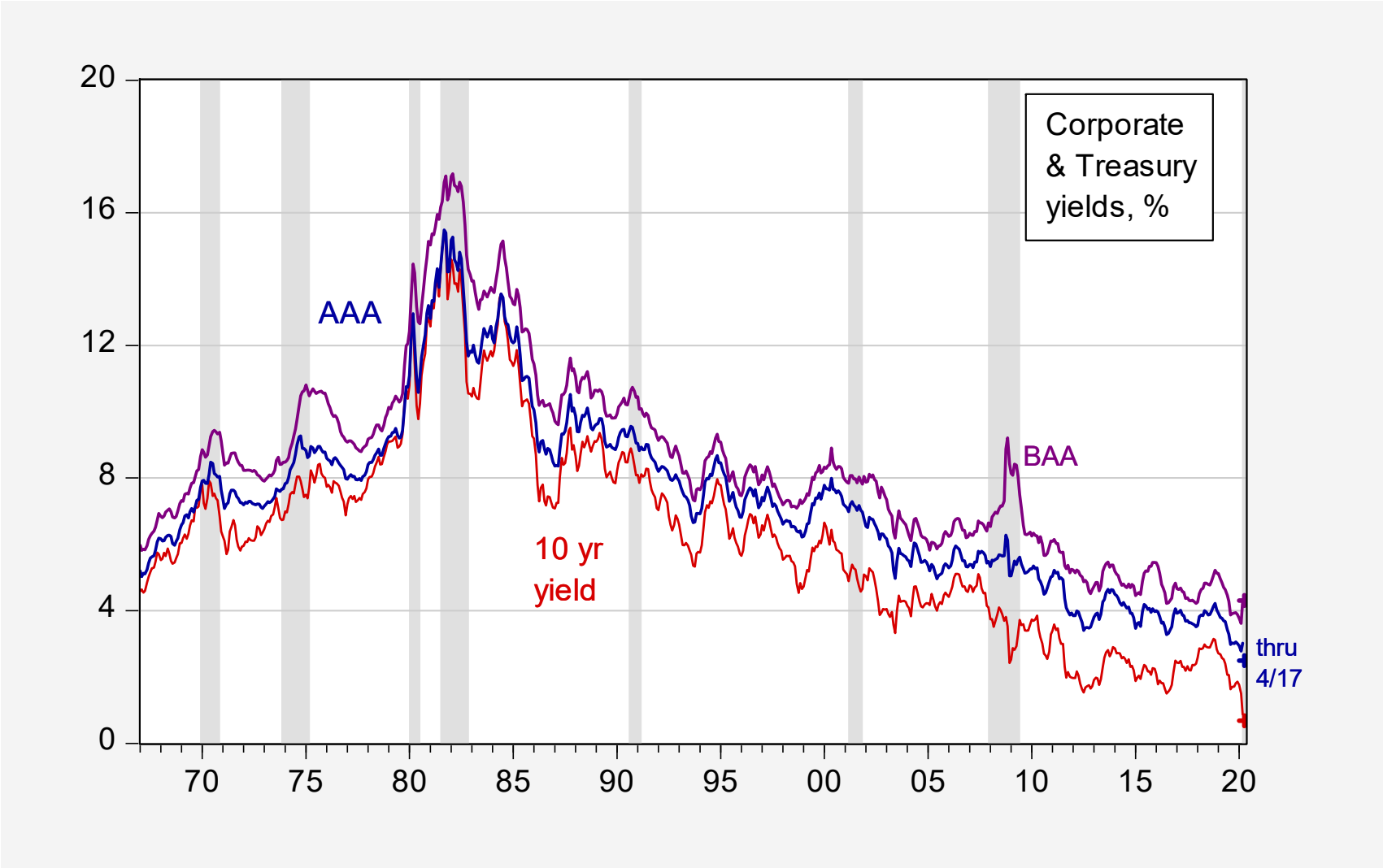
- Overview
- Frictions the when Spread is Exogenous
- Exogenous Spread & Financial Crises/Recessions
- The Endogenous Component of Spread

Overview

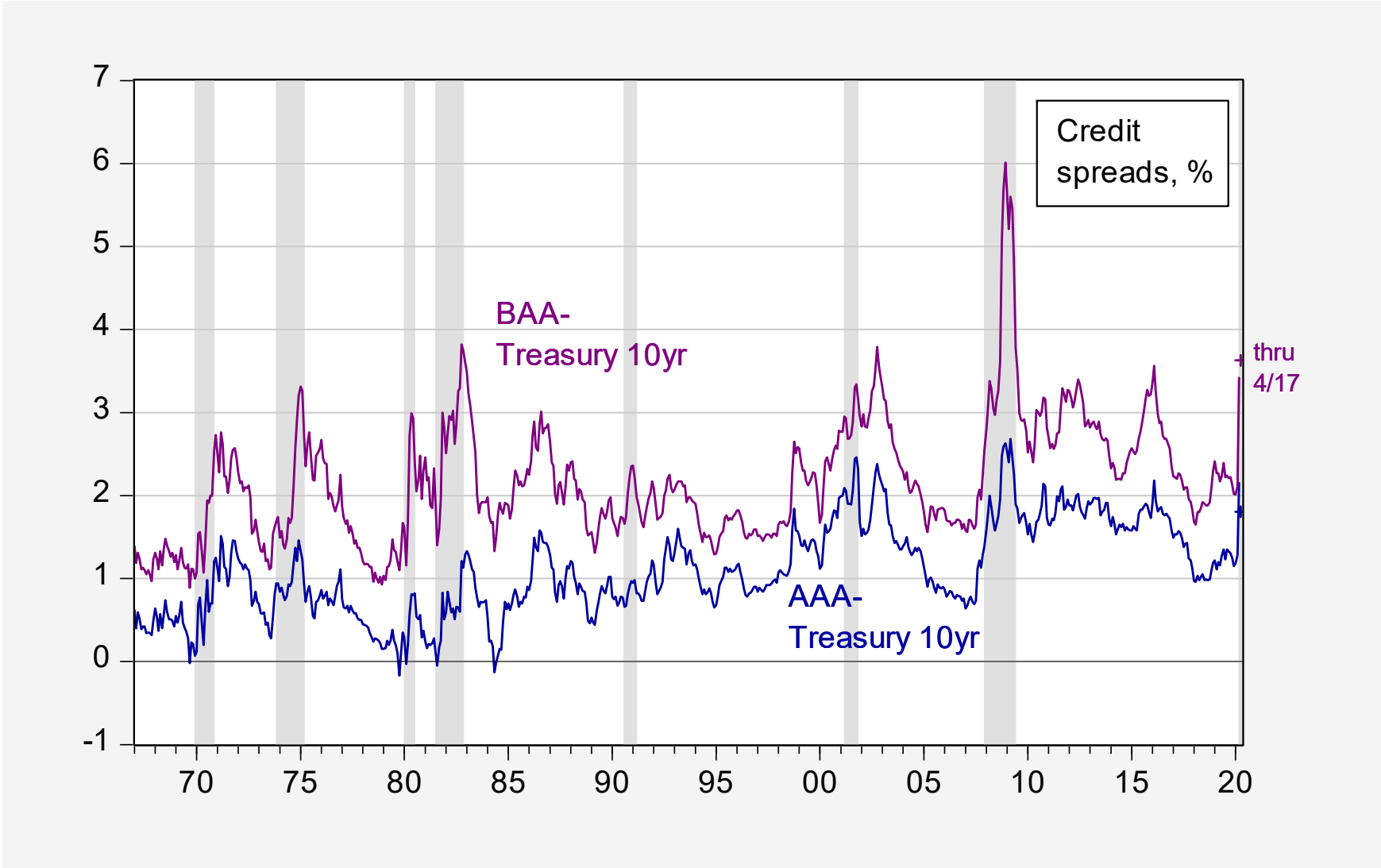
Overview: Financial Frictions

- So far in all the treatments, risk and uncertainty do not make an explicit appearance
- Financial problems do not make an appearance at all (at least not in the second half of the course)
- Marginal product of capital equals real interest rate
- Households, firms can borrow as much as they want at the given interest rate
- There is no quantity rationing
- But we know some firms pay more to borrow than others – and the excess of borrowing rates over a risk free rate varies over time
- Suggests using the credit spread

Corporate Bond Yields



Credit Spreads



Note: Corp bond yields pertain to mixed and changing average maturities

Where's the spread, *f*, show up?

$$C_t = C^d(Y_t - G_t, Y_{t+1} - G_{t+1}, r_t) \tag{35.1}$$

$$N_t = N^s(w_t, \theta_t) \tag{35.2}$$

$$P_t = \bar{P}_t + \gamma(Y_t - Y_t^f) \tag{35.3}$$

$$I_t = I^d(r_t + f_t, A_{t+1}, K_t) \tag{35.4}$$

$$Y_t = A_t F(K_t, N_t) \tag{35.5}$$

$$Y_t = C_t + I_t + G_t \tag{35.6}$$

$$M_t = P_t M^d(r_t + \pi_{t+1}^e, Y_t) \tag{35.7}$$

$$r_t = i_t - \pi_{t+1}^e \tag{35.8}$$

Frictions when Spread Is Exogenous

Banks, Government

Intermediary takes deposits, S, makes loans B^I and B^G to firms and govt, D^I is firm dividends

$$D^I_{t+1} = (r_t + f_t)B^I_t + r_t B^G_t - r_t S_t \tag{35.9}$$

Govt borrows and taxes to spend s.t. intertemporal budget constraint

$$G_t \leq T_t + B^G_t \tag{35.10}$$

$$G_t + r_t B^G_t \leq T_{t+1} + B^G_{t+1} - B^G_t \tag{35.11}$$

Households

Unchanged relative to previous. Optimize

$$C_t + S_t \leq w_t N_t + D_t - T_t \tag{35.12}$$

$$C_{t+1} + S_{t+1} \leq w_{t+1} N_{t+1} - T_{t+1} + D_{t+1} + D^I_{t+1} + (1 + r_t) S_t \tag{35.13}$$

$$U = u(C_t, 1 - N_t) + \beta u(C_{t+1}, 1 - N_{t+1}) \tag{35.14}$$

FOCs

$$u_C(C_t, 1 - N_t) = \beta(1 + r_t) u_C(C_{t+1}, 1 - N_t) \tag{35.15}$$

$$u_L(C_t, 1 - N_t) = w_t u_C(C_t, 1 - N_t) \tag{35.16}$$

$$u_L(C_{t+1}, 1 - N_{t+1}) = w_{t+1} u_C(C_{t+1}, 1 - N_{t+1}) \tag{35.17}$$

Firms

Maximize *V* by choosing *N*, or *I*

Financing Cost

$$\max_{N_t, I_t} \quad V_t = A_t F(K_t, N_t) - w_t N_t + \frac{1}{1+r_t}\Big[A_{t+1}F(K_{t+1}, N_{t+1}) + \underbrace{(1-\delta)K_{t+1}}_{\text{Liquidation Value}}) - w_{t+1}N_{t+1} - \overbrace{(1+r_t+f_t)B_t^I}^{\text{Financing Cost}}\Big] \quad (35.18)$$

$$\boxed{D_t + \frac{D_{t+1}}{1+r_t}}$$

Where investment follows law of motion:

$$K_{t+1} = I_t + (1-\delta)K_t$$

Recast problem as Max K_{t+1}

Since

$$B_t^I = I_t = K_{t+1} - (1-\delta)K_t$$

$$\max_{N_t, K_{t+1}} \quad V_t = A_t F(K_t, N_t) - w_t N_t +$$
$$\frac{1}{1+r_t}\Big[A_{t+1}F(K_{t+1}, N_{t+1}) + (1-\delta)K_{t+1}) - w_{t+1}N_{t+1} - (1+r_t+f_t)(K_{t+1} - (1-\delta)K_t)\Big] \quad (35.19)$$

Then FOCs are:

$$\frac{\partial V_t}{\partial N_t} = 0 \Leftrightarrow A_t F_N(K_t, N_t) = w_t \quad (35.20)$$

$$\frac{\partial V_t}{\partial K_{t+1}} = 0 \Leftrightarrow r_t + f_t + \delta = A_{t+1} F_K(K_{t+1}, N_{t+1}) \quad (35.21)$$

When Will Equilibrium Be Same as Social Planner's Solution?

$$u_C(C_t, 1 - N_t) = \beta u_C(C_{t+1}, 1 - N_{t+1})(A_{t+1} F_K(K_{t+1}, N_{t+1} + (1 - \delta)) \tag{35.22}$$

Combining (35.21) with (35.15), we would obtain:

$$u_C(C_t, 1 - N_t) = \beta u_C(C_{t+1}, 1 - N_{t+1})(A_{t+1} F_K(K_{t+1}, N_{t+1} + (1 - \delta) - f_t) \tag{35.23}$$

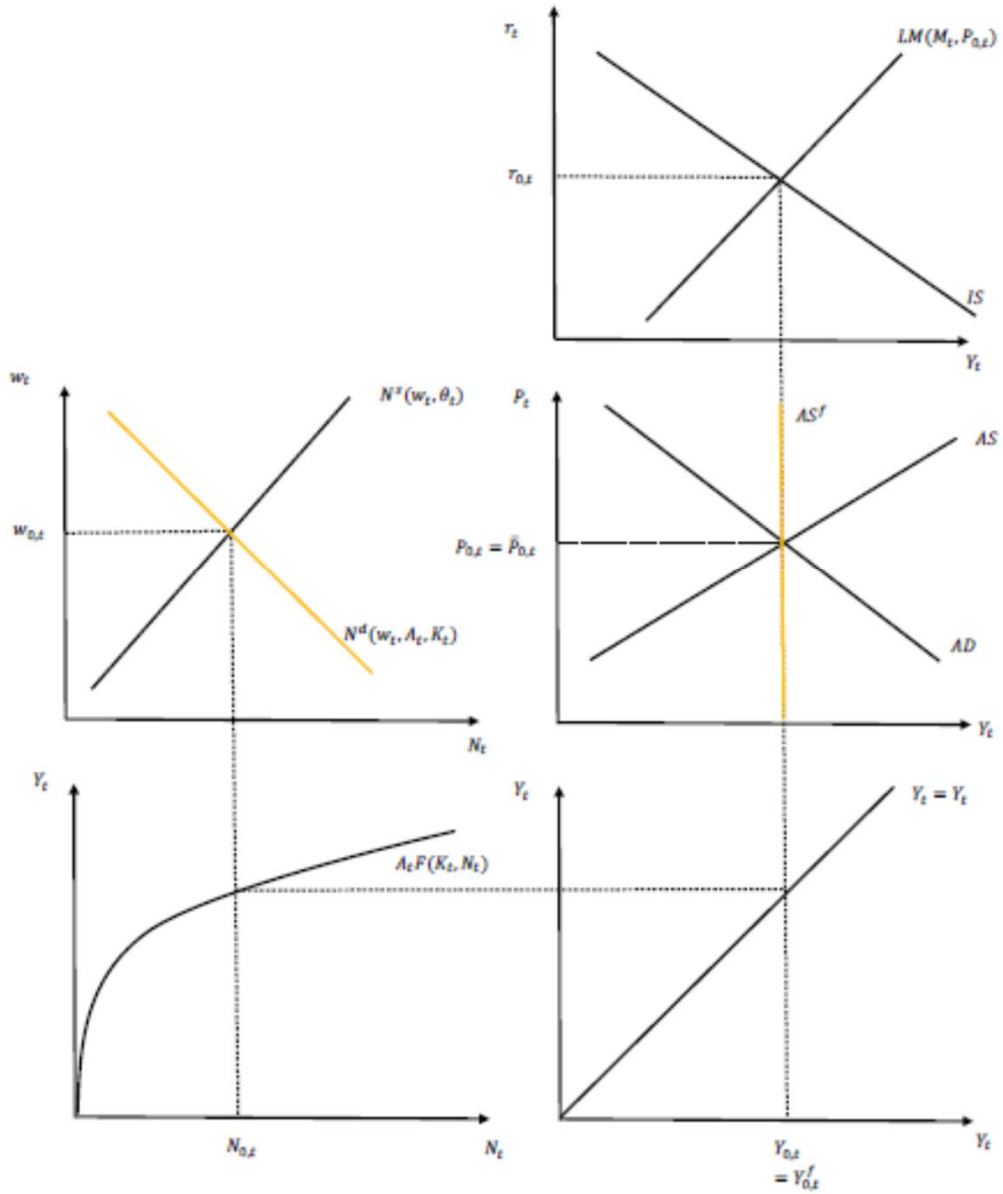
$f > 0$ implies consumption too high, investment too low, relative to social planner's solution

The Exogenous Spread and Financial Crises/Recessions

Equilibrium

Hard to see any impact of *f* in medium run equilibrium; one needs to have a shock

Figure 35.2: Equilibrium in the Partial Sticky Price Model with Financial Frictions



Where's the spread, *f*, show up?

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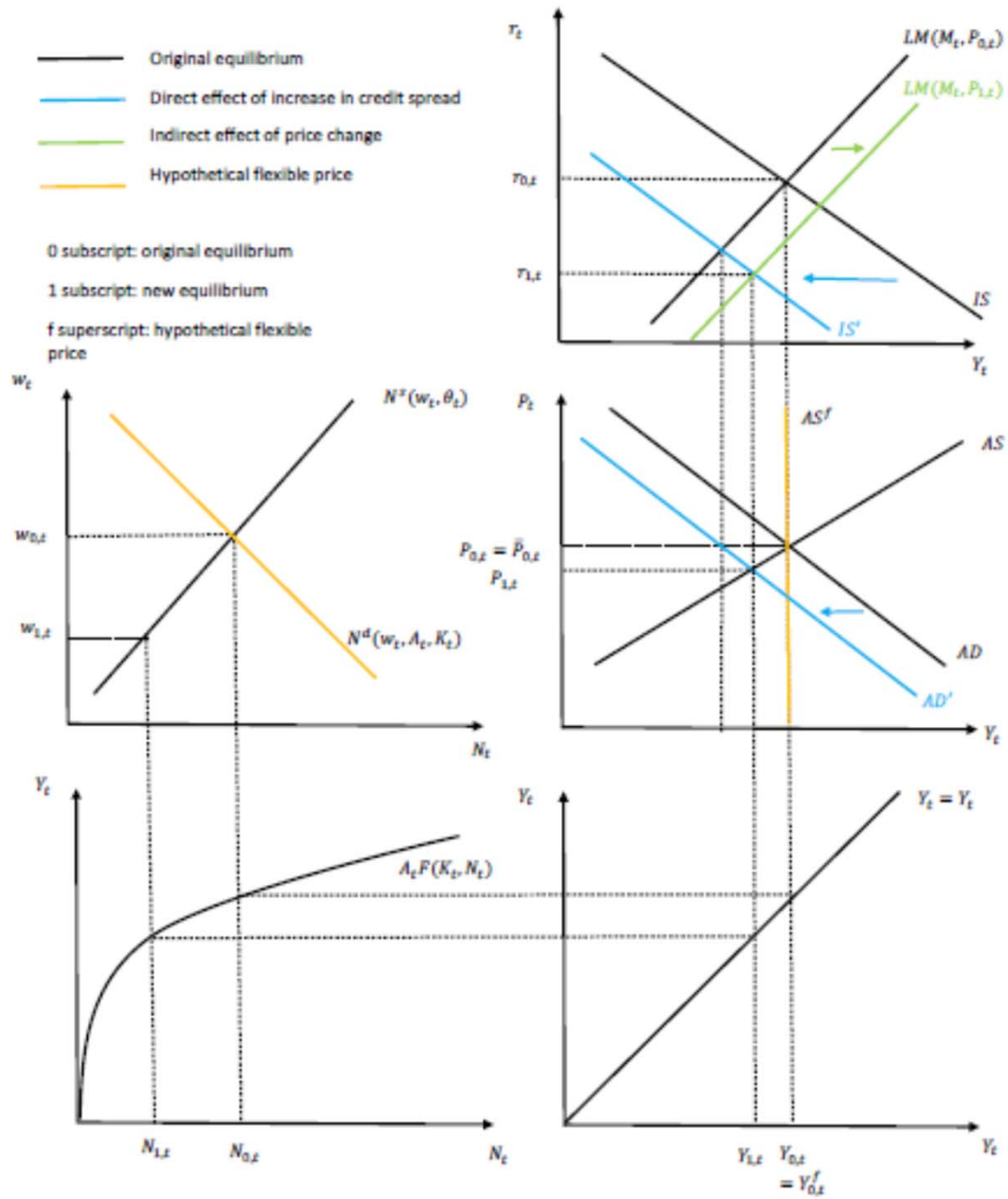
Exogenous increase in *f*

- IS shifts in (blue arrow)
- P falls (move along AS)
- LM shifts out (green arrow)
- Output falls
- *r* is lower, but w/higher *f*, *I* lower

Figure 35.3: Increase in Credit Spread

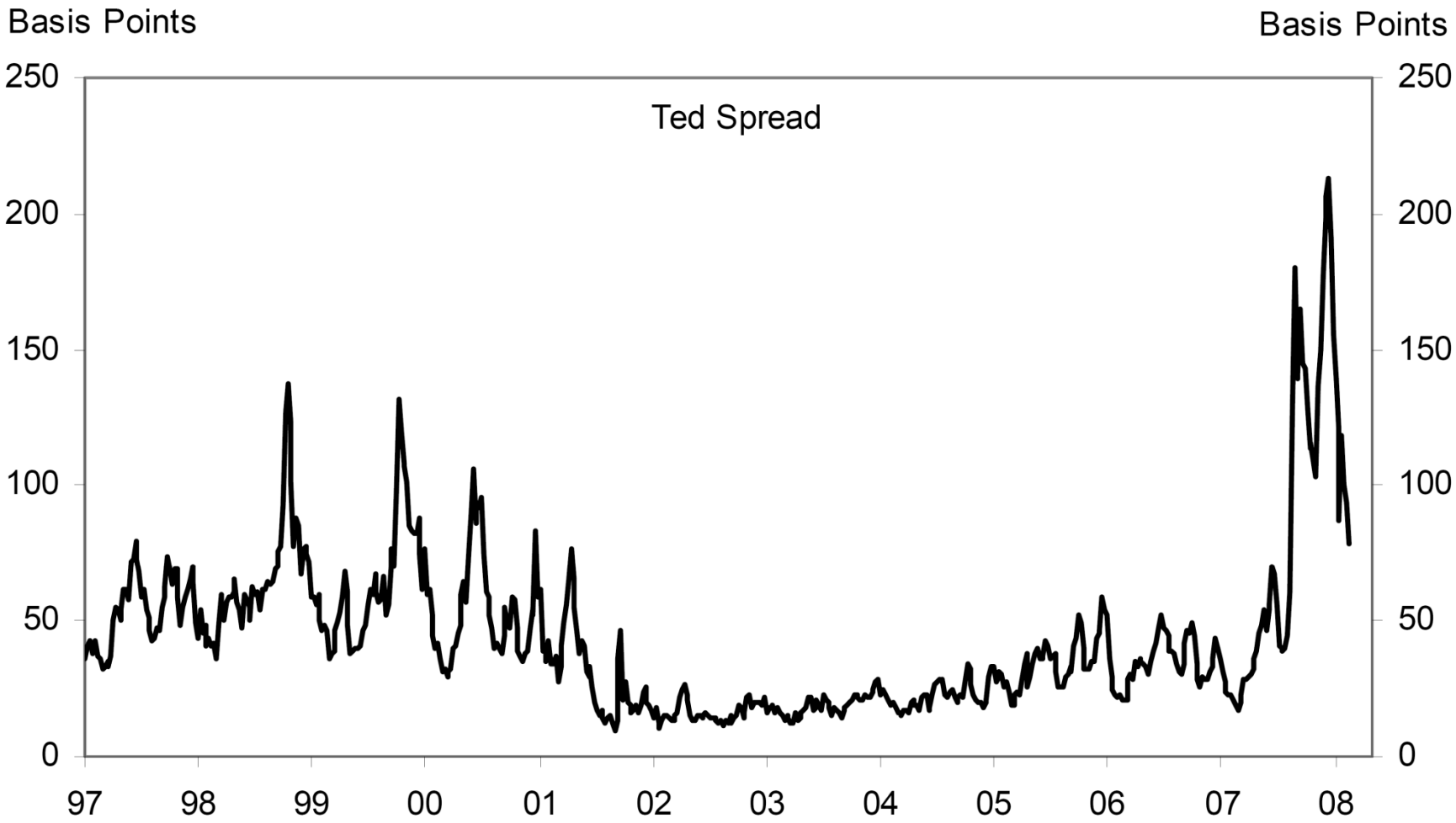


Interpreting Exogenous Increases in *f*

- Exogenous increases associated with “runs” on banks, panics
- Example is 2007-08 financial crisis where suddenly lots of bank assets were perceived as lower value than previously
- Here f moves in a way exogenous with respect to the business cycle
- But other movements in f a way endogenous with respect to the business cycle

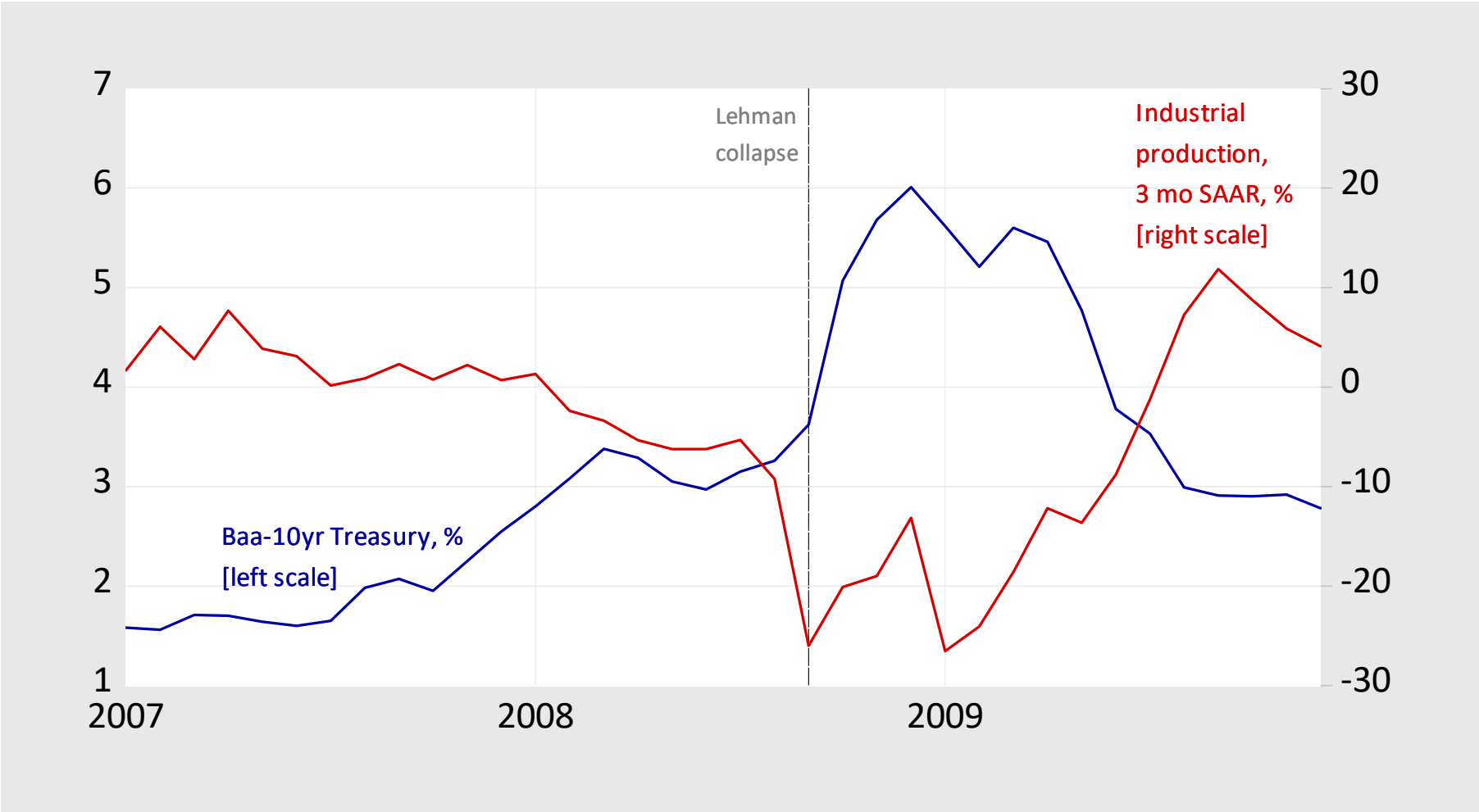
One Proxy – 3 month Libor-US Treasury

Exhibit 2.8 Treasury-Eurodollar (TED) Spread



Source: Financial Times. Federal Reserve Board.

Credit Spread during Great Financial Crisis



The Endogenous Component of the Spread

Interpreting Endogenous Changes in *f*

- But other movements in *f* a way endogenous with respect to the business cycle
- This feedback between business cycle and credit spread can be called a financial accelerator model
- Arises because of collateral constraints limit how much can be borrowed (Bernanke, Gertler & Gilchrist, 1999)
- Summarize as:

$$f_t = \bar{f}_t - aY_t \tag{35.24}$$

Intuition for Financial Accelerator

- Firms can only invest out of borrowing
- But firms can only borrow as much as value of capital stock (minus debt), which can be seized (this is called a collateral constraint)
- Value of capital stock goes down

  - during economic downturns as sales go down

  - as real interest rates go up

Collateral Constraints: Recession induced decline in capital value

Pre-Shock Firm Balance Sheet

Assets	Liabilities
Capital (1 million machines × $1000/machine = $1 billion)	Debt ($700 million)
	Equity ($300 million)

Net worth = $300 million

Post-Shock Firm Balance Sheet

Assets	Liabilities
Capital (1 million machines × $800/machine = $1 billion)	Debt ($700 million)
	Equity ($100 million)

Price of machines falls by 20%
Net worth = $100 million

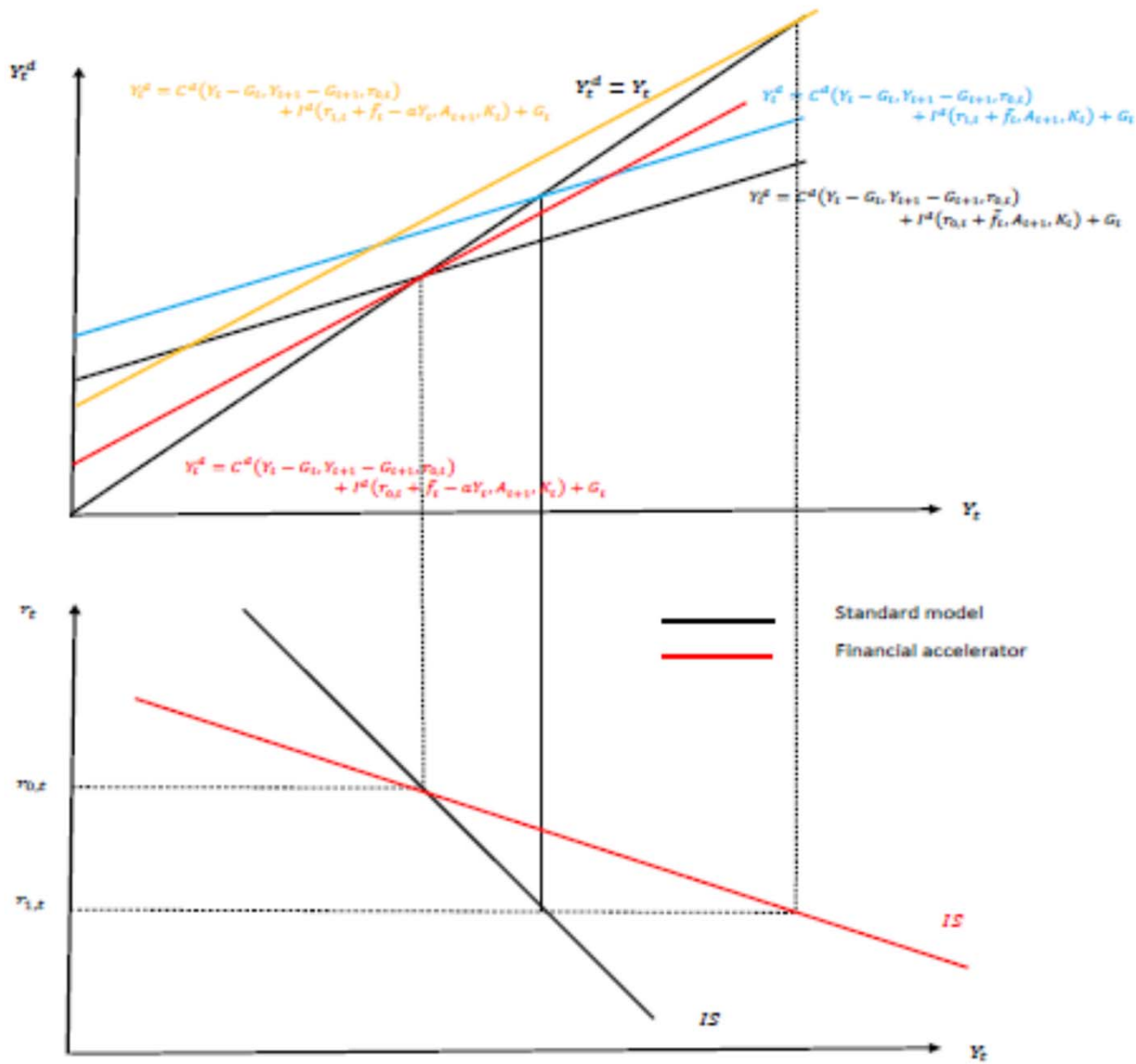
Intuition for Financial Accelerator

- But if all firms behave the same, investment falls reducing aggregate demand, which further reduces value of capital, hence borrowing, hence investment
- Cycle repeats…
- This implies any change in *r* results in larger change in AD
- I.e., flatter IS curve

Derivation of IS

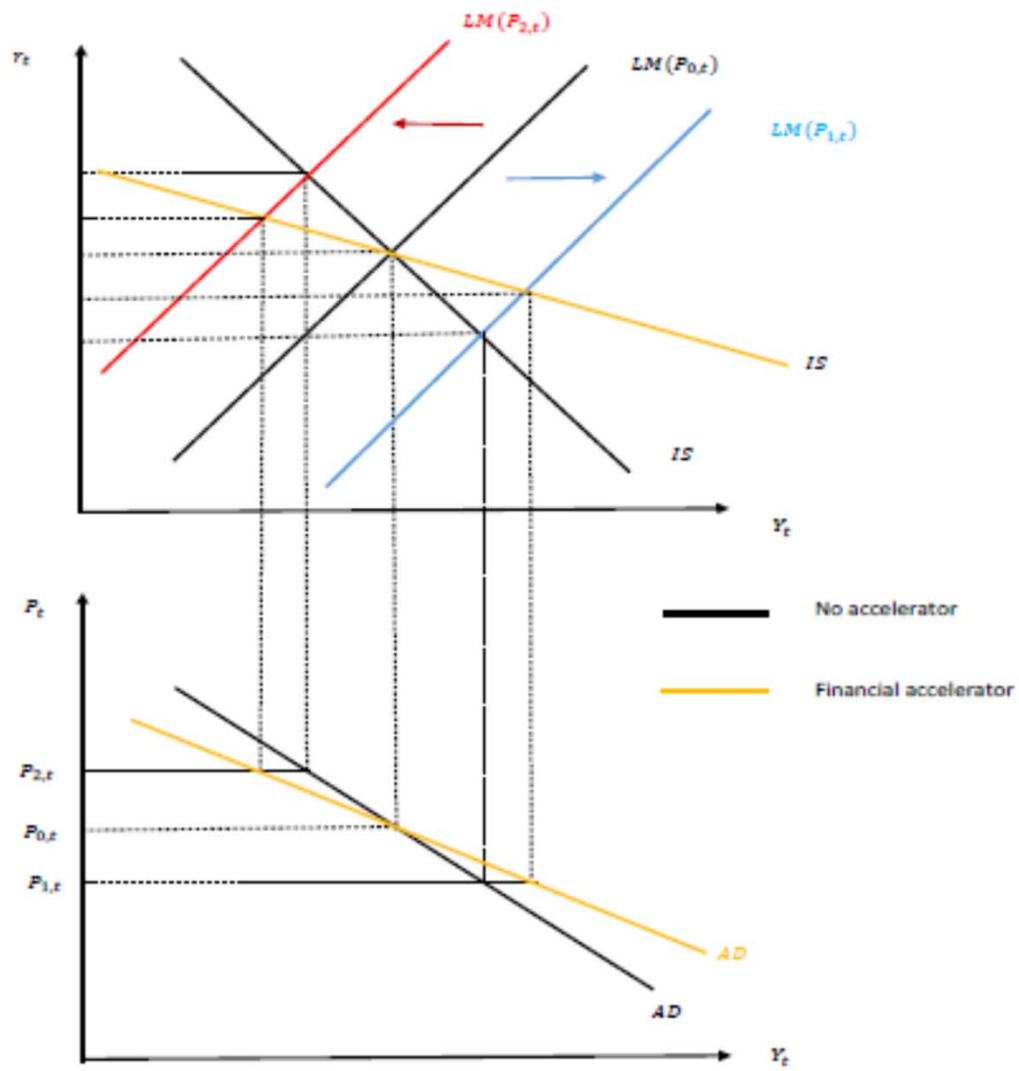
- Feedback leads to flatter IS

Figure 35.4: The IS Curve with the Financial Accelerator



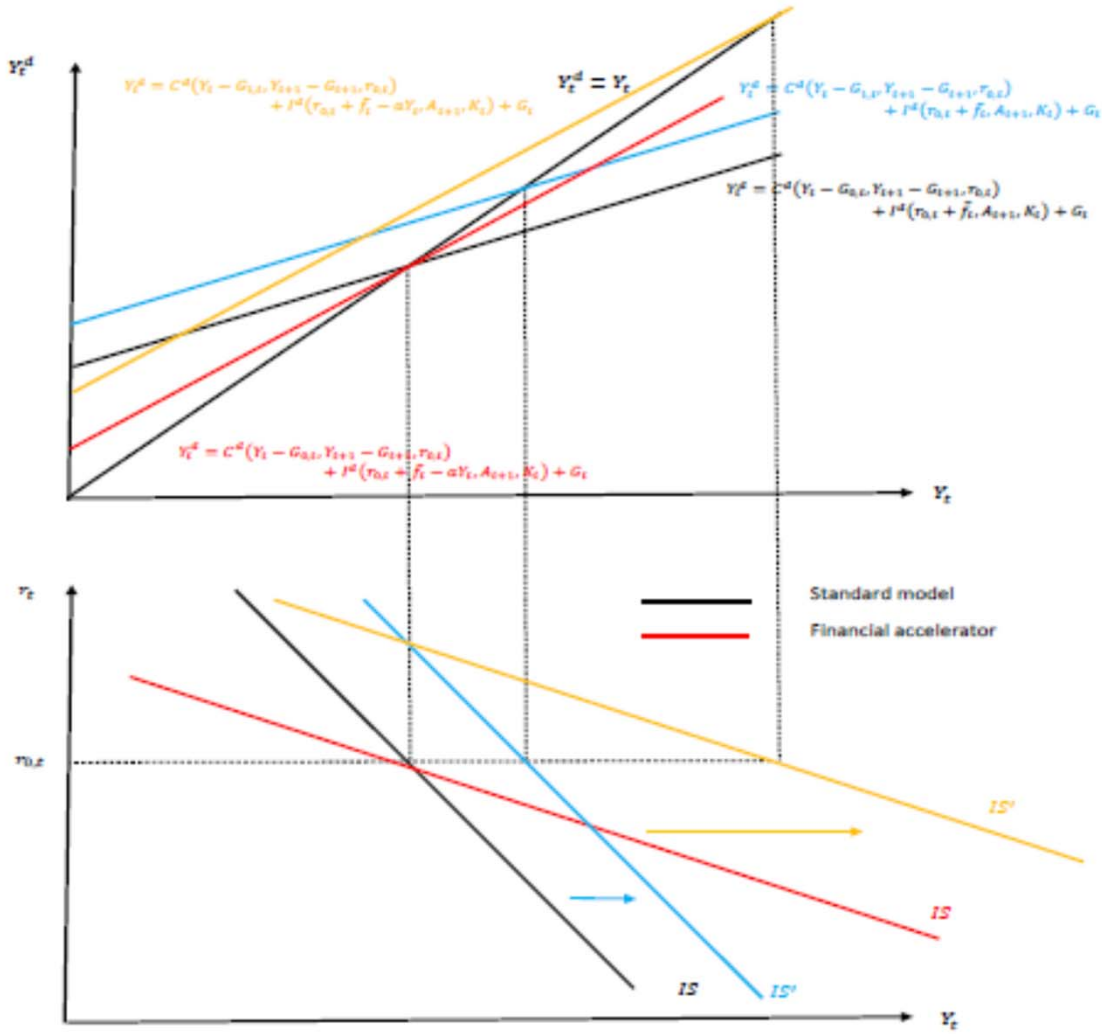
Flatter AD Curve

Figure 35.5: The AD Curve with the Financial Accelerator



Shift: Increase in G

Figure 35.6: Shift of the IS Curve with the Financial Accelerator



IS-LM AD-AS

Figure 35.7: IS-LM-AD-AS Curves with Financial Accelerator

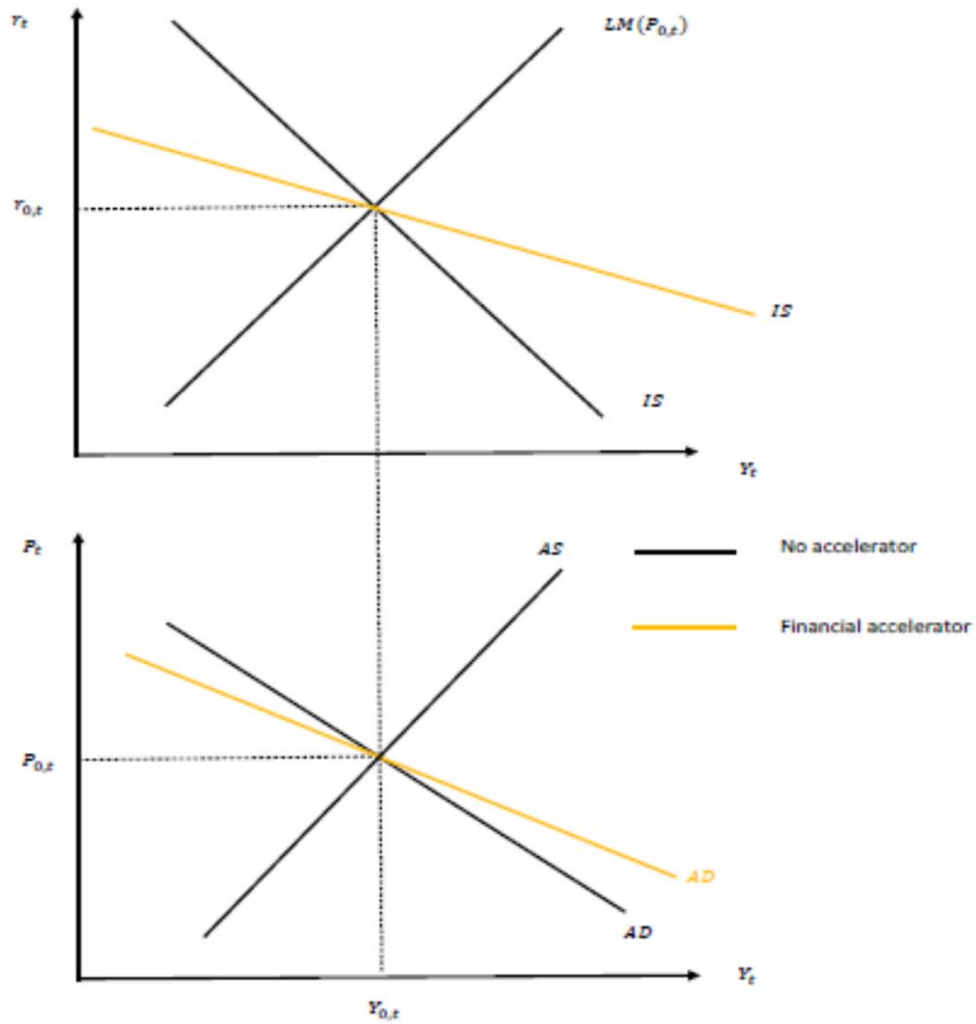


Figure 35.8: Supply Shock with Financial Accelerator

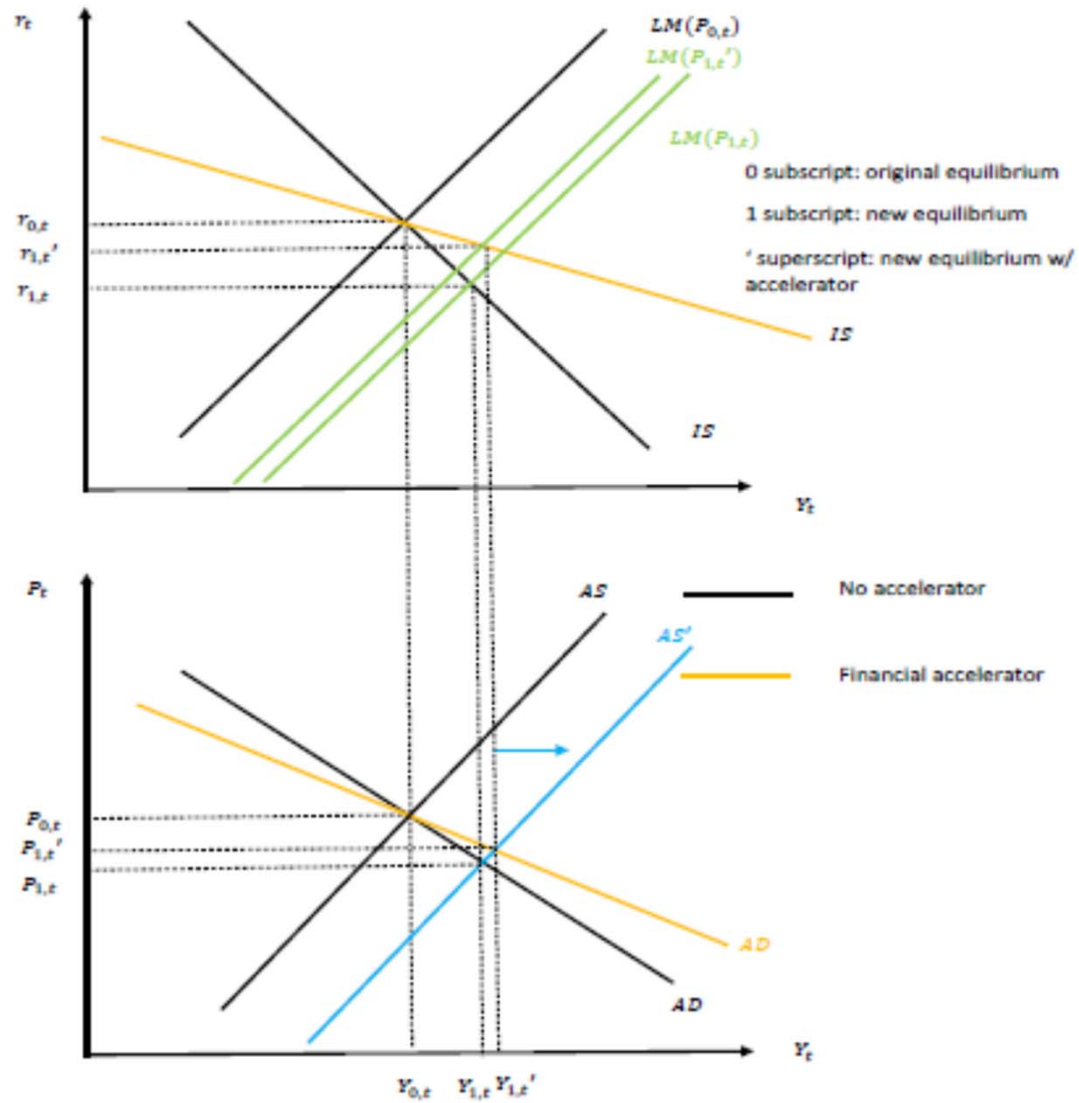
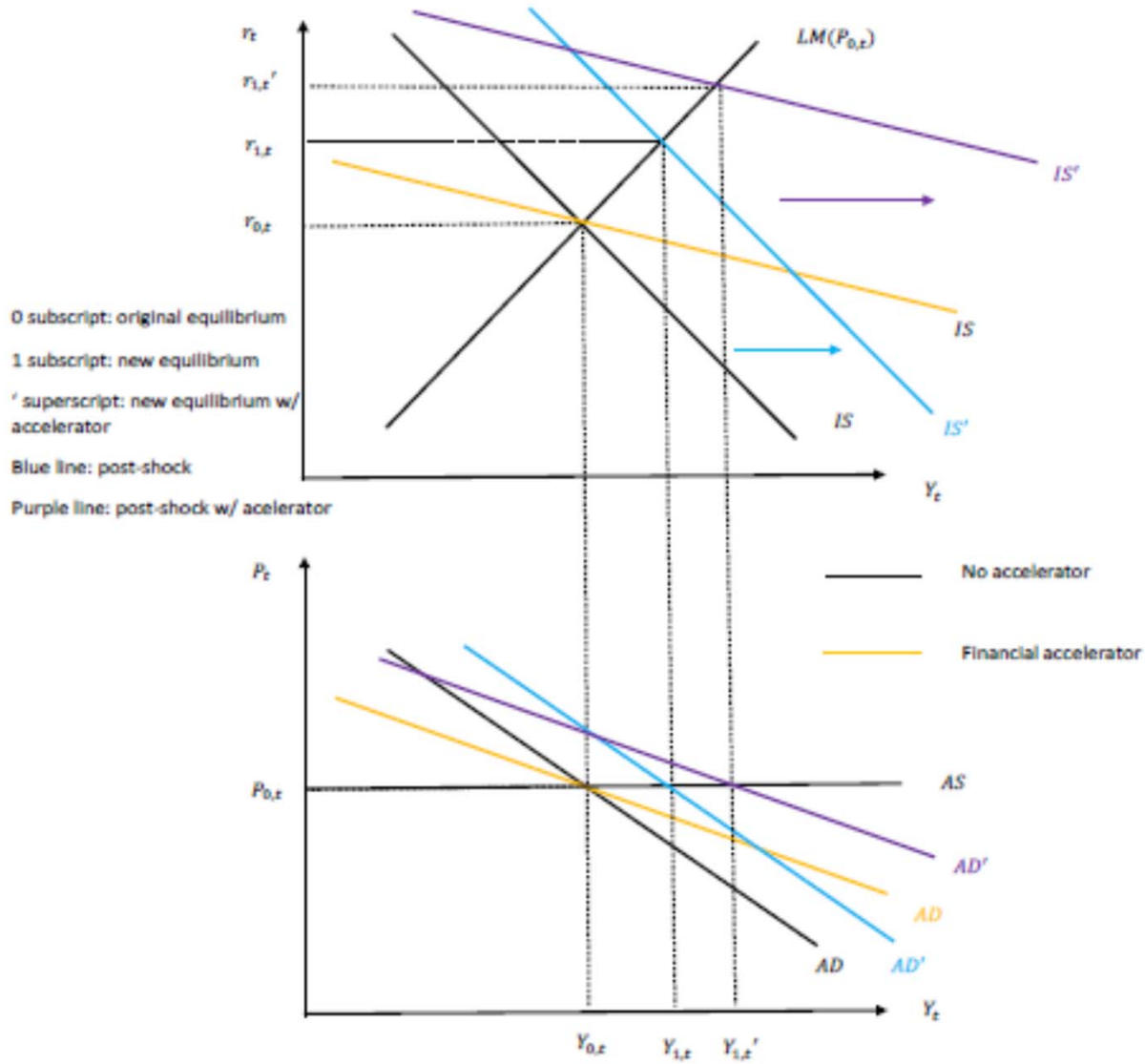


Figure 35.9: Demand Shock with Financial Accelerator, Simple Sticky Price Model



Summary

- Financial structure only matters if there are frictions
- One friction – here assume firms borrow at higher rate than households
- Positive credit spread means equilibrium is not Pareto optimal
- Increase in f shifts in IS
- Defaults rise with economic weakness
- Financial accelerator flattens IS, AD
- And amplifies shocks