A Macroeconomic Model with Financially Constrained Producers and Intermediaries

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Overview:

- Model that combines risk-averse households, financially-constrained firms and intermediaries.
- Occasionally binding constraints in both corporate and financial sectors.
- Possibility of intermediary default and government bailouts.
- Prior literature – explores occasionally binding constraints and key non-linearities but doesn't offer a clear distinction between firms and intermediaries (Brunnermeier and Sannikov, He and Krishnamurthy, Gertler and Kyotaki).

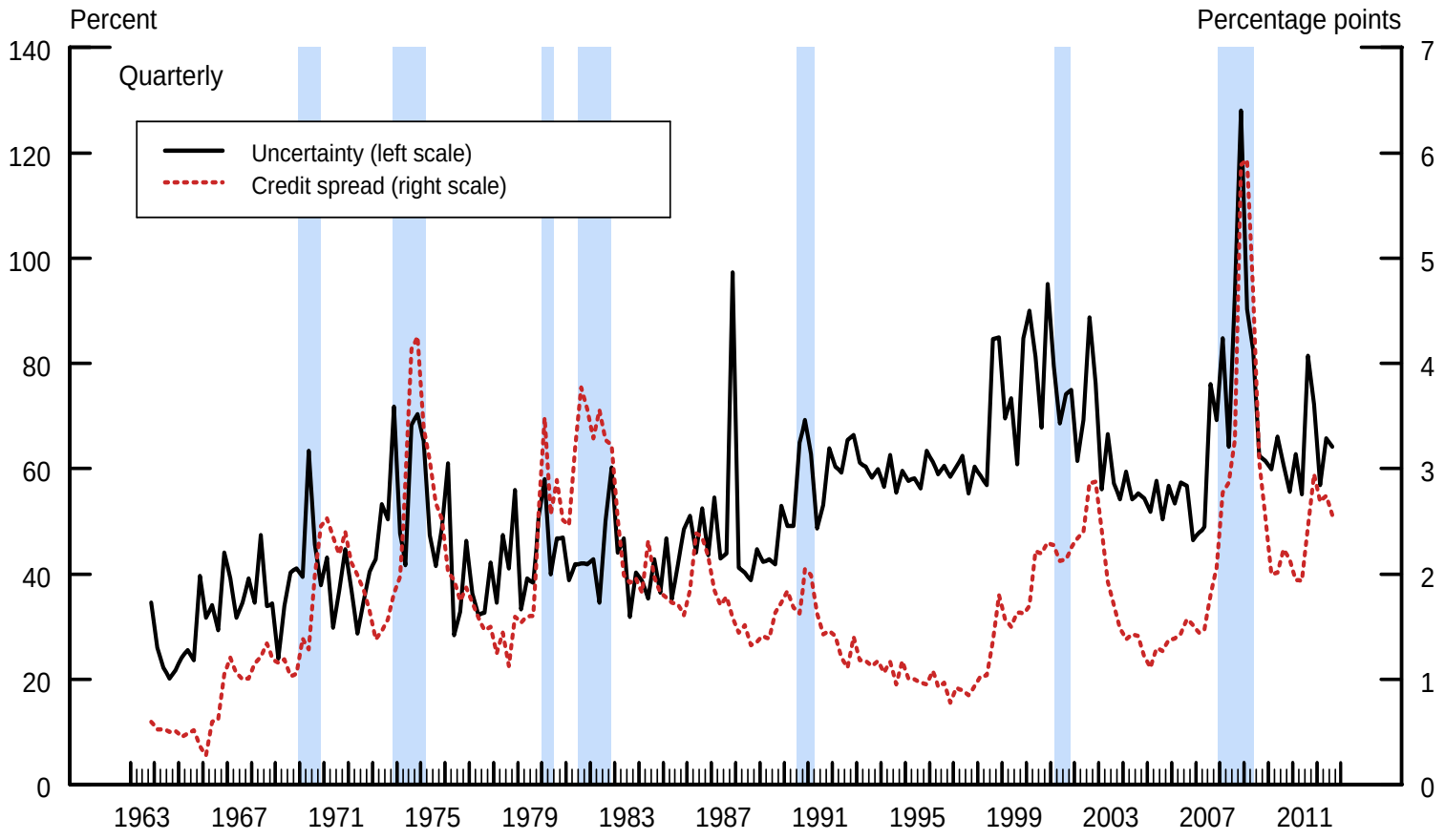
Ingredients:

- Knightian households – only hold safe assets.
- Firms – finance capital stock use combination of internal net worth and defaultable long-lived debt.
- Intermediaries – hold long-lived debt of corporate sector financed with short-term deposits from households.
  - Combine maturity transformation and bear credit-risk.
  - Face occasionally binding constraint (regulatory?).
  - Can default on depositors which requires government bailout.

Results

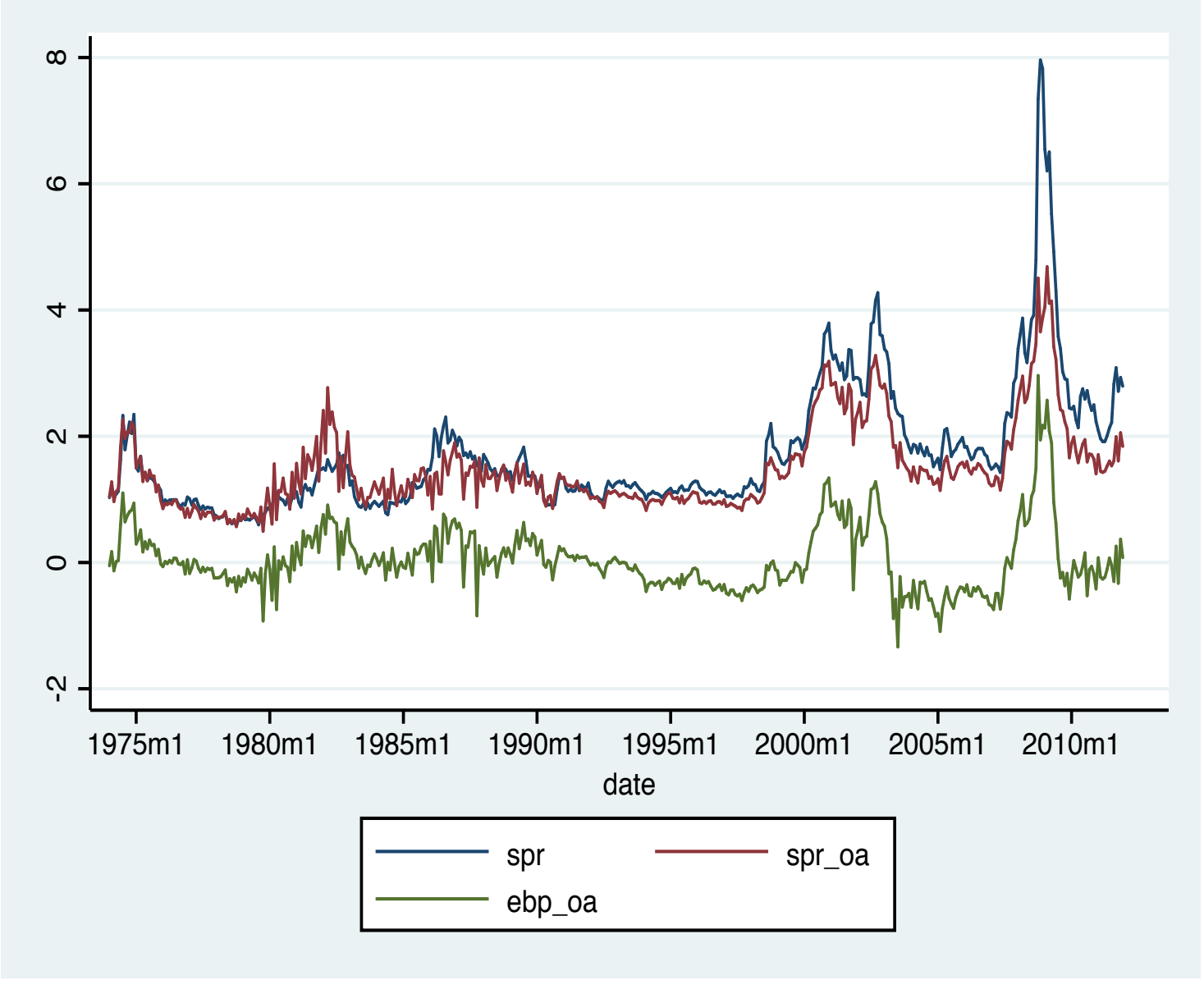
- Prolonged contraction as heightened uncertainty lowers bond prices leading to large losses in intermediary balance sheets and increased funding costs for non-financial sector.
- Widening credit spreads on corporate bonds due to intermediary asset pricing mechanism.
- Increased demand for safe assets and falling real rates soften the blow to financial sector.

Credit Spreads vs Uncertainty



GSZ and Caldera et al: uncertainty only affects economy if linked to widening credit spreads.

Credit Spreads vs Excess Bond Premium (GZ 2012)



Excess Bond Premium vs Broker-Dealer CDS (GZ 2012)

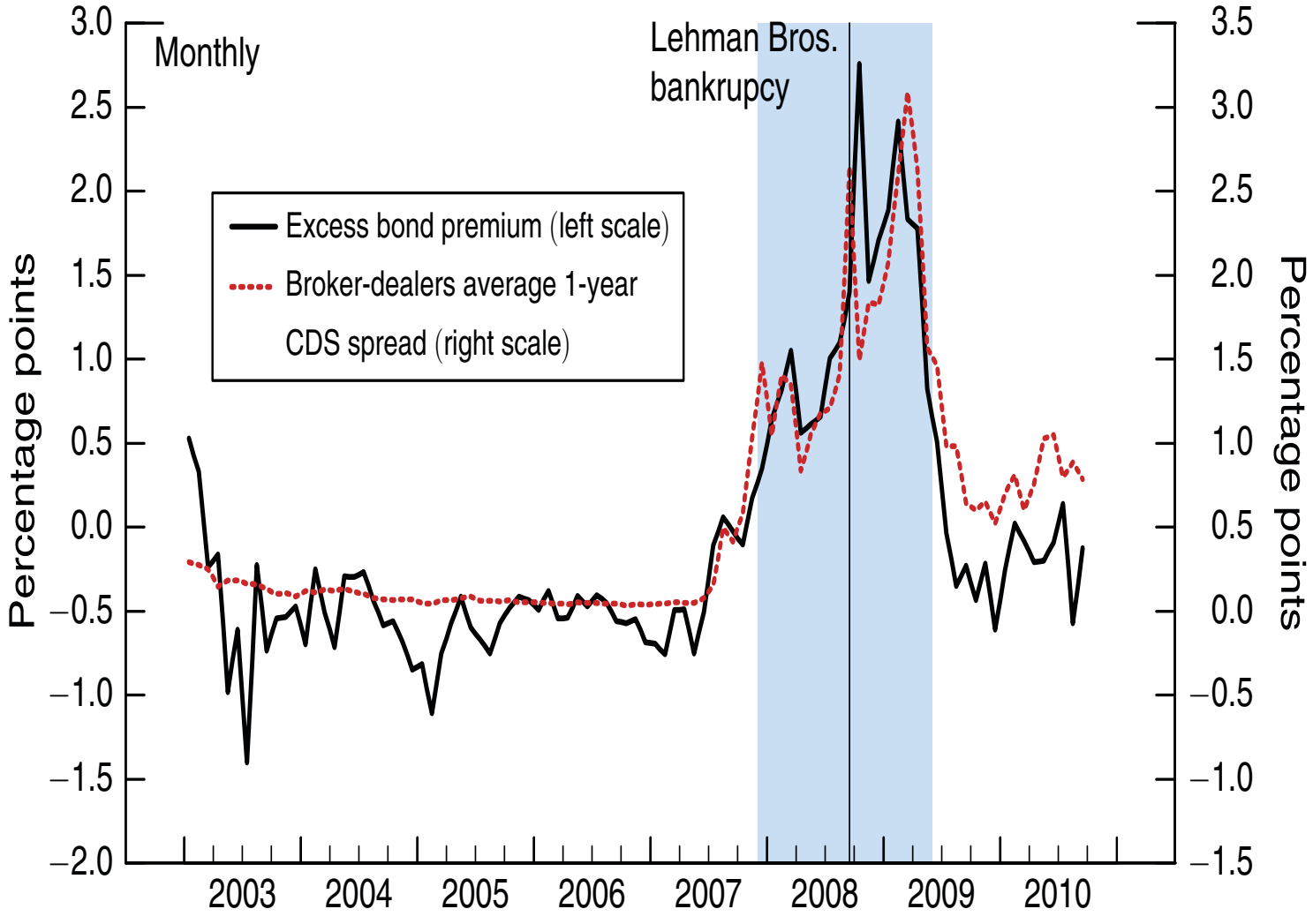


FIGURE 8. THE EXCESS BOND PREMIUM AND FINANCIAL INTERMEDIARY CDS SPREADS

Intermediaries:

- Assume zero recovery on defaulted debt and ignore taxes
- Max PDV of utility subject to

$$C_t^I = (1 - \Phi(\omega_t)) \left[1 + \delta q_t^m\right] A_t - D_{t-1} - \left(q_t^m A_{t+1} - q_t^f D_t\right)$$

$$D_t \leq \xi q_t^m A_t^I$$

where $\Phi(\omega_t)$ denotes fraction of long-term bonds defaulted on by corporate sector.

- Euler equations for long-term bonds

$$1 - \xi \lambda_t^I = E_t \left(1 - F_\rho\left(\rho_t\right)\right) M_{t,t+1}^I \left(1 - \Phi(\omega_{t+1})\right) \frac{\left(1 + \delta q_{t+1}^m\right)}{q_t^m}$$

Firms:

- Assume log-normal idiosyncratic shock over profits rather than output and again ignore taxes.
- Max PDV of Utility subject to

$$\begin{aligned} C_t^B + p_t K_{t+1} &= (1 - \Phi(\omega_t)) \left[\pi_t^* K_t + p_t (1-\delta) K_t\right] \\ &\quad - (1 - \Phi(\omega_t)) \left[\left(1 + \delta q_t^m\right) A_t^B\right] + q_t^m A_{t+1}^B \end{aligned}$$

where

$$\pi_t^* = \frac{(1 - \Phi(\omega_t - \sigma))}{1 - \Phi(\omega_t)} \pi_t$$

- Euler equation on debt issuance (assuming no binding constraint)

$$1 = E_t M_{t,t+1}^B \left[(1 - \Phi(\omega_{t+1})) \frac{\left(1 + \delta q_{t+1}^m\right)}{q_t} \right]$$

Arbitrage in bond market:

- Combining firm and intermediaries Euler equation on debt implies

$$E_t\left(\left[M^B_{t,t+1} - \left(1 - F_\rho\left(\rho_t\right)\right) M^I_{t,t+1}\right] R^B_{t+1}\right) = \xi \lambda^I_t$$

where

$$R^B_{t+1} = \left(1 - \Phi(\omega_{t+1})\right) \frac{\left(1 + \delta q^m_{t+1}\right)}{q^m_t}$$

- Intermediaries become more risk averse relative to firms in recession – this drives bond prices down and required return up – credit spreads widen by more than required compensation for default risk.
- Intermediaries have no direct effect on equity prices however.

Tobin's Q:

- Firms' pricing kernel determines asset price p_t:

$$p_t = E_t M^B_{t,t+1} \left(1 - \Phi\left(\omega_{t+1}\right)\right) \left[\pi^*_{t+1} + \left(1 - \delta^k\right) p_{t+1}\right]$$

- Default risk increases effective discount factor but does not imply large declines in price.
- This suggests we can't get large fluctuations in asset prices unless we have a binding constraint on firms (or extreme risk aversion in the corporate sector during downturn).

Optimal default choice on corporate debt:

- Model assumes simple cutoff rule based on "subidiary" within-period profits falling below required debt burden (liquidity not solvency).
- Conglomerate that makes within-period optimal default choice determines cutoff based on savings in bond issuance relative to marginal costs of default

$$\phi(\omega_t)\left(1+\delta q_t^m\right)B_t = \left[\phi(\omega_t-\sigma)\pi_t + \phi\left(\omega_t\right)p_t\left(1-\delta^k\right)\right]K_t$$

Role of savers:

- Precautionary savings during downturn increases demand for safe assets.
- Contraction in financial sector decreases supply of safe assets.
- Result: sharp drop in risk free rate benefits banks who can recapitalize more quickly.
- Also solves the “comovement” puzzle – consumption falls sharply despite shock to “investment”.

Timing:

- Spike in credit spreads is short-lived.
- Recessionary effects are long-lasting.
- Consistent with evidence during Great Recession.

Market vs book values:

- Intermediaries: book leverage is procyclical, market leverage countercyclical as in data.
- Market value of of corporate sector (equity) drops initially but then jumps 100% relative to steady-state.
  - Strikingly counterfactual.
  - Why? (asset prices rebound but do not rise above steady-state).

Policy experiments:

- Intermediaries gain from tighter regulation (at least over some range) while borrowers lose.
- Intuition – intermediary sector fails to internalize the cost of excessive leverage.
    - Familiar result that restricting leverage of intermediary sector can be welfare improving owing to pecuniary externality.
- On net, corporate sector gains from a financial crisis – paper suggets gains reflects "buying opportunities" during the fire sale but who are they buying from?

Summary:

- Rich model with many moving parts that captures key elements of financial crisis:
  - Credit spreads widen more than default risk and are closely tied to intermediary balance sheets during recession.
  - Consumption falls despite investment-driven contraction.
  - Deterioration in debt markets is short-lived while contraction is long-lived.
- Welfare analysis highlights key tradeoff between achieving low average funding costs and financial stability.