A Macroeconomic Model with Financially Constrained Producers and Intermediaries

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March 31st, 2017
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.
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.
GSZ and Caldera et al: uncertainty only affects economy if linked to widening credit spreads.
types of institutional investors by their active procyclical management of leverage: expansions in broker-dealer assets are associated with increases in leverage as broker-dealers take advantage of greater balance sheet capacity; conversely, contractions in their asset holdings are associated with the deleveraging of their balance sheets.

The solid line in Figure 8 depicts the excess bond premium, while the overlayed dotted line represents the average one-year CDS spread for these institutions. The striking degree of comovement between the two series over the period shown again supports the interpretation that the excess bond premium fluctuates closely in response to movements in capital and balance sheet conditions of key financial intermediaries.14 Indeed, the collapse of Lehman Brothers on September 15, 2008—a watershed event in the recent crisis—provides a dramatic example of how disruptions in the effective risk-bearing capacity of the financial sector can influence the supply of credit.

To analyze more formally how shocks to the profitability of financial intermediaries affect our gauge of credit supply conditions, we consider a VAR, consisting of the option-implied volatility on the S&P 500 (VIX), the (value-weighted) excess market return, the (value-weighted) excess portfolio return of broker-dealers, the average one- and five-year broker-dealer CDS spreads, and the excess bond premium. By including both the one- and five-year CDS spreads, we allow such financial shocks to affect the market assessment of near- and longer-term default risk for these institutions. The VAR, using three lags of each endogenous variable, is estimated over the 2003:1–2010:9 period and also includes a dummy variable for September 2008.15

Within this multivariate framework, we trace out the impact of an orthogonalized shock to the excess return of broker-dealers, an innovation that, according to 14 Prior to 2003, only a small subset of broker-dealers had CDS contracts traded in the market. 15 Standard regression diagnostics revealed that this observation exerted an unduly large influence on the estimated coefficients.

Figure 8. The Excess Bond Premium and Financial Intermediary CDS Spreads

Notes:

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Intermediaries:

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

\[
C_I^t = (1 - \Phi(\omega_t)) \left[ 1 + \delta q^m_t \right] A_t - D_{t-1} - \left( q^m_t A_{t+1} - q^f_t D_t \right)
\]

\[
D_t \leq \xi q^m_t A_t^I
\]

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

- Euler equations for long-term bonds

\[
1 - \xi \lambda^I_t = E_t \left( 1 - F_\rho (\rho_t) \right) M^I_{t,t+1} \left( 1 - \Phi(\omega_{t+1}) \right) \frac{1 + \delta q^m_{t+1}}{q^m_t}
\]
Firms:

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

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

where

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

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

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

- Combining firm and intermediaries Euler equation on debt implies

\[ E_t \left( [M_{t,t+1}^B - (1 - F \rho(\rho_t)) M_{t,t+1}^I] R_{t+1}^B \right) = \xi \lambda_t^I \]

where

\[ R_{t+1}^B = (1 - \Phi(\omega_{t+1})) \frac{(1 + \delta q_{t+1}^m)}{q_t^m} \]

- 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.
Firms’ pricing kernel determines asset price $p_t$:

$$p_t = E_t M_{t,t+1}^B (1 - \Phi (\omega_{t+1})) \left[ \pi_{t+1}^* + (1 - \delta^k) p_{t+1} \right]$$

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

\[ \phi(\omega_t) (1 + \delta q^m_t) B_t = \left[ \phi(\omega_t - \sigma) \pi_t + \phi(\omega_t) p_t \left( 1 - \delta^k \right) \right] K_t \]
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 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 suggests 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.