Capital Constraints and Asset Prices

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Capital Constraints

Distinguish between two types of capital constraints

A. Market segmentation: some capital is kept (exogenously) from participating (continuously) in a given market
   - Only "sophisticated" capital (risk-bearing capacity) prices certain assets; restrained by risk aversion
   - "Unsophisticated" are constrained; under-participate (relative to Walrasian)
   - Equity issuance constraints

B. Borrowing constraints: some agents' participation limited by ability to borrow
   - "Sophisticated" agents are constrained; under-participate (relative to Walrasian)
   - "Unsophisticated" need not be constrained; restrained by risk aversion
   - Asset-specific leverage constraints ("margin" constraints)

Consequences on Risk Prices

A. Market segmentation
- higher at all times
- more volatile at all times
- cross-sectional implications; relate risk prices with quantities and risk tolerance (proxied by capital)

B. Margin constraints
- higher some times (when constraints bind or close to binding)
- more volatile some times (when constraints bind or close to binding)
- cross-sectional implications; relate risk prices with quantities, risk tolerance, and the margin level and the status of the funding constraint

Testable Predictions

- Common:
  - Pricing kernel (market specific) depends on the positions (inventories) of sophisticated agents: when observed to increase ("supply shock"), expected returns should increase
  - When their risk tolerance drops (because of capital loss), expected returns should increase
  - Cross-section: expected returns depend on covariance of asset payoffs with inventory payoff
- In addition, margin constraints
  - Give rise to dependence on additional parameters, namely margins and severity of constraint
  - In particular, cashflows properties no longer determine prices. In fact, even assets with perfectly correlated cashflows may have different prices ⇒ failure of the Law of One Price
  - Additional observables:
    - Margins { cross-sectional restrictions
    - Constraint severity { time-series restrictions

Capital Mobility and Dynamics

- Markets react to profit opportunities
  - Capital flows with varying speed (market specific)
  - Time signature of price reactions to supply (reversion) shocks
  - (Darrell Duffie's AFA presidential address 2010)
- Regulators may react to liquidity shortages
  - Goal is to reduce required returns by diminishing the cost of capital (not risk premium)
  - Low required returns ⇒ high investment
  - Implementation: capitalize intermediaries, esp. by lending *at low margins*
  - As funding illiquidity measures drop, prices recover

Modelling

- Frequently partial equilibrium: asset supply varies exogenously
- CARA-normal, i.e., (myopic) mean variance

$$\max_{q_t} \mathrm{E}\left[q_t^\top (p_{t+1} - Rp_t)\right] - \frac{A}{2}\mathrm{Var}_t\left[q_t^\top p_{t+1}\right]$$
$$\text{s.t.} \quad q_t = s_t$$

$\Rightarrow$

$$p_t = R^{-1}\left(\mathrm{E}_t\left[p_{t+1}\right] - {}^{A}\mathrm{Var}_t\left[p_{t+1}\right] s_t\right)$$

- Make simplifying assumptions, such as:
  - one-period (two-dates) model
  - i.i.d. asset payoff innovations
  - perfect foresight of supply d, or independence of supply and CFs

  to get

$$p_t = \sum \text{Disc. Exp. CFs} - {}^{A} \times \text{Disc. Innov. Var} \times \text{Supply}$$

- In general, there are other covariance terms (e.g., supply goes up together with innovation variance)

Empirical Evidence

- Catastrophe risk (Froot and O'Connell 1999)
  - Following big losses ($^{A} \nearrow$), premia jumped (and stayed high)
- Stock market
  - Index recomposition (Greenwood 2005): cross-sectional effects as predicted by theory for Nikkei 225
  - Market-maker inventories (Hendershott and Seasholes 2007)
  - Mutual-fund trades (Coval and Stafford 2007)
- Treasury bonds
  - Supply fluctuations; stronger effects following arbitrageur losses
  - Krishnamurthy and Vissing-Jorgensen (2010), Greenwood and Vayanos (2010)
- Corporate bonds
  - Lower prices during glut of bonds in underwriters' inventories (Newman and Rierson 2003)

Empirical Evidence

- Options
  - As long as not perfectly hedgeable
  - Bollen and Whaley (2004) – Lee-Ready type algorithm
  - Gârleanu, Pedersen, and Poteshman (2010) – data on "market-making sector" ⇒ stronger effects following losses
- Foreign exchange
  - Inter-currency flows of funds due to stock-index rebalancing (Hau, Massa, and Peress 2005)
  - Broker-dealer balance sheets (Adrian, Etula, and Shin 2010)
- Commodities
  - Hong and Yogo (2010) – open interest growth has predictive power
  - Acharya, Lochstoer, and Ramadorai (2010): variation in demand and pricing agent's capital
- Many omitted names/papers

Modelling

- Restrictions (à la C-CAPM) derived in continuous-time models
- Simple mean-variance model:

$$\max_{q_t} \mathrm{E}\left[q_t^\top (p_{t+1} - R p_t)\right] - \frac{{}^{B}}{2}\mathrm{Var}_t\left[q_t^\top p_{t+1}\right]$$
$$\text{s.t.} \quad q_t = 1$$
$$\sum_i |q_t^i| p_{t+1}^i m_t^i \leq W_t^B$$

$\Rightarrow$

$$p_t = (R + \quad D(m))^{-1}\left(\mathrm{E}_t[p_{t+1}] - \quad {}^{B}\mathrm{Var}_t[p_{t+1}]\,1\right)$$

- May add another agent (say, risk-averse lender), then aggregate

Modelling

- *Margin CAPM* holds:

$$\mathrm{E}_t[R^i_{t+1}] - R = \quad {}_t \; {}^i_t + m^i_t \quad x;$$

with $\quad {}_t = \mathrm{E}_t[R^{mkt}_{t+1}] - R - \left(\sum_i m^i_t q^i_t\right) \quad {}_t x$

- Implications:
  - The higher m, the larger the required return when $\quad > 0$
  - Even for $\quad {}_t = 0$, returns affected by possibility of future funding constraints via $\quad {}_t$
  - The higher m, the larger the exposure to (countercyclical) $\quad \Rightarrow$ higher volatility and when constraints (close to) binding
  - If all agents constrained, assets with identical CFs but different margin requirements may have different prices:

$$\mathrm{E}_t\left[R^i_{t+1} - R^{i'}_{t+1}\right] \approx \left(m^i_t - m^{i'}_t\right) \quad {}_t$$

- If R^u_t is B rate agents willing to pay for uncollateralized lending

$$\quad {}_t = R^u_t - R$$

Examples

- Hindy (1993), Hindy-Huang (1994)
- Geanakoplos (1997), Fostel and Geanakoplos (2008)
- Kiyotaki and Moore (1997), ...
- Ashcraft, Gârleanu, and Pedersen (2010), Gârleanu and Pedersen (2010)

Empirical Evidence: TALF – Survey

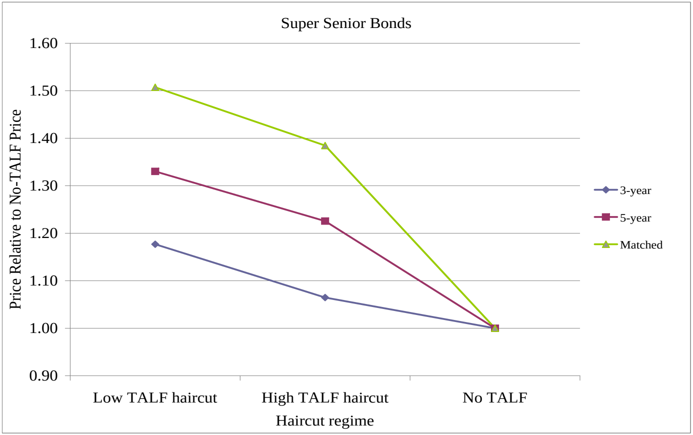

Figure: Excess Bid for Super-Senior CMBS with Fed Funding relative to Cash Bid (Ashcraft, Gârleanu, and Pedersen (2009)).

Empirical Evidence: TALF – Market Response

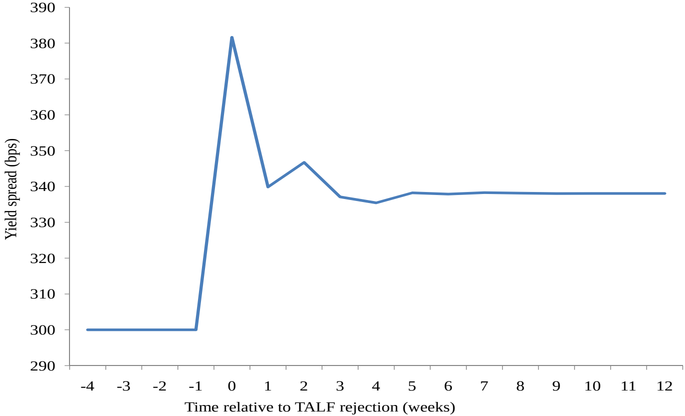

Figure: The yield-spread response of CMBS bonds rejected from the TALF program during the period July to September 2009 (Ashcraft, Gârleanu, and Pedersen (2010)).

Empirical Evidence: CDS-Bond Basis – Cross-Section

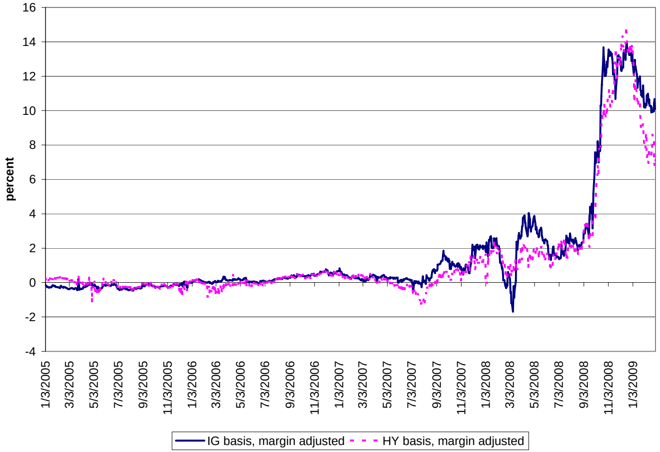

Figure: Investment Grade (IG) and High Yield (HY) CDS-Bond Bases, Adjusted for Their Margins (Gârleanu and Pedersen (2010)).

Empirical Evidence: CDS-Bond Basis – Time-Series

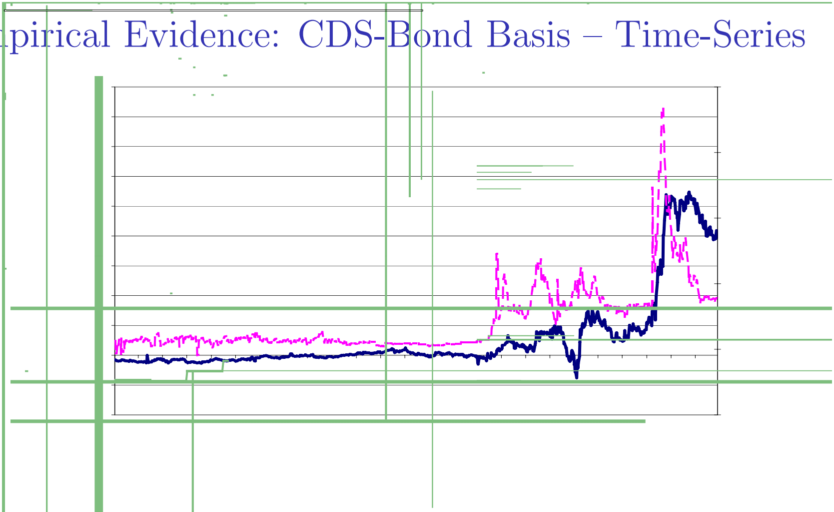

Figure: The CDS-Bond basis, the LIBOR-GCrepo Spread, and Credit Standards (Gârleanu and Pedersen (2010)).

Empirical Evidence: CDS-Bond Basis – 2nd Moments

	Investment Grade		High Yield	
	CDS	Bonds	CDS	Bonds
Volatility				
Full sample	3.02%	7.83%	13.31%	16.01%
Early	0.57%	0.51%	3.73%	2.76%
Crisis	3.92%	10.26%	17.19%	20.87%
Beta				
Full sample	0.12	0.26	0.54	0.69
	(0.02)	(0.05)	(0.08)	(0.09)
Early	0.05	-0.01	0.35	0.22
	(0.01)	(0.02)	(0.09)	(0.08)
Crisis	0.13	0.29	0.56	0.73
	(0.02)	(0.07)	(0.10)	(0.12)

Figure: Volatilities and Betas for Bonds (hedged with IR swaps) and CDS (Gârleanu and Pedersen (2010)).

Empirical Evidence: CIP Deviations

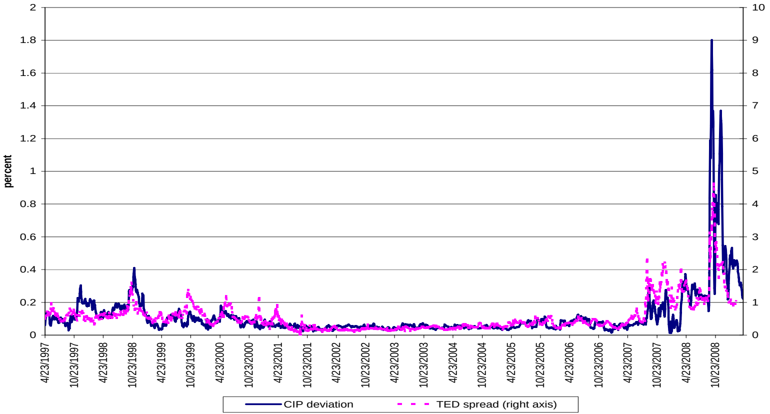

Figure: Average Deviation from Covered-Interest Parity and the TED Spread.

Careful analysis by Mancini-Griffoli and Ranaldo (2010)

Final Thoughts

- What determines capital dynamics?
  - Inattention
  - Search
  - Agency
- Enforcement of margin constraints requires knowledge of price – what about illiquid, opaque markets? Are there trading/manipulating issues?
  - Milbradt (2009)