Credit Default Swap Spreads and Systemic Financial Risk

Discussion

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- Idea
- Intuition
- The CDS-Cash Basis
- Comments

Idea

- Propose methodology to estimate Max and Min bounds on the probability that at least r banks default jointly within one month ('systemic risk').
  - Formulates the problem as a linear programming problem, by using the fact that defaults are discrete (binary) events.
  - Thus any 'higher order' event can be represented as a linear combination of 'elementary' events (independent and exhaustive).
  - An elementary event (for a total n banks) is a n-dimensional vector of zeros and ones.
  - The linear objectif function is constrained by information on
    1. marginal default probabilities extracted from Bonds.
    2. joint probability that two banks default extracted from CDS.
    3. elementary properties of probabilities (positive and sum to one).
- Estimates upper and lower bounds for the probability that $r = 4$ banks default together during the crisis.
- Proposes various identification approaches to account for liquidity discounts in bond prices
- One of the striking conclusions is that there was little increase in systematic risk during 2008-2009 period (mostly idiosyncratic)!

A (too?) simple example for the bounds

- Suppose two banks A and B that default with probability p_A and p_B. Then clearly we have:

$$p_{A,B} = p_A\, p(B|A) \quad (1)$$
$$p_B = p_A\, p(B|A) + (1 - p_A)\, p(B|noA) \quad (2)$$
$$(3)$$

- It is immediate (since $p(B|A)$ and $p(B|noA) \in [0,1]$) that if we know p_A and p_B, then the 'higher order' probability of 'systemic risk' satisfies the bounds:

$$\max(0, p_A + p_B - 1) \leq p_{A,B} \leq \min(p_A, p_B)$$

$\Rightarrow$ Bounds are not very informative (N.B.: for small p_a, p_B lower bound is 0). Overall not much information on higher order prob ('systemic risk') from knowledge about 'lower order' p_A and p_B !

- This paper solve for similar bounds for p_{ijkl} from information about all p_i and p_{ij}.

Q? Are the bounds obtained more informative than in the simple example? (N.B.: lower bound is always zero, how tight is the upper bound?)

$\Rightarrow$ Would be instructive to do a controlled experiment. (Simulate known, e.g., affine contagion model, and apply the bounds to see how well they work.)

CDS Basis

Q? Why does the Bond of bank i give information about p_i:

A! The credit spread is approximately equal to the (risk-neutral) expected loss: $p_i L$.

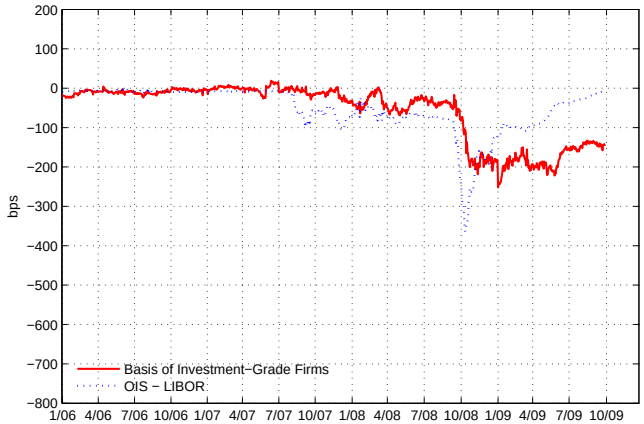
Q? Why does the CDS sold by bank j on a bond of bank i give information about the joint probability of default of the seller of protection j and the reference i:

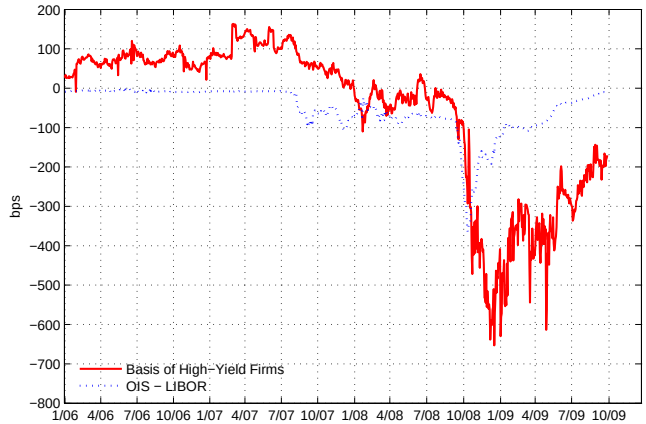
A! The CDS spread is approximately equal to the (risk-neutral) expected loss of i conditional on the seller j not defaulting: $CDS \approx (p_i - p_{i,j})L$.

- This ascribes all the CDS-Bond basis to counterparty credit risk.
- However, there are many other drivers of the basis, such as:
  - Liquidity - risk-free benchmark to measure bond credit spread(Treasury, Swap?)
  - Liquidity - corporate bond specific (Affects CDS via arbitrage)
  - Availability (lack) of arbitrage capital hinders arbitrage activity during the crisis.
  - . . . ?

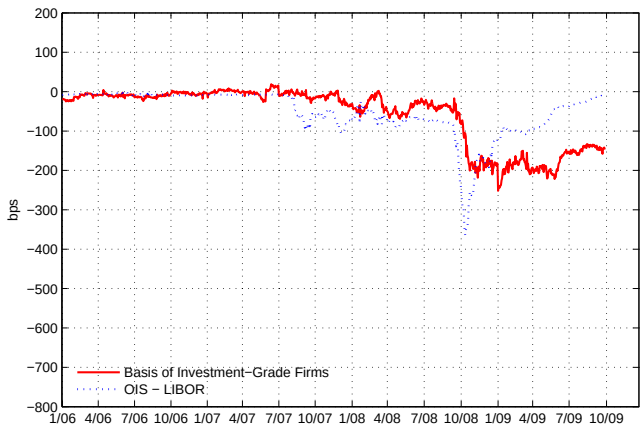
The Basis during the crisis

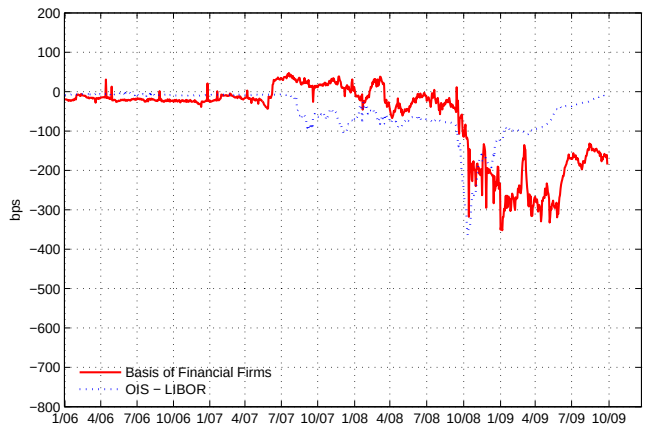
- Basis during the crisis became tremendously negative much more for HY (counterparty risk?):





- Not clear difference between Financials and non-financials:





- But basis on financials seems more volatile and slightly lower during LEH episode.

Trading the negative basis in practice

- In practice, a negative 'basis package' typically consists in:
  - Fund the haircut ($h\,B$) at your own funding cost: Libor+x where x reflects your risk
  - Borrow $(1-h)B$ at repo rate to purchase the bond.
  - Buy protection and post initial margin (M) funded at Libor+x
- There are subtleties about how to size the trade (JtD risk versus Recovery risk).
- Return on the basis trade using $\$(hB+m)$ capital is approximately:

$$\sim \text{Duration} \cdot \Delta\text{Basis} - B\left(h(\text{Libor}+x)+(1-h)\text{Repo}\right) - M(\text{Libor}+x)$$

$\Rightarrow$ Exposure (conditional on trade not converging) to:
  - funding/trading cost widening ($Libor, x\uparrow$): market liquidity?
  - collateral value deteriorating ($h\uparrow$): funding liquidity?
  - counterparty risk (affects the value of insurance purchased)

$\Rightarrow$ Assumptions about identifiying liquidity are crucial to identify the 'right' component of the CDS-cash basis used to identify p_{ik}

$\Rightarrow$ Indeed, results are **very** different across three different choices of bond liquidity specification/identification
(based on $\gamma_t^j = \alpha_j \lambda_t$ where α_j is constant firm specific (e.g., as in 2004) and λ_t is common to all bonds.)

Anecdote: Firms with positive basis during the crisis

ShortName	Crisis I	Crisis II	Credit Rating	Industry
Newmont Mng Corp	286	250	BBB	Basic Materials
Berkshire Hathaway	127	244	AAA	Financials
Amern Tower Corp	237	226	BB	Technology
Emc Corp	259	188	BBB	Technology
MetLife Insurance Co	12	178	A	Financials
Boyd Gaming Corp	253	163	BB	Consumer Services
General Electric Co	89	154	AAA	Industrials
Windstream Corp	54	131	BB	Telecommunications
Penn Natl Gaming Inc	134	130	B	Consumer Services
Mylan Inc	204	122	BB	Health Care
AutoNation Inc	1	117	BB	Consumer Services
Las Vegas Sands Corp	108	106	B	Consumer Services

- Note that Berkshire and GE qualify as 'financials': So, why is their basis positive?

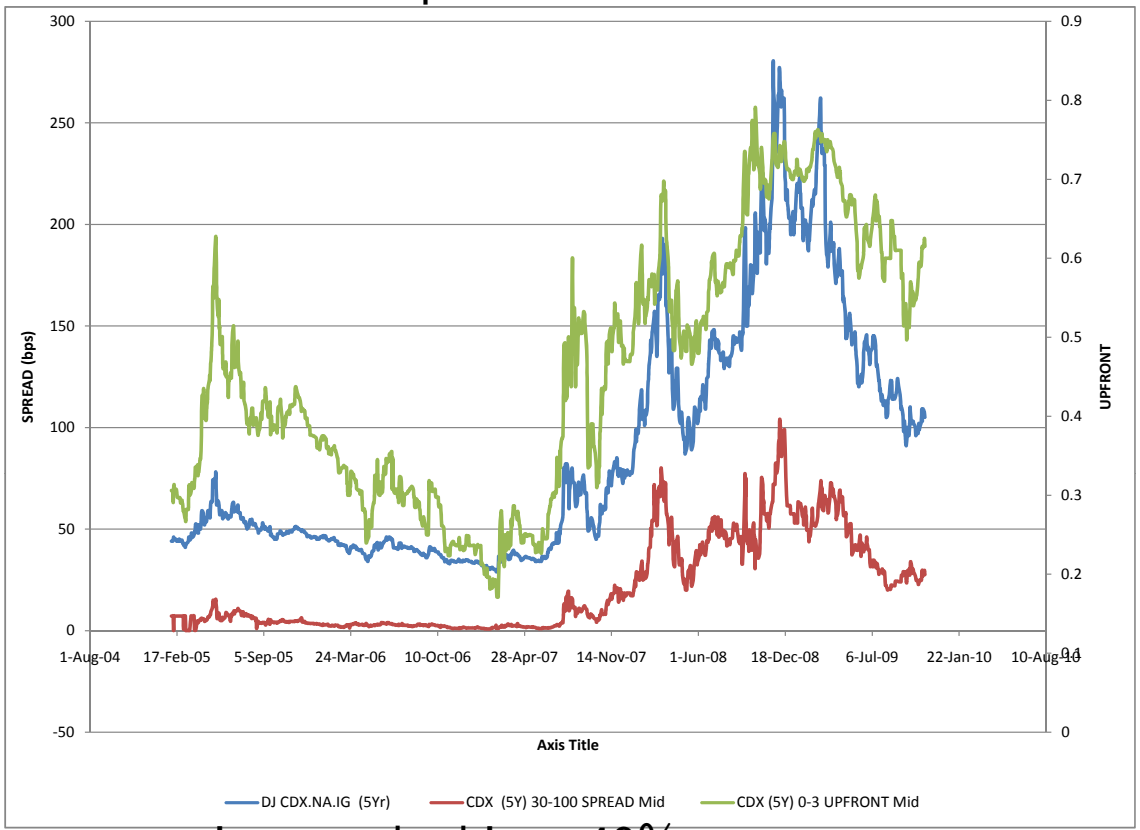
A! All dealers are long protection on Berkshire (big seller of derivatives - without collateral or MtM agreement - to the dealers!). So who is short?

$\Rightarrow$ Cannot take an average dealer as representative for the marginal counterparty credit risk. It matters what their positions are (long of short risk). Typically, dealers will not be net long dealer-risk. (Instead insurance companies, hedge funds).

- May explain why not much evidence of counterparty risk matters from cross-section of dealer quotes (Longstaff et al.).

Comment on Interpretation of Results

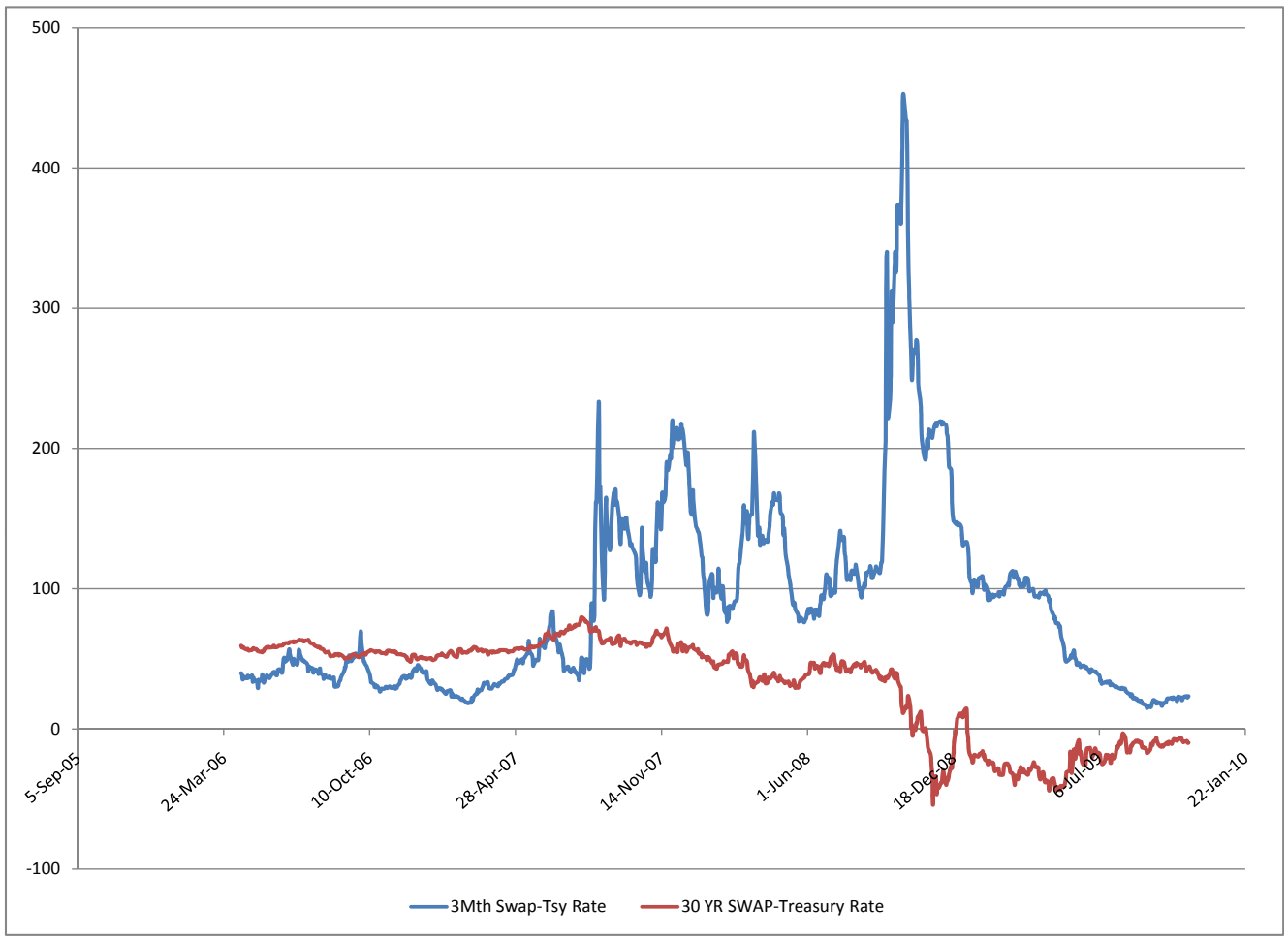
- Was it really mostly idiosyncratic risk and not systemic risk in 2008-2009: Evidence from super senior CDX.IG tranche spreads



- Implied correlation on equity tranche hit $> 40\%$
- Correlation on Super-Senior tranches > 1(!) with standard recovery assumption
- Relative importance of expected loss in senior tranche versus in equity tranche indicates increased perceived crash risk.

Evidence from Swap markets

- Evidence from Swap spreads



Conclusions

- Interesting framework for extracting probabilities of many banks default.
- Implementation depends crucially on identification assumption about liquidity
- 'Liquidity' seems to be more complex than assumed
- It may be problematic to assume that financials are the marginal counterparty selling all CDS (including CDS on financials).
- At least their exposure is changing dynamically and there is heterogeneity (e.g., Berkshire, GS $\neq$ Leh on subprime exposure...)
- Not sure one can conclude that systemic risk was not high in 2008-09. Afterall measure of liquidity risk extracted is at all time high then: not systemic?
- For making policy recommendation about systemic risk based on this measure, need to further think about:
  - P versus Q-measure
  - Upper and lower bounds (how relevant are they?)
  - Marking to Market and Collateral