Notes on Bonds: Liquidity at all Costs in the Great Recession
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Discussion

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- The CDS Basis
- Swap Spread
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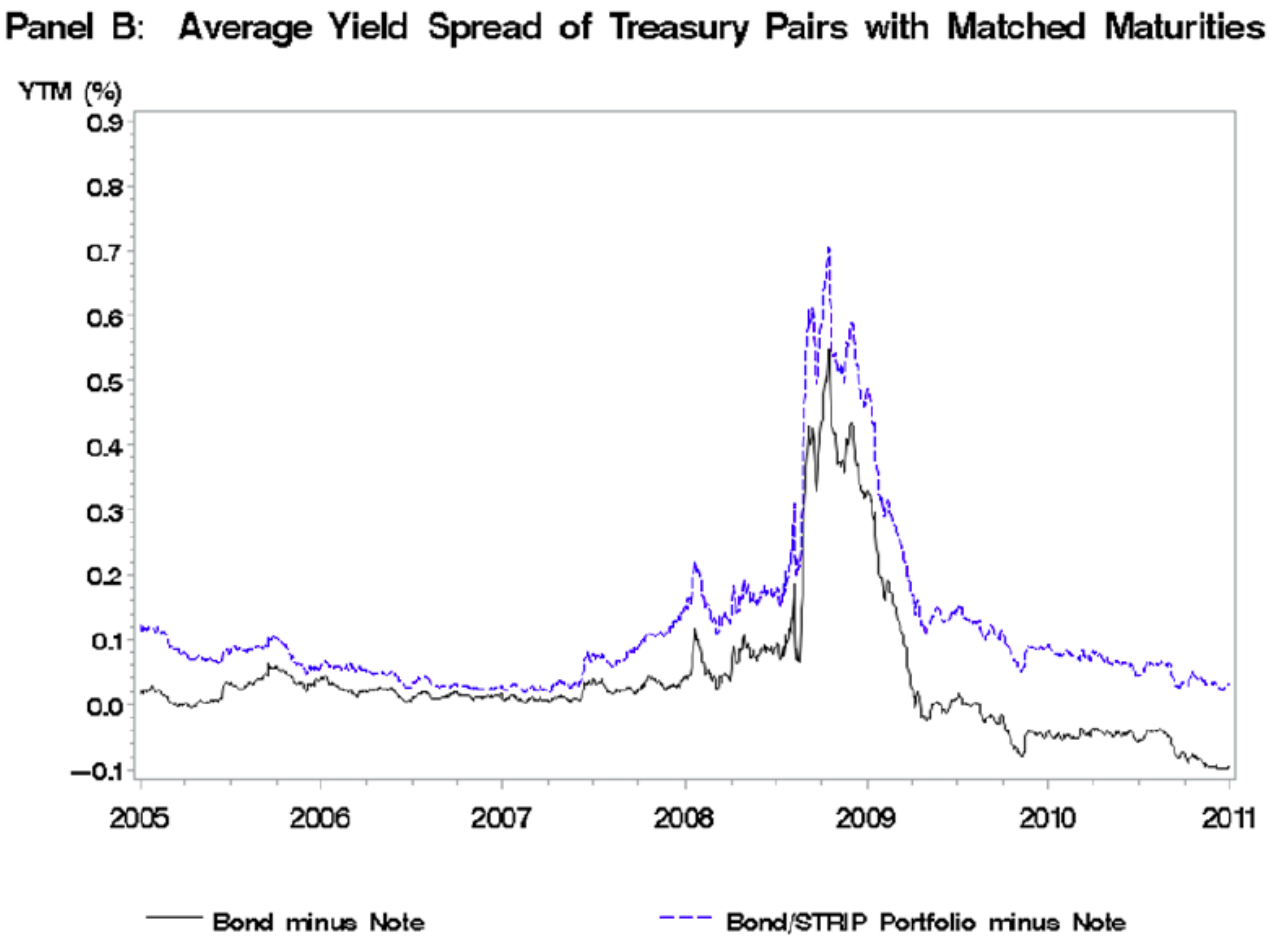
Summary

- Document large deviations from the Law of one Price among Treasury securities during the crisis
  - Off-the-Run notes (with 10Y at issue) became expensive relative to Off-the-run Bonds (30Y at issue) with similar remaining time to maturity
- The mispricing was persistent (from mid-2007 to mid-2009)
- Mispricing associated with difference in liquidity between securities:
  - Notes were more liquid than Bonds (e.g., lower Bid/Ask spreads)
  - Bonds traded above par (higher coupon)
- Mispricing was persistent because of limits to arbitrage:
  - Difficulty to locate the note to setup short positions
  - Length of drawdown on arbitrage suggests lack of arbitrage capital
- Investigate trades of Insurance companies and link demand for more liquid bond ("at any cost") to higher distress of Insurer.

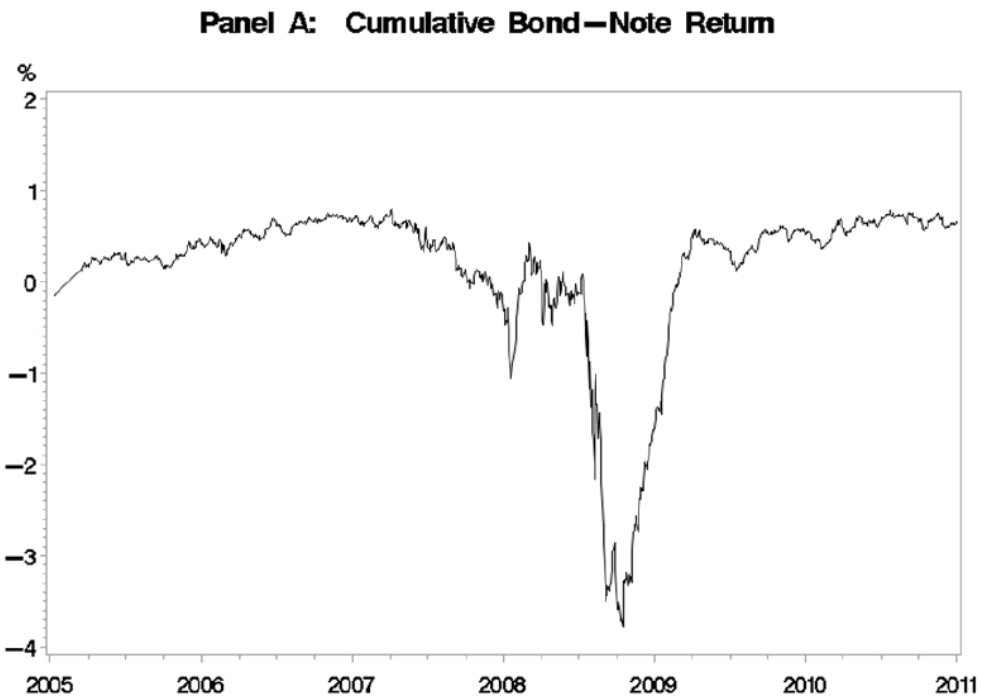
The Anomaly

- Document large deviations in yield to maturity of maturity-matched pairs of Notes and bonds.



The Arbitrage

- Document large deviations in YTM of maturity matched pairs of Notes and bonds.
- Find 16 pairs of notes and bonds with identical maturities for which can construct pure arbitrage portfolio:
  - Short the Note.
  - Long a fraction of the Bond so as to match the coupon payments on the note.
  - long a Treasury strip to match the full principal payment on the Note.



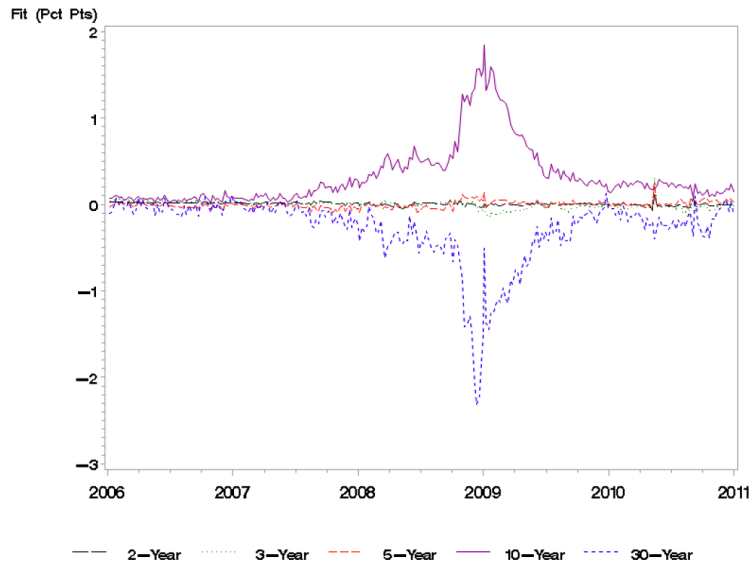
- The returns ("from a well-timed trade"!) well exceed the funding cost of the trade (GS Repo minus Repo Special).

The Anomaly generalized

- Investigate deviations for the whole universe of Treasury prices from model prices computed using a smooth parametric yield curve estimated using all securities.

Figure 5

Pricing Errors by Original-Issue Maturity



This figure presents the weekly average fitting errors by original-issue maturity buckets: thirty-year bonds, ten- year notes, five-year notes, three-year notes, and two-year notes. The fitting error is defined as the difference between the actual price of the security and the fitted price based on a smoothed yield curve. The vertical axis is measured in percentage points.

$\Rightarrow$ Provides new perspective on 'illiquidity factor' of Hu, Pan, Wang (2013)

- Might be interesting to 'double sort' deviations across maturity at origination and remaining maturity?

The Explanation: difference in liquidity

- Relate cross-sectional price deviations from smooth benchmark to security characteristics in panel regression.

- Price deviations increase during the crisis with:
  - higher Bid-Ask Spread
  - higher Outstanding Notional
  - higher share of notional used for stripping
  - lower trading volume
  - lower specials frequency ($\sim$ demand for shorting the notes)

$\Rightarrow$ differential liquidity seems to 'explain' the anomaly.

- Still, the dummy for Original issue maturity (10Y versus 30Y) remains statistically significant despite all liquidity controls (R^2 roughly doubles 20% vs. 39%).

The Explanation: limits to arbitrage

- Regress time series of average pricing error across all 16 bond-note arbitrage pairs on aggregate variables

- Pricing errors increase during the crisis with:
  - the average Bid-Ask Spread
  - the number of Fails in Treasury Repo market
  - the share of specials at zero rate
  - funding costs

$\Rightarrow$ Limits to Arbitrage

Arbitrage during the crisis

- This paper adds to the many examples of 'arbitrage' opportunities during the crisis:
  - Covered interest rate parity violations on USD transactions (Coffey, Hrung, Sarkar (2009))
  - Treasury bond-TIP breakeven rate versus Inflation Swap rate (Fleckenstein, Longstaff, Lustig (2011))
  - Corporate CDS-Cash basis (Bai and CD (2011)).
  - Sovereign CDS-Cash basis (Buraschi, Sener and Menguturk (2012))
  - Negative Swap-Treasury Spread
- It is an interesting addition, since the documented arbitrage does not require a position in a derivative instrument and thus rules out two plausible explanations:
  - Funding/leverage differential of the (unfunded) derivative versus (funded) cash position.
  - Counterparty Risk.
- Nevertheless all these papers bear many similarities

Common features

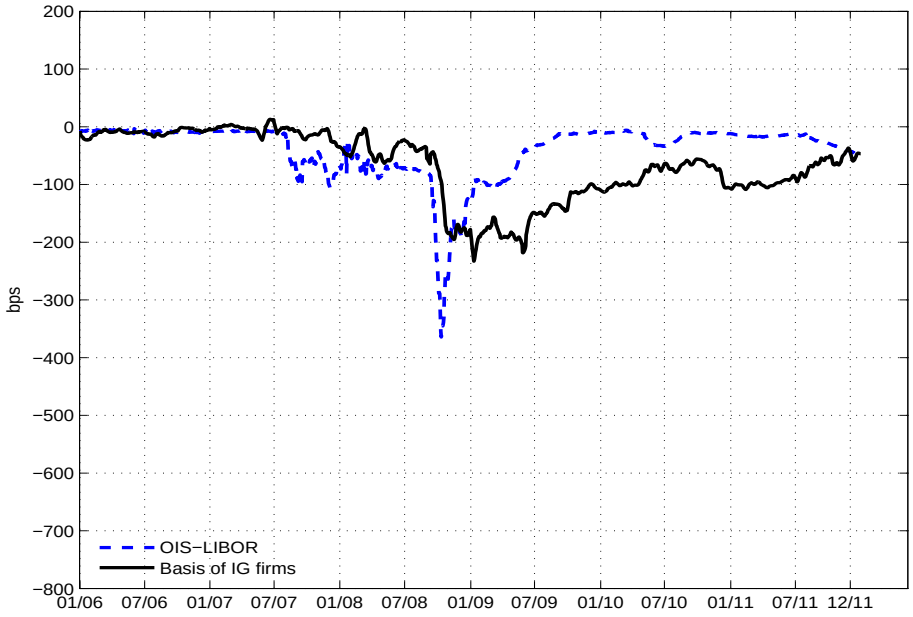
- All papers fail to identify the specific origin of the mispricing:
  - Why are the notes becoming more expensive relative to the bonds?
  - Why are specific CDS-Basis getting more negative than others?
- All find that there is high correlation between mis-pricing and liquidity of the instruments (e.g., bid-ask spreads).
  - Suppose average time between trades is τ then the equilibrium value of a security that pays a continuous coupon δ is (Amihud-Mendelsohn (1986)):

$$P = \frac{\delta}{r} - \frac{BA}{r\tau}$$

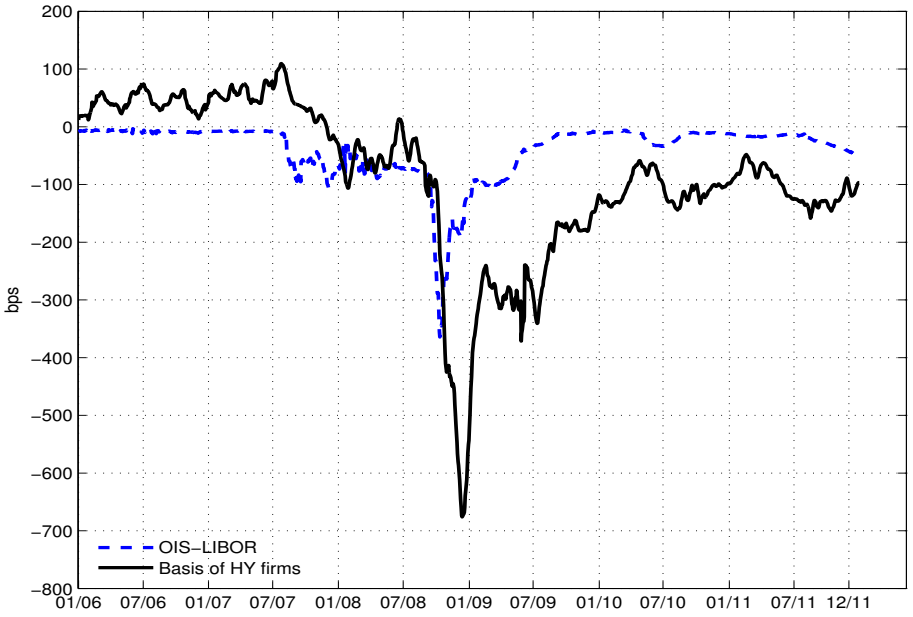
  - $\Rightarrow$ If BA differential widens then price differential widens.
  - $\rightarrow$ Suggests to add Bid/Ask spread times turnover as explanatory factor
- But why did Bid-Ask spread differential between two securities widen so much?
  - Adverse Selection?
  - Inventory Risk.... (for Treasury securities)?
  - Market power (of remaining liquidity providers)?
- All papers point to evidence of limits to arbitrage:
  - The higher the cost to implementing the arbitrage the larger the deviation
  - It seemed that arbitrage capital was scarce
- All have difficulty to assess size of the profits left on the table. What size trade could have been implemented?

The CDS-Cash Basis during the crisis

Tremendously negative!



IG Firms



HY Firms

In a frictionless market, negative basis is a free lunch:

$$\left.\begin{array}{l}\text{Borrow at Libor}\\ \text{Buy the bond}\\ \text{Buy protection}\end{array}\right\} \Rightarrow \text{Earn the basis } \textbf{risk-free}!$$

The CDS-Cash Basis during the crisis

Trading the Basis

- In practice, a negative 'basis package' typically consists in:
  - Fund the haircut $(h * B)$ at the cost (libor+f)
  - Borrow $(1-h) * B$ at repo rate to purchase the bond
  - Buy protection and post initial margin (M) at (libor+f).
- Return on the basis trade using $(hB + M)$ capital is approximately:

$$\begin{aligned} P\&L(t+1) \quad \approx \quad & D_B * \Delta Basis_t - D_B \Delta BAS_t \\ & -B_t^{ask} * [h(Libor + f) + (1-h) * (repo)] - M_t(Libor + f) \end{aligned}$$

  If default on bond occurs at time τ_B, then

$$P\&L(\tau_B) = R\,N + (B - N\,R)\mathbf{1}_{\tau_C > \tau_B}$$

- Exposure (conditional on trade not converging) to:
  - funding cost widening ($libor, repo, f \uparrow$)
  - collateral value deteriorating ($h \uparrow$)
  - trading cost increasing (BAS $\uparrow$)
  - counterparty risk ($\tau_C \leq \tau_B$)

What causes the negative basis?

Examples of 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

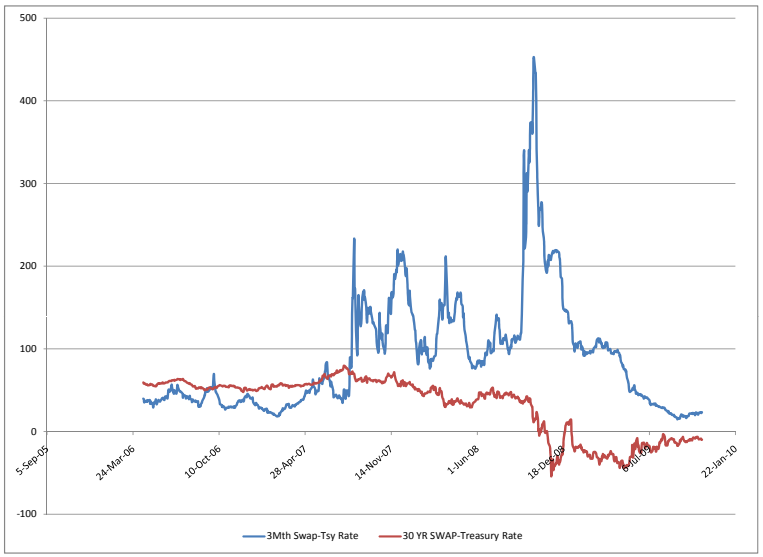
- Note that Berkshire and GE qualify as 'financials': So, why is their basis positive?

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

→ Many idiosyncratic reasons that drive the basis away from zero.

Evidence from Swap markets

- Evidence from Swap spreads



In a frictionless market, negative swap-Treasury spread is a free lunch:

$$\left.\begin{array}{l}\text{Buy Treasury Bond}\\ \text{Fund with Repo}\\ \text{Enter payer Swap}\end{array}\right\} \Rightarrow \begin{array}{l}\text{Earn the Treasury-Swap spread } (>0)\\ +\text{ the LIBOR-Repo } (>0) \text{ spread (risk-free)!}\end{array}$$

- Explanation?

Conclusion

- Another nice example of a disclocation during the crisis.
- Dislocations persist because trading costs are high and risk-capital is unavailable.
- What is the cause for such dislocation? (Why did Bid/Ask spread differential widen so much on two Treasury securities).
- Seems to be very specific to the US-Treasury market. .
  - Post reform of the Repo fail market anomaly seems to disappear. Causal?
  - No such dislocation in foreign (sovereign) bond markets (Cieslak).
- How much money was left on the table?
- What general implications (for policy) can one draw from this phenomenon?
  - Design of Repo market.
  - Treasury maturity issuance management.
  - Monetary policy transmission?