Liquidity Contagion:
the Emerging Sovereign Debt Market example

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30th International French Finance Association Conference

Friday, May 31 2013

"Supported by the project ECONOM&RISK (ANR 2010 blanc 1804 03)"

Summary

This paper

- We consider **the perspective of a fund manager** to:

1. Measure the sovereign debt market liquidity using the "CDS-Bond Spread basis",

2. Analyze the contagion effects applying a Regime Switching Dynamic Correlation model (RSDC):
   - with time-varying volatility specification,
   - allowing to disentangle interdependence and pure contagion.

Motivations

- Fund managers need some tools to deal with liquidity problems especially during crisis times.

Funding Providers

1. Trader is funded by banks,
2. Fund Manager is funded by external investors, *(fund clients)*.

Consequences:

- The behavior of funding providers can largely differ,
- The fund manager could have liquidity problems due to fund flows,
  - that may be huge according to some asset classes.

Motivations

The fund manager should:

1. work with liquidity constraints contractually defined,
   - in the characteristics of the fund.
2. build a portfolio to benefit from the diversification principle.

Question

How to manage a portfolio with such constraints?

Motivations

Background Idea

- Fund managers fear re-correlation of their assets,
  - especially when re-correlation effects come from liquidity problems.

- Liquidity problems can arise from both:
  1. the asset component of the fund balance sheet:
     - **Fund managers sell part of the risky asset portfolio.**
     - **Larger market impact due to the lack of liquidity.**
  2. the liability side of the fund balance sheet:
     - **Important fund outflows or deleveraging imposed by prime brokers in the case of leveraged (hedge) funds.**

Motivations

- **Fund Liquidity Management** consists in solving the liquidity mismatch between:
  1. asset liquidity (illiquid holdings),
  2. funding liquidity (offered liquidity to investors).

Fund A Balance Sheet	
Asset	Liability
Illiquid holdings	Daily liquidity offered to investors

Motivations

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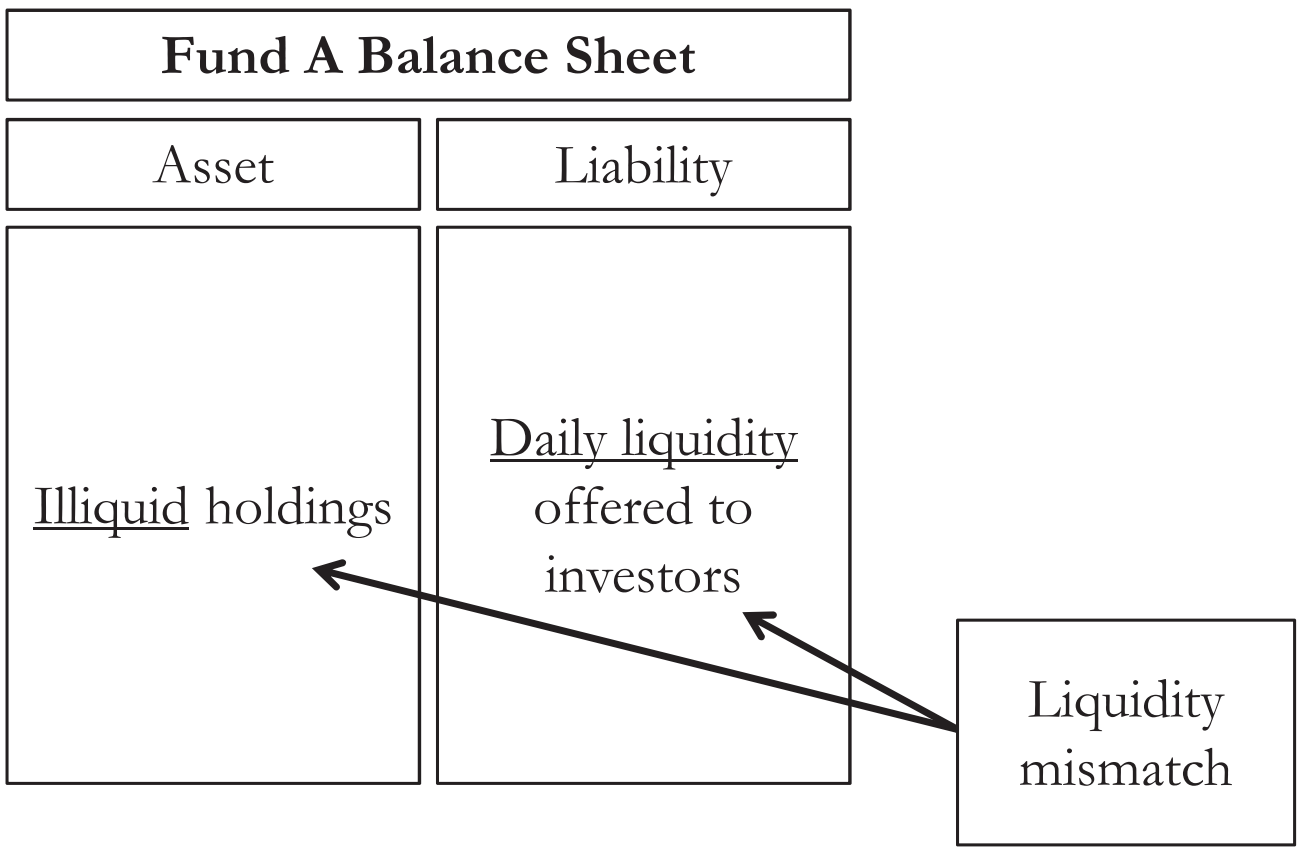

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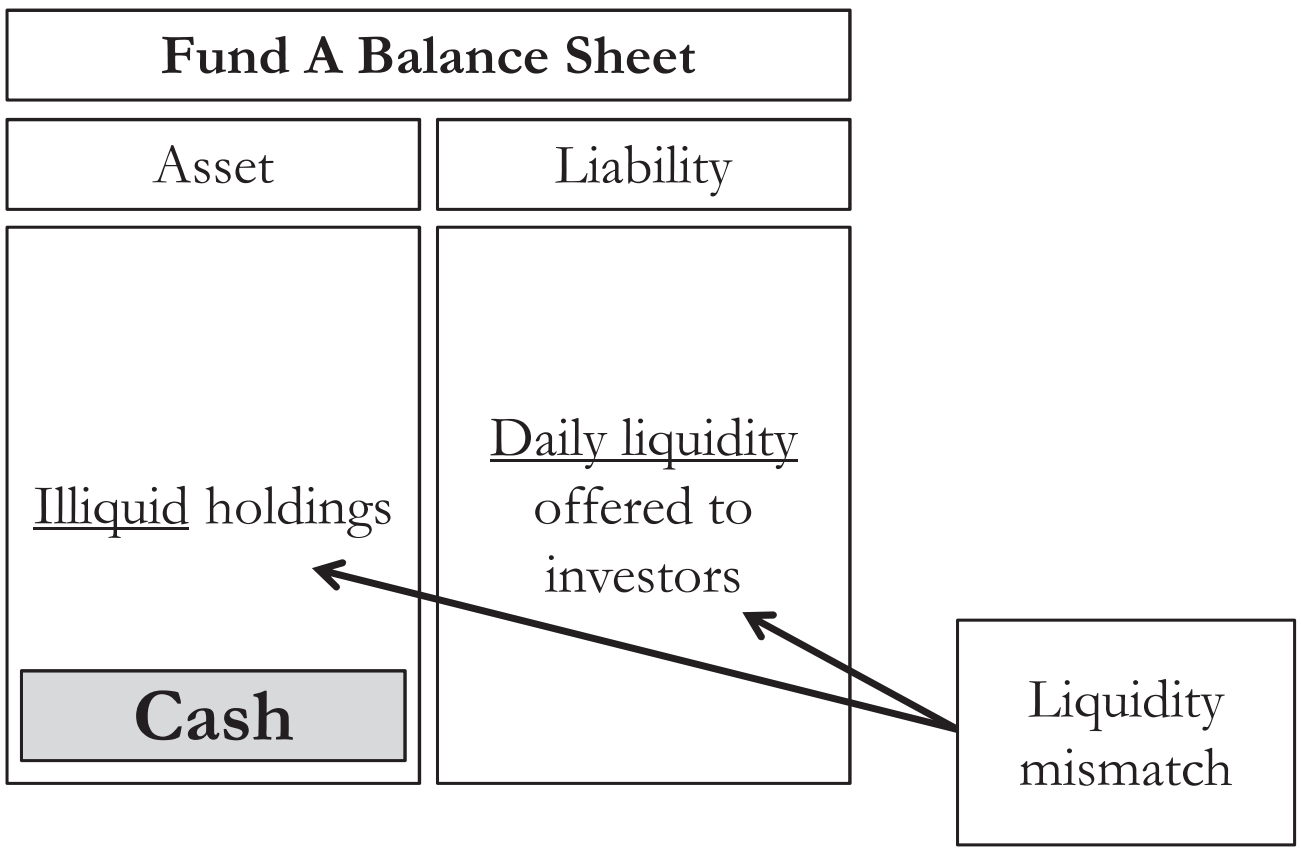


The case of Index Funds

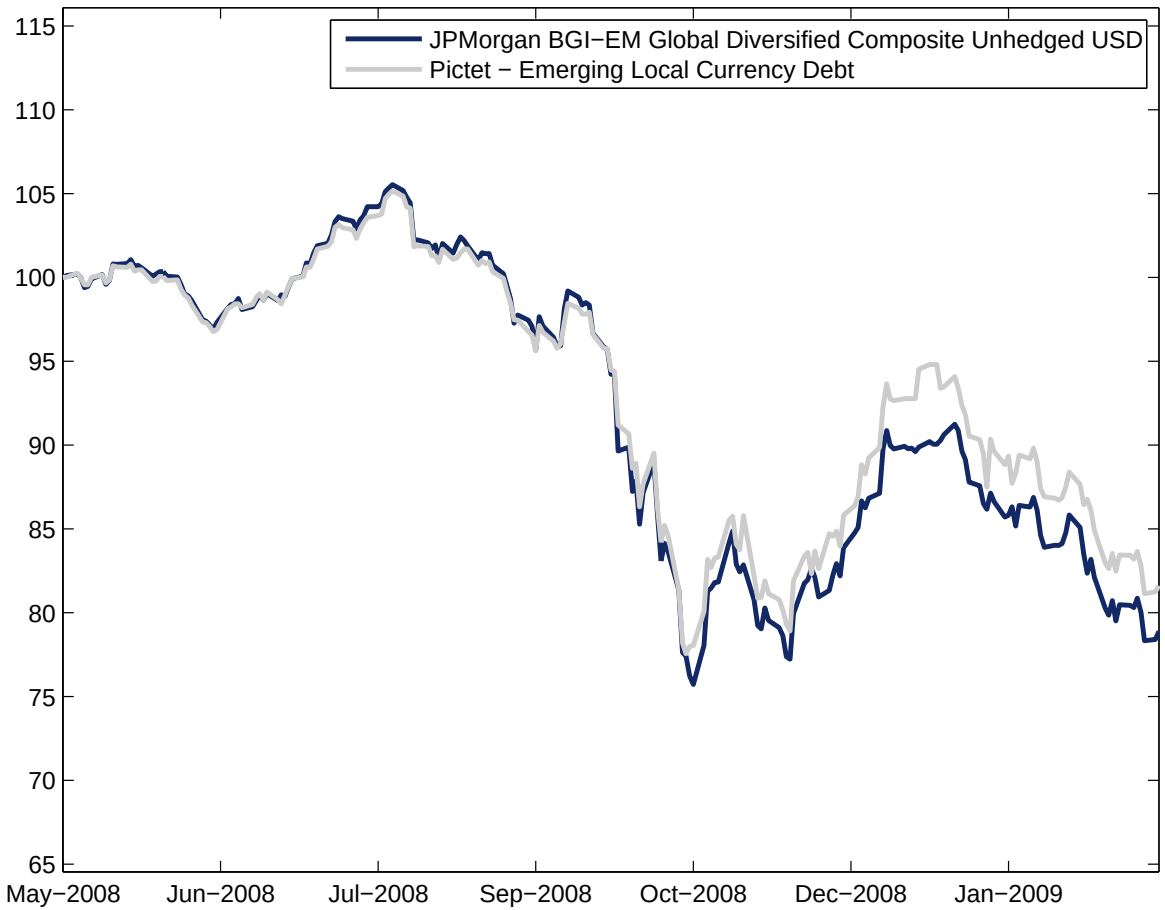
- In 2010, investors wanted a liquid exposure to the EM Sovereign Debt asset class (attracted risk adjusted returns),

- **JPMorgan GBI EM Global Diversified Index:** portfolio invested in 15 EM sovereign bonds (local currency),
  - Asset management firms offer attractive retail products (liquid) tracking this index.

UCITS EM Debt Funds	
Pictet Emerging Local Currency Debt	8.699
Julius Baer Multibond Local Emerging Bond Fund C	5.144
BNY Mellon Emerging Markets Debt Local Currency Fund	3.785
PIMCO Funds GIS Emerging Local Bond Fund	1.74
BlueBay Emerging Market LC Bond B	1.731
Pictet Asian Local Currency Debt	1.429
ING L Renta Fund-Emerging Market Debt Local Currency	1.358
BNPParibas L1 World Emerging Local	1.088

Table: Table: AUM in Bln (18/10/2010)

The case of Index Funds



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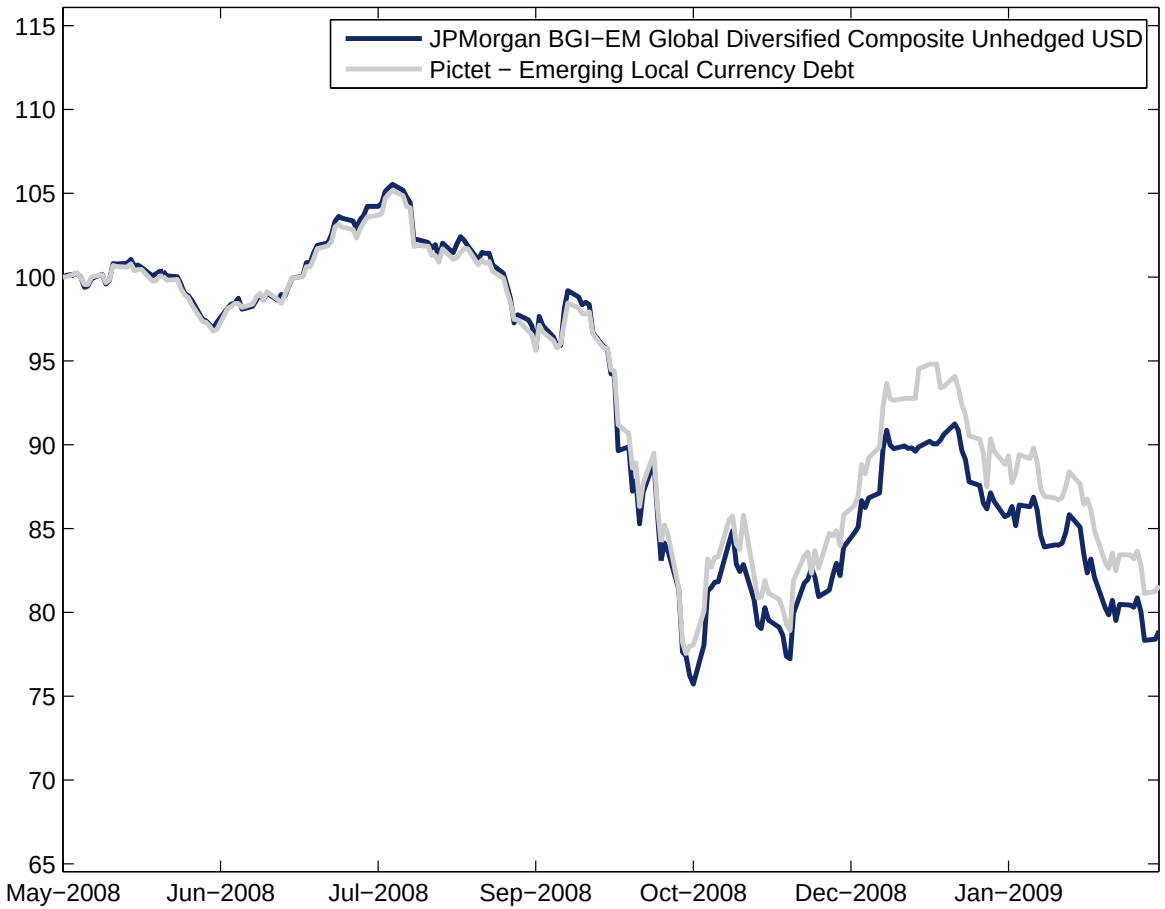

$800MLN outflows for a $8BLN fund

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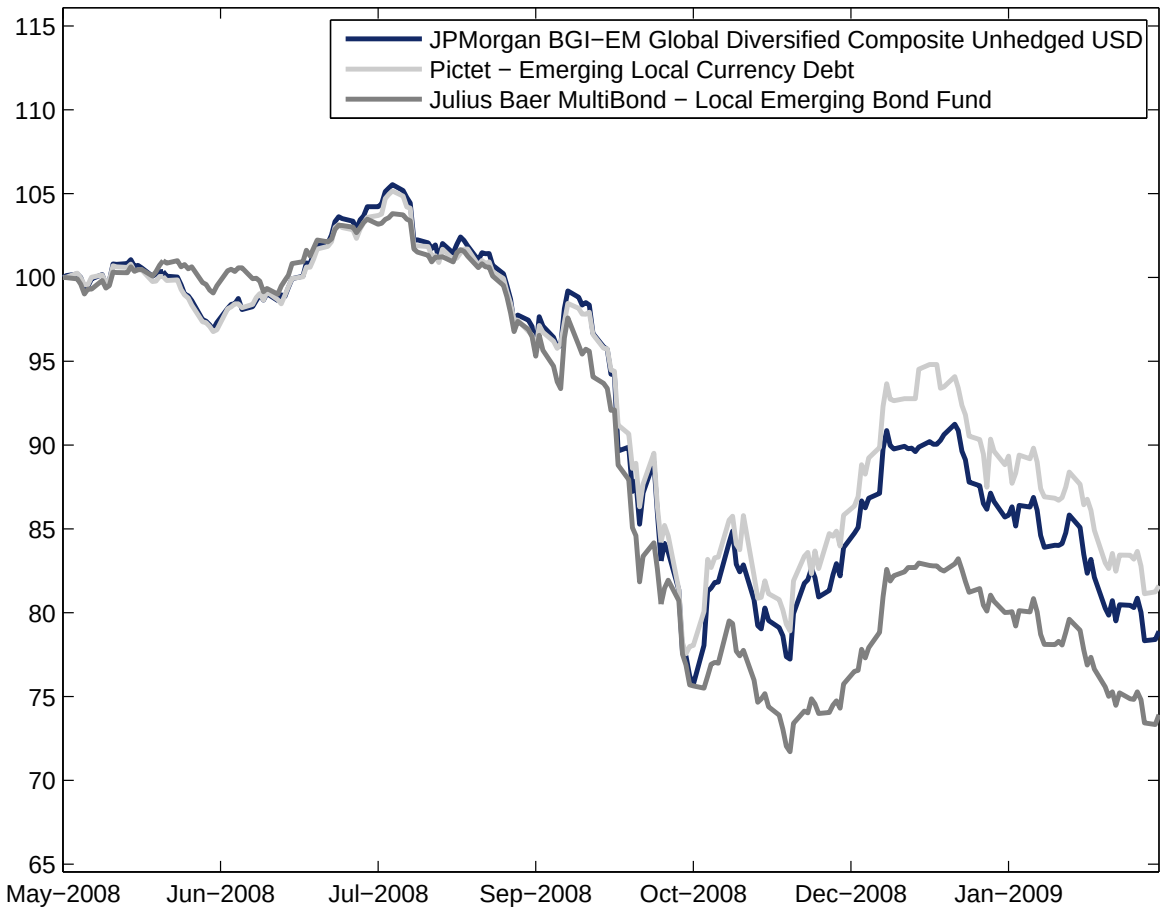

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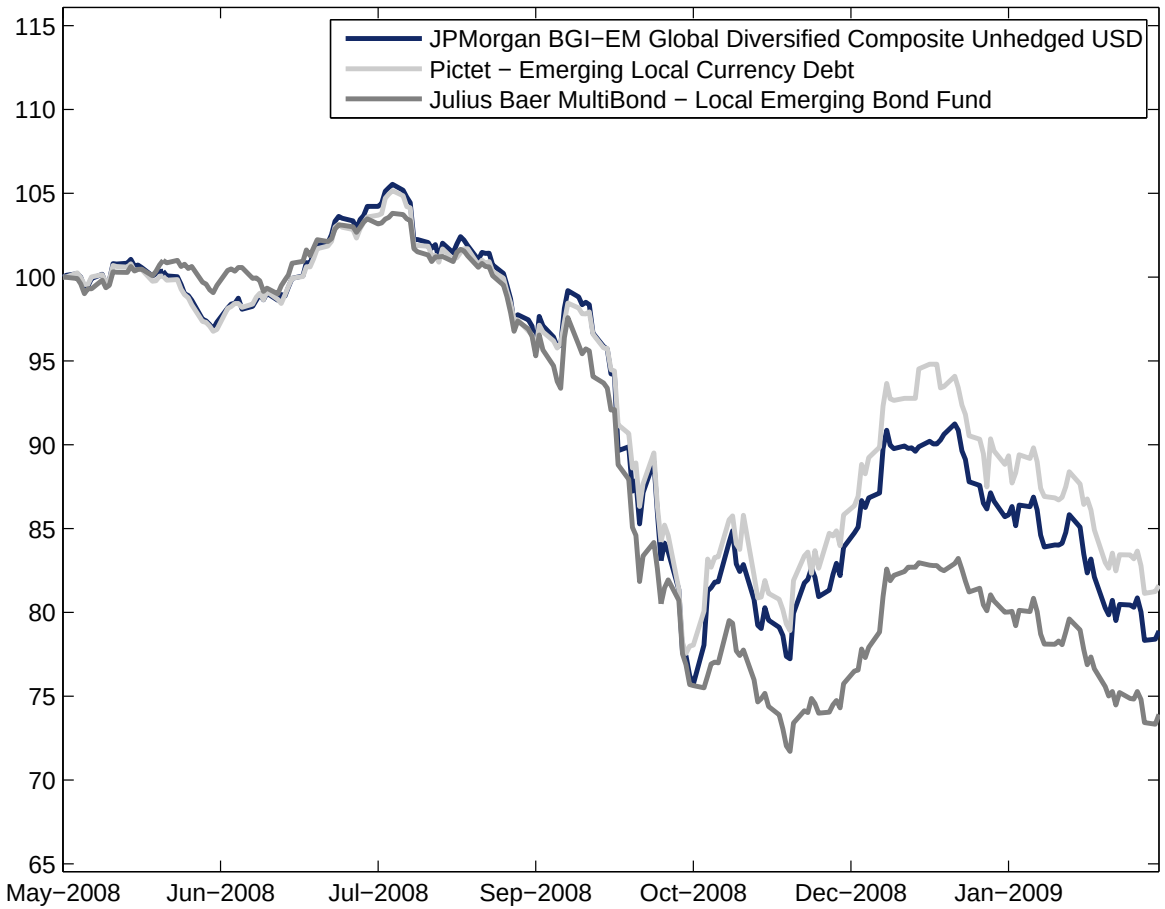

$1400MLN outflows for a $5BLN fund

Questions

1. How to measure liquidity on Emerging Markets and can we identify liquidity contagion effects?
2. Is there an increase of the commonality on the sovereign debt market during liquidity turmoils?
3. Are they pure contagion effects?

Summary

Measuring Liquidity

- Credit Default Swap (CDS) is an insurance contract against a credit event of a specific reference entity,
  - OTC contract between two parts, the buyer makes periodic payments until maturity or credit event and receives a payoff if the loan defaults.

- With bonds (cash instrument) + CDS protection (synthetic instrument), investors are hedged against default risk.

  In this case, investors should make a profit equal to the risk-free rate.

Measuring Liquidity

- **From the law of one price,** the CDS spread must be *similar* to the credit spread on the underlying bond.

Breaking Case

When the basis deviates from zero:

- **liquidity problem** on one or the other market.

Be aware of . . .

- Bai, Collin-Dufresne (2011) explain negative basis by several non liquidity-based additional factors:
  - **Collateral quality:** bias should be more negative for bonds with better collateral quality (smaller hair-cuts),
  - **Counterparty risk:** increasing counterparty risk of the protection sellers leads to lower CDS spreads, and then negative basis.

In this paper

- We focus on **the shift in terms of correlation structure**,
  - the dynamic of the basis commonalities is not impacted.

Summary

Definition

- **Financial contagion** refers to the notion that financial markets move more closely during turmoil.

Definition

The World Bank proposes three definitions, we use the more restrictive:

- **Contagion** occurs when cross-country correlations increase during crisis times relative to correlations during tranquil times.

Measurement

- Financial contagion is a major concern in literature,
  - but there is still no consensus about how to measure it.

Measuring contagion effects

"Estimating jumps in the correlation between financial time series when crisis occurs".

As a consequence:

- Contagion analysis focuses on the stability of estimated parameters,
  - comparing parameters obtained during calm and crisis periods.

Roberto Rigobón and Kristin Forbes, 2001. "Contagion in Latin America: Definitions, Measurement, and Policy Implications," Journal of LACEA Economia, LACEA - LATIN AMERICAN AND CARIBBEAN ECONOMIC ASSOCIATION.

Measurement

There exist two main issues in the contagion analysis:

1. Distinguish **interdependence** and **pure contagion**,
   - **Interdependence**: there is a high level of market co-movements in all periods,
   - **Pure Contagion**: a significant increase of cross market correlations after a shock (during a financial crisis).
2. Define the periods of crisis,
   - the set of informations has to be perfectly defined.

Measurement

Pure contagion vs Interdependence

As **the correlations are conditional on market volatility**:

- ARCH and GARCH models avoiding the problem of heteroscedasticity:
  - As a result $\rightarrow$ an increase of correlations can not be due to an increase of volatility.

Crisis periods

A state-space model allows to endogenously define the periods of crisis.

The RSDC model

Following Pelletier (2006):

Contagion model

$$r_t = H_t^{1/2} U_t \tag{1}$$

where $U_t|\Phi_{t-1} \sim$ iid $(0; I_K)$, U_t is the innovation vector, and Φ_t the information set available at time t.

$$H_t \equiv S_t \Gamma_t S_t \tag{2}$$

and S_t is a diagonal matrix composed of standard deviations $\sigma_{k,t}; k = 1, \cdots, K$ and Γ_t is the correlation matrix $(K \times K)$.

Both matrices S_t and Γ_t are dynamic.

One regime RSDC model $\Leftrightarrow$ CCC model

Estimation

Two-Step Procedure

1. Univariate TGARCH to model the conditional variance of each asset (matrix S_t),
   - take into account asymmetric effects in the conditional variance.
2. Expected Maximization algorithm to estimate correlation matrices (one matrix Γ_t for each state), transition probabilities and smoothed probabilities.

- one step likelihood maximization is untractable in the case of many assets,
  - for example: 4 assets, 2 regimes, TGARCH(1,1), the number of parameters is already equal to 35.

Summary

Data

- Pricing data for **5Y sovereign CDS** are obtained from Bloomberg,
  - the system collects CDS market quotation data from different industry sources.
- **5Y Bond yields** are obtained from Bloomberg,
  - the system computes the Generic series.
- The sample is ranging from 1/1/2007 to 3/26/2012
  - at a daily frequency.

Empirical Results

Definition

- Contagion appears when a shift in correlation occurs:
  - increase of probability to be in the state of high correlations
    $\rightarrow$ pure contagion effects.

- We have to determine:

1. if there is an increase in terms of correlations between the two states,
2. when the contagion effects occur.

Correlations matrices

	Brazil	Chile	Hungary	Mexico	Poland	Russia	South Africa	Thailand	Turkey
Brazil		0,1560	0,1712	0,0634	0,2660	0,0258	0,0970	0,0953	0,0014
Chile	0,0724		0,1274	0,1439	0,1762	0,1392	0,1873	0,0219	0,1842
Hungary	-0,0398	0,1383		0,1418	0,1852	0,2224	0,1760	0,1075	0,2415
Mexico	0,0180	0,2189	0,1203		0,2323	0,0162	0,0796	0,0703	-0,0071
Poland	0,0201	0,0199	0,0559	-0,0389		0,2866	0,2548	0,0553	0,3149
Russia	0,0277	0,1487	0,3145	-0,1323	-0,1010		0,1356	0,0429	0,1097
South Africa	-0,1106	0,0671	0,2682	0,1298	0,0636	0,3101		0,0690	0,1737
Thailand	0,0120	0,0033	0,2018	0,0724	0,0644	0,1095	0,2276		0,0763
Turkey	0,0912	0,0130	-0,2393	-0,1446	0,1297	-0,2866	0,1581	-0,1624	

Difference between correlations in state 1 and state 0 (CDS in black, Basis in blue).

- almost all the pairwise correlations increase,
- the difference between correlation matrices is **significant**,
  - meaning there exist pure contagion effects.

Smoothed Probabilities (1/2)

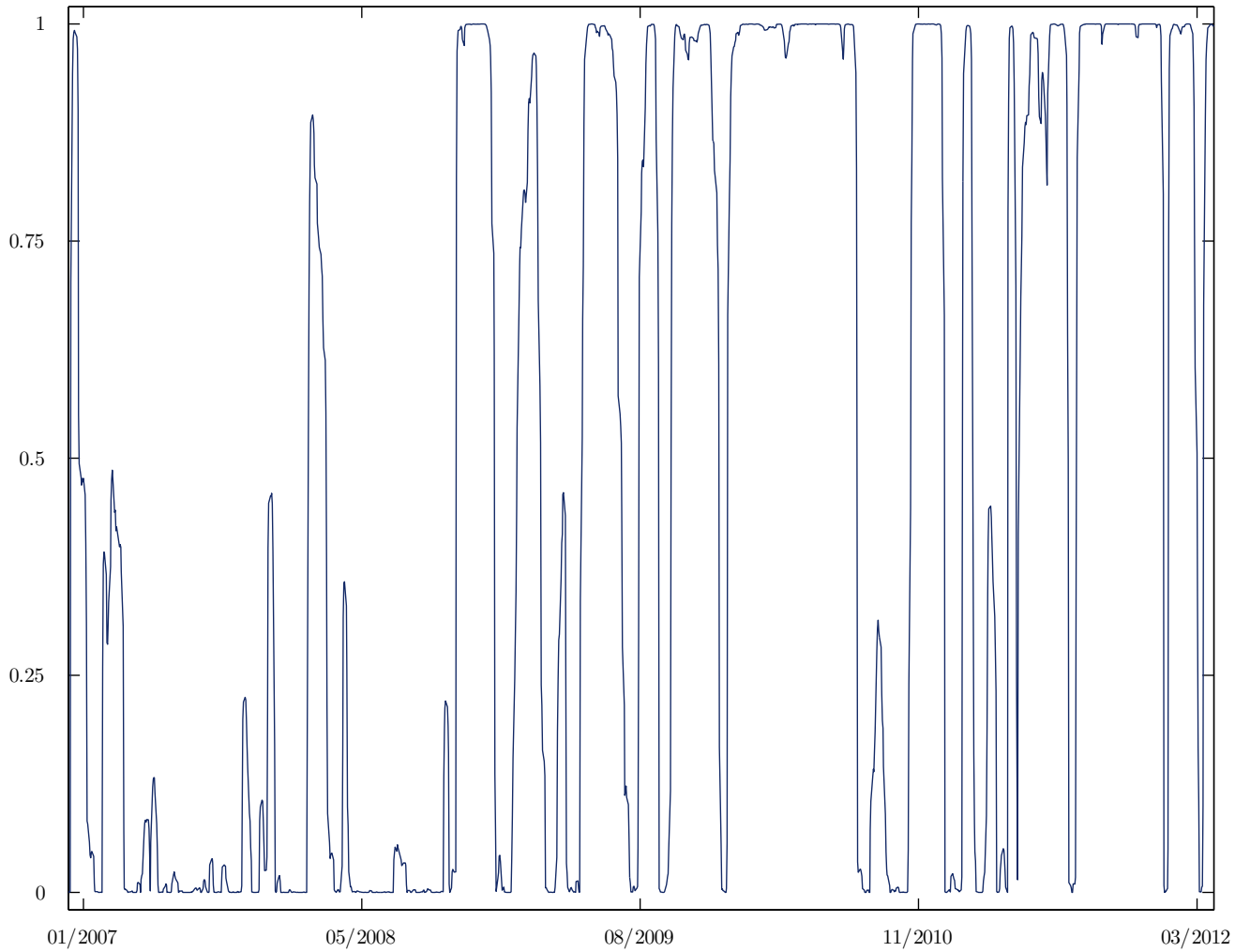

Figure: Smoothed probabilities for the CDS premiums.

Smoothed Probabilities (2/2)

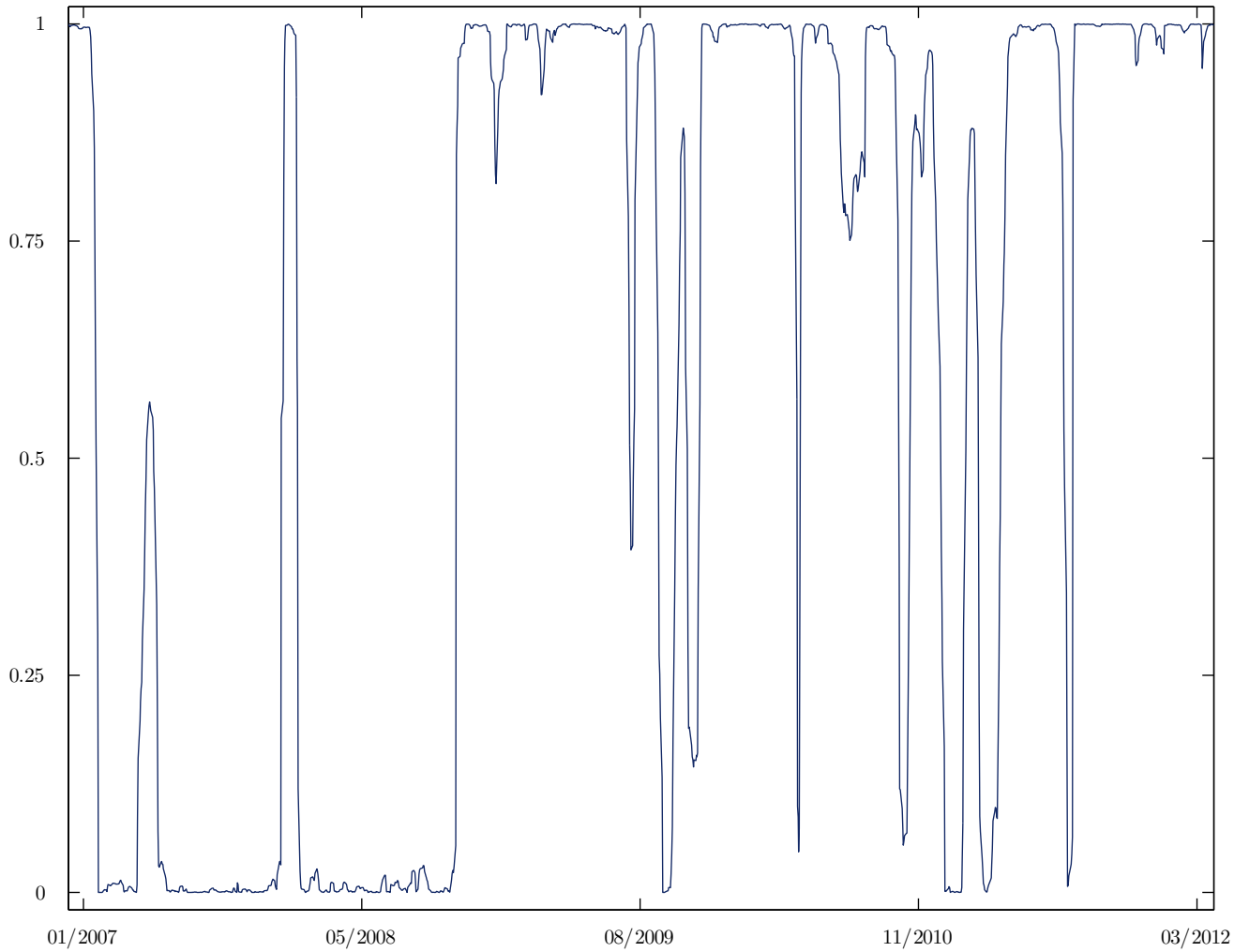

Figure: Smoothed probabilities for the CDS Bond spread basis.

Discussion

1. Regimes in CDS market and bond market similar to regimes in the CDS-bond bases.

2. From Pedersen, Garleanu (2010), Fontana (2010) and Bai, Collin-Dufresne (2011), we know that the basis is related to the credit risk of a bond.
   - *"Larger deviation from parity for lower rated bonds because it is more costly to finance the arbitrage trade"*

3. Our results are in line: basically, when CDS are highly correlated (regime 1) and investors are funding constrained, the basis deviates from parity.

Summary

Conclusion

1. The CDS Bond Spread Basis measures Emerging Sovereign Debt Market liquidity,
2. Correlation jumps allows to identify contagion effects,
   - such an event occurs in Sept. 2008 $\Rightarrow$ **re-correlation effect**.
3. There exist **pure contagion effects** both in terms of prices and liquidity on the Emerging Sovereign Debt market.