European Government Bond Dynamics during the Euro Crisis

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Disclaimer: The views expressed in this presentation are those of the authors, and do not necessarily reflect those of the European Stability Mechanism.
The euro area sovereign bond market as a whole needs attention

- From a **Euro area governance perspective**:
  - How homogeneous/diverse is the market? Are there clusters, blocks?
  - In the context of the euro crisis, does the market fear **contagion risks**?

- From a **public funding perspective**:
  - What is the **market risk** of sovereign bonds in comparison to other Euro area countries?
  - EFSF/ESM issued bonds at the private capital market to fund the rescue programmes. How are these bonds trading in the secondary market? Is the EFSF/ESM bond yield rather driven by asset quality or guarantee structure?

- From an **investor perspective**:
  - What does the market currently assume?
  - Which future uncertain events are priced into bond yields and their correlations?
  - Which events would be «tail events»?
Case Study: Euro area crisis

- Generic 10yr bonds
- 12 issuers: EFSF and 11 euro area sovereigns

Financial crisis becomes Euro area debt crisis. Yield volatilities spike up, yield levels diverge.

Convergence before EUR introduction

ECB measures and EFSF/ESM setup

Greek 2015 elections announced
Yield correlations are essential for a bond portfolio hedge

- High yield levels usually come together with high yield volatilities

<table>
<thead>
<tr>
<th>Issuer</th>
<th>Current 10Yr Yields</th>
<th>10Y Yields Vol 1Y window</th>
</tr>
</thead>
<tbody>
<tr>
<td>EFSF</td>
<td>0.71</td>
<td>0.50</td>
</tr>
<tr>
<td>DE</td>
<td>0.38</td>
<td>0.55</td>
</tr>
<tr>
<td>FI</td>
<td>0.49</td>
<td>0.55</td>
</tr>
<tr>
<td>NL</td>
<td>0.63</td>
<td>0.55</td>
</tr>
<tr>
<td>AT</td>
<td>0.59</td>
<td>0.57</td>
</tr>
<tr>
<td>FR</td>
<td>0.95</td>
<td>0.61</td>
</tr>
<tr>
<td>BE</td>
<td>0.85</td>
<td>0.62</td>
</tr>
<tr>
<td>IE</td>
<td>1.00</td>
<td>0.67</td>
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<td>ES</td>
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<td>0.73</td>
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<td>PT</td>
<td>4.04</td>
<td>1.13</td>
</tr>
<tr>
<td>EL</td>
<td>7.12</td>
<td>2.35</td>
</tr>
</tbody>
</table>

- Absolute yield levels contain Credit spread, Liquidity premium, Duration risk premium.
- High correlations indicate that investors and dealers regard markets as similar.
- Correlations give an indication how much a cross-hedge can reduce market (duration) risk.
Annual correlations of *daily* bond yield changes 2004 - 2009
Annual correlations of *daily* bond yield changes 2010-2015
Yield return correlations

- We aim to discuss yield dynamics as close to the market as possible
- Therefore, we use a model free approach, based on correlations
- The Pearson Correlation coefficient is defined as:

\[ r(X, Y) = \frac{\sum_{i=1}^{n}(X_i - \bar{X})(Y_i - \bar{Y})}{\sqrt{\sum_{i=1}^{n}(X_i - \bar{X})^2} \sqrt{\sum_{i=1}^{n}(Y_i - \bar{Y})^2}} \]

- Where \( X_i \) and \( Y_i \) denote the yield return time series of two bonds with \( n \) returns

- Problem with correlations:
  - They are unstable
  - Hidden factors lead to spurious correlations
Method overview: from time series to networks

Bond yield time series

Correlation matrix

Filtered influence network

Bootstrap filter

Correlation influence
Partial correlation

- The partial correlation measure is defined as

$$\rho(X, Y | Z) := \frac{r(X, Y) - r(X, Z) \cdot r(Y, Z)}{\sqrt{1 - r(X, Z)^2} \cdot \sqrt{1 - r(Y, Z)^2}}$$

Small absolute value would mean "Z strongly affects correlations between X and Y".

- The partial correlation is the correlation between the residual resulting from the linear regression from X with Z and Y with Z.
Partial correlation influence

- The correlation influence is defined as

\[ d(X, Y | Z) := r(X, Y) - \rho(X, Y | Z) \]

"How much of the correlation between X and Y is explained by their correlations to Z?"

- The average correlation influence is defined as

\[ d(X | Z) := \frac{1}{k} \sum_{i=1}^{k} d(X, Y_i | Z) \]

"How much does Z explain correlations between X and all other markets?"

The noise in the correlation influence estimator depends heavily on the specific pair:
DE->FR is very stable, but DE->GR is very volatile. We need a filtering concept.

We bootstrap average influences
- We draw \( n \) times a sample (with replacement) from the data, using data blocks of length 1-10 days
- For each sample, we calc the average influence matrix and the stddev across the samples
- These standard deviations act as “blur” indicator of the average influences

Histogram of corr influence bootstrap
Finland -> Greece in 2015

abs(mean) > 3 * stddev => correlation influence is «significant»

stddev of the bootstrap samples
Partial correlation networks of daily bond yield changes 2004 - 2009

Blue arrows: dominating positive correlations => reinforcing movements

Red arrows: dominating negative correlations => diverging movements
Partial correlation networks of *daily* bond yield changes 2010 - 2015

Blue arrows: dominating positive correlations => reinforcing movements

Red arrows: dominating negative correlations => diverging movements
Case Study: Negotiations of third Greek Programme

Question:
Did the market imply contagion risk to other Euro area countries beyond Greece?

Reuters, 19 April 2015:
“Greece’s Varoufakis warns of Grexit contagion”

Reuters, 27 June 2015:
“Euro zone prepared to guard against Greek risks – Dijsselbloem”
Weekly correlations of *hourly* bond yield changes Jan – Feb 2015

**Correlations in weekly intervals, using hourly yields**
Partial correlation networks of daily bond yield changes Jan – Feb 2015

19.1.-23.1. Before Greek elections

26.1.-30.1. After Syriza won

2.2.-6.2. Tsipras’ tour across Europe

9.2.-13.2. Tsipras confirms election promises

16.2.-20.2. Nervousness before Eurogroup Brussels

23.2.-27.2. Greece commits to programme extension; «Troika» become «Institutions»

Blue arrows: dominating positive correlations => reinforcing movements

Red arrows: dominating negative correlations => diverging movements
Weekly correlations of *hourly* bond yield changes Jun - Jul 2015

Correlations in weekly intervals, using hourly yields
Partial correlation networks of *daily* bond yield changes Jun - Jul 2015

- **8.6.-12.6.** Ongoing negotiations
- **15.6.-19.6.** Tsipras meets Putin
- **22.6.-26.6.** Many Eurogroup meetings without results
- **29.6.-3.7.** Referendum announced. ECB does not raise ELA. Capital controls.
- **6.7.-10.7.** Referendum against programme, ECB still does not raise ELA limit
- **13.7.-17.7.** Greece commits to third programme

Blue arrows: dominating positive correlations => reinforcing movements

Red arrows: dominating negative correlations => diverging movements
Case study: Brexit Referendum, June 2016

Question: Did the unexpected Brexit decision foster fears about a further dissolution of Europe?

UK and Switzerland are included into the analysis.
Case study: Brexit Referendum, June 2016
Case study: Brexit Referendum, June 2016

Blue arrows: dominating positive correlations => reinforcing movements

Red arrows: dominating negative correlations => diverging movements

Questions:

- What risks are priced into the European sovereign bond market?
- How do the French bonds move relative to «core European» and «peripheral» bonds?

**Case study: French presidential elections, 2017**

**Treat French Debt Like Italy, but Don’t Worry About Le Pen**

By JAMES MACKINTOSH
Updated Feb. 10, 2017 7:22 a.m. ET

France isn’t Greece. But as investors worry about the impending presidential election, French bonds have shifted from trading like haven German bunds to be treated more like troubled Italian debt.

The reassessment of France—from part of the eurozone’s financial core toward its periphery—shows the heightened concern about far-right National Front leader Marine Le Pen winning the presidency.

**Europe’s Periphery Debt Market Welcomes New Member: France**

Some investors are selling French government debt over concerns the country could leave the eurozone

By MIKE BIRD and JON SINDREU
Updated Feb. 21, 2017 8:19 a.m. ET
French bond spread reflects political risk

Japanese investors dump French debt at record pace
Money managers in Japan account for around 10 per cent of France’s outstanding debt market and have sold over ¥2tn of the country’s debt since November.

French bonds enjoy best run since Brexit vote
Rapid shift in investor sentiment towards presidential election
February 27, 2017 by: Mehreen Khan and Adam Samson

Investors brace for euro wobbles from upcoming French election

Investors sell off French debt as leftwinger surges in polls
Mélenchon's rise puts him in touching distance of run-off, pushing up bond yields
What happened since 2016?

Irish bonds improved, Portuguese and Italian bonds slid.
How is France positioned in Europe?

Bond market separation into core and periphery becomes less and less pronounced, with the exception of Greece.
In 2016, the «European core» was still a quite pronounced pattern in bond correlations.
In 2017, France is more correlated to Belgium and Ireland than to the northern group of countries, but far away from the periphery.
Conclusions and Outlook

- In periods of financial and political distress like 2012, the market fears contagion risk, leading to shearing forces between a core and a periphery bloc.
- Market trusts the guarantee structure of EFSF: market treats EFSF as a „core“ issuer.
- Market believes in stability framework: reattachment of periphery to core since 2013, Greece a special case.
- The Brexit referendum has caused only very short-term turbulences on the bond market, without triggering a „domino effect“.
- The French bond spread moves along with the probability of a le Pen victory in the second round, an event which would weaken the countries‘ credit.
- Separation into core and periphery becomes less and less pronounced. Contagion risk decreases.