Uncovering the common risk-free rate in the European Monetary Union

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The views expressed in this presentation are those of the author and do not necessarily represent those of the EIB or EIB policy.
Outline

1. A parsimonious bond model
2. Longitudinal Factor Analysis
3. Data sources and bond yield construction
4. Bond yield decomposition
5. Flight-to-quality and Flight-to-liquidity
6. Systemic risk
7. Common Euro-bonds
8. Concluding observations
1. A parsimonious bond model

\[ y_{it} = R_t + \pi_{it} \]  
\[ \pi_{it} = D_{it} + L_{BOND,it} \]  
\[ CDS_{it} = D_{it} + L_{CDS,it} - S_t \]  
\[ x_{it} \equiv y_{it} - CDS_{it} = a_i + b_i Z_t + e_{it} \]  
\[ R_t = \alpha + \beta Z_t \]
1. A parsimonious bond model

\[ \beta = b_B \]  (6)

See Hasbrouck (1996), Journal of Finance

\[ L_{BOND, it} = T_{BOND, it} \gamma \] and

\[ L_{CDS, it} = T_{CDS, it} \gamma \] (7)

See Amihud and Mendelson (1991), Journal of Finance

\[ y_{it} - CDS_{it} \delta - b_B \hat{Z}_t = \alpha + (T_{BOND, it} - T_{CDS, it}) \gamma + S_t + \xi_{it} \]  (8)
2. Longitudinal Factor Analysis

Classical methods: Principal Components and Factor Analysis, see Jöreskog (1969), Psychometrika
Rubin and Thayer (1982), Psychometrika

\[
x_{it} = a_i + b_i Z_t + e_{it} = a_i + b_i \left( \frac{x_{jt}}{b_j} - \frac{a_j}{b_j} - \frac{e_{jt}}{b_j} \right) + e_{it} \\
= a_i - \frac{b_i}{b_j} a_j + \frac{b_i}{b_j} x_{jt} + e_{it} - \frac{b_i}{b_j} e_{jt}
\]

\[
s_{ij}^2 = s_i^2 + \left( \frac{b_i}{b_j} \right)^2 s_j^2 
\]
2. Longitudinal Factor Analysis

Restrictions:

\[
\begin{align*}
    s_i^2 &= \frac{1}{2} \left( s_{ij}^2 + s_{ik}^2 - \left( \frac{b_i}{b_j} \right)^2 s_{jk}^2 \right) \\
    s_j^2 &= \frac{1}{2} \left( \left( \frac{b_j}{b_i} \right)^2 s_{ij}^2 + s_{jk}^2 - \left( \frac{b_j}{b_i} \right)^2 s_{ik}^2 \right) \\
    s_k^2 &= \frac{1}{2} \left( \left( \frac{b_k}{b_i} \right)^2 s_{ik}^2 + \left( \frac{b_k}{b_j} \right)^2 s_{jk}^2 - \left( \frac{b_k}{b_i} \right)^2 s_{ij}^2 \right)
\end{align*}
\]
2. Longitudinal Factor Analysis

\[
\hat{Z}_t = \frac{b_i^2}{s_i^2} x_{iit} - a_i + \frac{b_j^2}{s_j^2} x_{jt} - a_j + \frac{b_k^2}{s_k^2} x_{kt} - a_k
\]

(12)

\[
\hat{a}_i = \bar{E}_t [x_{iit}]
\]

(13)

\[
V[Z_t] = V[\hat{Z}_t] - s_{\hat{Z}}^2
\]

(14)
2. Longitudinal Factor Analysis

Average error in the estimated factor loadings

Average error in the estimated idiosyncratic risks \( \left( \frac{s_i^2}{b_i^2} \right) \)

PC = Principal Components, EM = Factor Analysis, LFA = Longitudinal Factor Analysis
3. Data sources and bond yield construction

- Daily 5-year and 10-year bond spot-yields based on Bloomberg (generic) z-spreads
- Maturity correction by interpolation (or extrapolation) of the closest bonds to the reference maturity but including the on-the-run bond (see Blanco (2001), Bank of Spain, and Ejsing and Sihvonen (2009), ECB WP)

Bond selection criteria:

- Plain vanilla fixed coupon bonds
- Original maturity > 4 years
- Minimum size of € 1 billion for French, German and Italian bonds. For all other issuers, including the EIB, the minimum size is € 500 million
3. Data sources and bond yield construction

- Bond transaction costs are measured by *bid-ask* spreads derived from executable quotes (source = Bloomberg bond trader composite)

- Data cleaning:
  - Prices before the bond issuance date are ignored
  - Outliers and missing values are replaced by interpolated values

- Credit Default Swap (CDS) price providers: Bloomberg generic, Credit Market Analysis (CMA) and Markit

- CDS transaction costs are measured by *ask-bid* spreads
3. Data sources and bond yield construction

10-year bond spot-rates (in %)

Source: Bloomberg, authors’ calculations
3. Data sources and bond yield construction

10-year CDS spreads (in basis points)

Source: CMA, Markit and Bloomberg
4. Bond yield decomposition

The Bund yield versus the common risk-free rate

5-year yield (in %)

10-year yield (in %)

Source: Bloomberg, authors’ calculations
4. Bond yield decomposition

10-year bonds

Credit Risk Premium (in b.p.)

Liquidity Risk Premium (in b.p.)

Source: Authors’ calculations
## 4. Bond yield decomposition

10-year bond yield decomposition (in basis points, end 2011)

<table>
<thead>
<tr>
<th>Country</th>
<th>Bond yield</th>
<th>Common risk-free rate</th>
<th>Credit Risk Premium (CRP)</th>
<th>Liquidity Risk Premium (LRP)</th>
<th>CRP before the crisis</th>
<th>LRP before the crisis</th>
</tr>
</thead>
<tbody>
<tr>
<td>Austria</td>
<td>302</td>
<td>81</td>
<td>195</td>
<td>26</td>
<td>2.3</td>
<td>0.3</td>
</tr>
<tr>
<td>Belgium</td>
<td>413</td>
<td>81</td>
<td>312</td>
<td>20</td>
<td>2.7</td>
<td>0.3</td>
</tr>
<tr>
<td>Finland</td>
<td>245</td>
<td>81</td>
<td>156</td>
<td>9</td>
<td>0.0</td>
<td>0.3</td>
</tr>
<tr>
<td>France</td>
<td>324</td>
<td>81</td>
<td>235</td>
<td>8</td>
<td>1.5</td>
<td>0.2</td>
</tr>
<tr>
<td>Germany</td>
<td>187</td>
<td>81</td>
<td>105</td>
<td>2</td>
<td>-0.8</td>
<td>0.2</td>
</tr>
<tr>
<td>Greece</td>
<td>3384</td>
<td>81</td>
<td>1739</td>
<td>1564</td>
<td>25.6</td>
<td>0.3</td>
</tr>
<tr>
<td>Ireland</td>
<td>835</td>
<td>81</td>
<td>654</td>
<td>100</td>
<td>0.6</td>
<td>0.5</td>
</tr>
<tr>
<td>Italy</td>
<td>690</td>
<td>81</td>
<td>583</td>
<td>27</td>
<td>24.2</td>
<td>0.2</td>
</tr>
<tr>
<td>Netherlands</td>
<td>231</td>
<td>81</td>
<td>145</td>
<td>5</td>
<td>1.7</td>
<td>0.3</td>
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<td>Portugal</td>
<td>1431</td>
<td>81</td>
<td>1067</td>
<td>283</td>
<td>11.7</td>
<td>0.3</td>
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<tr>
<td>Spain</td>
<td>544</td>
<td>81</td>
<td>438</td>
<td>25</td>
<td>2.0</td>
<td>0.4</td>
</tr>
<tr>
<td>EIB</td>
<td>307</td>
<td>81</td>
<td>190</td>
<td>36</td>
<td>9.9</td>
<td>1.2</td>
</tr>
</tbody>
</table>

**Source:** Authors’ calculations
5. Flight-to-quality and flight-to-liquidity

Groups are selected on ex ante liquidity risk or ex ante credit risk:

Lowest ex ante liquidity risk:
- Pre-crisis (February 2006 – June 2007): Austria, Belgium, France, Germany, Greece, and Italy
- Interbank crisis (July 2007 – August 2008): Belgium, France, Germany, Greece, Italy and Netherlands
- Subprime crisis (September 2008 – March 2010): Belgium, France, Germany, Italy, Netherlands and Spain

Lowest ex ante credit risk:
- Pre-crisis (February 2006 – June 2007): Finland, France, Germany, Ireland, Netherlands and Spain
- Interbank crisis (July 2007 – August 2008): Austria, Finland, France, Germany, Netherlands and Spain
- Subprime crisis (September 2008 – March 2010): Austria, Finland, France, Germany, Netherlands and EIB
5. Flight-to-quality and flight-to-liquidity

10-year bond liquidity risk premium (in basis points)

Interbank crisis versus pre-crisis

Subprime crisis versus Interbank crisis

Euro-area sovereign debt crisis versus subprime crisis
6. Systemic risk

Derived from 5-year instruments

- Double default risk in the CDS spread
- Common component in the Credit Risk Premium of AAA countries
- Credit Risk Premium on the Bund
- Average Credit Risk Premium on AAA bonds

Derived from 10-year instruments

In basis points

Source: Authors’ calculations
7. Common Euro-Bonds

Risk-free rate and risk premiums on the US Treasury bond, the Bund and a hypothetical common Euro-bond with joint and several guarantees

Source: Authors’ calculations
8. Concluding observations

- The long-term risk-free rate is neither equal to the Bund yield nor equal to the difference between the Bund yield and the CDS spread.
- Current risk-free rates imply very low or even negative real returns.
- The increase in bond spreads was mainly driven by credit risk for Germany and the Netherlands; for all other countries both credit and liquidity risk have played a significant role.
- Investors chase both credit quality and liquidity.
- Systemic risk was higher during the sovereign debt crisis in 2011 than during the subprime crisis at the end of 2008.
- Euro-bonds can reduce both credit and liquidity risk for all.
Vive l’Euro-bond
Vive l’Europe!
4. Bond yield decomposition

5-year bonds

Credit Risk Premium (in b.p.)

Liquidity Risk premium (in b.p.)

Source: Authors’ calculations
## 4. Bond yield decomposition

### 5-year bond yield decomposition (in basis points, end 2011)

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<thead>
<tr>
<th>Country</th>
<th>Bond yield</th>
<th>Common risk-free rate</th>
<th>Credit Risk Premium (CRP)</th>
<th>Liquidity Risk Premium (LRP)</th>
<th>CRP before the crisis</th>
<th>LRP before the crisis</th>
</tr>
</thead>
<tbody>
<tr>
<td>Austria</td>
<td>206</td>
<td>-11</td>
<td>166</td>
<td>51</td>
<td>1.2</td>
<td>0.5</td>
</tr>
<tr>
<td>Belgium</td>
<td>326</td>
<td>-11</td>
<td>285</td>
<td>52</td>
<td>0.6</td>
<td>0.5</td>
</tr>
<tr>
<td>Finland</td>
<td>151</td>
<td>-11</td>
<td>133</td>
<td>29</td>
<td>-0.1</td>
<td>0.4</td>
</tr>
<tr>
<td>France</td>
<td>206</td>
<td>-11</td>
<td>184</td>
<td>33</td>
<td>0.7</td>
<td>0.4</td>
</tr>
<tr>
<td>Germany</td>
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<td>0.4</td>
<td>0.3</td>
</tr>
<tr>
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<td>2417</td>
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<tr>
<td>Ireland</td>
<td>762</td>
<td>-11</td>
<td>558</td>
<td>214</td>
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<tr>
<td>Italy</td>
<td>602</td>
<td>-11</td>
<td>571</td>
<td>42</td>
<td>11.9</td>
<td>0.4</td>
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<tr>
<td>Netherlands</td>
<td>142</td>
<td>-11</td>
<td>138</td>
<td>15</td>
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<tr>
<td>Portugal</td>
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<td>-11</td>
<td>1104</td>
<td>494</td>
<td>7.4</td>
<td>0.5</td>
</tr>
<tr>
<td>Spain</td>
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<td>-11</td>
<td>371</td>
<td>53</td>
<td>1.7</td>
<td>0.4</td>
</tr>
<tr>
<td>EIB</td>
<td>225</td>
<td>-11</td>
<td>195</td>
<td>40</td>
<td>7.0</td>
<td>1.4</td>
</tr>
</tbody>
</table>

*Source: Authors’ calculations*