SENRIISK: Enhanced risk assessment for bond spreads

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OptiRisk specializes in optimization and risk analytics and is renowned for its research and development of models and software systems in these domains.

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SENRISK - Consortium

Partners

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Fraunhofer ITWM
PS Quant
ACATIS

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Eurostars
SEN Risk - Aim and purpose

Project aim:
- Development of an automated credit risk assessment tool
- Innovative Decision Support System for risk assessment of Fixed Income products incorporating news sentiments

Purpose:
- Valuation of sovereign and corporate bonds incorporating news-based information from the market.
- Predictive risk models shall be enhanced through
  - sentiments from firm-specific or macroeconomic news
  - social media sentiment
Components of **Fixed Income Risk Assessment** tool:

- **News Filters** - Detection of important news items relevant for specific region or company, building of daily news figures.

- **Monitoring** – Informative and efficient monitoring of single bonds as well as country- and sector-risks.

- **Screening** – Spotting investment opportunities and risks.

- **Products**
  - Credit Risk DSS platform
  - Consulting Services
Data

- Market data – source: Thomson Reuters
  - Short and long term bonds issued by sovereigns and corporates with available prices between 2007 and 2017.
- Market and Macroeconomic news sentiment
  - Source: RavenPack
  - Relevance and Event Sentiment Score considered, political and business news items concerning the issuing country or company
- Social media sentiment – source: StockPulse
Modelling bond closing yield: adding macro sentiment

- **Correlation analysis**: correlation between spread series and daily news series.
- Correlation is calculated over the whole time horizon as well as in **rolling windows** with length of 250 days.

- **Linear regression**

- **ARIMAX(p,i,q) Model** is given by

\[
d_t = \phi_0 + \sum_{k=1}^{p} \phi_k d_{t-k} + a_t + \sum_{k=1}^{q} \theta_k a_{t-k} + \sum_{l=1}^{m} \psi_l x_{lt}
\]

where \(d_{t}\) is the i-th difference of a time series, \(\{a_t\}\) is white noise and \(x_{lt}\) is the l-th external variable, \(l=1,...,m\). The external variable is uni- or multivariate.
Correlation analysis

• **Time series of spreads:** Spread $S_t, t = 1, ..., K$, of bond yield, the difference process of spreads $D_t = S_t - S_{t-1}, t = 2, ..., K$, and a volatility proxy $V_t = |D_t|, t = 2, ..., K$.

• **Correlation** between daily news and sentiment signals and single bond spread series as well as with mean bond spread for each investigated issuing country.

• **Rolling correlation** of news volume and mean country spread is indication of changing market regimes: we can fit a regime-switching model here.

• Correlation: 87% of analysed spread time series, at least one news sentiment series showed significant correlation with the spread series.
Correlation analysis

<table>
<thead>
<tr>
<th>Spain bond timeseries</th>
<th>Spreads</th>
<th>First spread difference</th>
<th>Volatility</th>
</tr>
</thead>
<tbody>
<tr>
<td>Daily news series</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>All Sentiment</td>
<td>66%</td>
<td>75%</td>
<td>47%</td>
</tr>
<tr>
<td>Volume All News</td>
<td>97%</td>
<td>31%</td>
<td>88%</td>
</tr>
<tr>
<td>All Impact</td>
<td>50%</td>
<td>78%</td>
<td>28%</td>
</tr>
<tr>
<td>Positive Sentiment</td>
<td>78%</td>
<td>0%</td>
<td>56%</td>
</tr>
<tr>
<td>Volume Positive News</td>
<td>88%</td>
<td>37%</td>
<td>91%</td>
</tr>
<tr>
<td>Positive Impact</td>
<td>78%</td>
<td>0%</td>
<td>59%</td>
</tr>
<tr>
<td>Negative Sentiment</td>
<td>91%</td>
<td>3%</td>
<td>78%</td>
</tr>
<tr>
<td>Volume Negative News</td>
<td>97%</td>
<td>59%</td>
<td>84%</td>
</tr>
<tr>
<td>Negative impact</td>
<td>91%</td>
<td>3%</td>
<td>78%</td>
</tr>
</tbody>
</table>

Percentage of significant correlations between news time series and long-term bonds issued by Spain between 2007 and 2017.
Rolling correlation

Correlation between volume of positive news and mean spread of long-term bonds changes its sign -> point to a change in market regimes
Correlation analysis - regime change

- Analysis of correlation series in Hidden Markov Model (HMM)
- We fit an HMM with three states to the time series, hidden regimes are filtered out through the Forward-Backward and the Viterbi algorithm.
- The estimates market regime is in line with the actual observed regime.
- Spain: Bond spreads widen between 2011 and 2014, the market is estimated as bullish or neutral before and after this period.
Correlation analysis - regime change

- Regime estimation for Spain and Germany based on rolling correlation between news volume and bond spreads
Correlation analysis - volatility

- Mean volatility of daily spread change and its correlation with daily news impact series for five European countries.
- Correlation decreases, when markets are calm, the correlation fluctuates around 0.2 in turbulent market times.
- Significant correlation between sentiment time series of all news and mean spread series.

France:  

UK:
ARIMAX modelling and prediction of spreads

- Results: Best one-step ahead prediction is gained when external variables are included.

- Mean spread of countries Germany, Spain, France, Italy and Great Britain is also predicted through an ARIMAX (1,1,1) model.

- Smallest error measures are attained when external variables “Volume of all news”, “All News Impact”, “Volume of negative news” and “Negative Impact” are combined.