The economic value of volatility transmission between stock and bond markets

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Available at SSRN: http://ssrn.com/abstract=938150

Objectives and contribution

- Analyze volatility spillovers between stocks and bonds in the European market.

- Design a trading rule in order to analyze the economic significance of the volatility spillovers observed between stocks and bonds.
1.1 Introduction: literature review

There is a vast amount of works on modeling volatility spillovers but they examine stock markets or bond markets separately.

- Only three references in bond-stock volatility spillovers
  - Kim et al (2001) in Australia

1.2 Introduction

Stock-bond volatility linkages:

- Common information
- Cross-market rebalancing

A shock in one market may generate cross-market asset rebalancing. Then, information spillover takes place and this generate trading and volatility in both markets
2. Data

- Futures to avoid short sale constraints and microstructure effects
- Bond market → Euro Bund futures contract
- Stock market → DJ Euro Stoxx 50 index
- Sample: 1991-2006
- Weekly frequency
3.1 Econometric model

- First step: VAR model

\[ R_{1,t} = \mu_1 + \sum_{j=1}^{3} c_{1,j} R_{1,t-j} + \sum_{j=1}^{3} d_{1,j} R_{2,t-j} + u_{1,t} \]

\[ R_{2,t} = \mu_2 + \sum_{j=1}^{3} c_{2,j} R_{1,t-j} + \sum_{j=1}^{3} d_{2,j} R_{2,t-j} + u_{2,t} \]

- Second step: the residuals of the model are orthogonalised

- Third step: Asymmetric Dynamic Conditional Covariance model [Kroner and Ng (1998)]
3.2 Econometric Model: the variance

- The ADC model [Kroner and Ng (1998)] is defined as:

$$H_t = D_t R D_t + \Phi \Theta$$

where:

$$D_t = \begin{bmatrix} d_{1t} \\ d_{2t} \end{bmatrix}, \quad d_{it} = \sqrt{\theta_{it}} \text{ for all } i, d_{jt} = 0 \text{ for all } i \neq j$$

$$R = \begin{bmatrix} r_{1t} \\ r_{2t} \end{bmatrix}, \quad r_{it} = 1 \text{ for all } i, r_{jt} = \rho_{jt} \text{ for all } i \neq j$$

$$\Phi = \begin{bmatrix} \phi_{1t} \\ \phi_{2t} \end{bmatrix}, \quad \phi_{it} \text{ for all } i$$

$$\theta_{it} = w_{it} + b_i \theta_{i-1} b_j + a_i e_{i-1} + a_j + g_i \eta_i \eta_{j-1} \text{ for all } i, j$$

$$\Theta = \begin{bmatrix} \theta_{it} \end{bmatrix}$$

and $a_i, b_i$ and $g_i$ for $i = 1, 2$ are parameter vectors $2 \times 1$

$w_{it}, \rho_{jt}$ and $\phi_{it}$ for $i, j = 1, 2$ are scalars

$\eta_i = \max[0, -e_i]$ for $i = 1, 2$

3.3 Econometric Model: the variance

$$\begin{bmatrix} \sigma_{11,t} \\ \sigma_{12,t} \\ \sigma_{21,t} \\ \sigma_{22,t} \end{bmatrix} = \begin{bmatrix} \sqrt{\theta_{11,t}} \\ 0 \\ \sqrt{\theta_{21,t}} \\ \sqrt{\theta_{22,t}} \end{bmatrix} \begin{bmatrix} 1 \\ \rho_{12} \\ 1 \\ 0 \end{bmatrix} \begin{bmatrix} \sqrt{\theta_{11,t}} \\ 0 \\ \sqrt{\theta_{21,t}} \\ \sqrt{\theta_{22,t}} \end{bmatrix} + \begin{bmatrix} 0 \\ \phi_{1t} \\ 0 \\ \phi_{2t} \end{bmatrix} \begin{bmatrix} \theta_{11,t} \\ \theta_{12,t} \\ \theta_{21,t} \\ \theta_{22,t} \end{bmatrix} = \begin{bmatrix} \theta_{11,t} & \theta_{12,t} \\ \theta_{12,t} & \theta_{22,t} \end{bmatrix}$$

where:

$$\begin{bmatrix} \theta_{11,t} & \theta_{12,t} \\ \theta_{21,t} & \theta_{22,t} \end{bmatrix} = \begin{bmatrix} w_{11} & w_{12} \\ w_{21} & w_{22} \end{bmatrix} + \begin{bmatrix} b_1 & b_2 \\ b_2 & b_1 \end{bmatrix} \begin{bmatrix} \sigma_{11,t-1} & \sigma_{12,t-1} \\ \sigma_{21,t-1} & \sigma_{22,t-1} \end{bmatrix} + \begin{bmatrix} a_1 & a_2 \\ a_2 & a_1 \end{bmatrix} \begin{bmatrix} e_{11,t-1} & e_{12,t-1} \\ e_{21,t-1} & e_{22,t-1} \end{bmatrix} + \begin{bmatrix} g_{11} & g_{12} \\ g_{21} & g_{22} \end{bmatrix} \begin{bmatrix} \eta_{11,t-1} & \eta_{12,t-1} \\ \eta_{21,t-1} & \eta_{22,t-1} \end{bmatrix}$$
4.1 Empirical Results

\[ \sigma_{1,t}^2 = c_{11}^2 + b_{11}^2 \sigma_{1,t-1}^2 + 2b_{11}b_{21} \sigma_{12,t-1} + b_{21}^2 \sigma_{2,t-1}^2 + a_{11}^2 \varepsilon_{1,t-1}^2 + 2a_{11}a_{21} \varepsilon_{1,t-1} \varepsilon_{2,t-1} + a_{21}^2 \varepsilon_{2,t-1}^2 + g_{11}^2 \eta_{1,t-1}^2 + 2g_{11}g_{21} \eta_{1,t-1} \eta_{2,t-1} + g_{21}^2 \eta_{2,t-1}^2 \]

\[ \sigma_{2,t}^2 = c_{12}^2 + c_{22}^2 + b_{12}^2 \sigma_{1,t-1}^2 + 2b_{12}b_{22} \sigma_{12,t-1} + b_{22}^2 \sigma_{2,t-1}^2 + a_{12}^2 \varepsilon_{1,t-1}^2 + 2a_{12}a_{22} \varepsilon_{1,t-1} \varepsilon_{2,t-1} + a_{22}^2 \varepsilon_{2,t-1}^2 + g_{12}^2 \eta_{1,t-1}^2 + 2g_{12}g_{22} \eta_{1,t-1} \eta_{2,t-1} + g_{22}^2 \eta_{2,t-1}^2 \]

4.2 Empirical results

\[
\begin{align*}
\sigma_{1,t}^2 &= 1.81 \times 10^{-6} + 0.8667 \sigma_{1,t-1}^2 + 0.0592 \sigma_{12,t-1} + 0.0010 \sigma_{12,t-1}^2 + 0.0431 \varepsilon_{1,t-1}^2 + 1.32 \times 10^{-6} + 0.0107 \varepsilon_{1,t-1}^2 + 0.0070 \varepsilon_{2,t-1}^2 + 0.0024 \varepsilon_{2,t-1}^2 + 0.0126 \\
&= (13.486), (80.8852), (-0.8456), (0.4230), (3.3959) \\
0.00846 &= 0.0156 \varepsilon_{2,t-1}^2 + 0.1213 \sigma_{12,t-1} + 0.2563 \sigma_{12,t-1} + 0.1355 \eta_{2,t-1}^2 + 0.0354 \\
&= 0.0190 + 0.0238 + 0.0349 + 0.0254 \\
&= (2.3899), (2.1858), (5.0768), (-7.3284), (5.3211) \\
\end{align*}
\]

\[
\begin{align*}
\sigma_{2,t}^2 &= 1.39 \times 10^{-6} + 1.39 \times 10^{-6} \sigma_{1,t-1} + 0.0023 \sigma_{12,t-1} + 0.9001 \sigma_{12,t-1} + 0.0007 \varepsilon_{1,t-1}^2 + 7.83 \times 10^{-6} + 3.14 \times 10^{-6} \varepsilon_{1,t-1}^2 + 0.0024 \varepsilon_{1,t-1}^2 + 0.0300 \varepsilon_{1,t-1}^2 + 0.0001 \\
&= (1.7754), (0.4729), (-0.9489), (29.9821), (5.1744) \\
0.0122 &= 0.0517 \varepsilon_{2,t-1}^2 + 0.0111 \sigma_{12,t-1} + 0.0022 \sigma_{12,t-1} + 0.0011 \eta_{2,t-1}^2 + 0.0024 \\
&= 0.0134 + 0.0004 + 0.0039 + 0.0038 \\
&= (4.9847), (3.8524), (2.4939), (-0.5585), (0.2872) \\
\end{align*}
\]
4.3 Empirical Results

- Stock volatility responds asymmetrically to its own shocks.
- Bond volatility responds symmetrically to its own shocks.
- Volatility spillovers between stock and bond markets in Europe are asymmetric and bidirectional.

Most common evidence in the literature

- HIGH Stock Market Uncertainty
- Low bond-stock correlation
5.1 Trading Strategy

- Pardo and Torró (2006) develop a trading rule exploiting the asymmetric volatility spillovers between large and small-cap companies in Spain.

- Adapting the intuition behind their strategy we propose to differentiate between:
  
  - **Good** volatility pieces of **news**: an expected decrease in volatility
  
  - **Bad** volatility pieces of **news**: an expected increase in volatility
Simultaneous items of volatility news

5.2 Trading Strategy

Crossed trading strategy

- Bad volatility news on asset “i” → Short position on asset “j”
- Good volatility news on asset “i” → Long position on asset “j”
### 5.3 Trading Strategy: total period results

**Total period (13/09/00-18/01/06)**

#### Buy and hold strategy in the total period

<table>
<thead>
<tr>
<th></th>
<th>EuroStoxx 50 return</th>
<th>Euro Bund futures return</th>
<th>Risk free interest rate</th>
</tr>
</thead>
<tbody>
<tr>
<td>EuroStoxx 50 return</td>
<td>-37.27</td>
<td>14.11</td>
<td>10.81</td>
</tr>
<tr>
<td>Euro Bund futures</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Risk free interest rate</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

#### Trading Profitability in the total period

<table>
<thead>
<tr>
<th>Type of volatility news</th>
<th>Euro Bund futures</th>
<th>EuroStoxx50 futures</th>
</tr>
</thead>
<tbody>
<tr>
<td>Bad</td>
<td>-1.20</td>
<td>37.29</td>
</tr>
<tr>
<td>Good</td>
<td>18.98</td>
<td>-4.03</td>
</tr>
<tr>
<td>Total</td>
<td>17.78*</td>
<td>33.26*</td>
</tr>
</tbody>
</table>

### 5.4 Trading Strategy: bearish period results

**Bearish period (13/09/00-05/03/03)**

#### Buy and hold strategy in the bearish period

<table>
<thead>
<tr>
<th></th>
<th>EuroStoxx 50 return</th>
<th>Euro Bund futures return</th>
<th>Risk free interest rate</th>
</tr>
</thead>
<tbody>
<tr>
<td>EuroStoxx 50 return</td>
<td>-91.11</td>
<td>10.75</td>
<td>4.66</td>
</tr>
<tr>
<td>Euro Bund futures</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Risk free interest rate</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

#### Trading Profitability in the bearish period

<table>
<thead>
<tr>
<th>Type of volatility news</th>
<th>Euro Bund futures</th>
<th>EuroStoxx50 futures</th>
</tr>
</thead>
<tbody>
<tr>
<td>Bad</td>
<td>-0.39</td>
<td>63.07</td>
</tr>
<tr>
<td>Good</td>
<td>12.37</td>
<td>-35.08</td>
</tr>
<tr>
<td>Total</td>
<td>11.98*</td>
<td>27.99*</td>
</tr>
</tbody>
</table>
### 5.5 Trading Strategy: bullish period results

**Bullish period (12/03/03-18/01/06)**

<table>
<thead>
<tr>
<th>Type of volatility news</th>
<th>Euro Bund futures</th>
<th>EuroStoxx50 futures</th>
</tr>
</thead>
<tbody>
<tr>
<td>Bad</td>
<td>-0.82</td>
<td>-25.78</td>
</tr>
<tr>
<td>Good</td>
<td>6.62</td>
<td>31.05</td>
</tr>
<tr>
<td>Total</td>
<td>5.80*</td>
<td>5.47*</td>
</tr>
</tbody>
</table>

### 5.6 Trading Strategy: Accumulative return

![Accumulative return of the strategy on Euro Bund futures](image1.png)

![Accumulative return of the strategy on EuroStoxx 50 futures](image2.png)
5.7 Trading Strategy: main results

- Positive results (6 out of 6)
- Best result: news coming from the Euro Bund futures
- Specially in the bearish period
- Less financial requirements → Strategy very profitable

6.1 Conclusions

First objective
Analyze volatility spillovers between stocks and bonds in Europe

Volatility transmission between stocks and bonds is bidirectional.

Stocks ↔ Bonds

Stock volatility responds asymmetrically to its own shocks.
Bond volatility responds symmetrically to its own shocks.
6.2 Conclusion

**Second objective**
Exploit volatility transmission between stocks and bonds by means of a trading rule that distinguishes between bad and good news

Volatility spillovers are economically significant since the trading rule offers profitable returns after transaction costs

Better results after news coming from the Euro Bund futures (specially in the bearish period)

The trading rule can be applied to different markets and assets

Efficient market hypothesis

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**Muchas gracias**

Cualquier
- pregunta,
- crítica o
- sugerencia

será muy bien acogida