An analysis of the bid-ask spread in the German power continuous intraday market

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Context
The power spot market in Germany
### The orders book

<table>
<thead>
<tr>
<th>Quantity</th>
<th>Ask Price</th>
<th>Bid Price</th>
<th>Quantity</th>
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<tbody>
<tr>
<td>20</td>
<td>35</td>
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The bid-ask spread

<table>
<thead>
<tr>
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The bid-ask spread is the difference in price between the lowest price for which a seller is willing to sell a MWh of power and the highest price that a buyer is willing to pay for it.
Market depths are the total volume available in the orders book on the ask (sell depth) and the bid (buy depth) side.
Research questions

- How are the bid-ask spread and the market depths behaving over the trading session?
- What are the determinants of the bid-ask spread on the market?
Dynamic analysis
Empirical strategy

How are the bid-ask spread and the market depths behaving over the trading session?

- Dynamic analysis
- Period: 1st of June to 15th of November 2015
- Data: German intraday continuous orders books (EPEX SPOT)
- Granularity: microseconds
Figure 1: Evolution of the best buy and best sell prices over a trading session

Figure 2: Bid-ask spread over an average trading session
Results

Figure 3: Evolution of the best buy and sell depths over a trading session

Figure 4: Sell depth over an average trading session
Econometric analysis
What are the determinants of the bid-ask spread on the market?

- Panel data econometrics / FGLS estimator
- Period: 1st of June to 15th of November 2015
- Data: German intraday continuous orders books + trades books + aggregate curves of the German Day-Ahead Market (EPEX SPOT) + load (EEX) + fundamentals forecasts and generation (EEX, EuroWind)
- Granularity: trading session
Empirical strategy

\[
BAS = \beta_1 \mathbb{1}_{wkd} + \beta_2 L + \beta_3 WAP + \beta_4 AM + \beta_5 V \\
+ \beta_6 \Delta W_+ + \beta_7 \Delta S_+ + \beta_8 \Delta W_- + \beta_9 \Delta S_- + \beta_{10} ES + \beta_{11} EP
\]

\(\mathbb{1}_{wkd}\): dummy variable for week-end  
\(L\): load (MWh)  
\(WAP\): weighted average price (€/ MWh)  
\(AM\): number of active members  
\(V\): volume of the market (GWh)  
\(\Delta W_+\): Positive solar forecast error (GWh)  
\(\Delta S_+\): Positive solar forecast error (GWh)  
\(\Delta W_-\): Negative wind forecast error (GWh)  
\(\Delta S_-\): Negative solar forecast error (GWh)  
\(ES\): Elasticity of the supply curve of the DAM  
\(EP\): Elasticity of the purchase curve of the DAM
Empirical strategy

\[
BAS = \beta_1 \mathbb{1}_{wkd} + \beta_2 L + \beta_3 WAP + \beta_4 AM + \beta_5 V \\
+ \beta_6 \Delta W_+ + \beta_7 \Delta S_+ + \beta_8 \Delta W_- + \beta_9 \Delta S_- + \beta_{10} ES + \beta_{11} EP
\]

\[
\Delta W = W - \hat{W} \\
\Delta W_+ = \max\{\Delta W, 0\} \\
\Delta W_- = \min\{\Delta W, 0\}
\]

\(W\): wind generation (GWh)  
\(\hat{W}\): wind forecast (GWh)
Empirical strategy

\[ BAS = \beta_1 wkd + \beta_2 L + \beta_3 WAP + \beta_4 AM + \beta_5 V \\
+ \beta_6 \Delta W_+ + \beta_7 \Delta S_+ + \beta_8 \Delta W_- + \beta_9 \Delta S_- + \beta_{10} ES + \beta_{11} EP \]
<table>
<thead>
<tr>
<th></th>
<th>Estimate</th>
<th>Std. Deviation</th>
</tr>
</thead>
<tbody>
<tr>
<td>Dummy week-end</td>
<td>0.074***</td>
<td>0.004</td>
</tr>
<tr>
<td>Load (GWh)</td>
<td>-0.007***</td>
<td>0.0002</td>
</tr>
<tr>
<td>WAP (€/ MWh)</td>
<td>0.005***</td>
<td>0.0001</td>
</tr>
<tr>
<td>IDM volume (GWh)</td>
<td>0.087***</td>
<td>0.001</td>
</tr>
<tr>
<td>Number of active members</td>
<td>-0.008***</td>
<td>0.0001</td>
</tr>
<tr>
<td>Positive solar FE (GWh)</td>
<td>0.0247***</td>
<td>0.001</td>
</tr>
<tr>
<td>Positive wind FE (GWh)</td>
<td>0.004***</td>
<td>0.001</td>
</tr>
<tr>
<td>Negative solar FE (GWh)</td>
<td>-0.005***</td>
<td>0.001</td>
</tr>
<tr>
<td>Negative wind FE (GWh)</td>
<td>0.022***</td>
<td>0.001</td>
</tr>
<tr>
<td>Elasticity sell side</td>
<td>6.546***</td>
<td>0.110</td>
</tr>
<tr>
<td>Elasticity buy side</td>
<td>1.765***</td>
<td>0.048</td>
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<tr>
<td>Observations</td>
<td>3,713</td>
<td></td>
</tr>
<tr>
<td>( R^2 )</td>
<td>0.233</td>
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</tbody>
</table>
Conclusion
Key take aways

- The bid-ask spread has a "U-shape" over the trading session.
- The spread is negatively correlated with the liquidity and positively with the volatility.
- The liquidity is the main driver of the German intraday power market's spread.
Thank you!

Please, feel free to share your comments or suggestions.

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