High-frequency trading in the modern institutional spot FX market

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Agenda

• Specifics of the EBS FX market

• What is HFT in the FX market?

• Taxonomy of the EBS customers

• Major events (central bank interventions)

• Contributions of HFT to the FX volatility
1.1 EBS Market

- EBS is a limit-order OTC market.

- Order matching in three regions: LN, NY, TY

- Consolidated regional order books are identical

- The order relative positions in different regional order books may be not identical due to latency effects

- Orders are submitted in units of millions of the base currency (e.g. MM EUR for EUR/USD).
1.2 EBS market

Trading only between counterparties with bilateral credit. Customers establish credit with each other, and can change it at any time.

EBS is mainly an inter-dealer market – but PB business model lets in hedge funds and professional trading firms (PTC).

Two types of access:
- GUI based: manual traders (MT)
- Automated interface (AI)

Aggregators: AI/MT (?)

Algorithmic trading (algos) => Execution strategies (Johnson, 2010)
  Slicing large orders; ‘smart’ order routing
1.3 EBS market

Major event in March 2011: introducing decimal pips.

EUR/USD: 1.2345(6)
2.1 Taxonomy of the EBS customers

What about FX?

In 2010-2011 only one customer placed on average more than 500 orders a day.
The max average number of orders placed by AI exceeded 14000.
No bank AI placed on average more than 3000 orders a day.

Table 1. AI customer types

<table>
<thead>
<tr>
<th>Type of AI</th>
<th>Slow AI</th>
<th>HFT</th>
<th>Ultra-HFT</th>
</tr>
</thead>
<tbody>
<tr>
<td>Daily order #</td>
<td>&lt;=500</td>
<td>501 - 3000</td>
<td>&gt; 3000</td>
</tr>
</tbody>
</table>

Data: May – Oct 2011 (26 weeks); active at least 14 weeks.
2.2 Taxonomy of the EBS customers

Table 2. Distribution of average daily order numbers

<table>
<thead>
<tr>
<th>Group</th>
<th>Avg daily order #</th>
<th>MT all</th>
<th>Slow Al &lt;=500</th>
<th>HFT 501 - 3000</th>
<th>Ultra-HFT &gt; 3000</th>
</tr>
</thead>
<tbody>
<tr>
<td>EURUSD</td>
<td>3.7%</td>
<td>5.7%</td>
<td>29.0%</td>
<td>61.6%</td>
<td></td>
</tr>
<tr>
<td>USDJPY</td>
<td>3.8%</td>
<td>14.6%</td>
<td>62.9%</td>
<td>18.7%</td>
<td></td>
</tr>
<tr>
<td>USDCHF</td>
<td>1.6%</td>
<td>22.7%</td>
<td>52.8%</td>
<td>22.8%</td>
<td></td>
</tr>
<tr>
<td>EURCHF</td>
<td>2.1%</td>
<td>16.2%</td>
<td>46.9%</td>
<td>34.9%</td>
<td></td>
</tr>
<tr>
<td>EURJPY</td>
<td>1.0%</td>
<td>8.9%</td>
<td>54.8%</td>
<td>35.3%</td>
<td></td>
</tr>
</tbody>
</table>

Table 3. Average fill ratio for various EBS customer groups

<table>
<thead>
<tr>
<th>MT</th>
<th>Slow Al</th>
<th>HFT</th>
<th>Ultra-HFT</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Bank Al</td>
<td>PTC</td>
<td>Aggregator</td>
</tr>
<tr>
<td>----</td>
<td>---------</td>
<td>-----</td>
<td>-----------</td>
</tr>
<tr>
<td>50.8%</td>
<td>48.9</td>
<td>26.6</td>
<td>57.1</td>
</tr>
</tbody>
</table>
2.3 Taxonomy of the EBS customers

Share of the taker EURUSD orders as a function of average daily number of orders
3.1 Liquidity provided by various customers

Bid/offer spread for USDJPY, week ending 30-Sep-2011
3.2 Liquidity provided by various customers

Percentage of time with two-sided market for USDJPY on 4-Aug-2011 (BoJ intervention)
3.3 Liquidity provided by various customers

Bid/offer spread for USDJPY on 4-Aug-2011 (BoJ intervention)
3.4 Liquidity provided by various customers

Percentage of time with two-sided market for USDCHF on 6-Sep-2011 (SNB intervention)
3.5 Liquidity provided by various customers

Bid/offer spread for USDCHF on 6-Sep-2011 (SNB intervention)
4.1 HFT contributions to volatility

Regressing returns on HFT trading volume?.

Number of orders within one second summed over week ending 28-Oct-2011
4.2 HFT contributions to volatility

Integrated volatility (IV):

\[ dX = \mu(t)dt + \sigma(t)dW \]

Integrated volatility: \( IV = \int_0^T \sigma^2(t)dt \)

Empirical data are available on a finite grid with spacing \( \tau = T/N \)

Realized volatility: \( RV = \sum_{i=1}^{N-1} (X(t_i) - X(t_{i-1}))^2 \quad \tau = t_i - t_{i-1} \)

\( RV \Rightarrow IV \) as \( N \Rightarrow \infty \)

If \( \mu = 0 \) and \( \sigma = \text{const} \), \( RV = \sigma^2T \) (does not depend on \( \tau \))
4.3 HFT contributions to volatility

Annualized realized volatility for the days of BOJ and SNB interventions
4.4 HFT contributions to volatility

Two types of events causing volatility:

- Taker activity (market impact) is a result of natural trading interest and hence must be filtered out...

- Maker activity (price discovery) in FX is dominated by HFT.

**Conclusion:** HFT in FX not just affect volatility, HFT determine volatility.
Q & A