



Áron Gereben

Magyar Nemzeti Bank (the Central Bank of Hungary)

**The use of the microstructure approach to foreign
exchange markets in a central bank**

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Outline



- **Background** – How do financial markets and monetary policy look like in Hungary?
- **Motivation** – How did the MNB become interested in FX microstructure?
- **Data** – What data sources do we use for these analyses?
- **Research results** – What did we learn about the Hungarian FX markets so far?
- **Ongoing work** – What do we have in the pipeline?
- **Policy use** – What are the policy issues that we can explore using microstructure based analysis?

Background



- **Hungary is an emerging market** – domestic financial markets, including the FX market are highly vulnerable to external and internal shocks
- **Mixed monetary regime** – Inflation targeting and a wide (+/-15%) exchange rate band, a mix that can lead to potential conflicts
- **2003 speculative attack** – The strong edge has been tested by the market, but the central bank successfully defended the band
- **Small open economy**, and relatively low monetisation – The exchange rate channel plays a key role in the transmission mechanism of monetary policy
- Planned **ERM II entry** in the foreseeable future

Learning about the exchange rate is highly important for the central bank



- Starting point: we observed that **some financial flows show strong co-movements with the exchange rate**
- „Canonical” models of exchange rate determination, assuming frictionless markets and information homogeneity could not explain these relationships
- Microstructure theory emphasises the importance of the trading mechanism, and allows for heterogeneous information among market participants
- Can provide explanations for the observed links between financial flows and the exchange rates
- The MNB is relatively well-endowed with data on FX flows



Data requirements for microstructure analysis:

- Relatively high frequency
- Prices and quantities
- Order flow: need to identify the initiator of trades

Two data sets are available for us:

- Daily foreign exchange transaction reports by domestic financial institutions - **customer order flow**
- Reuters D3000 Spot Matching orders and transactions - **inter-dealer order flow**



Daily foreign exchange transaction reports:

- Domestic banks report all FX transactions on a daily basis (price and quantity)
- They indicate the type of the partner (bank/non-bank, domestic/nonresident etc.)
- No time stamp, only date
- This information can be aggregated at daily frequency to **customer order flows to market-making banks**
- Data is available with a 2-day lag: can be used for continuous monitoring
- 5-year coverage, including extreme events



Reuters D3000 Spot Matching data:

- This is an electronic limit order book, and the key platform of the EUR/HUF trading
 - The database contains all the orders that have been submitted and all the trades that have been concluded during a given period, at 100th of a second frequency
 - It can be inferred whether a trade was initiated as a buy or a sell
 - We have two years' worth of data: 2003-2004
 - This information can be used to create time series of **inter-dealer order flow** at various frequencies
 - Data is not available on a continuous basis, Reuters provides it only at request
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The impact of customer order flow on the exchange rate

- **Data:** Uses the banks' daily FX reports as source data
- **Aim:** Empirical analysis of the relationship between customer order flow and the exchange rate of the Hungarian forint
 - can order flow explain the dynamics of the exchange rate?
 - does it matter who submits the order?
 - can we identify „push” and „pull” customers, ie. information providers and liquidity providers?
- **Methodology:** based on Carpenter and Wang (2003), Mende and Menkhoff (2003), Bjønnes, Rime and Solheim (2004), Marsh and O'Rourke (2005)

Research results

$$ds_t = \beta_0 + \sum_i \beta_i x_t^i + \varepsilon_t$$

<i>Variables</i>	(1) <i>Generic model</i>	(2) <i>Model with push customers</i>	(3) <i>Model with pull customers</i>
Constant (β_0)	-0.082 (-1.06)	-0.114 (-1.55)	0.058 (0.60)
Foreign banks' order flow (β_{fb})	-0.124 (-17.91)	-0.127 (-21.42)	-
Foreign non-banks' order flow (β_{fo})	-0.186 (-12.12)	-0.201 (-14.22)	-
Domestic (non-market making) banks' order flow (β_{db})	0.027 (1.17)	-	0.285 (14.41)
Domestic non-banks order flow (β_{do})	0.003 (0.24)	-	0.115 (7.28)
Central bank's order flow (β_{cb})	-0.185 (-11.66)	-0.169 (-28.64)	-
<i>Order flow from dom. non-market- making banks to the central bank</i>	<i>-0.376</i> <i>(-1.14)</i>	-	<i>-1.299</i> <i>(-19.61)</i>
Adjusted R ²	0.302	0.305	0.147





Findings:

- Customer order flow is able to explain a significant part of the fluctuations of the forint/euro exchange rate.
- The data is consistent with the model of „push” and „pull” customers, and with empirical findings at other markets.
- Foreign clients and the central bank seem to play the role of push customers. Their order flow is positively correlated with the exchange rate. The information embedded in their trading drives the exchange rate.
- Domestic clients are the „pull” customers, providing the liquidity to the market. Their order flow is negatively correlated with the exchange rate.

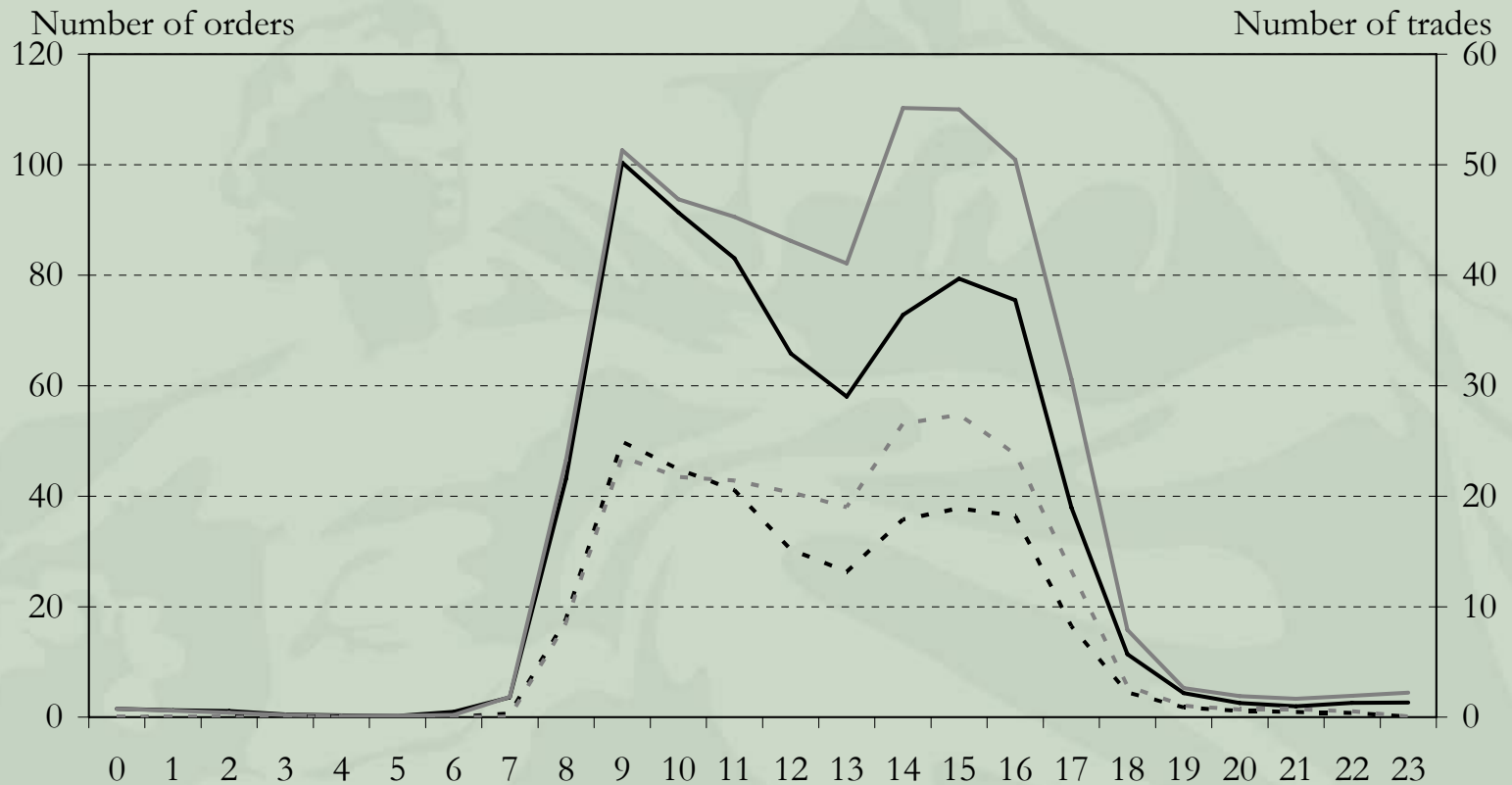


The characterisation of the EUR/HUF trading using high-frequency data

- **Data:** Reuters D3000 Spot matching
- **Aim:** Learn about the intraday patterns of the FX trading from first-hand trading data
 - How does quotes, trades, the bid-ask spread, the depth and the width of the order book evolve intraday?
 - Does the Hungarian FX market show any difference relative to more mature markets?
 - Does inter-dealer order flow have an impact on the exchange rate in case of the Hungarian forint? (Evans-Lyons, Scalia)

Research results

Liquidity over the trading day



— Number of orders - 2003

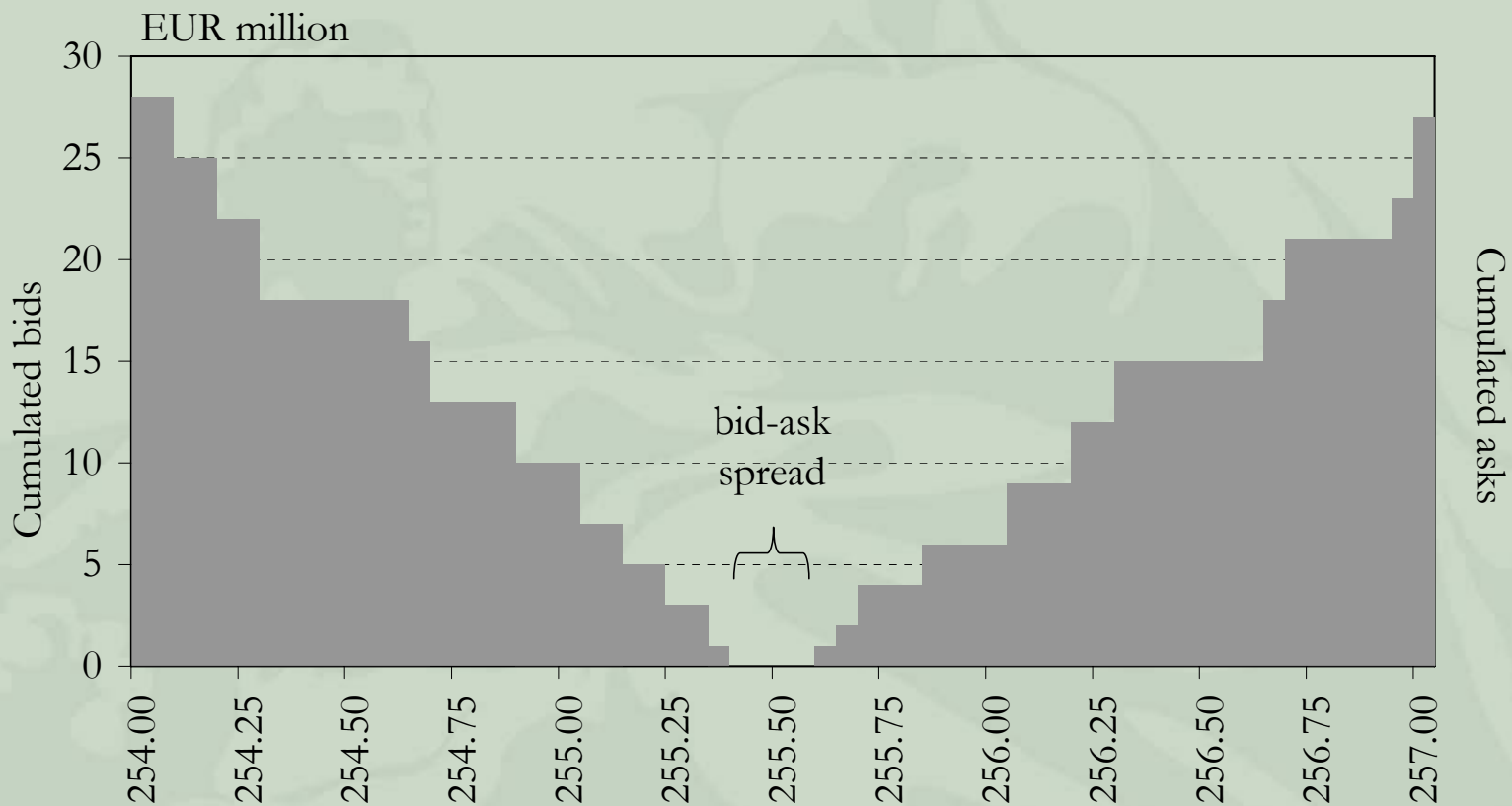
— Number of orders - 2004

- - - Number of trades - 2003 (right hand scale)

- - - Number of trades - 2004 (right hand scale)

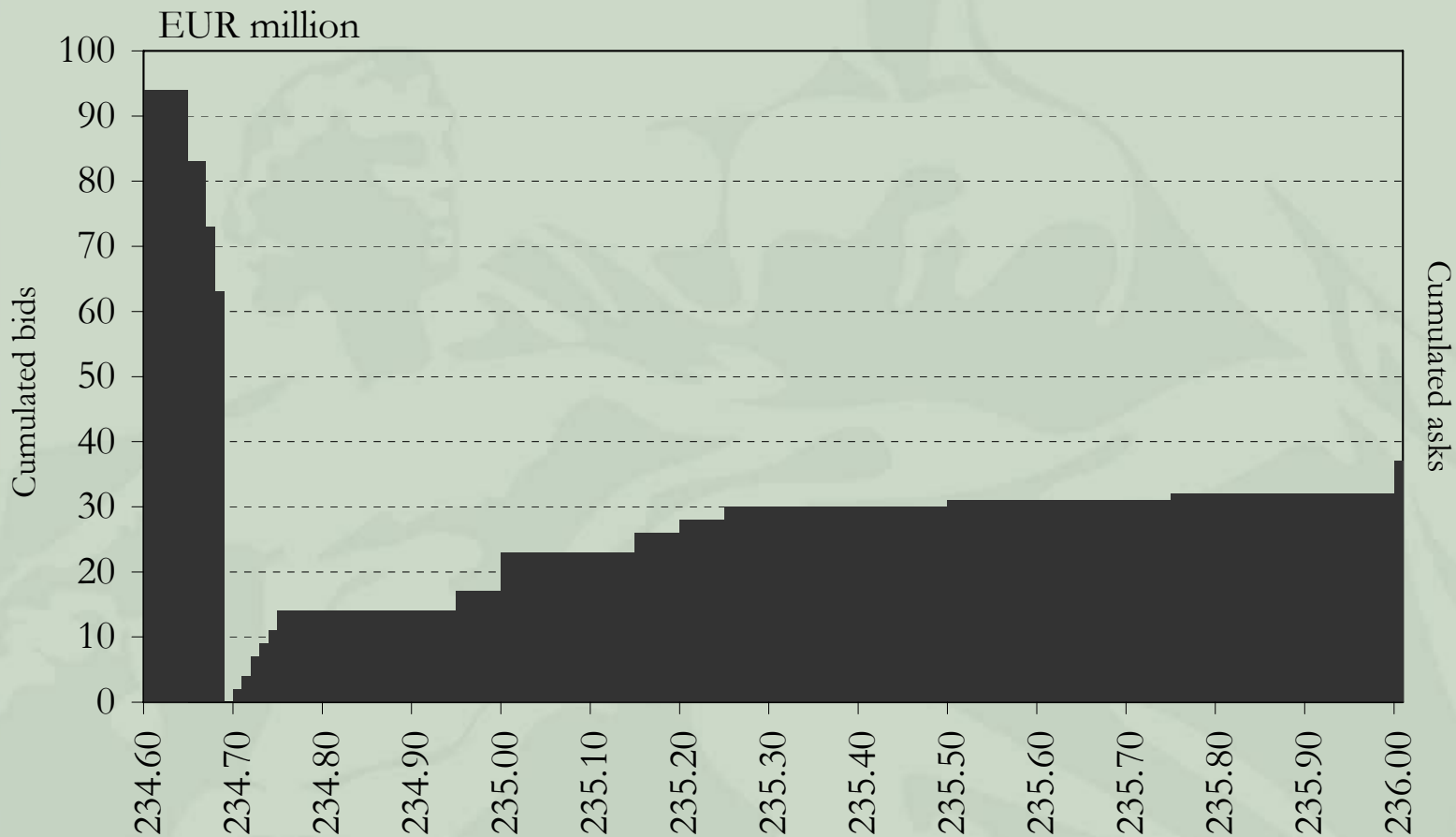
Research results

The trading book on a normal trading day



Research results

The trading book during the 2003 speculative attack



Findings:

- Although the Hungarian FX market is much smaller in terms of size and liquidity than its more developed peers, the intraday patterns of various liquidity indicators are quite similar.
- Interdealer order flow can explain a large part of the exchange rate dynamics, as shown by Evans and Lyons for some major currency pairs and by Scalia for some emerging FX markets.





Macroeconomic news announcements, order flow and exchange rates

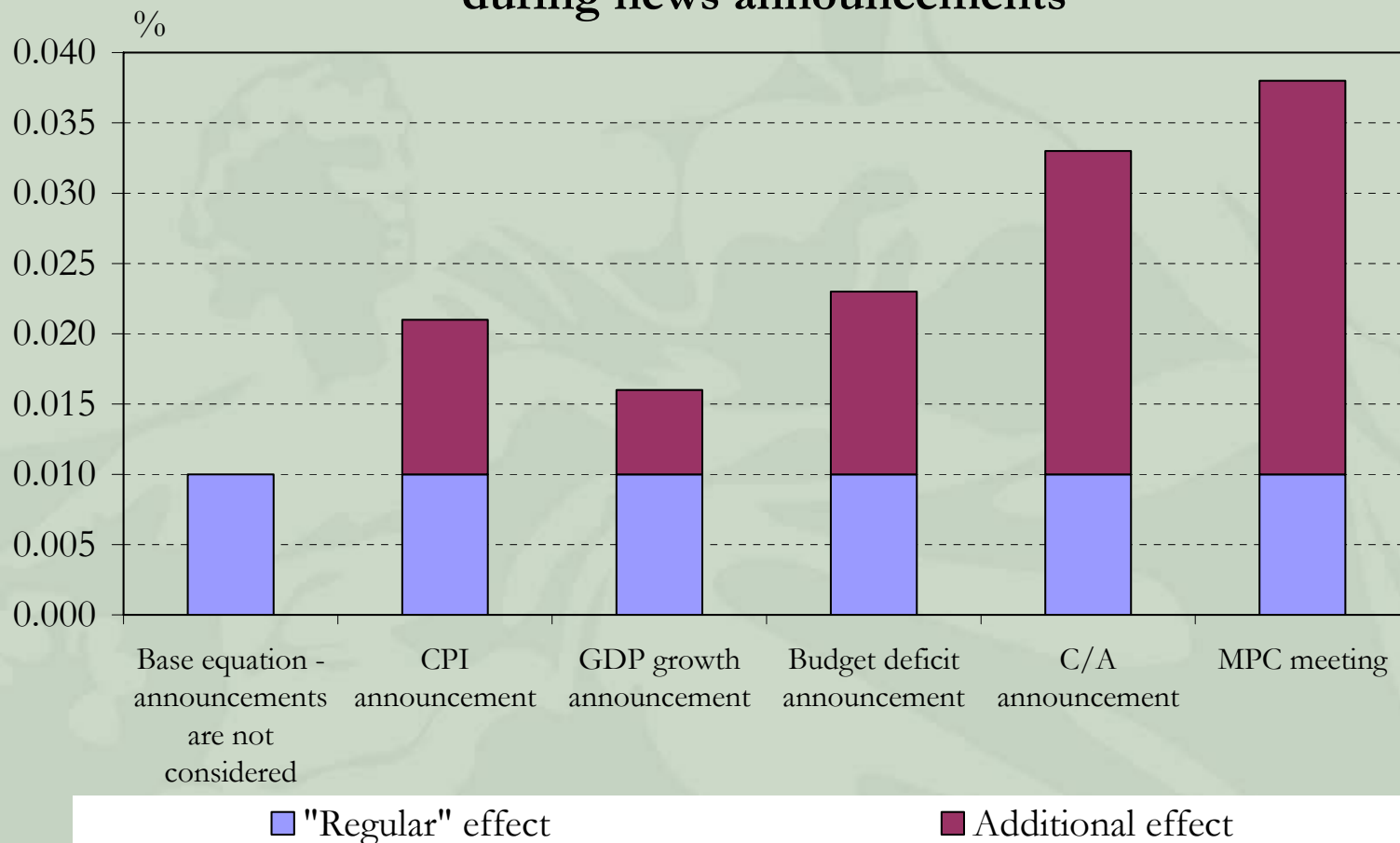
- We look at the role of the order flow in the transmission of macro news announcements to prices

Preliminary findings:

- Order flows react to news
- The impact of order flow on exchange rates is larger during news announcements
- Informations on fundamentals enter into the prices via a direct channel and an indirect channel, through order flow, with the indirect channel accounting for about $\frac{3}{4}$ of the total impact

Ongoing work

The impact of order flow to the exchange rate during news announcements





The order flow – exchange rate relationship in turbulent markets

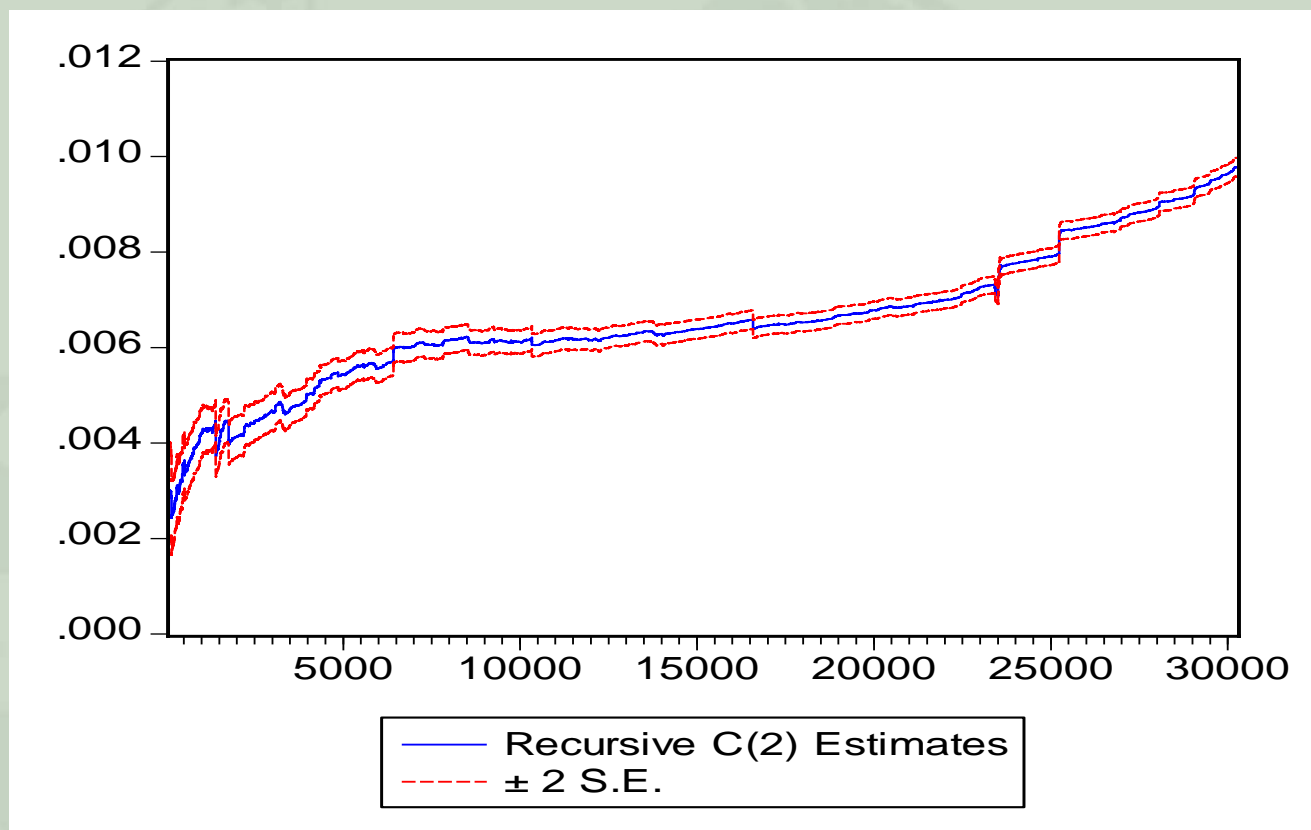
- How does the relationship between the order flow and the exchange rate change under turbulent market conditions?
- Emerging markets, such as Hungary, are good test grounds for such analysis

Preliminary findings:

- The impact of order flow is much larger when markets are under stress

Ongoing work

The impact of order flow to the exchange rate is increasing with volatility



Market monitoring

- Knowing the key customer types and their role on the FX market helps us to better understand the behaviour of the exchange rate.
- As customer order flow is available almost immediately (2-day lag), we are able to include informations from customer order flow into regular – weekly and monthly - market analyses for the Bank's decision-making bodies.





Lessons for intervention

- Microstructure analyses helps us to better prepare for potential interventions on the FX markets
- The link between order flow and exchange rates provides clues on the potential impact of interventions
- This impact may depend on the circumstances
- Intervention around news announcements may be more effective
- Similarly, intervention in turbulent times may have larger impact than intervention under regular market conditions