Discussion of “Supply-Demand Symmetry”
by Carlo Acerbi

Discussant: Susanne von der Becke, ETH Zurich, Entrepreneurial Risks
Agenda

- Summary
- Discussion
- Conclusion
Motivation

- Question: what properties must a liquidity surface (LS) possess, when supply and demand are symmetrical?
- Initial intuition: even market impact \( \bar{\mu}(s, T) = \bar{\mu}(-s, T) \) as a function of order size \( s \) and execution time horizon \( T \)
- Does not make sense, e.g. stock price floored at zero, upside uncapped ….

**Need definition based on invariance principle assuming equivalent liquidity on buy and sell side**

Liquidity Surface:

Source: Acerbi et. al, 2012
Summary

Defining Supply-Demand Symmetry

- Dual representation in FX market
- Insight extended to general securities where in a regular LS, supply and demand are symmetrical if

\[ L(s) = -m\phi(s) \]

Where \( m \) is the fair value and the function \( \phi : D \rightarrow D \)
1. Is an involution \( \phi = \phi^{-1} \)
2. Convex and strictly decreasing
3. And \( \phi(0) = 0 \)

- Conjugation relationship \( s \leftrightarrow \tilde{s} \)
- Deviations from symmetry are excess of supply or demand
Summary

Supply-Demand Symmetry

\[ L(s)/m \]

Marginal and Average Impact:
Discussion

Contribution of this paper

- Formalization of supply-demand symmetry of liquidity surface
- Even impact function good approximation of symmetry only for small size scales and highly liquid markets
- Many cases possible where buy and sell side of security have the same liquidity, yet impact function not even
- Even impact always corresponds to excess supply, except in a perfectly liquid market
- Model independent definition, no assumptions
- **Key claim**: supply-demand equilibrium should be understood as symmetry not as even impact! Current impact models are biased to underestimating ask-side impact and overestimating bid-side impact.
Discussion

Open questions

- The proof of the pudding: can the theory be validated empirically?
- Data challenges: order book information, unrevealed orders
- Will it help devise better market impact models?
- At the moment theoretical contribution not risk management tool
Discussion

Supply-Demand at Criticality

  - Analysis of impact of meta-orders, 500’000 trades in futures market
  - Average supply/demand V-shaped curve: locally linear latent order book, liquidity vanishes at current price
  - Anomalous high impact of small trades => markets close to critical state where small perturbations lead to strong non-linear effects

\[ \Delta(Q) = Y\sigma \sqrt{\frac{Q}{V}} \]
Market Impact under Invariance to Business Time

- Scaling trades in units of business time rather than calendar time
- Order flow imbalances (fraction of volume) result in greater price impact in larger liquid markets than in less liquid small markets
- Speed of liquidation magnifies short term price effects
- Quantification of systemic risks resulting from sudden liquidations

Conclusion

- Symmetry as formal definition of supply demand equilibrium for liquidity surface
- Current models treating equilibrium as even impact biased to underestimating ask-side impact over-estimating bid-side impact
- Challenge to apply insight to devise risk management tools (market impact, liquidity and systemic risk)
References

