

Order Book Characteristics and the Volume Volatility Relation

Empirical Evidence from a Limit Order Market

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- study the price discovery process in an electronic limit order market
 - is the volume-volatility relation similar to what is found for dealer markets?
- examine the relation between the shape of the limit order book, trading volume and volatility
 - does the shape of the order book explain differences in volatility and trading activity across firms and time?

Stylized empirical fact:

- positive correlation between trading volume and price volatility
- **Clark(1973):** The Mixture of Distributions Hypothesis (MDH)
- price movements and trading volumes driven by the same time-varying arrival rate of new information (“mixing variable”)

Empirical evidence

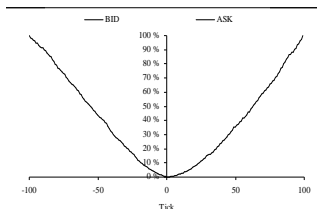
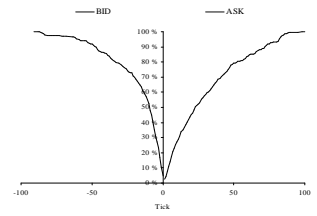
- Harris (1986, 1987) support for MDH
- Jones/Kaul/Lipson (1994) - ”volatility/number of trades relation”
- this study - similar results as Jones et.al. (1994)

Extensions to the MDH

- **Models based on heterogenous valuations**
 - difference of opinion models (symmetric information)
e.g. Harris/Raviv (1993)
 - strategic microstructure models (asymmetric information)
e.g. Shalen (1993) - "dispersion of beliefs"
 - strategic behavior by uninformed generate excess volume and volatility (self generating trades)
- Variables capturing disagreement and dispersion of beliefs
 - analyst earnings forecasts (e.g. Ghysels/Jürgens, 2001)
 - volume from trader types (e.g. Daigler/Wiley, 1999)

- does the shape of the limit order book proxy for heterogeneity in beliefs?
 - if limit orders reflect traders' reservation prices/heterogenous valuations...
 - ...differences in the shape of the order book may proxy for degree of disagreement about fundamental value

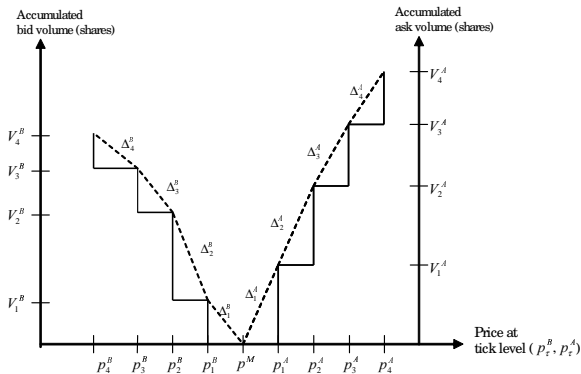
Average order books for Norsk Hydro (NHY) and Opticom (OPC)



- Norsk Hydro is a large, old, diversified company
- Opticom is a large, young, IT research based company with no current cash flows
- reflect greater disagreement about value in OPC than NHY?

- detailed transactions and order data covering 2.5 years from the Oslo Stock Exchange (OSE)
 - fully computerized limit order book system similar to e.g. Paris, Toronto, Stockholm and Hong Kong
 - all trades and orders (submissions, amendments, deletions) from February 1999 through June 2001 (572 trading days)
 - able to rebuild the full order book at any point in time
 - remove firms not traded on at least 70% of the sample days - reducing the sample to 108 companies

Measuring the shape of the order-book:



$$|\epsilon_{i,t}| = \beta_0 M_{i,t} + \beta_1 N_{i,t} + \beta_2 AV_{i,t} + \beta_3 MCAP_{i,t} + \beta_4 SPR_{i,t} \\ + \beta_5 OV_{i,t} + \beta_6 SLOPE_{i,t} + \sum_{j=1}^{12} \rho_{i,j} |\epsilon_{i,t-j}| + \eta_{i,t}$$

Variables	Est.	t-value	std.err
<i>M</i> (Monday)	0.035	0.30	0.034
<i>N</i> (trades)	0.005	43.71	0.000
<i>AV</i> (tradesize)	0.018	4.62	0.004
<i>ln(MCAP)</i> (firmsize)	-0.046	-1.37	0.034
<i>SPR</i> (% spread)	0.203	38.88	0.005
<i>SLOPE</i>	-0.085	-8.92	0.010
<i>OV</i> (ordervolume)	0.026	20.92	0.004
<i>R</i> ²	0.230		
<i>N</i> (firms')	108		
<i>T</i> (time series)	572		
F-test (no fixed effects)	12.65**		

- gentler slope → higher volatility

Relationship between number of trades and order book shape

Variables	MODEL 1		
	Est.	t-value	std.err
<i>M</i> (Monday)	-6.62	-4.72	1.40
<i>AV</i> (trade size)	1.10	6.81	0.16
<i>MCAP</i> (firm size)	59.57	43.68	1.36
<i>SPR</i> (% spread)	-2.47	-11.59	0.21
<i>SLOPE</i>	-8.97	-23.12	0.39
<i>OV</i> (order-book volume)	4.98	32.83	0.15
R^2	0.423		
<i>N</i> (firms)	108		
<i>T</i> (time series)	572		
F-test (no fixed effects)	180.8**		

- gentler slope → more trades

The relationship between the average shape of the order book and the spread in analyst forecasts (coeff. of variation from I/B/E/S)

	SLOPE		
	Estimate	Std.err	p-value
Intercept	12.328	2.037	< .0.01
ln(analysts)	-0.741	0.214	< .0.01
FORECAST	-0.008	0.003	< .0.01
R-sq.	0.58		
F-test	24.79		
Cross-sections	65		
Time series obs.	29		

- greater variation in analyst forecasts → greater dispersion in the order-book (gentler slope)

- The "standard" volume (number of trades) volatility relation is evident in an electronic limit order market
 - trade-size unimportant once number of trades is accounted for (Jones/Kaul/Lipson, 1994)
- the shape of the limit order book explain both volatility and volume across companies and time
- consistent with models where greater heterogeneity increase volatility and trading volume
- order book shape related to disagreement among analyst