



Observatory of
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On Equity Trading Strategies

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PART I:
Systematic trading strategy with
Fundamentals
a practitioner approach

PART II:
Trading behaviours of Member
Firms in Market venues
a researcher approach

PART I:

Systematic trading strategy with Fundamentals

a practitioner approach

Outline

- A brief overview of fundamental analysis and related investment strategies.
- Introduction to Fundamental market Ratio
- Review of some scientific evidence of predicting power of fundamental analysis
- Systematic trading strategy

Fundamental Analysis: What is it?

- Fundamental analysis serves to answer questions, such as:
 - Is the company's revenue growing?
 - Is it actually making a profit?
 - Is it in a strong-enough position to beat out its competitors in the future?
 - Is it able to repay its debts?
 - Is management trying to "cook the books"?

Fundamental Analysis: Basic Assumptions

- Intrinsic Value:
the price on the stock market does not reflect a stock “real” value
- ...in the long run...:
the stock market will reflect the fundamentals

...BUT:

- Estimate:
You don't know if your estimate of intrinsic value is correct
- How long...
will it take for the intrinsic value to be reflected in the market place?

Criticisms of Fundamental Analysis

- Proponents of Technical Analysis:
 - “Market discounts everything!” All NEWS about a company is already priced into a stock.
 - More Insight into price than in Fundamentals
- “Believers” of Efficient Market hypothesis:

Any opportunities for excess returns (from either Technical or Fundamental analysis) is almost immediately whittled away by the market’s many participants.

 - “Value Stocks are ‘Fallen Angels’ and therefore more risky. Premium returns are expected and required”

E. Fama and K.French, J.Finance 47, 427(1992)
K.C. Chan and N. Chen, J.Finance 46, 524(1991)

Building a Systematic Investing strategy based on Companies' Fundamental Characteristics

We follow two main guidelines:

- Follow the intuition behind the discretionary approach of traditional fundamental investing
- Exploit quantitative results suggested by academic research

Financial Statements

- Balance Sheet
Asset, Liabilities, Equity
- Income Statements
Revenues, Expenses
- Statement of Cash Flow
Cash Flow from: Income, Investment and
Financial Activities

Financial Ratios

- Profitability Indicators

- Gauges how well a company uses resources in generating profit and shareholder values
- Compares measures of benefits (**earnings, income...**) with measure of investments

- Liquidity

- Measure a company's ability to pay off its short-term debt obligations
- Compares **most liquid assets** with its **short-term obligations**

- Market Ratios

- Estimate the attractiveness of a potential or existing investment and get an idea of its valuation compared to its market values

- Financial Leverage

- Asses the amount of **Financial Risk** a firm has taken on. Gauge the ability to satisfy fixed financing obligations (interests, principal and lease obligations)
- Compare the amount of debt with capital

- Activity Ratios

- Measure the benefits produced by the totality of firm's assets, and sets of specific assets.

- Cash Flow Indicator Ratios

Focus on cash being generated and the safety net that it provides to the company. These ratios can give users another look at the financial health and performance of a company.

Financial Ratios

- Profitability Indicators

- Gauges how well a company uses resources in generating profit and shareholder values
- Compares measures of benefits (**earnings, income...**) with measure of investments

- Return on equity (ROE):

$$\text{Net Income/Shareholder Equities}$$

Shows how well a company uses investment funds to generate earnings growth

...But not all high-ROE companies make good investments. Some industries have high ROE as they require no assets, such as (consulting firms). Other industries require large infrastructure (oil refiners).

- Return on Assets (ROA):

$$(\text{Net Income} + \text{Interest exp}) / \text{Asset}$$

is an indicator of how profitable a company is before leverage...

- Gross Margin: (Sales - Cost of good sold)/Sales

How efficiently production is managed...But a change in GM may be due to...change in Volume (affectes sales and cost of goods) in Price or Cost of production...

A more detailed analysis is given by:

- Operating Margin:

$$(\text{Sales} - \text{Cost of good sold} - \text{Operating exp}) / \text{Sales}$$

A more detailed analysis of company performance...but it does not tell us how these operations have been Fnanced, then...

- Net Profit Margin:

$$\text{Net Income/Sales}$$

Net Income generated by each dollar of revenue...

- Cash Flow Return on Investments...

- Efficiency ratio...

- Risk adjusted return on capital... and some more...

Financial Ratios

- Profitability Indicators

- Gauges how well a company uses resources in generating profit and shareholder values
- Compares measures of benefits (**earnings, income...**) with measure of investments

- Liquidity

- Measure a company's ability to pay off its short-term debt obligations
- Compares **most liquid assets** with its **short-term obligations**

- Current Ratio:

Current Asset/Current Liabilities

Compares the amount of most liquid assets (those that can be converted into cash within 12 months or the next business cycle) with the short term obligations...

....But not all current assets can be easily converted into cash...for example

Inventory...

- Quick Ratio:

(Current Assets-Inventory)/Curr Liab.

a more conservative measure of liquidity.

- Operating cash flow Ratio: **Operating Cash flow/Total Liab.**

Since it adjusts for liabilities, receivables, and depreciation, operating cash flow is a more accurate measure of how much cash a company has generated (or used) than traditional measures of profitability such as net income or EBIT...

- Business Cycle length Ratios...

- ...

- Activity Ratios

- Measure the benefits produced by the totality of firm's assets, and sets of specific assets.

- Financial Leverage

Financial Ratios

- **Market Ratios**

- Estimate the attractiveness of a potential or existing investment and get an idea of its valuation compared to its market values

- **EPS (Earnings per share):** $\text{Net Income/Shares Outstanding}$

- **P/E (Price to Earnings) Ratio:** $\text{Market Price/Earnings}$

- The most common market valuation measure of a stock.

- Current investor demand for a company share.

- >High P/E: investor expectation of company growth (Growth Investors...)

- **P/B (Price to Book) Ratio:** $\text{Price/Equity share} = (\text{Asset} - \text{Liab.})$

- Compares market value with accounting value of share owned by investors. A higher P/B ratio implies that investors expect management to create more value from a given set of assets, all else equal.

- **PEG (P/E to Growth) Ratio:** $\text{Price}/(\text{Earning Growth})$

- Determines the relative trade-off between the price of a stock, the earnings, and the company's expected (or historical) growth.

- Widely employed indicator of a stock's possible true value.

- **Dividend yield:** $\text{Dividend/Market Price}$

- A high dividend yield can be considered to be evidence that a stock is under priced or that the company has fallen on hard times and future dividends will not be as high as previous ones...

- **Dividend Payout Ratio:** Dividend/Income

- Investors seeking high current income and limited capital growth prefer companies with high DPR.

- **P/CF (Price over Cash Flow):** P/Income

-

Financial Ratios

- Financial Leverage

- Asses the amount of **Financial Risk** a firm has taken on. Gauge the ability to satisfy fixed financing obligations (interests, principal and lease obligations)
- Compare the amount of debt with capital

- Debt Ratio = $\text{Liabilities}/\text{Assets}$

- D/E (Debt to Equity) = $\text{Liabilities}/\text{Equity}$

- Times Interest Earned = $\text{EBIT}/\text{Annual Interest Costs}$

- Debt Service Cov Ratio = $\text{Net Op. Income}/\text{Total debt services}$

-

- Activity Ratios

- Measure the benefits produced by the totality of firm's assets, and sets of specific assets.

- Asset turnover = $\text{Sales}/\text{Assets}$

- Inventory turnover = $\text{COGS}/\text{Inventory}$

- Cash Conversion Cycle

-

- Cash Flow Indicator Ratios

Focus on cash being generated and the safety net that it provides to the company. These ratios can give users another look at the financial health and performance of a company.

- Trough the magic of accounting and non-cash-based transactions, companies that appear very profitable can actually be at a financial risk if they are generating little cash from these profits

- Numerous studies have confirmed that institutional investment firms rank free cash flow ahead of earnings as the single most important financial metric used to measure the investment quality of a company.

- CF/Sales -Free CF/Operating CF -

Some Popular Quantitative (**Discretionary**) Fundamental Strategies

- Value Investing
- Growth Investing
- GARP (Growth at a Reasonable Price)
- Income Investing
- Dogs of the Dows
- DCF analysis

Value Investing

- Looks for stocks with strong fundamentals - (**earnings, dividends, book value, and cash flow**) - that are selling at a bargain price, given their quality. The value investor seeks companies that seem to be incorrectly valued (undervalued) by the market. Potential to increase in share price when the market corrects its error in valuation.
 - **A Typical set of criterion are the following:**
 1. Share price should be less than some fraction of “intrinsic worth”.
 2. Look at companies with **P/E ratios** at the lowest 10% of all equity securities.
 3. **PEG (Price/Earnings to Growth)** should be less than one.
 4. Stock **price/book value** < 1.
 5. There should be no more debt than equity (i.e. **D/E ratio** < 1).
 6. **Current assets/current liabilities** > 2.
 7. **Dividend yield** should be at least two-thirds of the long-term AAA bond yield.
 8. **Earnings growth** should be at least 7% per annum compounded over the last 10 years.

Growth Investing/GARP

- **Growth investors** focus on the future potential of a company, with much less emphasis on its present price
- **Typically they look at:**
 1. Strong Historical Earning Growth: (5-10 years of 5-12% **EPS** annual growth)
 2. Strong forward Earning Growth (**consensus estimate**, qualitative position within industry)
 3. Strong management of Revenues and Costs: current **profit margins** beat last 5 years average profit margins
 4. Efficient Asset Management: stable or increasing **Return on Equity**
 5. Very high **P/E** ratios (up to 50/60)
- Every comparison must be done relative to general condition of the **industry sector** and **economy**.
- **GARP Investors** use a variation of Growth strategies with a stronger focus on present values:
 1. Less strongly growing stocks (as too high growth is riskier)
 2. Positive **Cash Flows** & positive **Earning momentum**
 3. Comparatively lower **P/E** ratios (typically in the 15/25 range)
 4. Like Value investors GARP seeks low **P/B**, typically **below industry average**
 5. **PEG** in the 0.5/1 range (price is lower than it should be given earning growth)
- In a **Bull market Growth** strategies are favoured, while **Bearish markets** favours **Value** & **GARP** strategies.

Income investors/Dogs of the Dow

- Income investors seeks for a stable long term income, mostly through **dividends**.
They end up focussing on:
 1. Long lived, established companies, with little prospects for further growth.
 2. High **dividend yields** (5-6%, while average S&P500 yields is 2-3%)
 3. Historical high dividend yields, as a measure of **sustainability**
 4. General **fundamentals analysis**. Is the company comparatively healthy to justify high yields?
- Dogs of the Dow:
a variant of income strategy where every year the best 10 out of the 30 companies of the DJIA are assessed based on dividend and earning criteria.

Cash Flow Analysis

- Discounted Cash Flow Model:

The intrinsic value of a company is the net present value of all its future cash flows:

$$DCF = \frac{CF_1}{(1+r)} + \frac{CF_2}{(1+r)^2} + \dots + \frac{CF_q}{(1+r)^q} + \dots$$

CF_i = Future Cash Flow estimate

r = Discount rate (WACC)

- Pros:

- Produces the closest thing to an “**intrinsic stock value**”

- Relies on **Free Cash Flow**, which is a trustworthy metric that avoid most of arbitrariness in **reported earnings**.

- Cons:

- Relies on estimates of future: **Cash Flows, discount rates, Perpetuity growth rates**

- Valuations are particularly sensitive to assumption of **discount rates**, and **growth rates**

- Suited only for long term investments

How investors interpret and use Fundamental Ratios

- **Overall look:**

Fundamentals cannot be viewed in isolation. Investor's judgement is made by incorporating several aspects of firms at the same time.

- **Appropriateness:**

For **each** industry sector/Line of business a set of appropriate ratios need to be considered.

- **Benchmark:**

Firm's financial ratios need to be compared with companies in the same industry and similar line of business

- **Economy:**

Predictability of the performance need a closer look at performance under different economic conditions. Historical analysis, under different environments (inflation, recession, prosperity...)

It all seem reasonable. But, is there any scientific evidence that fundamental analysis may work?

- Banz (1981) J. Fin 41, 779; Basu (1983) J. Fin 12, 129; Rosenberg, Reid, and Lanstein (1985) J. Port Manag 11, 9; Lakonishok, Shleifer and Vishny (1994), J. Fin 49 1541. They show patterns in average stock returns not explained by the capital asset pricing models, but rather by stock size B/P, E/P, CF/P, and past sales growth.
- R.A. Haugen and N.L. Baker “Commonality in the determinants of expected stock returns” J. Fin. Econ. 41, 401 (1996)
Demonstrate that fundamentals provide a strong predictive power of the expected returns of long term strategies. They show that this feature is persistent in many different market and time periods.
- M Cooper, W Jackson, G Patterson “Evidence of predictability in the cross-section of bank stock returns” Journal of Banking & Finance 27, 817 (2003)
Examine the predictability of the cross-section of bank stock returns by taking advantage of the unique set of industry characteristics that prevail in the financial services sector

Predictability power of stock returns

R.A. Haugen and N.L. Baker "Commonality in the determinants of expected stock returns" J. Fin. Econ. 41, 401 (1996)

- H&B analyse the predictability power of several Firm's Characteristics on excessive stock returns.
- They analyse stocks belonging to Russel 3000 from 1979-93
- The Characteristics that they consider are:
 - **Risk Related Factors: market Beta, macro-economic betas, stocks' own variances, financial leverage ratios (debt/equity, time interest earned, etc...).**
 - **Price Level Factors: Earnings/Price, Book/Price, Div/Price, Cash Flow/Price, Sales/Price, and relative trends...**
 - **Liquidity Factors: market Capitalisation, price per share, volume/market cap., volume trend**
 - **Growth Potential Factors: profit margins, Cap. turnover, Return/Asset, Ret/Equity, and relative trends...**
 - **Technical History Factors: Excess return (relative to S&P500) averaged over 1,2,3,6,12,24 and 60 months**

Methodology

- Monthly regression (180 regressions):

$$\left\{ \begin{array}{l} r_{j,t} \rightarrow \text{return of stock } j \text{ in month } t \\ c_{i,t} \rightarrow \text{regression coeff for factor } i \text{ and month } t \\ F_{i,j,t-1} \rightarrow \text{exposure to factor } i \text{ for stock } j \text{ in } t-1 \\ u_{j,t} \rightarrow \text{unexplained component of return} \end{array} \right.$$

$$r_{j,t} = \sum_i c_{i,t} \cdot F_{j,i,t-1} + u_{j,t}$$

- Projections for the following month:

$$E(r_{j,t}) = \sum_i E(c_{i,t}) \cdot F_{j,i,t-1}$$

$$\left\{ \begin{array}{l} E(r_{j,t}) \rightarrow \text{expected rate of return} \\ E(c_{i,t}) \rightarrow \text{expected payoff to factor } i \text{ in } t \\ F_{i,j,t-1} \rightarrow \text{exposure to factor in } t-1 \end{array} \right.$$

$E(c_{i,t})$ = average of payoff over trailing 12 months

- **In sample:** first 90 regressions (1979-1986):
Coeffs are averaged and **ranked** according to **t-stats**
Out of sample: remaining 90 regressions (1986-1993)
t-stats and mean are compared with in-sample stats
- **Test:** Null Hyp: mean payoffs of to all factors across entire period are all zero
Method: Hotelling-T² test
- **Out-of-Sample Accuracy test:** comparison between expected monthly returns and realised monthly returns

Most important factors

- Null Hyp: mean payoffs of to all factors across entire period are all zero
 Method: Hotelling-T² test
 Result: 8.206 -> Probability = 0.000

Factor	1979/01 through 1986/06		1986/07 through 1993/12		
	Mean	<i>t</i> -stat.	Mean	<i>t</i> -stat.	
One-month excess return	T	-0.97%	-17.04	-0.72%	-11.04
Twelve-month excess return	T	0.52%	7.09	0.52%	7.09
Trading volume/market cap	L	-0.35%	-5.28	-0.20%	-2.33
Two-month excess return	T	-0.20%	-4.97	-0.11%	-2.37
Earnings to price	P	0.27%	4.56	0.26%	4.42
Return on equity	G	0.24%	4.34	0.13%	2.06
Book to price	P	0.35%	3.90	0.39%	6.72
Trading volume trend	L	-0.10%	-3.17	-0.09%	-2.58
Six-month excess return	T	0.24%	3.01	0.19%	2.55
Cash flow to price	P	0.13%	2.64	0.26%	4.42
Variability in cash flow to price	R	-0.11%	-2.55	-0.15%	-3.38

Expected Return Accuracy test

- Each month, **expected returns** are ranked and collected in 10 deciles (Dec.1= lower) Decs reformed monthly
- In each decile, every stock's monthly **realised returns** are calculated and linked with **expected returns**.
- The **average annual realised returns per decile** are reported
- The **slopes** are obtained by regression of **realised return** on **decile ranking**
- **R²** coefficients of determination are **surprisingly high**
- Consistency: each year there is a tendency for **realised returns** to **grow** from decile 1 to 10
- The spread between decile 1 and 10 is about 35%
- Average of **realised returns** over entire period are reported.
- To asses result against **EMHyp.** and **CAPM and APT**, annualised risk measures are reported

	Dec. 1	Dec. 2	Dec. 3	Dec. 4	Dec. 5	Dec. 6	Dec. 7	Dec. 8	Dec. 9	Dec. 10	Slope	R ²
Annual return												
1979	33.5%	32.6%	33.9%	43.1%	35.2%	36.3%	47.3%	40.1%	39.3%	43.4%	1.1%	0.446
1980	17.4%	26.2%	25.4%	27.2%	25.8%	41.3%	42.6%	45.3%	55.6%	68.4%	5.0%	0.897
1981	-15.6%	-14.2%	-7.9%	-4.6%	2.1%	5.6%	0.4%	6.3%	9.7%	16.2%	3.3%	0.931
1982	3.2%	15.5%	21.8%	24.6%	24.0%	25.9%	32.1%	34.6%	39.5%	49.7%	4.1%	0.929
1983	11.8%	18.0%	23.4%	29.5%	28.8%	39.3%	37.8%	46.1%	45.1%	54.5%	4.4%	0.962
1984	-30.9%	-20.7%	-13.4%	-9.1%	-6.5%	1.0%	2.8%	12.8%	15.4%	22.4%	5.5%	0.986
1985	4.3%	18.4%	26.6%	37.8%	34.9%	37.8%	34.9%	41.2%	43.4%	45.7%	3.7%	0.776
1986	-15.2%	-7.1%	1.9%	9.2%	12.1%	15.1%	19.9%	23.2%	23.0%	30.9%	4.7%	0.925
1987	-23.8%	-12.3%	-5.0%	-6.8%	0.0%	1.6%	-3.4%	-2.0%	1.2%	-5.1%	1.8%	0.486
1988	1.5%	10.4%	18.5%	24.0%	22.2%	28.8%	26.9%	25.9%	29.7%	27.0%	2.5%	0.714
1989	-3.0%	8.2%	9.7%	16.8%	18.7%	21.5%	28.5%	29.8%	32.4%	28.7%	3.6%	0.893
1990	-46.9%	-36.2%	-27.5%	-21.7%	-15.5%	-12.7%	-10.2%	-9.9%	-2.9%	1.3%	4.8%	0.937
1991	23.9%	29.3%	36.5%	42.0%	45.2%	45.7%	51.1%	46.6%	46.9%	57.4%	3.1%	0.817
1992	2.5%	7.5%	16.3%	20.3%	17.8%	15.7%	17.1%	18.9%	21.1%	24.5%	1.8%	0.619
1993	6.4%	9.2%	18.2%	18.5%	19.9%	20.1%	20.0%	20.7%	24.2%	22.2%	1.6%	0.738
Average returns												
1979-93	-4.5%	3.7%	10.3%	15.1%	16.5%	22.3%	21.6%	24.0%	27.1%	30.9%	3.5%	0.932
Annualized risk												
1979-93	22.62%	20.59%	19.28%	19.21%	18.19%	18.10%	17.83%	17.95%	17.45%	18.50%		

Average Firm Characteristics by deciles

	Dec. 1	Dec. 2	Dec. 3	Dec. 4	Dec. 5	Dec. 6	Dec. 7	Dec. 8	Dec. 9	Dec. 10
Risk										
Market beta	1.21	1.16	1.13	1.11	1.09	1.07	1.05	1.03	1.02	1.00
Volatility (total return)	41.42%	38.42%	36.99%	36.00%	35.16%	34.29%	33.59%	32.86%	32.50%	33.22%
Debt to equity	1.03	0.95	0.89	0.87	0.85	0.83	0.83	0.82	0.85	0.85
Debt to equity growth	0.27%	0.12%	0.08%	0.05%	0.05%	0.06%	0.05%	0.02%	0.04%	-0.03%
Interest coverage	1.76	4.63	5.74	6.36	6.48	6.66	6.98	6.98	6.98	6.63
Interest coverage growth	-0.64%	-0.31%	-0.19%	-0.10%	-0.12%	-0.11%	-0.09%	-0.05%	-0.05%	-0.02%
Liquidity										
Trading volume (millions/month)	\$42.42	\$42.42	\$47.19	\$42.74	\$65.23	\$51.79	\$56.02	\$51.73	\$60.94	\$60.89
Market capitalization (millions)	\$470	\$513	\$564	\$593	\$635	\$680	\$755	\$843	\$931	\$1011
Price per share	\$14.93	\$18.03	19.91	\$21.21	\$22.58	\$24.01	\$25/58	\$27.62	\$29.31	\$30.21
Price level										
Earnings yield	-1.55%	3.10%	5.25%	6.42%	7.26%	7.83%	8.31%	8.71%	9.19%	10.00%
Cash flow yield	6%	10%	12%	13%	14%	14%	15%	15%	15%	17%
Dividend yield	2.19%	2.33%	2.41%	2.48%	2.59%	2.72%	2.90%	3.05%	3.19%	3.69%
Sales to price	2.07	2.07	2.01	2.04	2.05	2.06	2.07	2.10	2.13	2.14
Book to price	0.81	0.77	0.74	0.73	0.74	0.74	0.74	0.74	0.76	0.80
Growth potential										
Asset turnover	84%	98%	106%	112%	115%	116%	118%	119%	118%	115%
Asset turnover growth	-0.13%	-0.11%	-0.09%	-0.08%	-0.08%	-0.07%	-0.05%	-0.03%	-0.01%	0.05%
Profit margin	-1.16%	3.31%	5.08%	6.01%	6.48%	6.73%	7.02%	7.15%	7.41%	7.86%
Profit margin growth	-0.95%	-0.46%	-0.27%	-0.16%	-0.10%	-0.06%	-0.02%	0.03%	0.04%	0.07%
Return on assets	-1.51%	2.26%	3.98%	4.92%	5.36%	5.66%	5.94%	6.10%	6.24%	6.50%
Return on assets growth	-1.11%	-0.62%	-0.40%	-0.28%	-0.20%	-0.15%	-0.09%	-0.03%	0.01%	0.08%
Return on equity	-2.14%	5.10%	8.75%	10.93%	12.19%	13.02%	13.69%	14.13%	14.61%	15.39%
Return on equity growth	-1.18%	-0.68%	-0.45%	-0.32%	-0.23%	-0.16%	-0.10%	-0.03%	0.02%	0.07%
Earnings growth	-0.41%	0.28%	0.53%	0.67%	0.75%	0.79%	0.83%	0.87%	0.91%	0.95%
Technical (excess returns)										
One month	0.09%	-0.27%	-0.12%	-0.08%	0.03%	0.07%	0.14%	0.18%	0.09%	-0.14%
Two months	-1.80%	-1.03%	-0.70%	-0.55%	-0.32%	-0.14%	0.03%	0.30%	0.58%	1.21%
Three months	-6.89%	-2.93%	-0.49%	1.11%	2.37%	3.52%	4.53%	5.63%	6.83%	8.83%
Six months	-12.14%	-4.39%	-0.02%	2.69%	4.90%	6.98%	8.87%	10.81%	12.92%	16.60%
Twelve months	-15.74%	-2.34%	4.73%	8.59%	12.08%	14.95%	18.00%	20.72%	24.44%	30.01%

Tendencies 1->10:

- ↓ **Financial Leverage**
- ↑ **Level of Interest Coverage**
- ↓ **Market betas**
- ↓ **Volatility of return**
- ↑ **Rates of Earning Growth**
- ↑ **Profitability :**
- Profit Margins
 - Asset Turnover
 - Return on Asset
 - Return on Equity
 - rates of growth in earning per share
- ↑ **Market Cap**
- ↑ **Liquidity**
- ↑ **Price per share**

Systematic approach vs. discretionary Investment

- Overall look:

Fundamentals cannot be viewed in isolation. Investor's judgement is made by incorporating several aspects of firms at the same time.

-> We use the most commonly used Fundamental Ratios (48) which consider several possible quantitative aspects of Firms: Profitability, Financial Leverage, Growth prospects, return on Investments, Market Indicators ratios, Cash Flow ratios...

- Appropriateness:

For **each** industry sector/Line of business a set of appropriate ratios need to be considered.

-> Each Industry sector is analysed separately and for each of them a customized set of Fundamental ratio is used

- Benchmark:

Firm's financial ratios need to be compared with companies in the same industry and similar line of business

-> Sector neutrality and market neutrality sets automatically a benchmark for the comparison of a firm performance. Firms performing above sector average performance are automatically put in a long position and viceversa.

- Economy:

Predictability of the performance need a closer look at performance under different economic conditions. Historical analysis, under different environments (inflation, recession, prosperity...)

-> In-sample data is selected to cover a diverse set of historical environments, and the performance of the final model is tested according to the best performance on the overall period

Conclusion PART I

- There seems to be an empirical evidence that fundamental information produces a positive return
- Our approach mixes a systematic analysis of basic signals from the market, with an educated guess of the typical investor strategy.
- Self-fulfilling validation of common investing strategies, or intrinsic value of the method?
- A possible route: empirically grounded agent based model of financial market



Observatory of
Complex Systems
University of Palermo

PART II:
Trading behaviours of Firms in
Market venues
a researcher approach

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PART II:

Trading behaviours of Member Firms in Market venues a researcher approach

Outline

- Motivations
- Description of Data sets and Market Structure
- Trading behaviour of market members on-book and off-book on LSE
 - Transaction Volumes for different type of market transaction
 - OnBook/OffBook Market Member trading activity

Motivation

- Most of the studies presented up to now follow one of the two approaches.
 - Empirical studies of aggregated quantities, such as prices, volumes.
 - Theoretical and/or numerical studies of agent based models in the attempt of reproducing the stylized facts of aggregated variables.
- Only in few cases an agent based empirical investigation is possible due to the lack of data.

Firm Features

Firms are credit entities and investment firms which are members of the stock exchange and are entitled to trade in the market.

Firms are not agents. A firm may act on behalf of many different agents.

This could be due either because a firm acts as an intermediary or because a firm is doing client trading.

Therefore it is not a priori obvious that one can extract resulting strategies/behaviour from firm data, unless in most of the firms one behaviour is overall dominant.

Market Structure

London Stock Exchange

LSE provides different venues:

- “On Book”:
 - Stock Exchange Trading System (SETS) a **completely automated order driven electronic book**.
 - Only Highly liquid stocks trade on SETS, including: FTSE 100, leading FTSE 250, securities with traded options...
 - **Only Member Firms** are allowed to trade on SETS
 - Transactions are reported immediately
- “Off Book”:
 - Member Firms can also trade securities “off-book”
 - Typically between a Member Firm and a counterparty
 - This counterparty **need not be a Member Firm**
 - Trades may occur via telephone or computer
 - Transactions are reported within 3 mins.
 - **About 20% of Total number of transactions**
 - **About 50% of Total Value of transaction**

The London Stock Market Database

Database dimensions =40 Gigabyte

The database contains the information about the transactions at the London Stock Exchange (LSE) during the period 2004-2006.

Snapshot of our database

SEQU	TICODE	SECTOR	COUNT	CURR	PRICE	VOLUME	DATE	TIME	TYPE	BUYER	SELLER	...
70218	GB0004726	SET2	GB	GBX	74.75	5780	17032004	10:40	AT	268	87	...
108583	GB0030888	STMM	GB	GBX	236.5	9171	31032004	11:41	AT	268	72	
239605	GB0002295	AIM	GB	GBX	35.5	65000	17032004	15:37	O	243	142	
221556	GB0009895	SET1	GB	GBX	2515	89	26032004	16:07	AT	633	387	
93487	IE0004678	STMM	IE	EUR	13.1	1250	25032004	11:41	AT	528	58	
36053	GB0031274	SET1	GB	GBX	303.05	1462	2032004	09:29	O	351	233	
206514	GB0031259	STMM	GB	GBX	32.75	150000	17032004	16:02	O	351	19	
69011	GB0001585	STMM	GB	GBX	187.75	25000	22032004	10:51	AT	292	243	
163738	GB0001585	STMM	GB	GBX	198.75	2000	31032004	15:31	AT	490	23	
52268	GB0003054	SEAQ	GB	GBX	140	7600	2032004	10:11	X	363	69	
.....											

Information on all order and transactions OnBook and OffBook

Off Book

OnBook

Buyer and Seller Firms

Firm Features

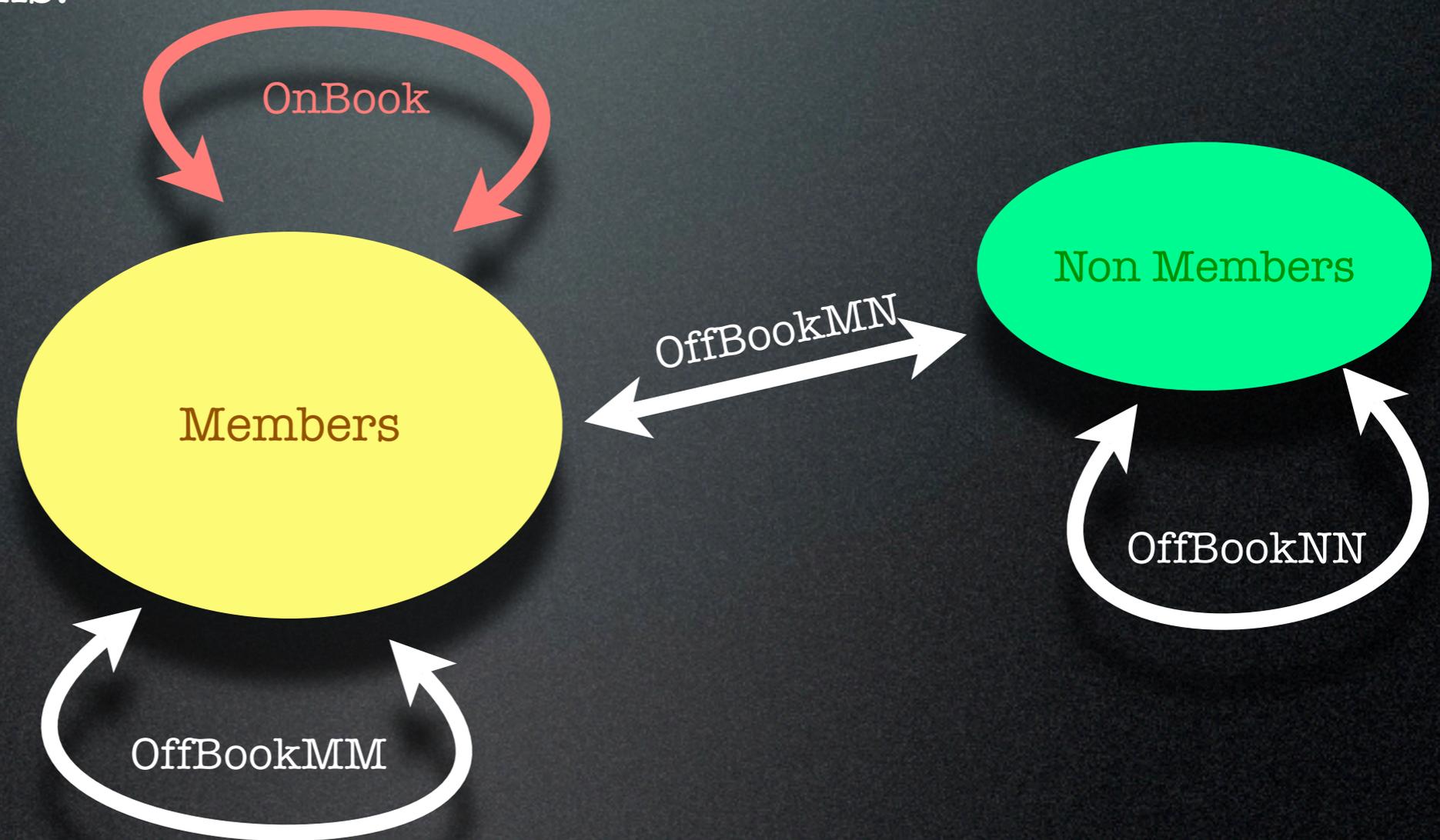
- Identity of **Firms** are coded into number
- Some code are associated to **Market Member** and others to **Non-Members**
- **Member** have a unique Firm code.
- We do not know whether different **NonMembers** may share the same code
- We do not have direct information about whether a code is associated to a **Member** or a **Non Member**.
- **We infer this from the data:**
 - We associate a **Member** to a code for which at least 1 transaction on-Book, accross all **92 stocks of the SET1** for the investigated year
- **We find:**
 - **229 Market Member** codes
 - **163 distinct Non Member** codes

Market Structure

London Stock Exchange

We consider
4 mutually exclusive
set of transactions:

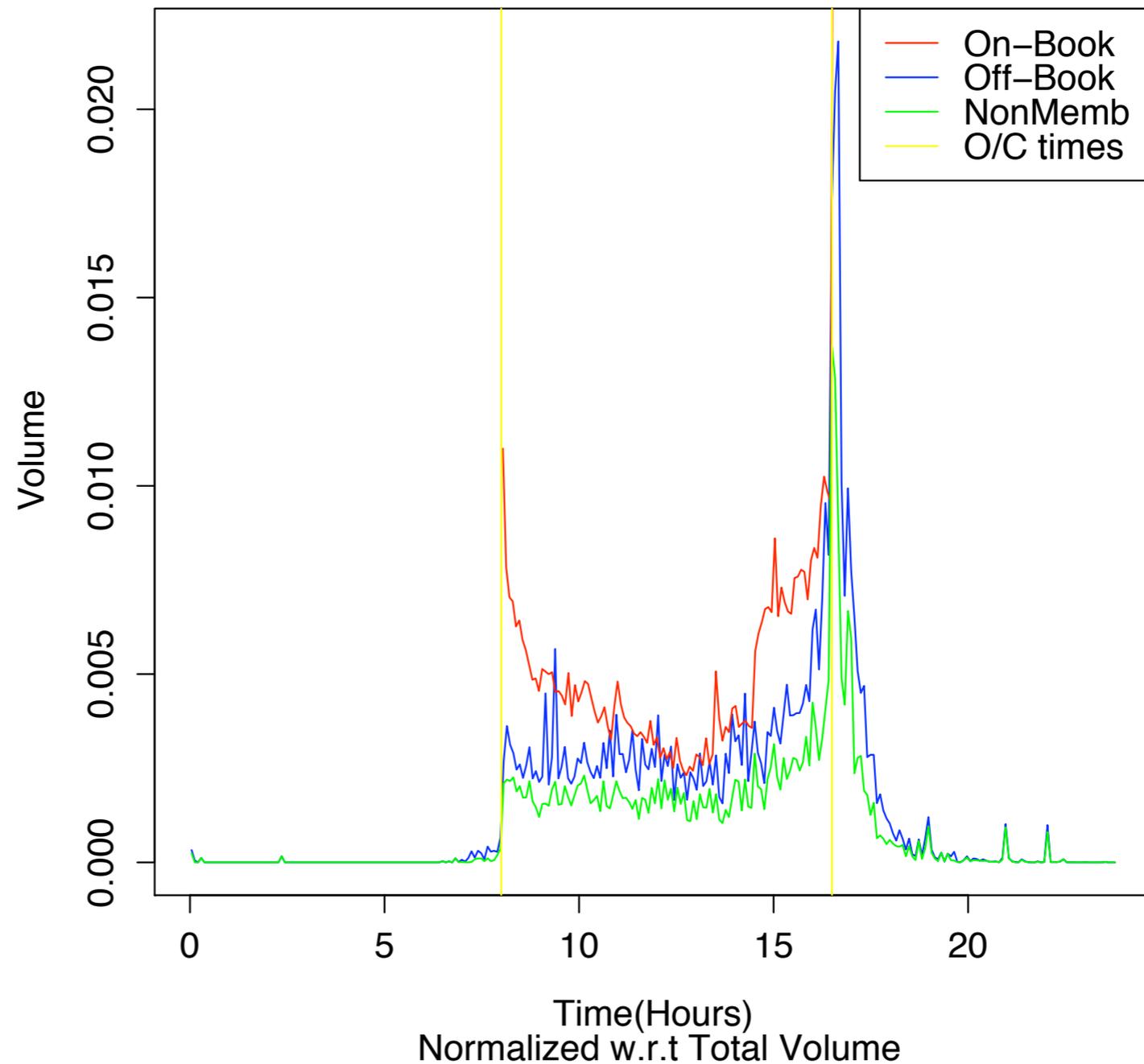
1. OnBook
2. OffBookMM
3. OffBookMN
4. OffBookNN



Transaction Volume

Typical intraday time distribution

Time distribution of Trades in Day VOD 2004



Transaction Volume for different type of transactions

- From the set of all the stocks exchanged in the LSE during the 2004-2006 we selected the first 10 most liquid ones...
- Here we will show results for two of the most representative (Vodafone, Astrazeneca).

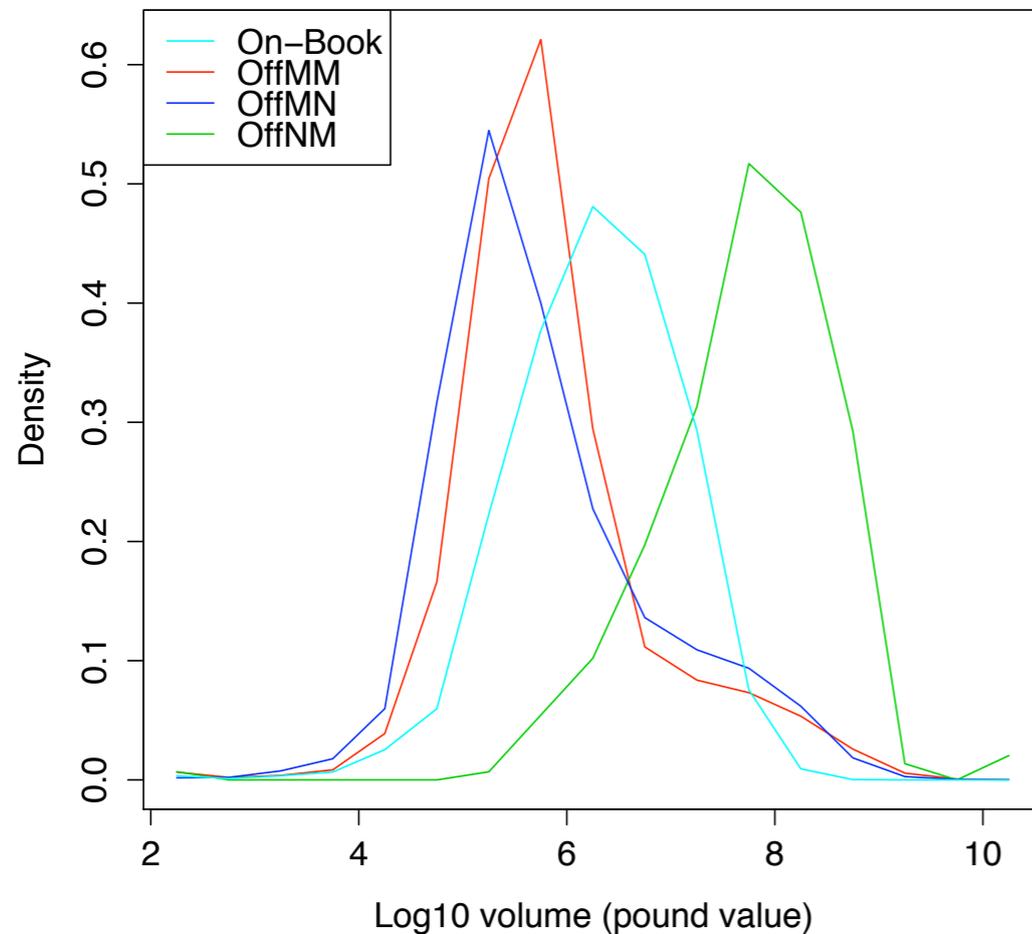
- OnBook 89% (AZN) - 76%(VOD) of total number of transactions while only about 50% of the total value (GBP)
- 70% of Transactions offBook are between Members and NonMembers

VOD	OnBook	OffMM	OffMN	OffNN
Number	757 739	76 091	158 543	294
Volume	$5.27 \cdot 10^{12}$	$1.79 \cdot 10^{12}$	$2.81 \cdot 10^{12}$	$9.79 \cdot 10^{10}$
Avg V	$6.96 \cdot 10^6$	$2.35 \cdot 10^7$	$1.772 \cdot 10^7$	$3.33 \cdot 10^8$
SDev V	$1.514 \cdot 10^7$	$2.42 \cdot 10^8$	$1.278 \cdot 10^8$	$1.901 \cdot 10^9$
Median V	$2.07 \cdot 10^6$	$5.01 \cdot 10^5$	$3.63 \cdot 10^5$	$6.99 \cdot 10^7$
Max V	$8.37 \cdot 10^8$	$2.81 \cdot 10^{10}$	$2.29 \cdot 10^{10}$	$2.12 \cdot 10^{10}$

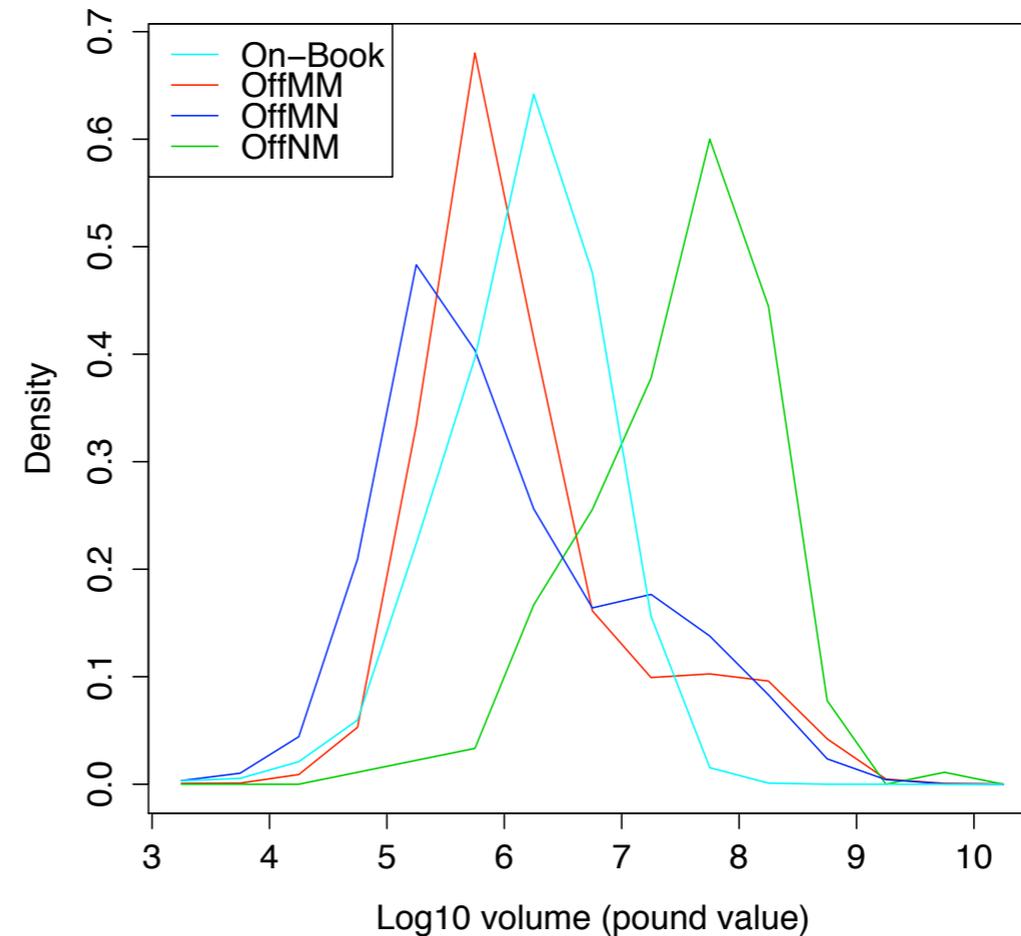
AZN	OnBook	OffMM	OffMN	OffNN
Number	703 528	27 014	62 881	180
Volume	$2.62 \cdot 10^{12}$	$8.66 \cdot 10^{11}$	$1.48 \cdot 10^{12}$	$1.88 \cdot 10^{10}$
Avg V	$3.73 \cdot 10^6$	$3.204 \cdot 10^7$	$2.36 \cdot 10^7$	$1.042 \cdot 10^8$
SDev V	$6.96 \cdot 10^6$	$2.16 \cdot 10^8$	$1.194 \cdot 10^8$	$2.84 \cdot 10^8$
Median V	$1.829 \cdot 10^6$	$8.57 \cdot 10^5$	$6.08 \cdot 10^5$	$4.56 \cdot 10^7$
Max V	$4.61 \cdot 10^8$	$1.53 \cdot 10^{10}$	$1.044 \cdot 10^{10}$	$3.52 \cdot 10^9$

Transaction Volume for different type of transactions

VOD 2004 Volume Distr of Trades



AZN 2004 Volume Distr of Trades



VOD

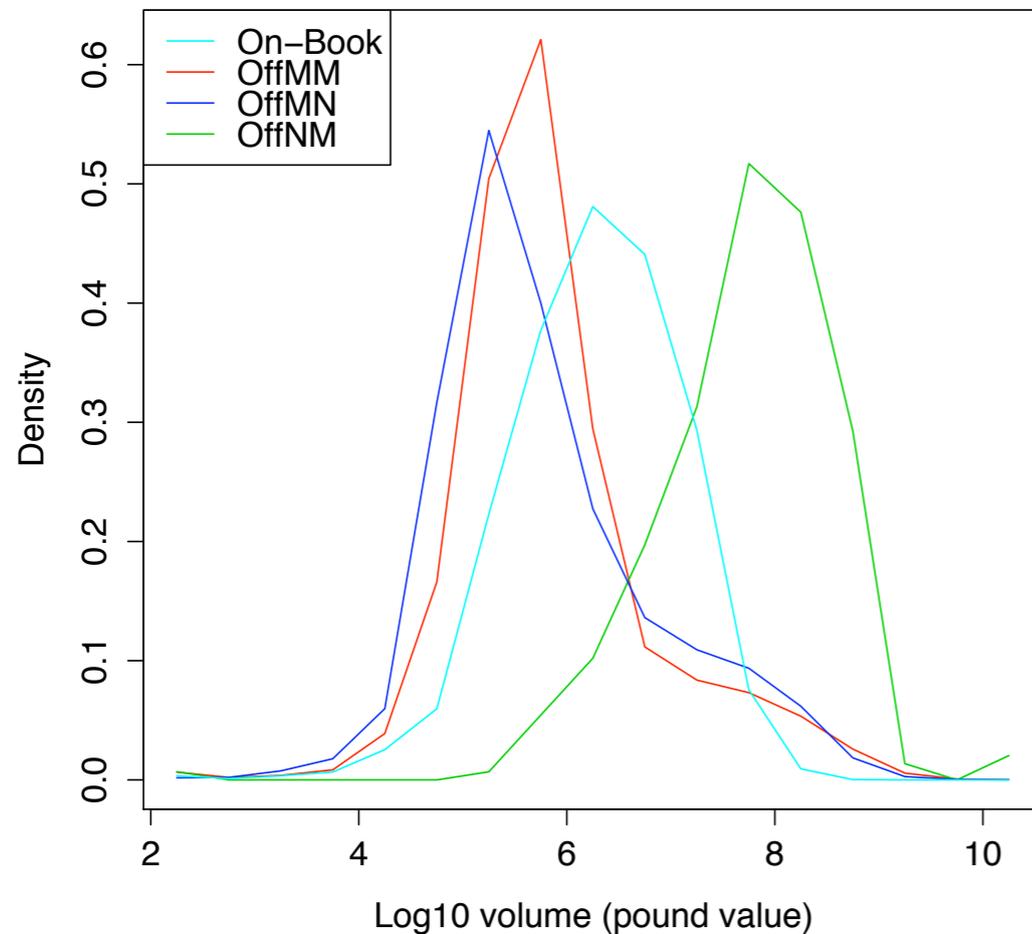
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AZN

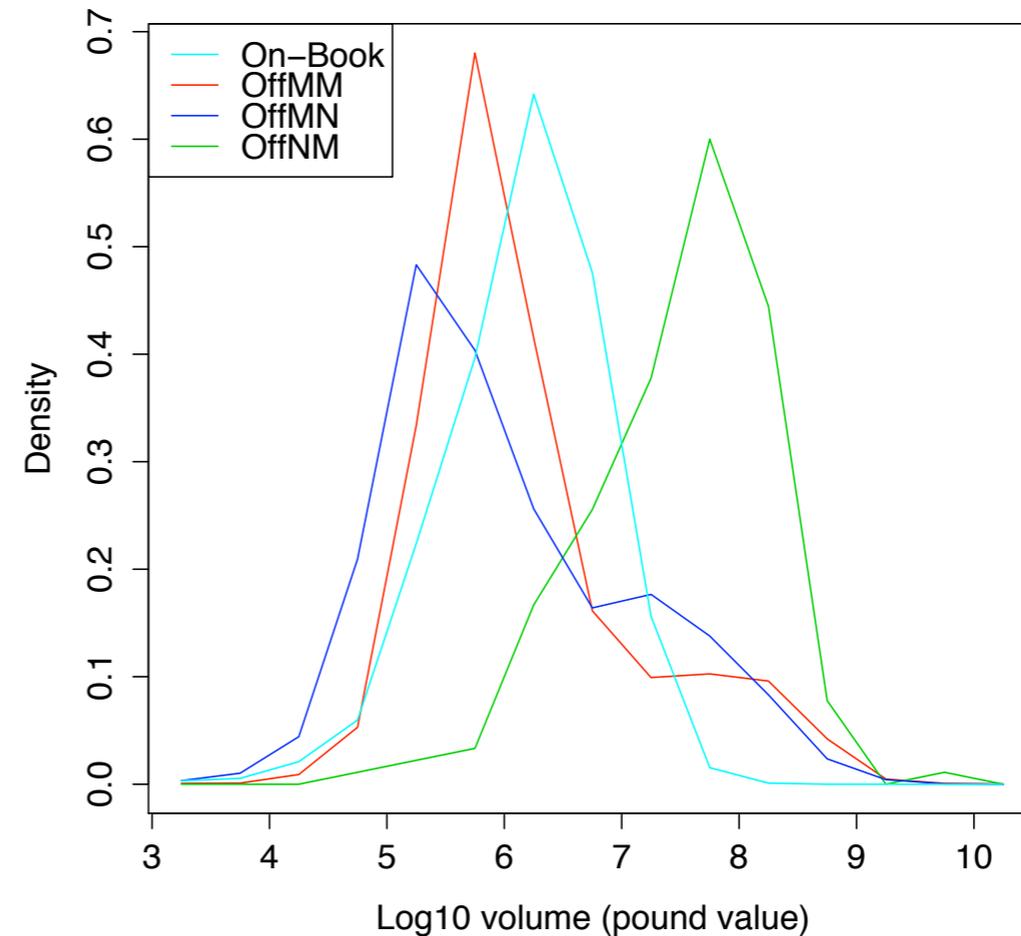
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Transaction Volume for different type of transactions

VOD 2004 Volume Distr of Trades



AZN 2004 Volume Distr of Trades

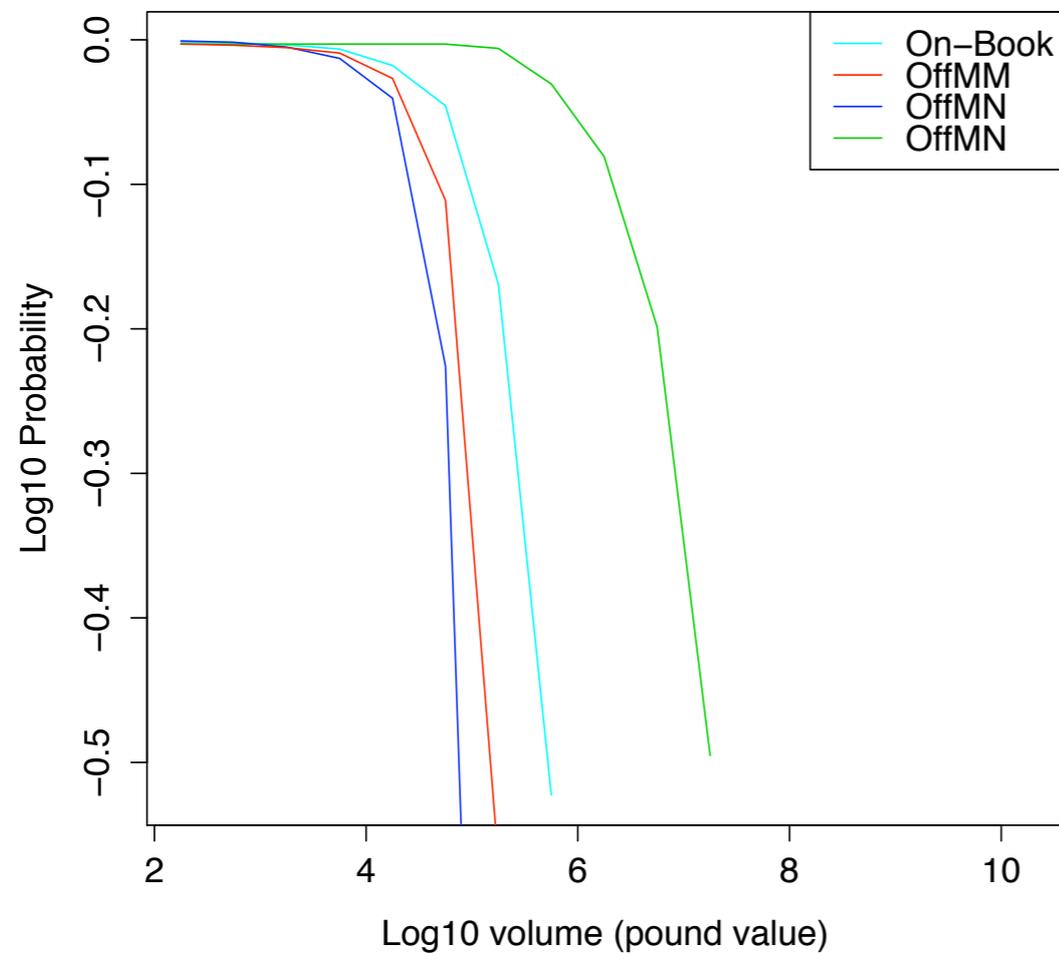


- **OnBook** is peaked around 10^6 GBP confirms [1] that trans-vol in e-markets rarely exceeds the vol available at the opposite best, hence volume distribution of transactions is a quite peaked distribution
- **OffBook** is broadly more distributed, peaked around 10^5 GBP, with much longer tails, and significant peaks 10^7 - 10^8 GBP -> **Eterogeneity Retail-Istitutional Investors**
- **OffBook NN**, Small set with very large volumes. Possibly, transactions between large institutions that are mediated by market members, where mediating member need not be recorded.

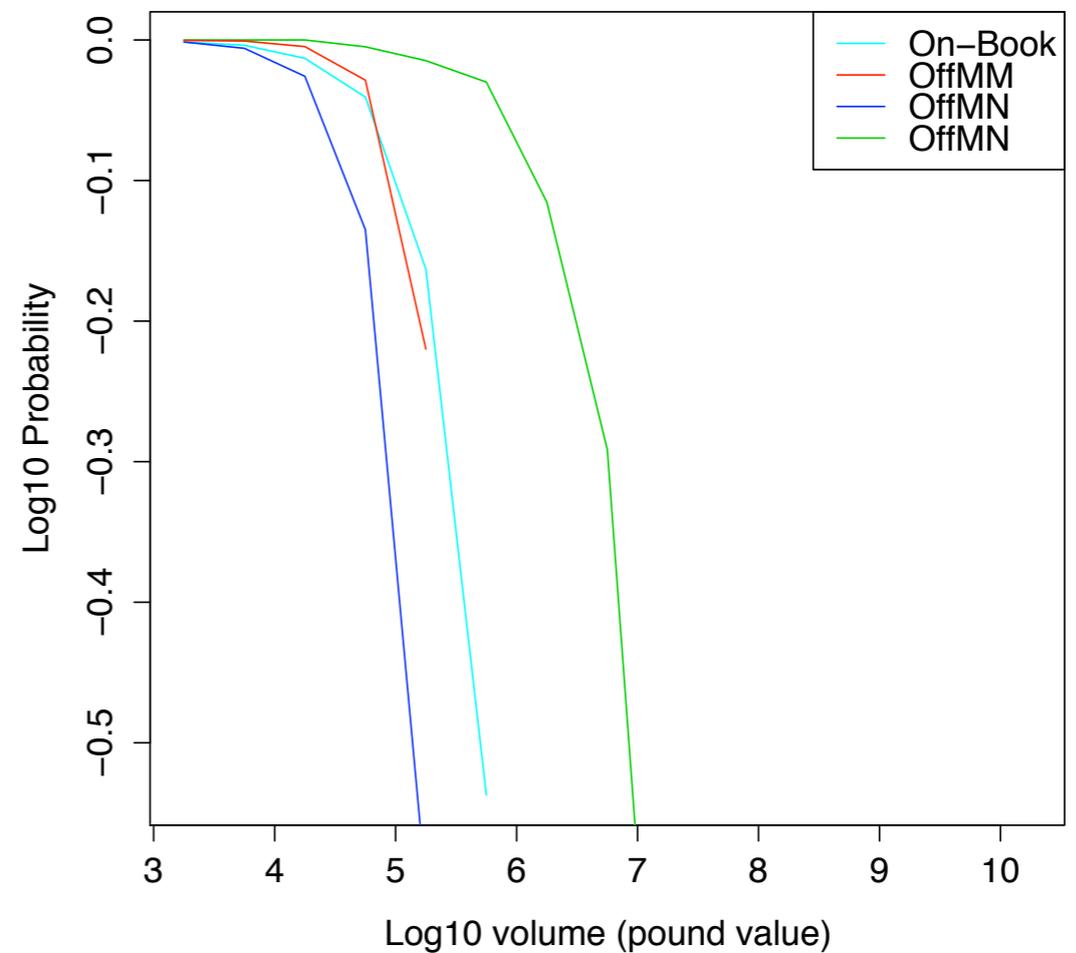
[1] J. D. Farmer, L. Gillemot, F. Lillo, S. Mike, and A. Sen. What really causes large price changes? Quantitative Finance, 4(4):383397, 2004.

Transaction Volume: Asymptotic power law

VOD 2004 Volume Distr of Trades



AZN 2004 Volume Distr of Trades



$$P(V > x) \sim x^{-\alpha}$$

1% Hill	VOD	AZN
OnBook	2.49 ± 0.05	2.09 ± 0.04
OffNM	1.62 ± 0.07	1.69 ± 0.11
OffMM	1.6 ± 0.1	$1.82 \pm .0.19$

Transaction Volume: Asymptotic power law

- A similar behaviour with $\alpha = 1.5$ has been observed in US, (and economically motivated[‡]) for transactions **OnBook+OffBook**.*
- We hypothesize that the off-book transactions are the main responsible for the power law tail.
- The Off-Book tail is much fatter than the On-Book one.

*Gopikrishnan P, V. Plerou, X. Gabaix, and H. E. Stanley. Statistical properties of share volume traded in financial markets. *Physical Review E*, 62(4):R4493 R4496, 2000

‡X. Gabaix, P. Gopikrishnan, V. Plerou, and H. Stanley. Institutional investors and stock market volatility. *Quarterly Journal of Economics*, 121:461504, 2006.

$$P(V > x) \sim x^{-\alpha}$$

1% Hill	VOD	AZN
OnBook	2.49 ± 0.05	2.09 ± 0.04
OffNM	1.62 ± 0.07	1.69 ± 0.11
OffMM	1.6 ± 0.1	$1.82 \pm .0.19$

Market Member trading activity on-book and off-book

- Here we study the relation of trading activities of **Members**:
 1. **OnBook**
 2. **OffBook with Members**
 3. **OffBook with Non Members**
- Member behaviour is very heterogeneous
- We select very active members, i.e. with at least:
 - 100 trades off-book
 - 200 trades on-bookin the investigated stock.
- We find 29 members for **Vodafone**, 23 members for **Astrazeneca**.

Investigated Variable:

- **Inventory variation** = the value (i.e. price times volume) of an asset exchanged as a buyer minus the value exchanged as a seller in a given time interval.

$$I_i(t) \equiv \sum_{s=t}^{t+\tau} \epsilon_i(s) p(s) V_i(s)$$

sign
+1 for buys
-1 for sells

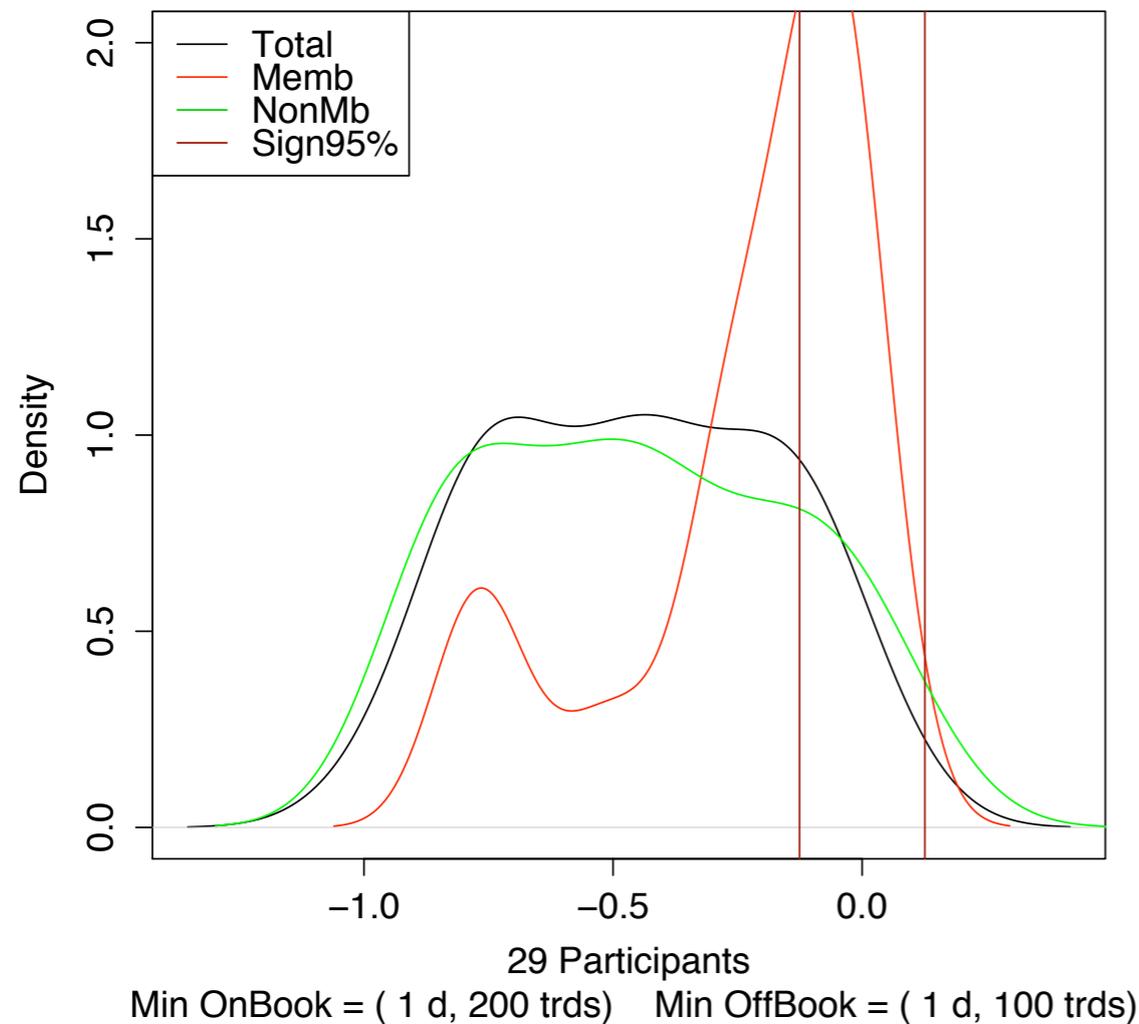
price

volume

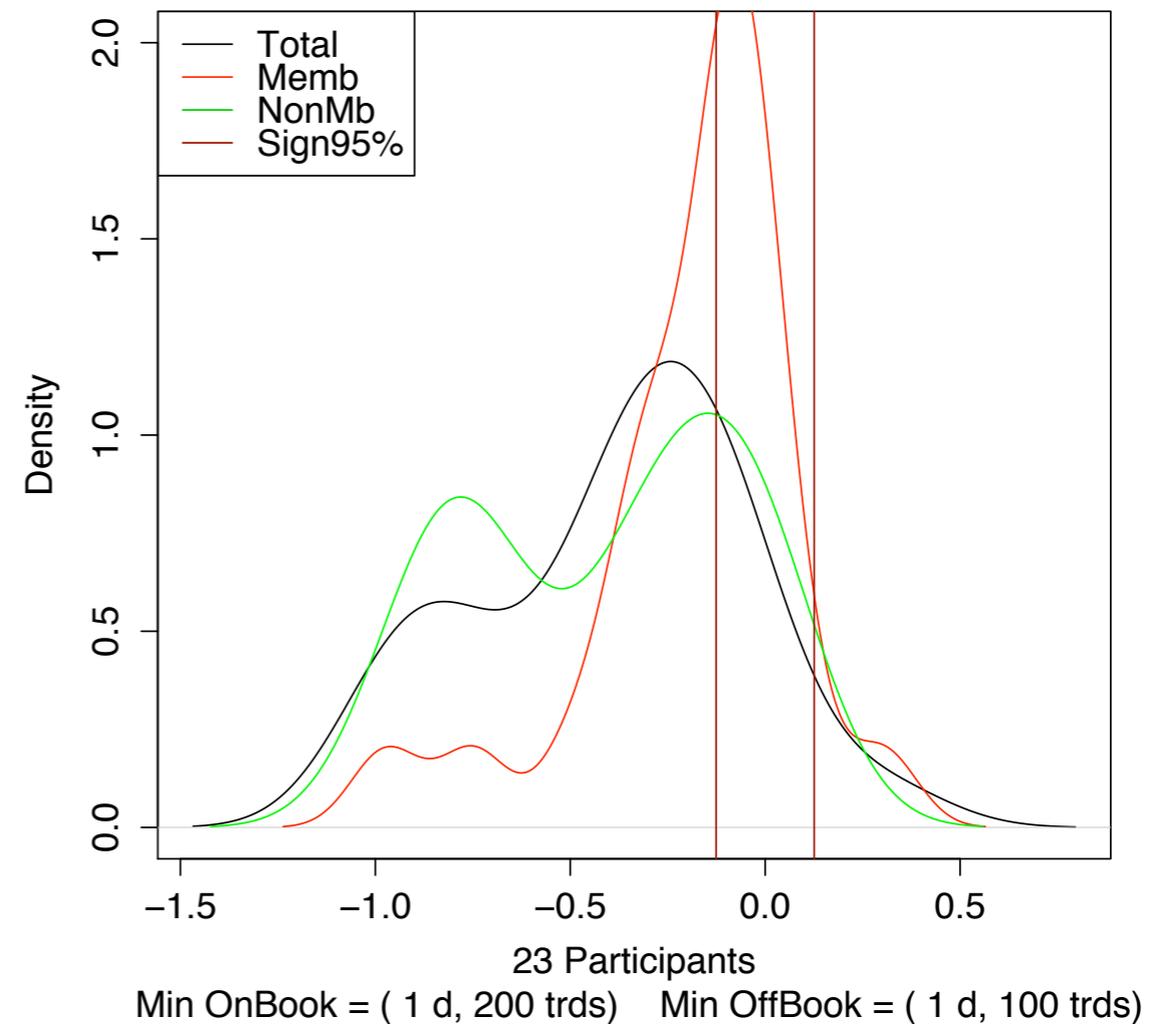
- In most case we will consider $\tau = 1$ day
- or for intraday info $\tau = 15$ mins

Correlation of daily inventory variation OnBook vs OffBook

Correlation On vs Off-Book VOD 2004



Correlation On vs Off-Book AZN 2004



VOD	Total	Memb	NonMb
AvgV	-0.453	-0.2338	-0.4509
SDev	0.2809	0.2573	0.3074
Max	0.03051	0.03199	0.07581
Min	-0.9671	-0.7962	-0.8687

AZN	Total	Memb	NonMb
AvgV	-0.3873	-0.1856	-0.4061
SDev	0.3431	0.2726	0.341
Max	0.3011	0.3011	0.05808
Min	-0.9725	-0.9725	-0.9214

Correlation of daily inventory variation OnBook vs OffBook

- Significant anti-correlation between onBook and offBook with **NonMembers**
- Not significant transactions between onBook and offBook with **Members**

Trades initiated offBook are not channelled to other members off-book

VOD	Total	Memb	NonMb
AvgV	-0.453	-0.2338	-0.4509
SDev	0.2809	0.2573	0.3074
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Max	0.3011	0.3011	0.05808
Min	-0.9725	-0.9725	-0.9214

Response Function To Large Inventory Variations

- We focus here on intra-day inventory variations over time intervals of **15 minutes**
- **Large Inventory Variation (LIV)** = We select the Top 0.5% quantile of the 15min inventory variations time series due to off book transactions between **Members and NonMembers**

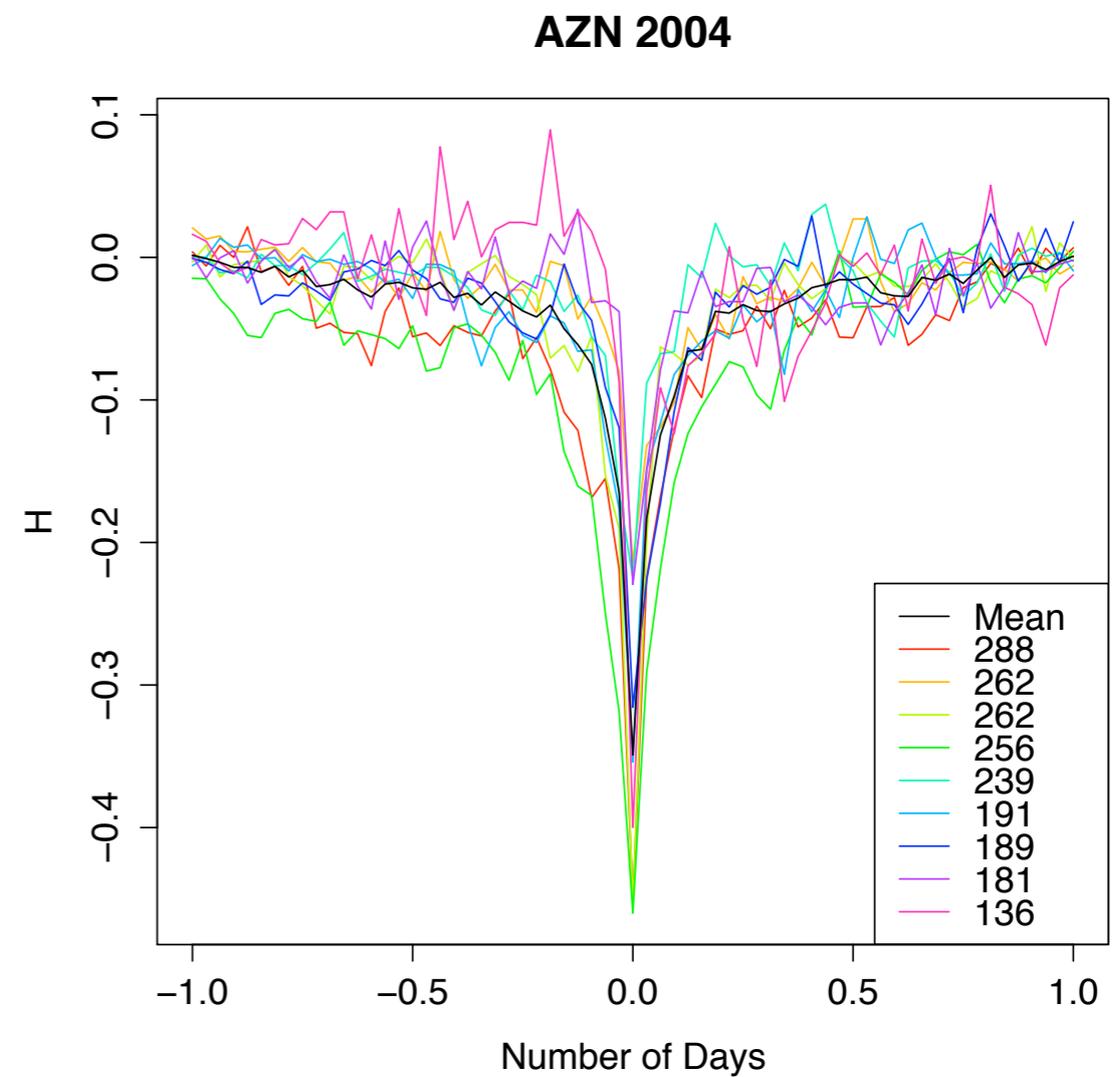
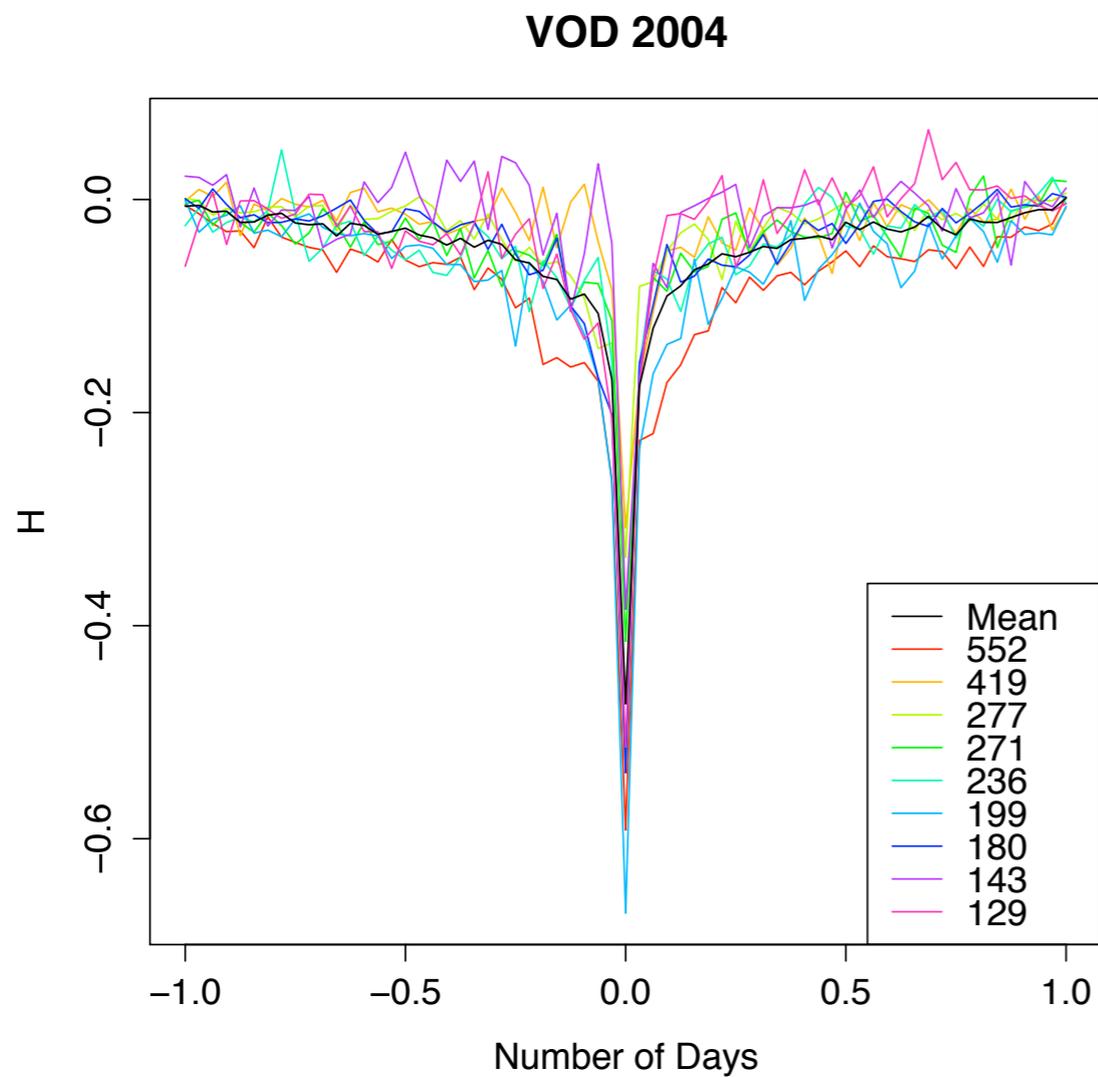
$$\mathcal{H}(\tau) \equiv \left\langle \frac{I_{t+\tau}^{\text{on}}}{I_t^{\text{off}} N} \right\rangle$$

15min Inventory Variation On Book

Average over number of LIV

LIV

Response Function of Most active Members



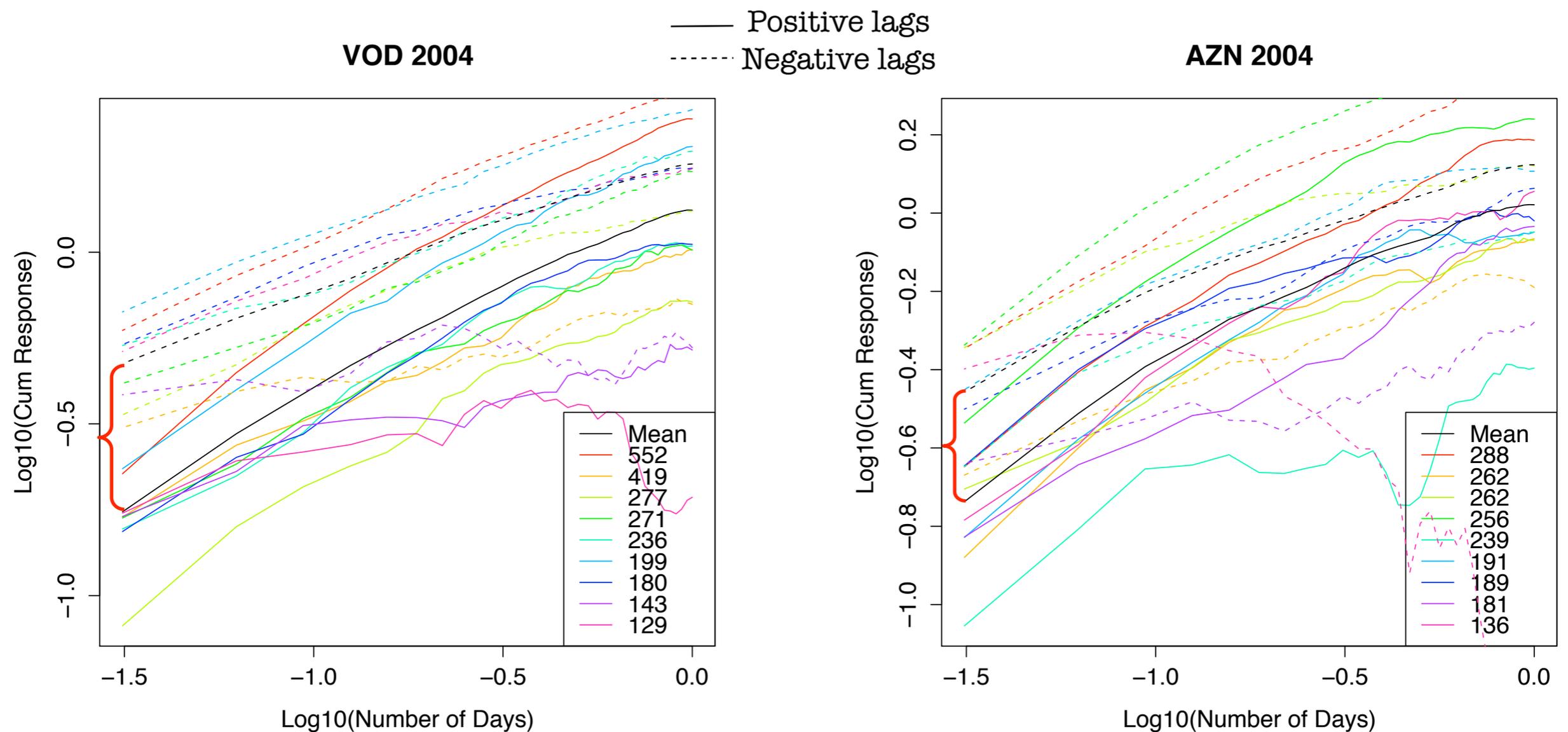
- Large peak $\tau = 0$ -> about 40-50% of the LIV is sold (bought) by the **member OnBook** within the same 15min.

Cumulative Response function

- We find significant negative values of H , both for $\tau > 0$ and $\tau < 0$
- Interpretation: **Members** can act both as a **Dealer** and as **Brooker**:
 - $\tau < 0$ -> **Broker**: tries to fulfill the order of the client **on-book** and then trades with the client **off-book**
 - $\tau > 0$ -> **Dealer**: first trades **off-book** with the client and then tries to trade her excess inventory in the **book**

Cumulative Response function

- **Asymmetry** between past and future: **dealer/broker** asymmetry?
- Power law behaviour $\mathcal{H}(\tau) \sim 1/|\tau|^\gamma$



Cumulative Response function

- **Asymmetry** between past and future: **dealer/broker** asymmetry?

- Power law behaviour $\mathcal{H}(\tau) \sim 1/|\tau|^\gamma$

- Fitting for the average response function:

γ	VOD	AZN
Future	0.56	0.46
Past	0.38	0.36

- Possible Interpretations:

- Member acts as a Direct Market Access for the client

- Client use her own proprietary trading algorithm to split her order to the market.

- Member acts as a dealer/broker:

- The member trades off-book and tries to spread its own inventory across the market

Conclusion

- Very active firm, can be characterized by similar behavior OnBook/OffBook
- OffBook transaction volumes can be much larger and smaller of typical Onbook transactions
- Large off book transaction between Member and nonMember is largely responsible for correlation between onbook/offbook transactions
- Significant correlation both for positive and negative lag suggests that Member can act both as dealer and as broker