Modeling and analysis of financial crashes using empirical market microstructure with parallel computations in R

Perm State
National
Research
University

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MiFIT

Master in Finance & Information
Technology program

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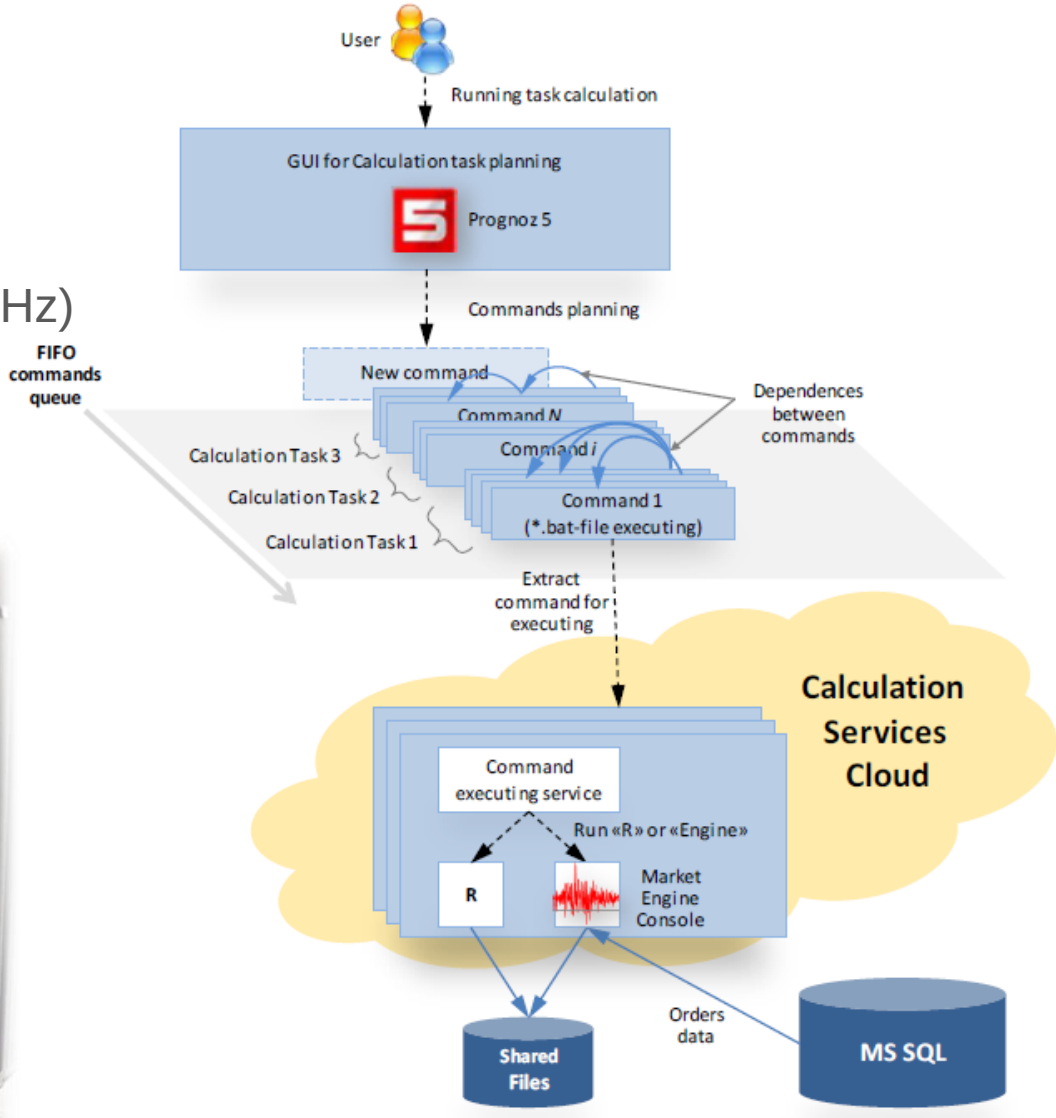
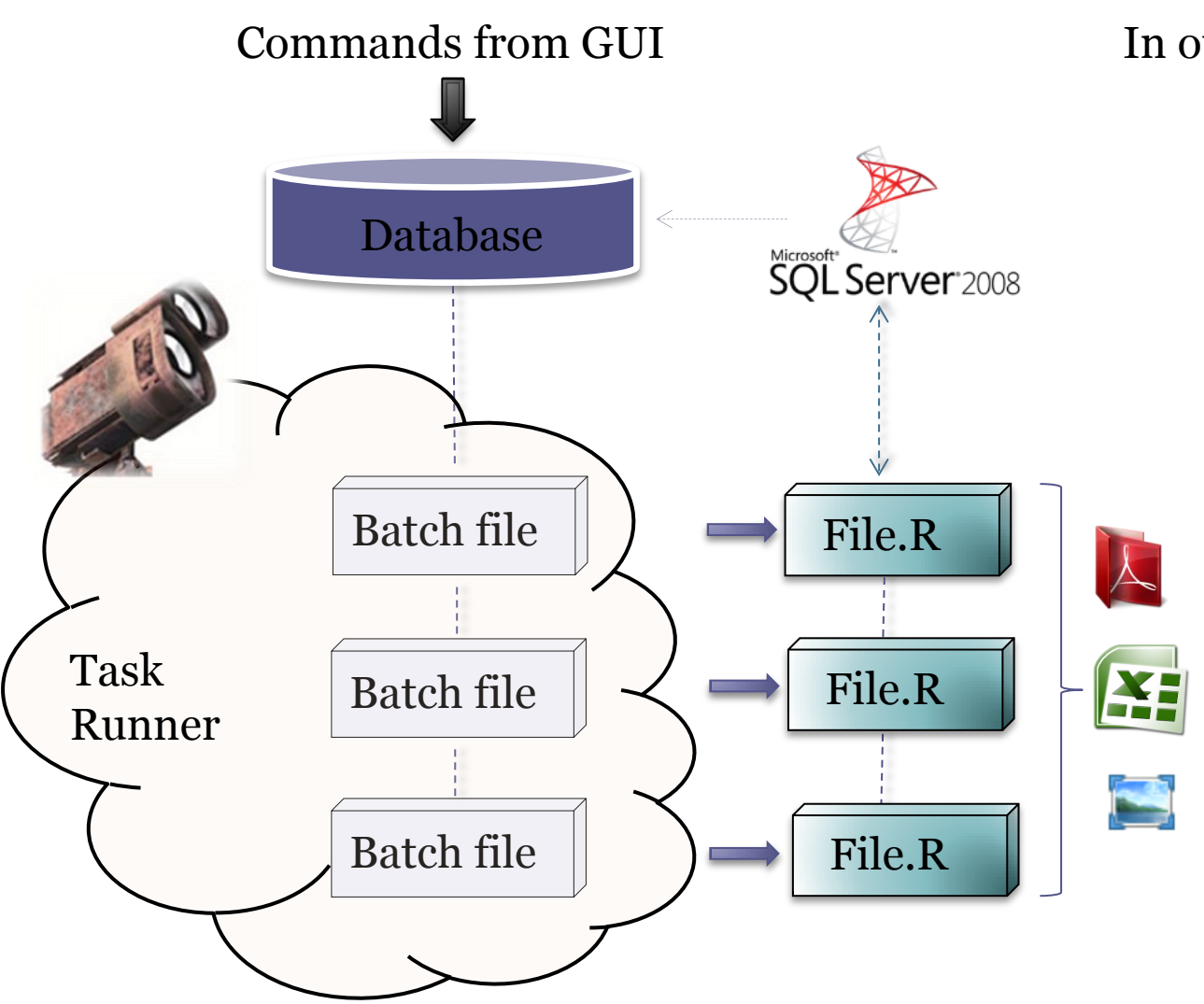
Architecture of cluster

- ✓ Installation Site: Perm State National Research University
- ✓ Supercomputer type: Cluster
- ✓ Number of nodes: 9
- ✓ Total Number of Cores: 108
- ✓ CPU type: Intel Xeon 5650 (2.66 GHz)
- ✓ RAM per node: 64 Gb
- ✓ OS: Windows Server 2003



Cluster for Reverse Engineering and Agent-based Modeling of Market Microstructure in Perm State National Research University

Using R in cluster



In our work we use:

package rusquant

package RODBC

t.test

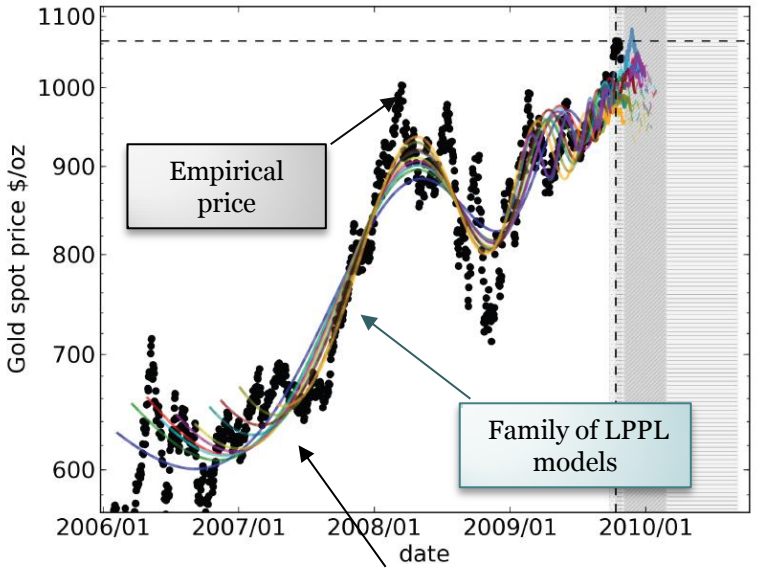
nls

commandArgs

and some other standard commands...

Model Log Periodic Power Law (LPPL)

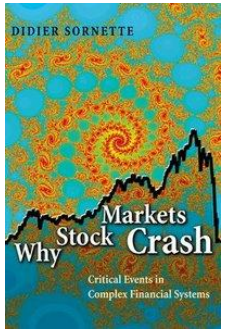
Model has been developed as a flexible tool to detect bubbles. The LPPL model considers the faster-than-exponential increase in asset prices decorated by accelerating oscillations as the main diagnostic of bubbles…

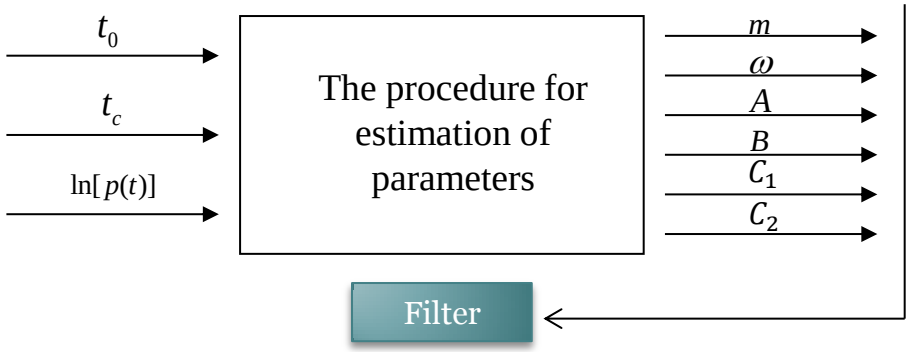


$$\ln[p(t)] = A + B(t_c - t)^m + C_1(t_c - t)^m \cos[\omega \log(t_c - t)] + C_2(t_c - t)^m \sin[\omega \log(t_c - t)]$$

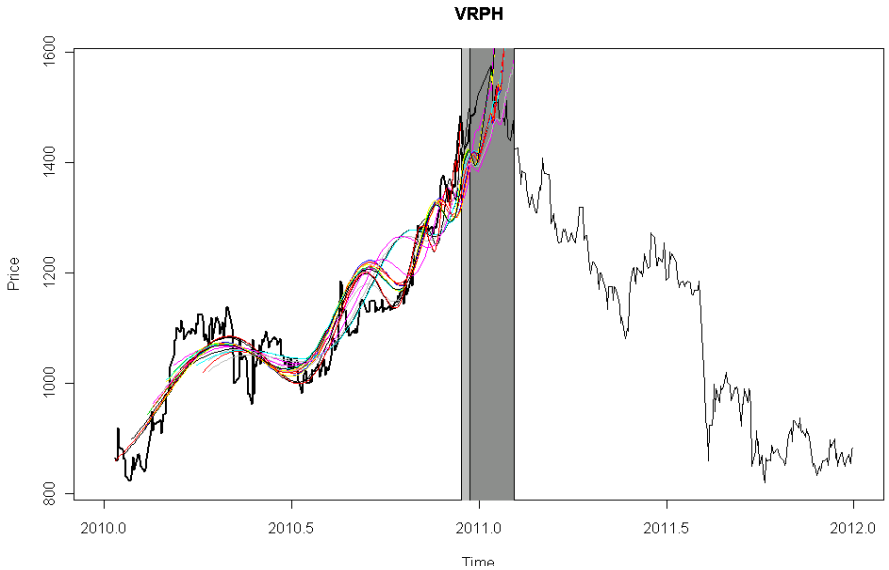
Authors :
A.Johansen, O.Ledoit, D.Sornette (JLS)

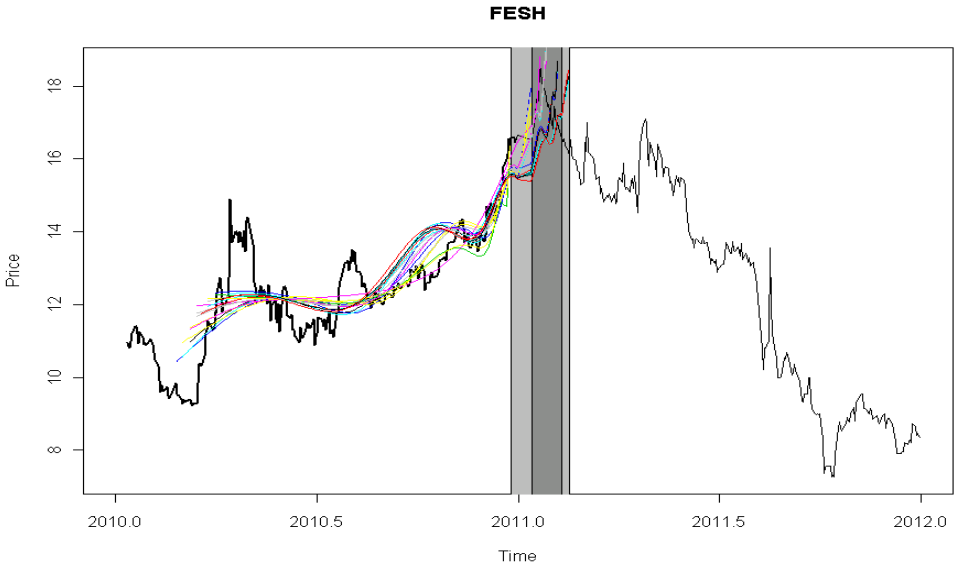
Sources:

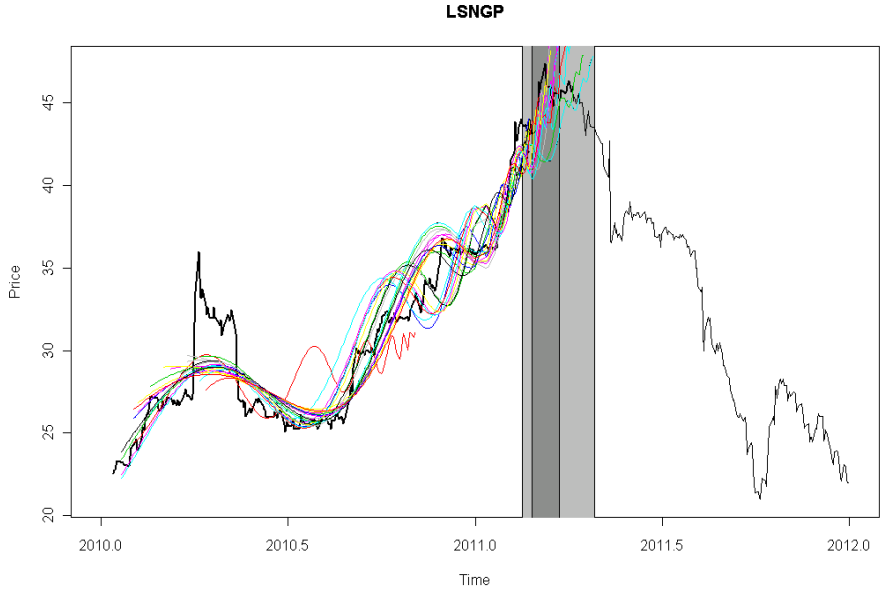




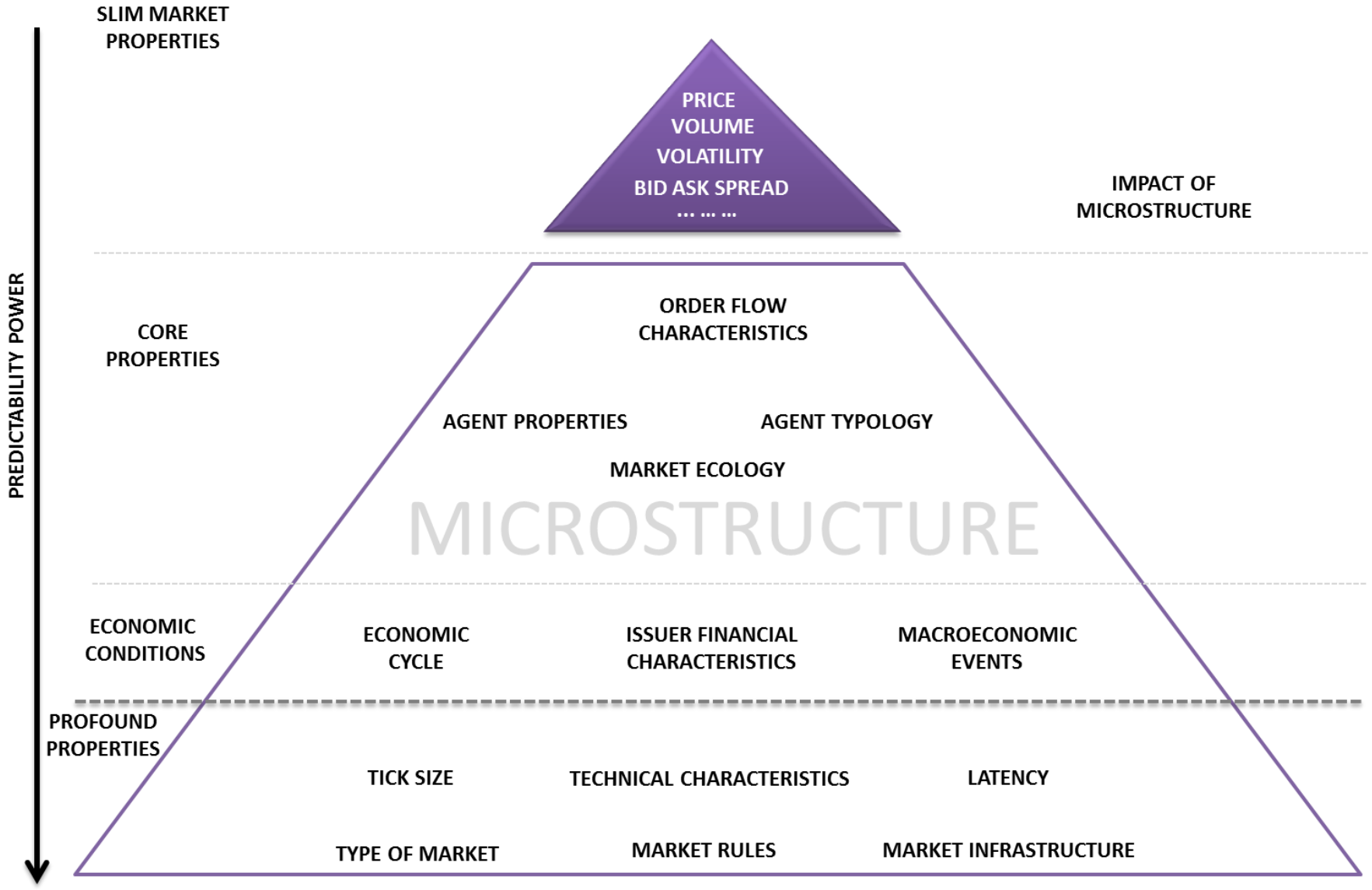
Results of modeling bubbles (Russian financial market, 2010 – 2012)







Market hierarchy



Order flow characteristics

Frequency

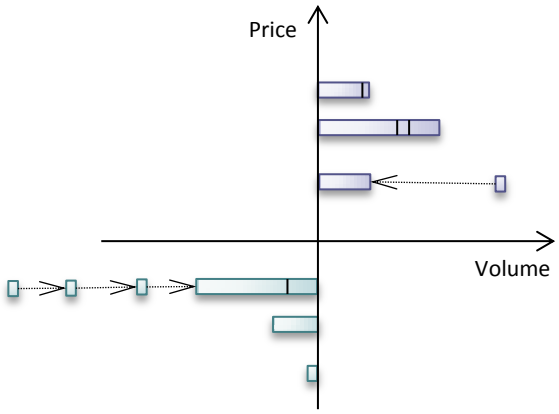
- How often orders are coming?

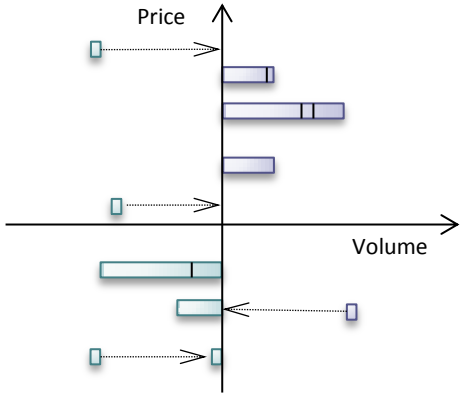
Width

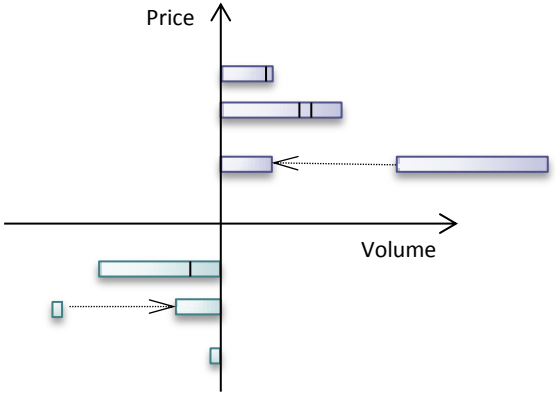
- In what part of order book orders are coming?

Volume

- What is the volume of coming orders?







Analysis of financial crashes using empirical market microstructure

In each bubble, we calculated changes of characteristics from NORMAL to HOT situation…

Main idea to compare changes in microstructure of bubbles and non bubbles…

Changes in order flow	Price deviation from best ask/best bid	↓
	Duration time between orders	→
	Volume of orders	↓

Industry	Number of bubbles
Energy	8
Ferrous metallurgy	1
Non-ferrous extractive metallurgy	1
Engineering	3
Retailing	2
Transport	1
Pharmaceutics	1
Finance	2
Chemistry	1

We use commercial data from Moscow exchange about order flow (orderlog)

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For more details,

see attachment R code in

r-group.mifit.ru