P-adic theory of stock market Agents based model

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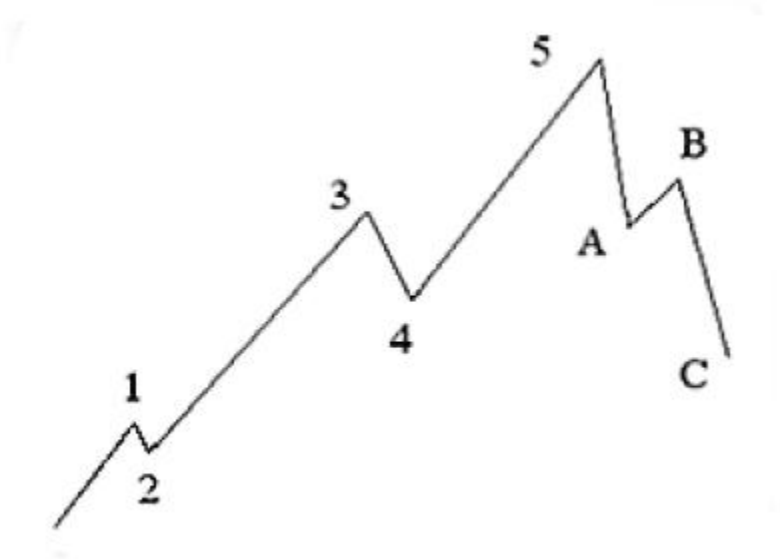
Elliott wave theory

VERY PRACTICAL APPROACH BUT UNKNOWN MATHEMATICAL BASES



P-adic mathematics

A new look at the price dynamics
Prices are described by P-adic numbes!

All know the fields of real numbers: 0.314…, 2.35:

$$10^{\nu}\sum_{n=0}^{\infty} b_n \left(\frac{1}{10}\right)^n$$

Why these numbers are bad? Answer: Heavy tails !

When you have heavy tails, you're dealing with a p-adic numbers!

$$x = p^{\nu}\sum_{n=0}^{\infty} a_n p^n$$

P is prime number (the base of p-adic fields)

Comparison of p-adic function and real data

Main procedure: Mapping: $a_n \to (a_n)^D$ D is fractal dimension

Real Data

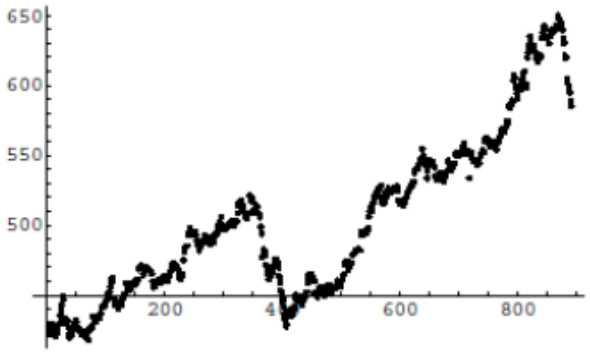


Fig 2. *Russian stock Index*

Mapping of P-adic straight line

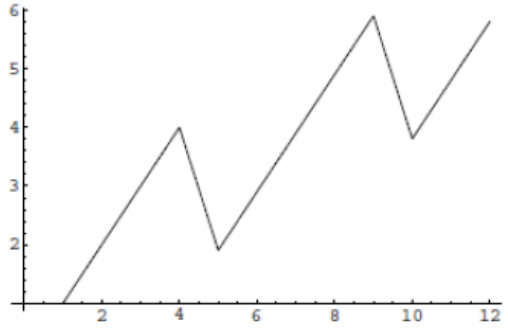


Fig.3. *Subcritical wave (First Level of Fractal) for D>1, p=3*

Two type of p-adic function (Elliott waves): subcritical and supercritical

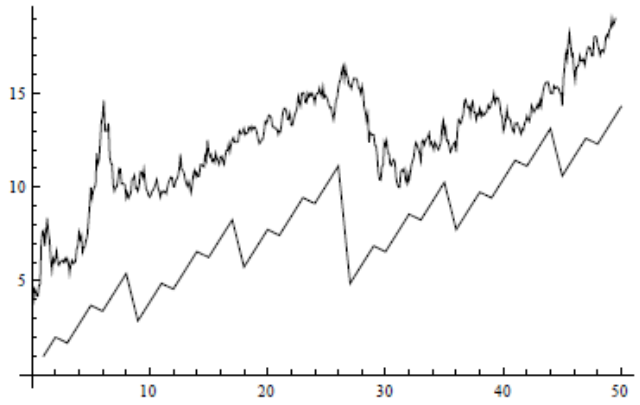


Fig 4. *Subcritical wave (Third Level of Fractal)for D>1, p=3 The second curve shows the real data.*

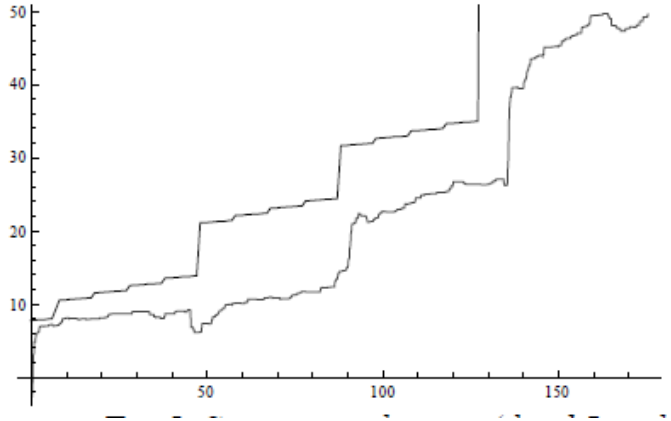
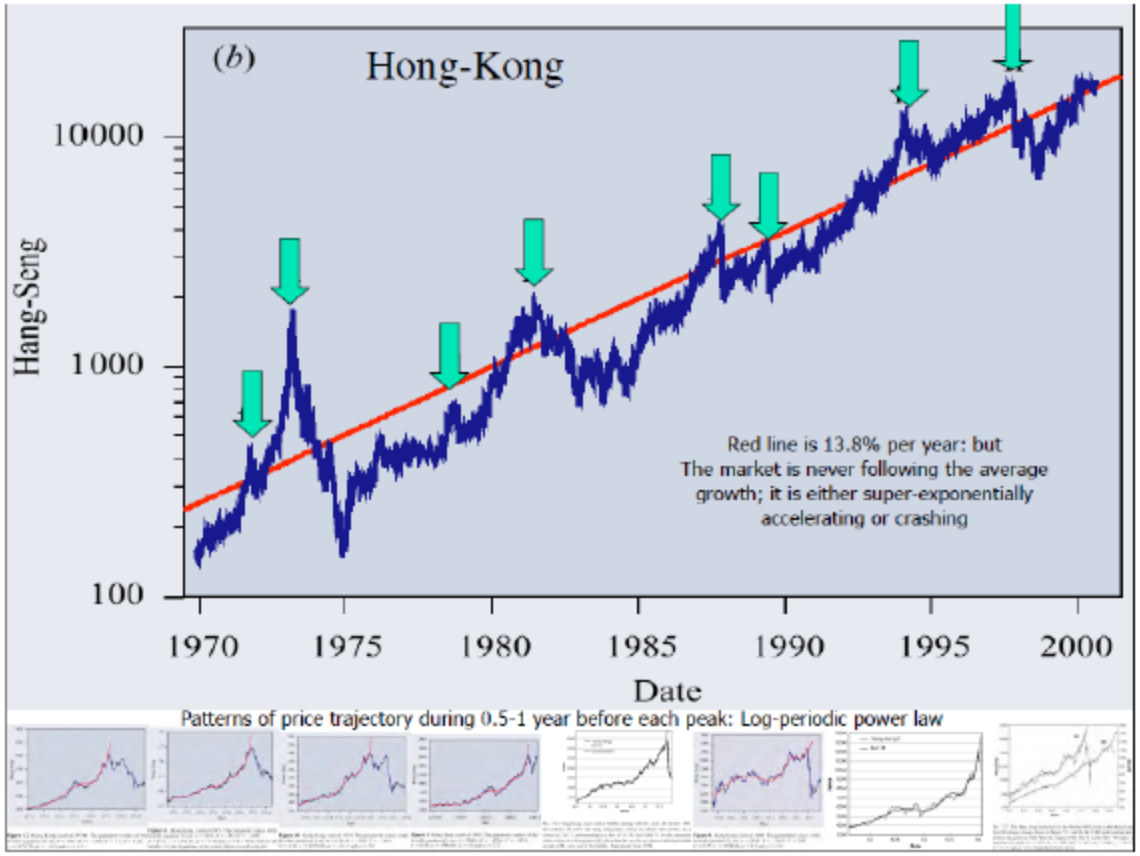


Fig 5. Supercritcal wave (third Level of Fractal) for D<1, p=3
This type of wave is not presented in the Elliott theory.

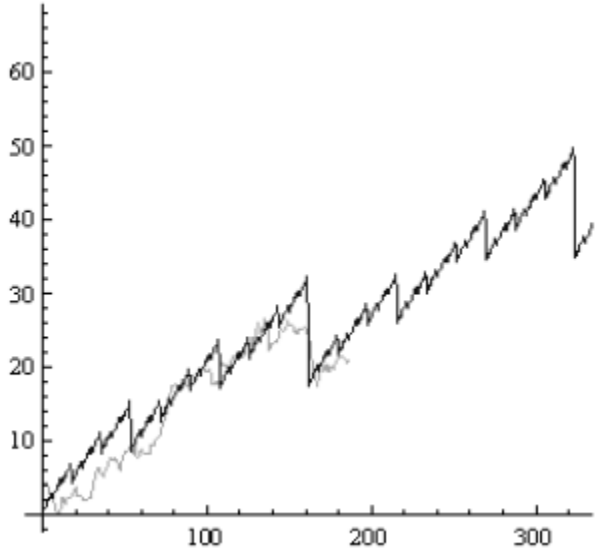
Crash as p-adic correction

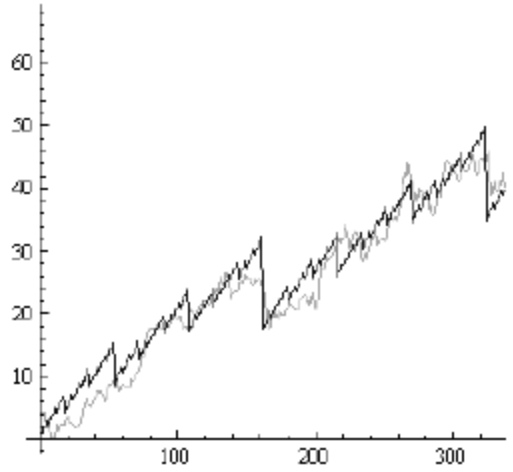


This chart is taken from the presentation of D. Sornette

Stock market crashes are very similar to p-adic type function

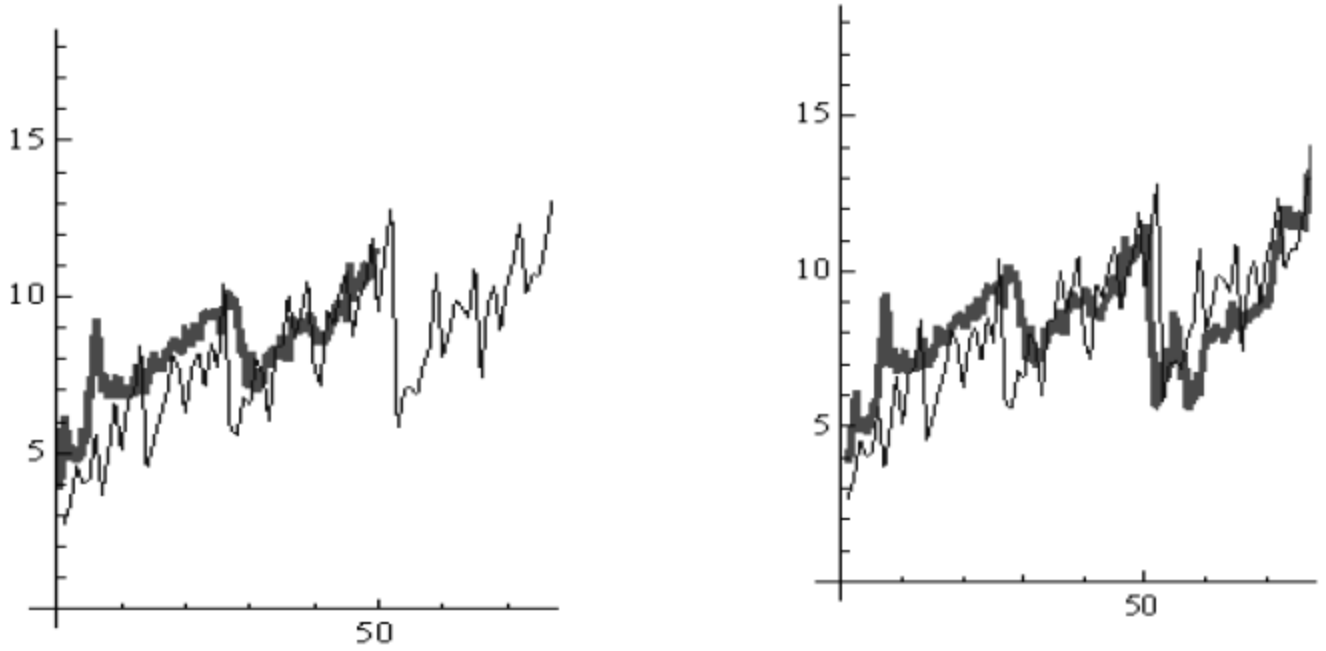
P-adic interpolation and extrapolation as Forecast procedure





01.07.2006-01.04.2007 *IBM Year timeframe* 01.07.2006-01.07.2008

Forecast – PROGNOZ of Gazprom

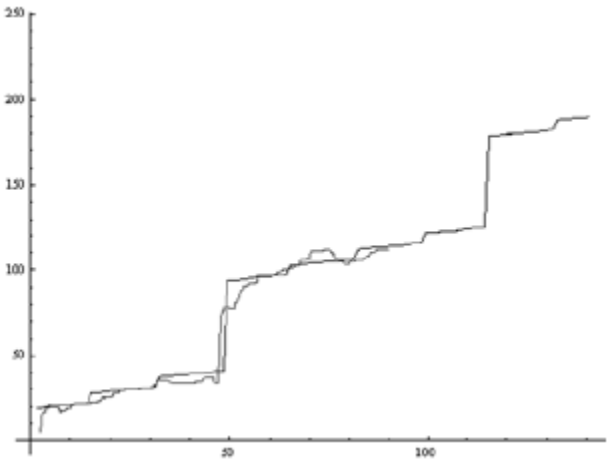


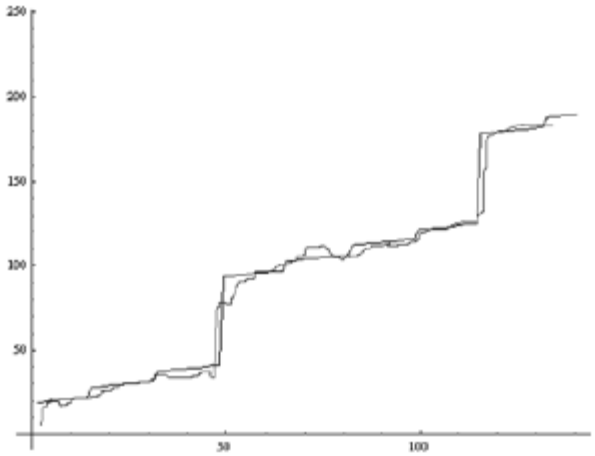
Gazprom Daily time frame

01.06.2009

01.06.2009-02.06.2009

Forecast: RTS Index



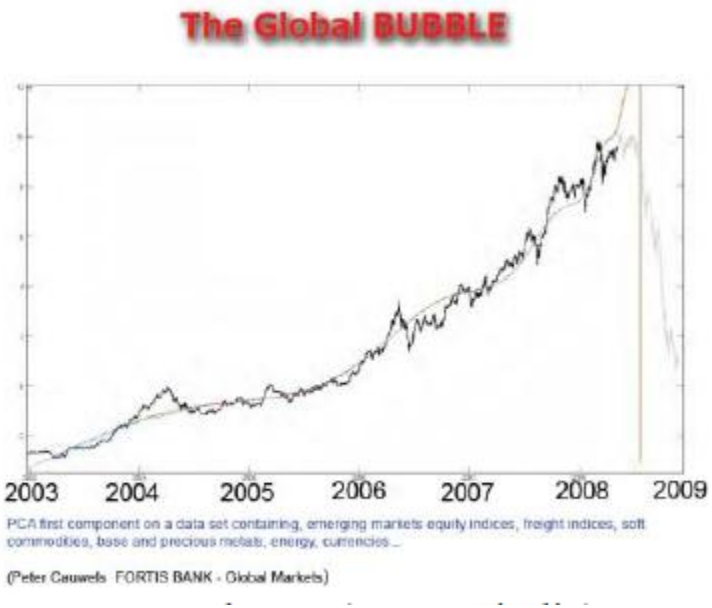


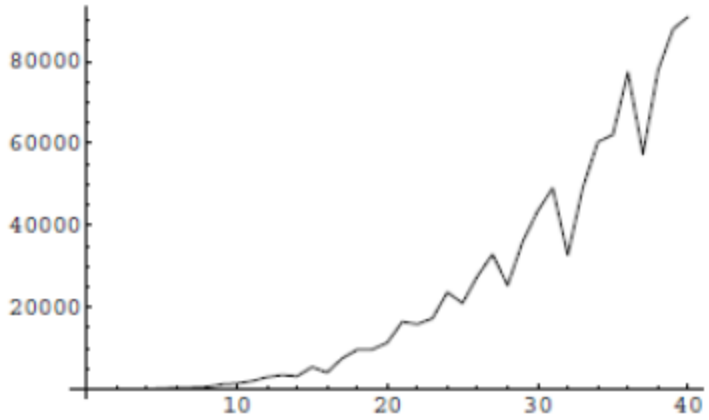
RTS index Weekly time frame

27.05.2009-30.05.2009

27.05.2009-1.06.2009

P-adic description of crash





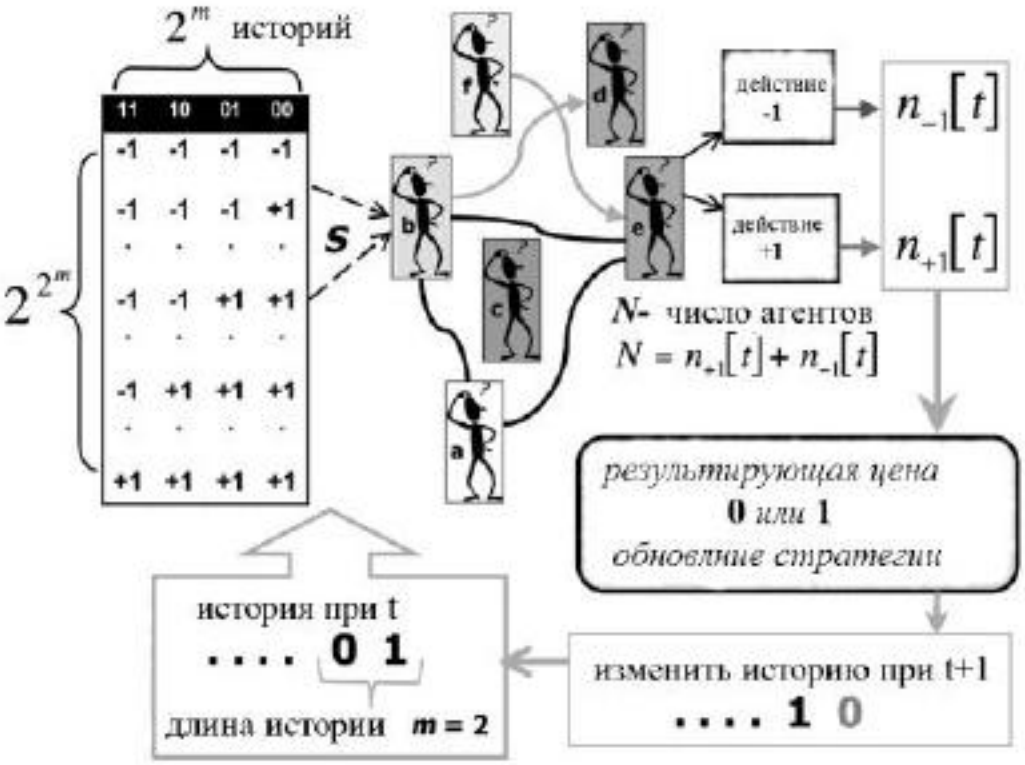
Sornette Theory (Log Periodic)

P-adic Theory (Power Low Function Only)

This Figure shows the power low function x^3 with D=0.45.

Microscopic approach

Scheme of Minority Game : Agent Base Modelling



Second step

Heisenberg model and Spin Glass Model

$$\sum_{\mu}(A^{\mu})^2 = \frac{1}{2}+\frac{1}{N}[\sum_{i}h_i s_i+\frac{1}{2}\sum_{ij}J_{ij}s_i s_j]$$

Mathematical model of agents based stock market

- Each trader may be in the following states:
- I 0 > - shell state
- I ↑ > - trade buys shares
- I ↓ > - trade sells shares
- I 2 > trade holds shares

Hubbard model as model for trader's ensemble

Hubbard model As a Square Root of Spin Glass Model

$$\sum_{\mathbf{r}} U\, X_{\mathbf{r}}{}^{22} + \sum_{A,C,\mathbf{r},\mathbf{r}'} t_{-AC}(\mathbf{r}-\mathbf{r}')\, X_{\mathbf{r}}{}^{-A}\, X_{\mathbf{r}'}{}^{C}$$

Functional integral for Hubbard model

Functional integral for Hubbard model gives p-adic description

- This microscopic model gives the prosess of appearance of TREND and interpolate between Gaussian fluctuation and P-adic type condensation of BOSE type phase transition

The future!

- As well as “Trend is You Friend” P-adics are also very nice !

- P-adic Technical analysis?!