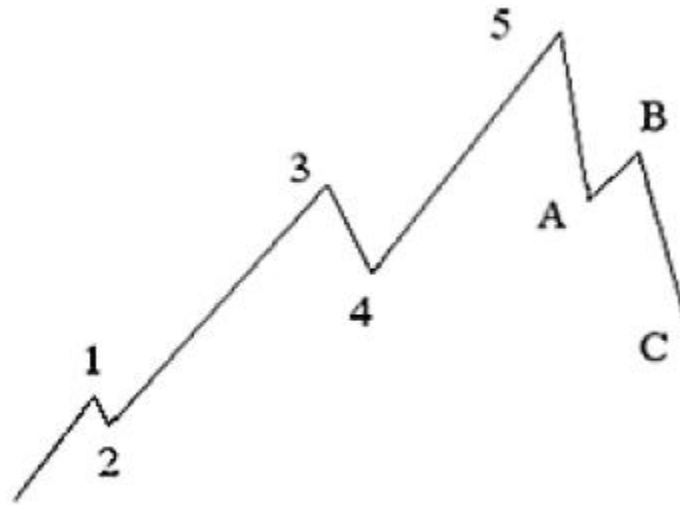# P-adic theory of stock market

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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: $a_n \rightarrow (a_n)^D$ D is fractal dimension
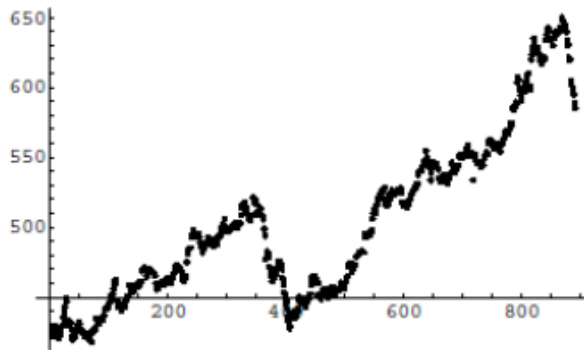
Real Data   Mapping of P-adic straight line
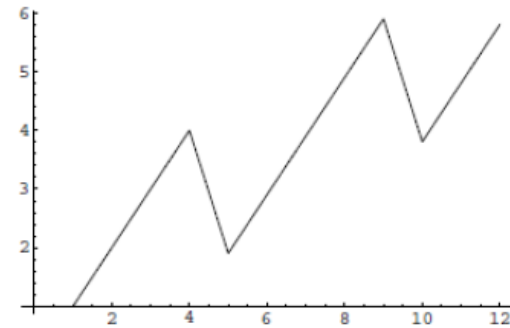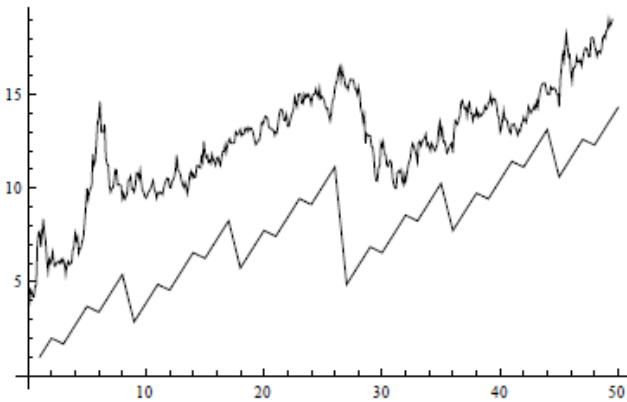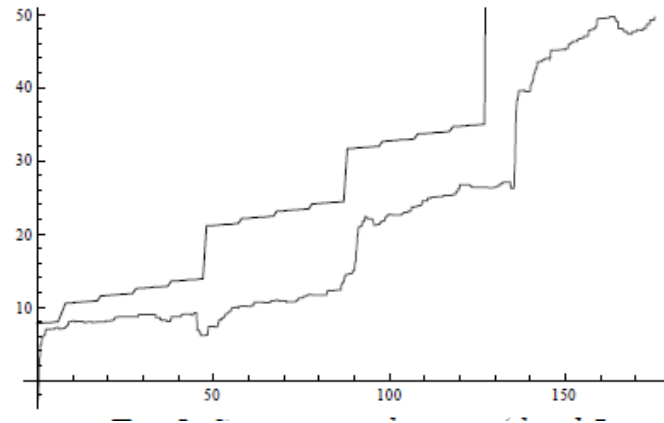

Fig 2. *Russian stock Index*

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

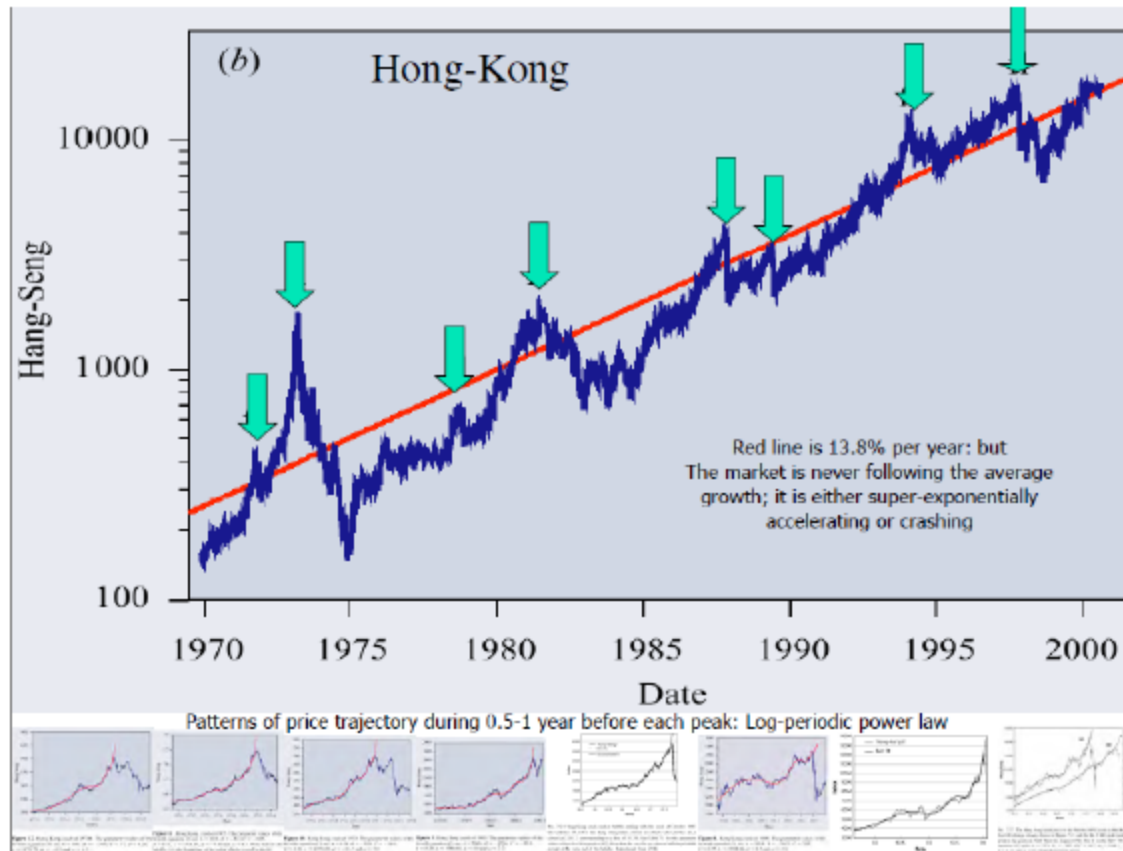# Two type of p-adic function (Elliott waves): subcritical and supercritical

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

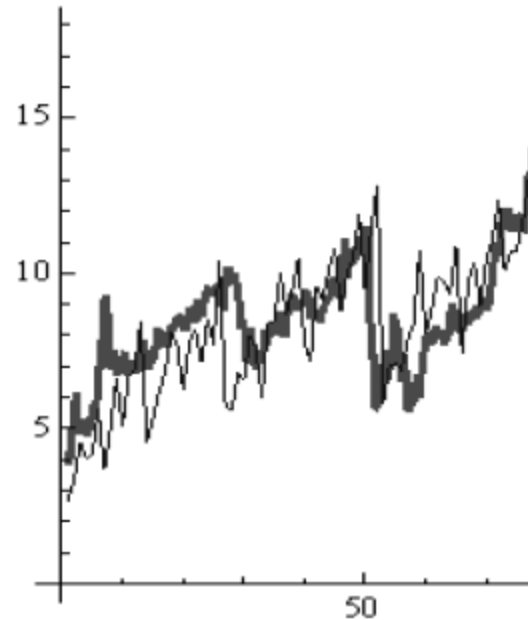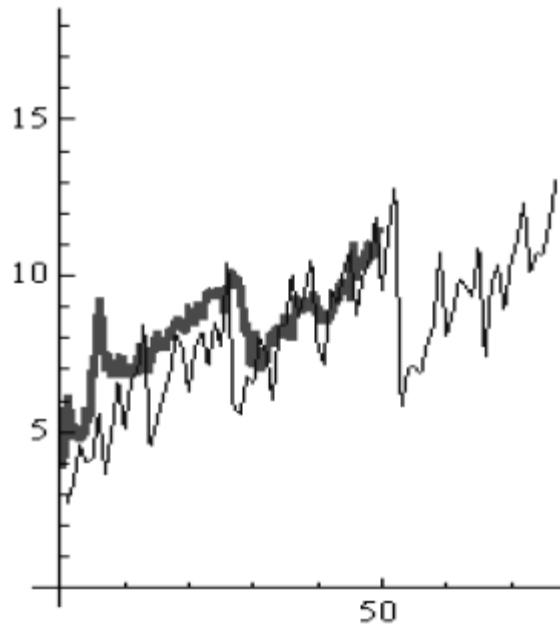# P-adic interpolation and extrapolation as Forecast procedure
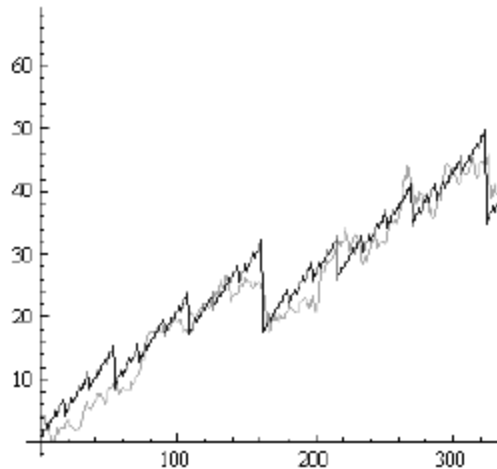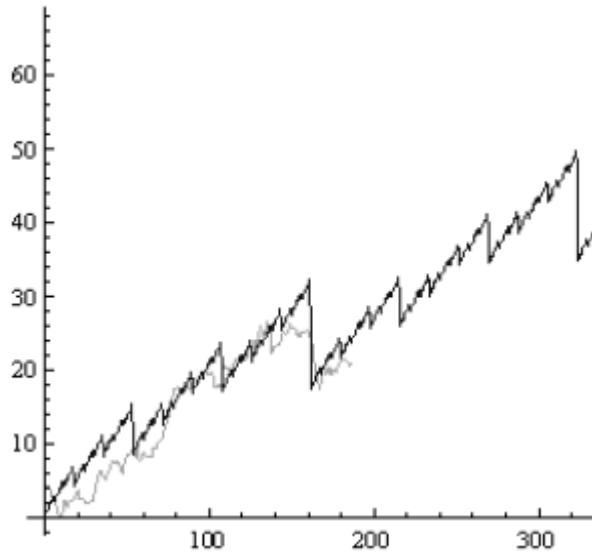
01.07.2006—01.04.2007   *IBM Year timeframe*   01.07.2006—01.07.2008
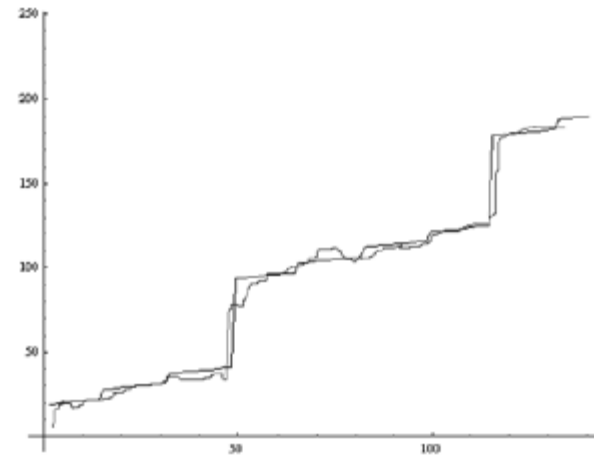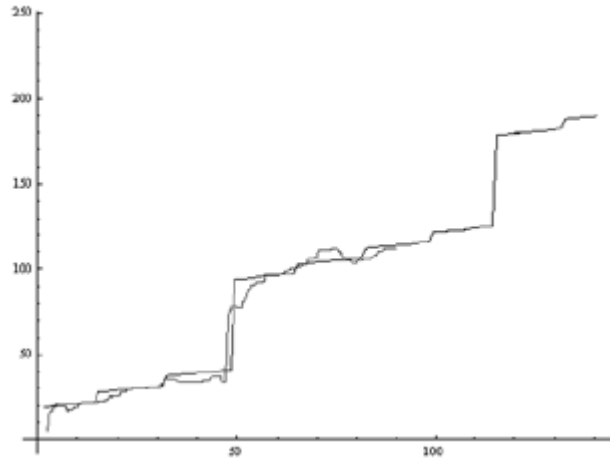
Forecast – PROGNOZ of Gazprom

Gazprom Daily time frame

01.06.2009

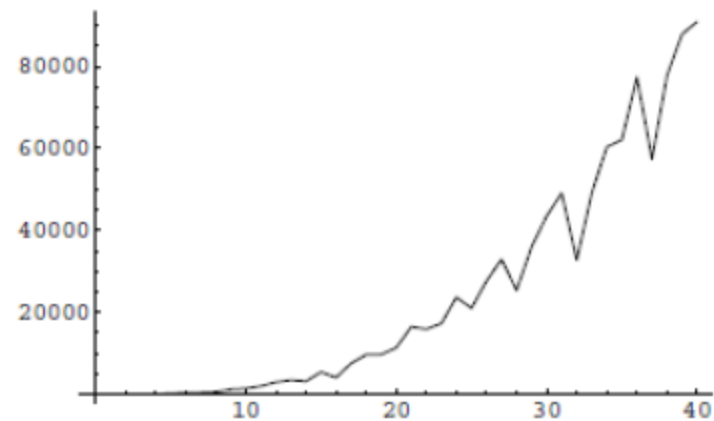01.06.2009–02.06.2009

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

The Global BUBBLE

PCA first component on a data set containing, emerging markets equity indices, freight indices, soft commodities, base and precious metals, energy, currencies ...

(Peter Cauwels FORTIS BANK - Global Markets)
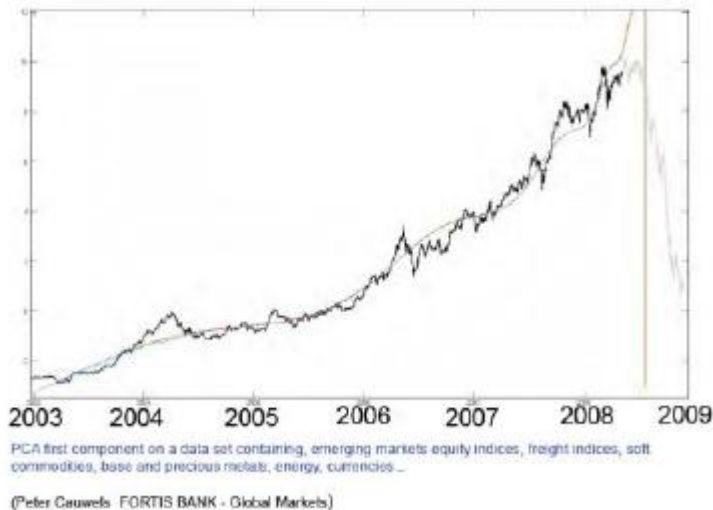
Sornette   Theory (Log Periodic)

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
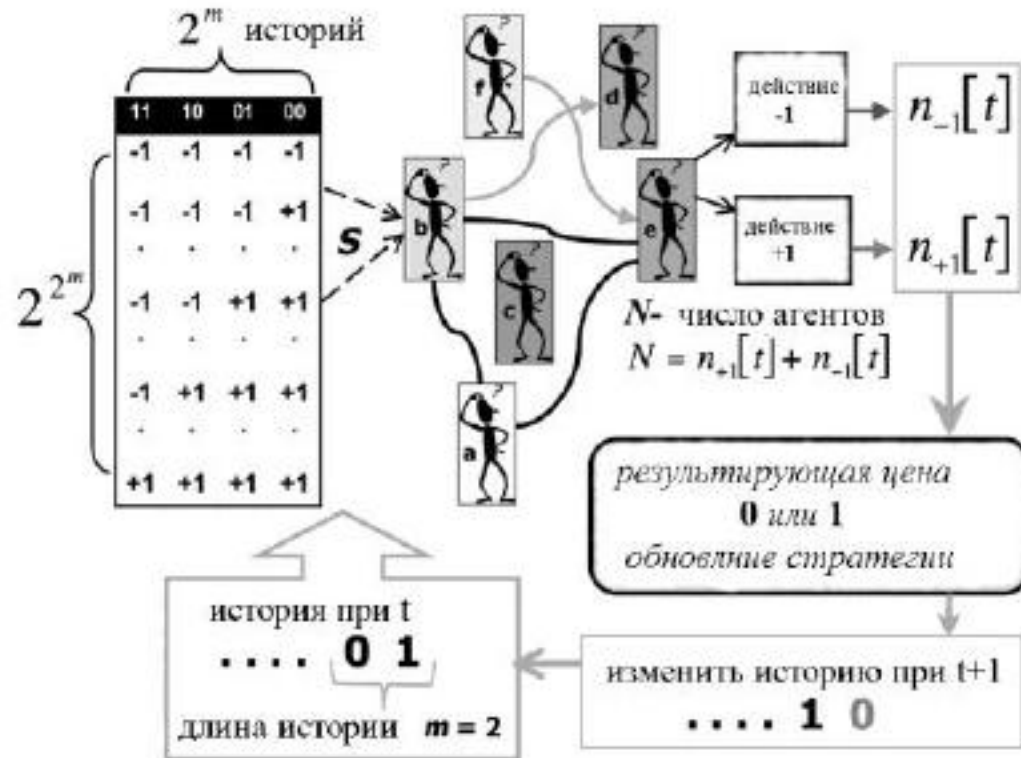
Second step

Heisenberg model and Spin Glass Model

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

Hubbard model as model for traders 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?!