

Financial extreme events with negative fractal dimensions



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FOREX

(Foreign exchange market)

Over-the counter market

Most traded currencies

1. USD

2. EUR

3. JPY

4. GBP

5. AUD

6. CHF

7. CAD

8. HKD

9. SEK

10. NZD

Top 10 currency traders

1. Deutsche Bank

2. UBS AG

3. Barclays Capital

4. Citi

5. Royal Bank of Scotland

6. JP Morgan

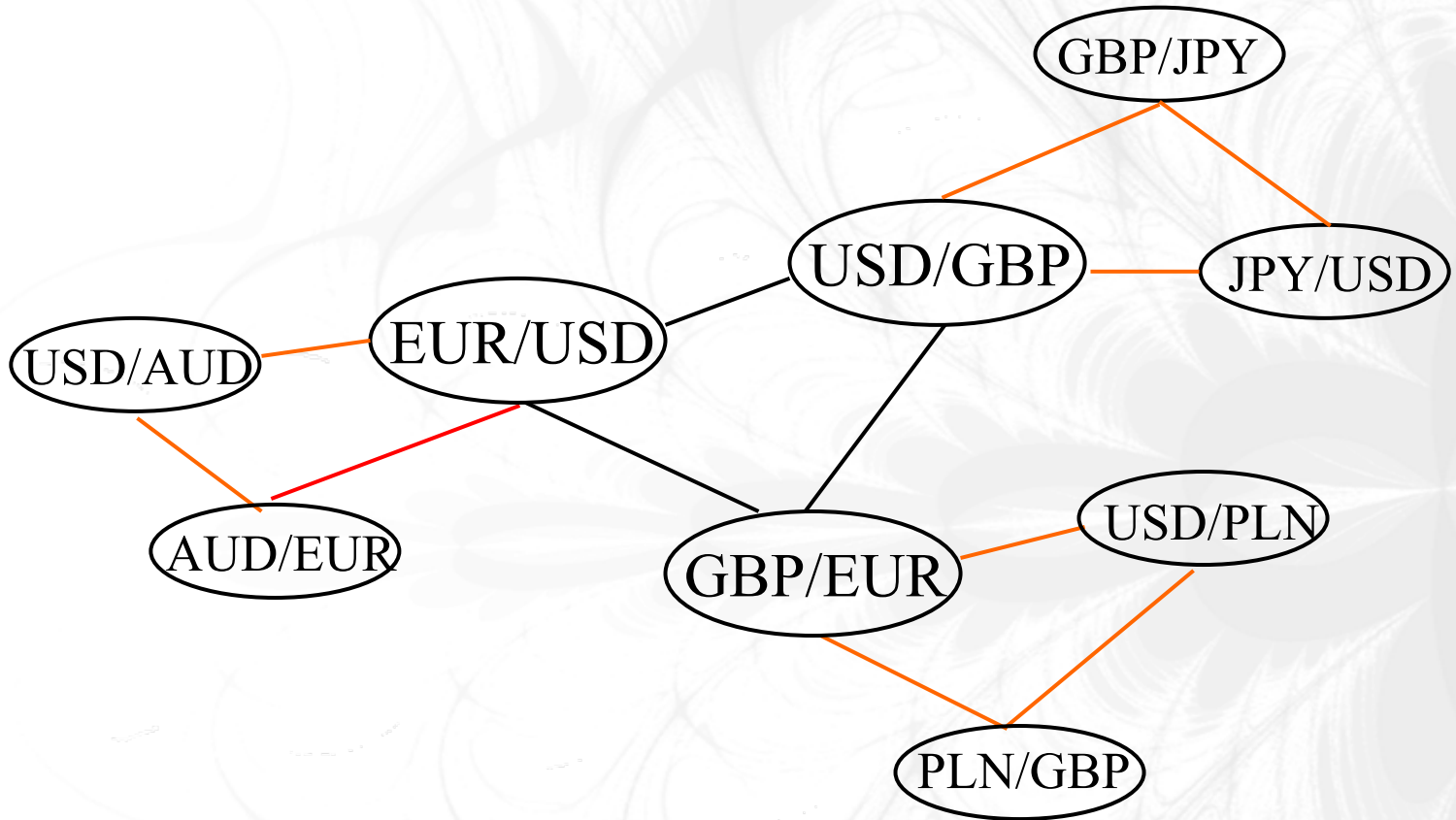
7. HSBC

8. Credit Suisse

9. Goldman Sachs

10. Morgan Stanley

TRIANGULAR ARBITRAGE



EUR → USD → GBP → EUR

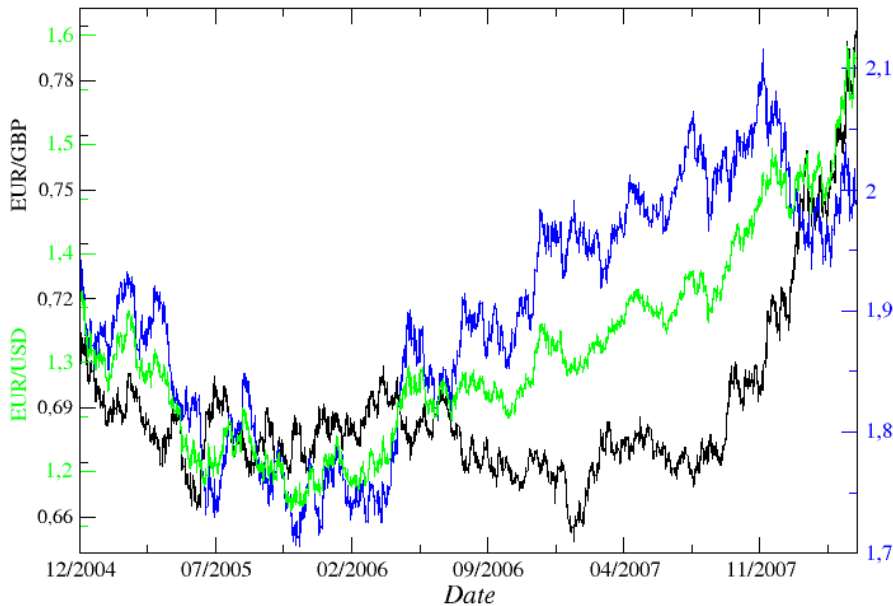


Logarytmiczna stopa zwrotu $g(t)$

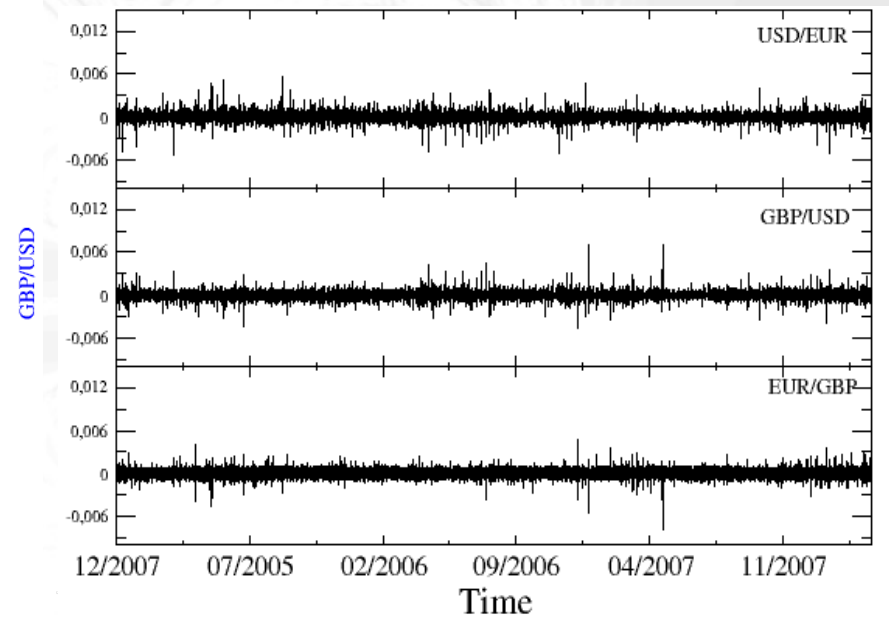
$r(t)$ - kurs wymiany w chwili t

$$g(t) = \ln(r(t)) - \ln(r(t-1))$$

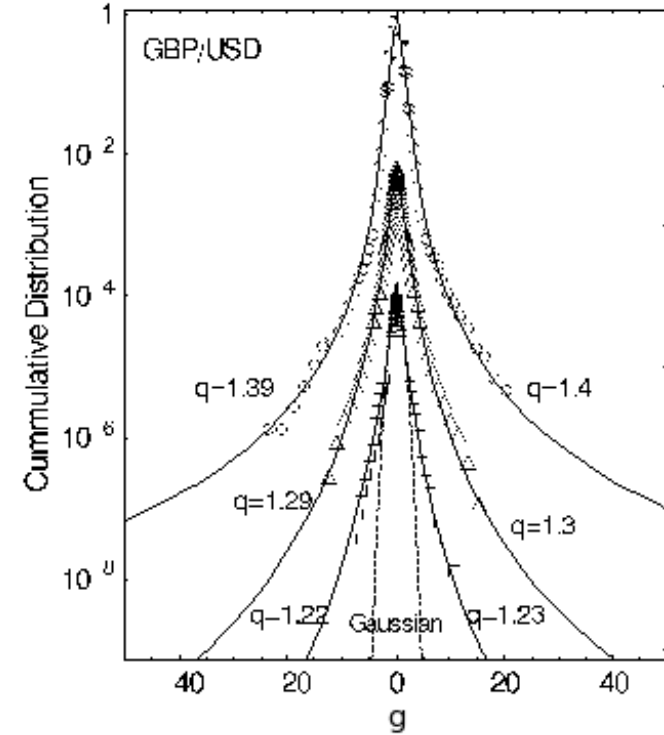
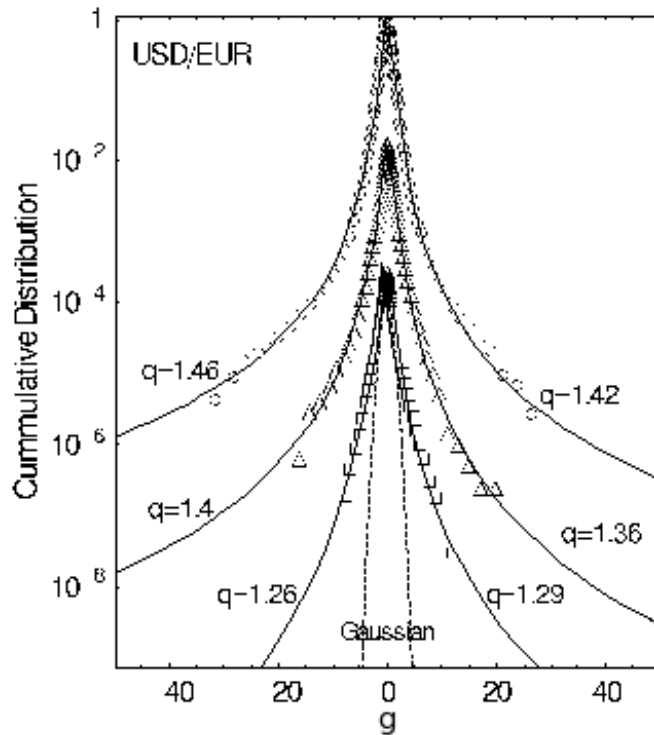
$r(t)$



$g(t)$



Skumulowane rozkłady fluktuacji

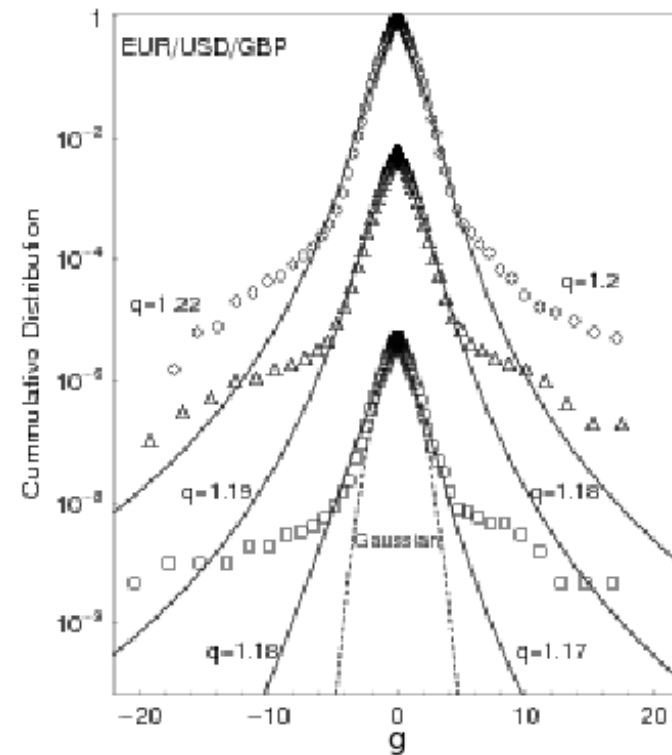
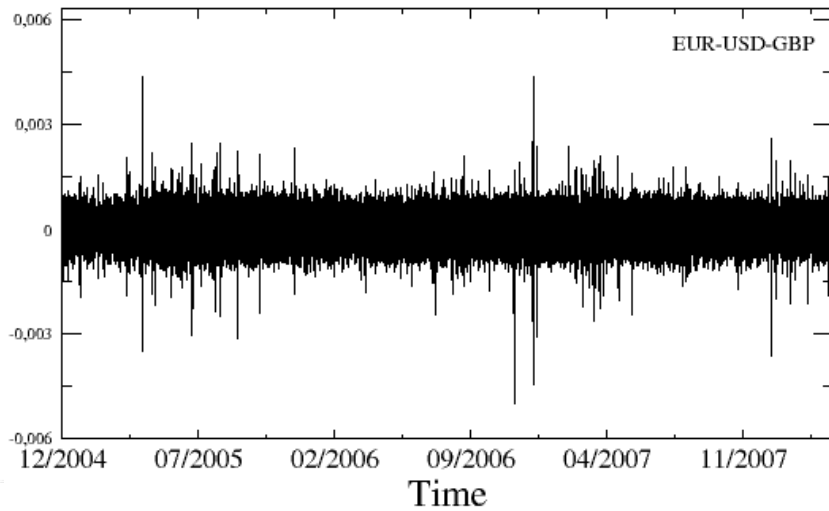


Dla dużych g $P(g) \sim g^{-\frac{2}{1-q}}$

$$\alpha_L = \frac{3-q}{1-q}$$

Dla arbitrażu:

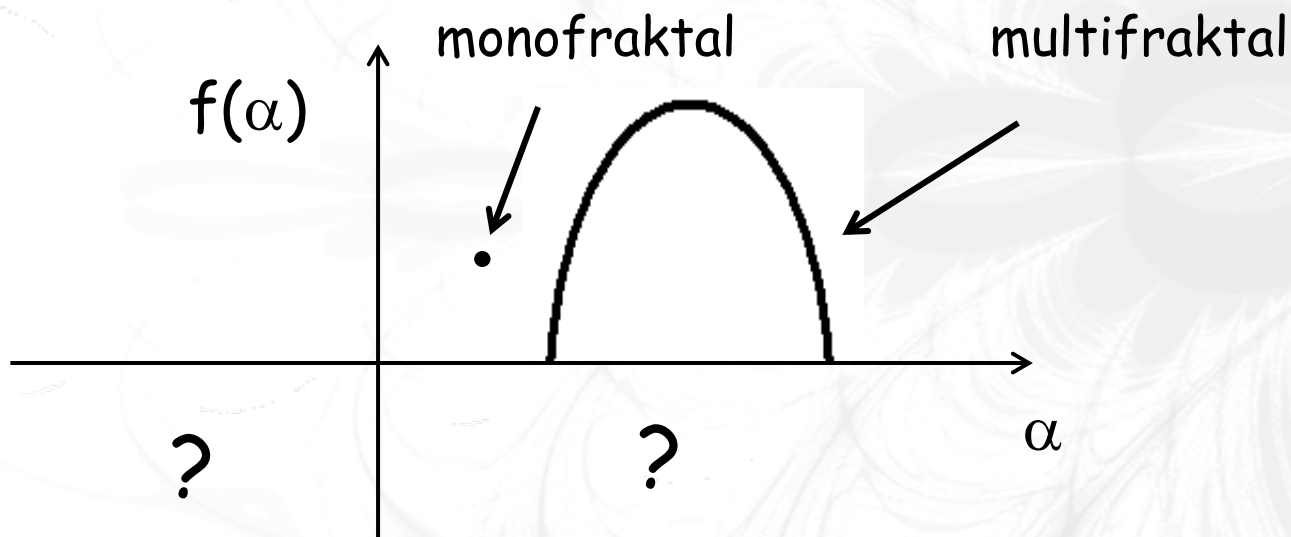
$$g_{USD/EUR}(t) + g_{GBP/USD}(t) + g_{EUR/GBP}(t) \neq 0$$



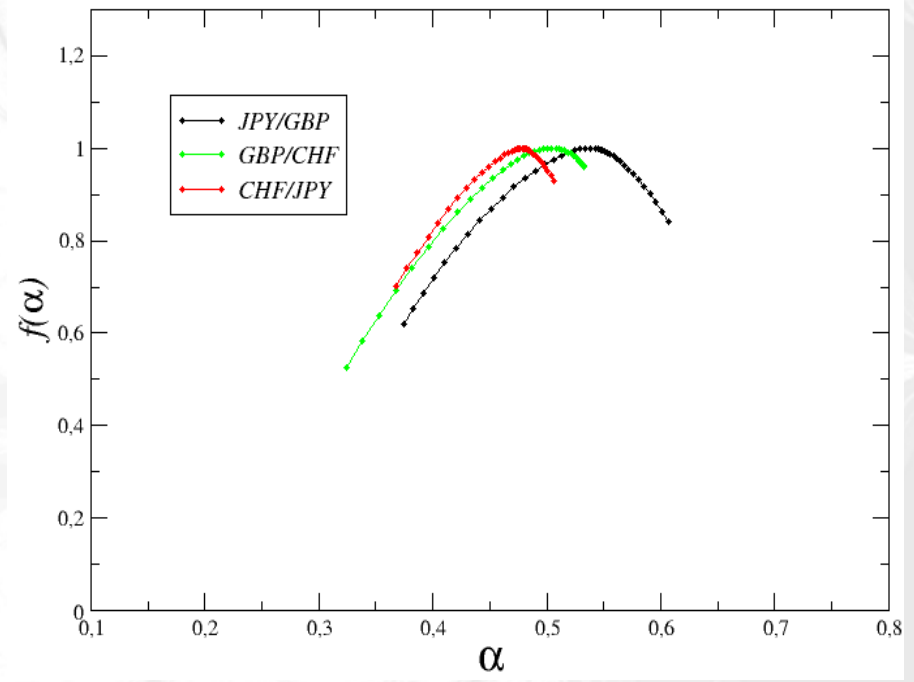
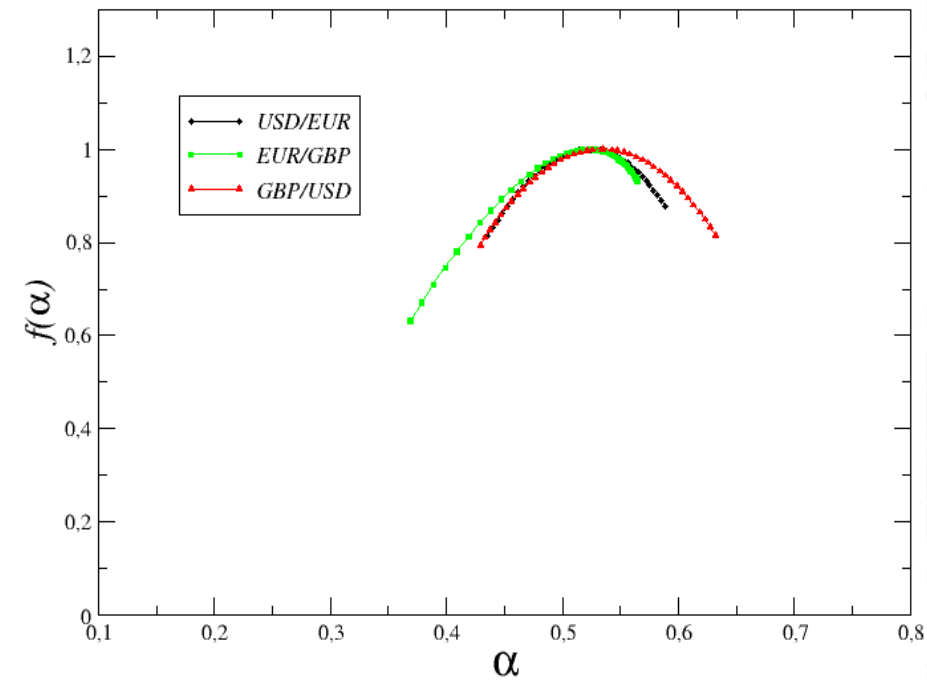
Spektrum osobliwości

α – wykładnik Höldera

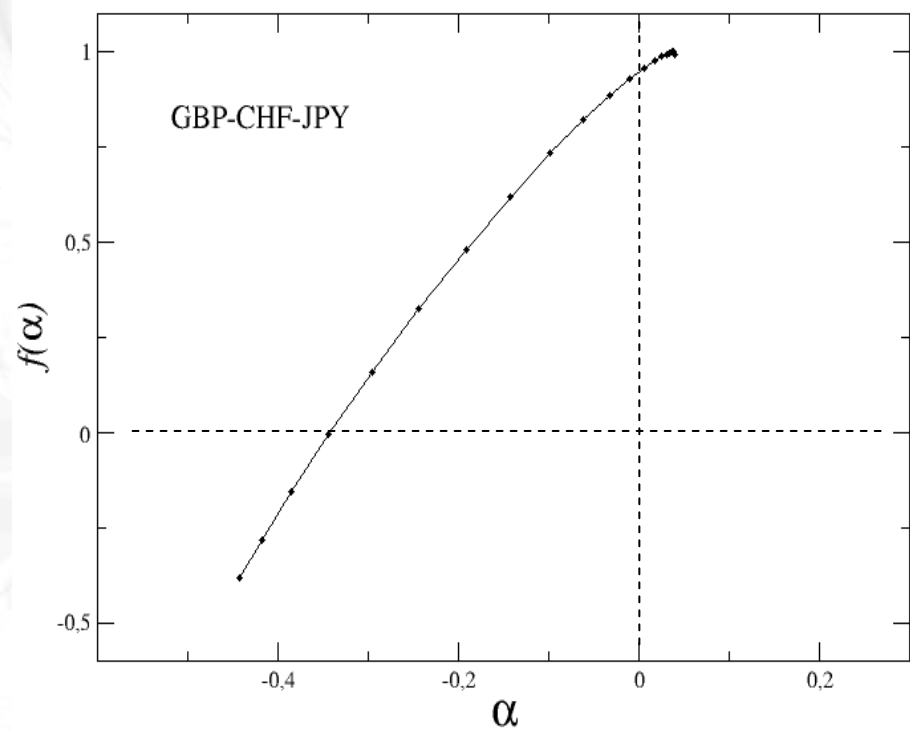
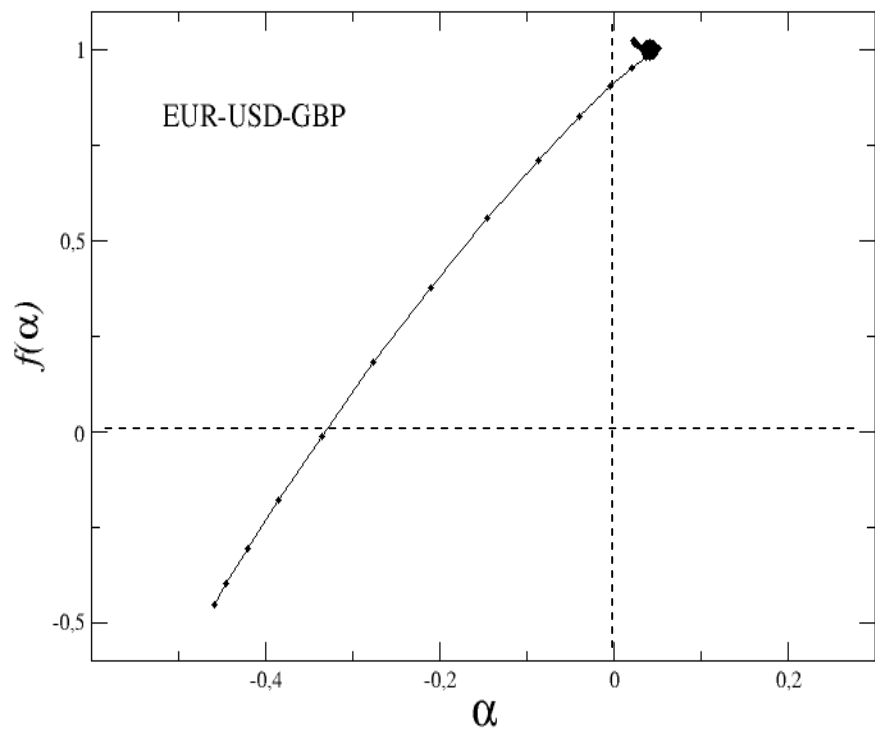
$f(\alpha)$ – wymiar fraktalny



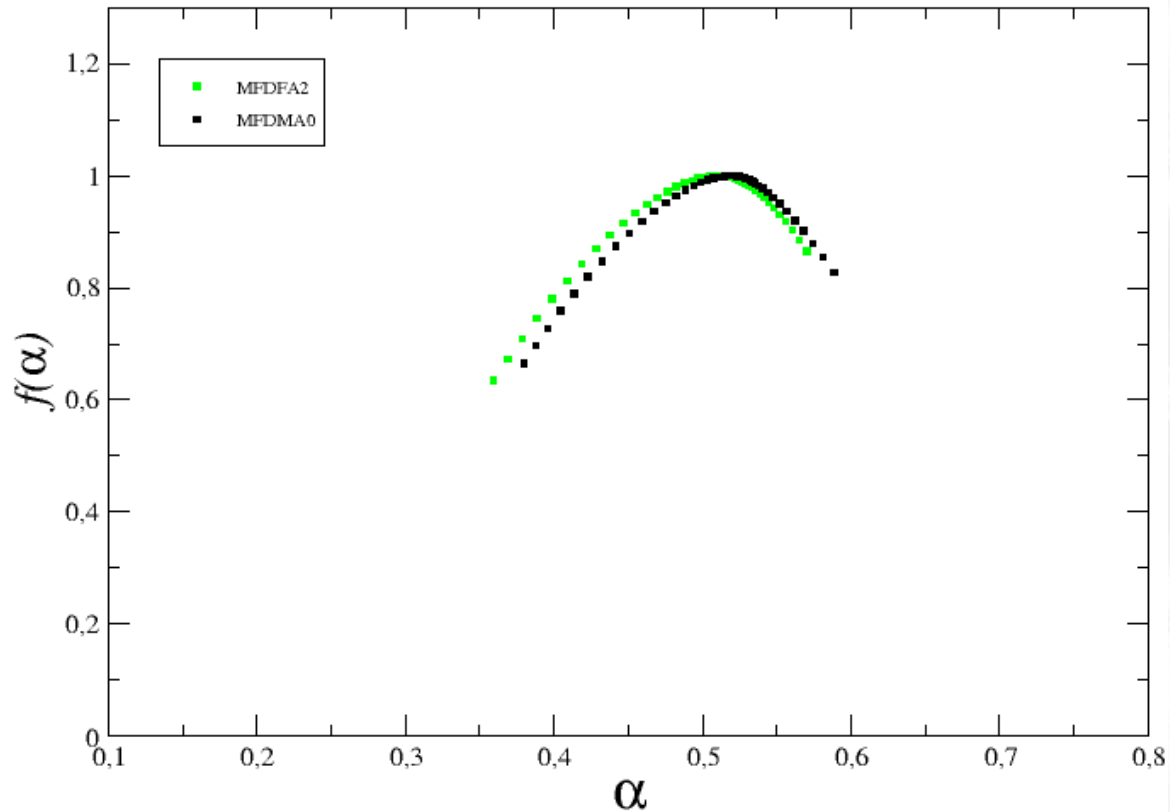
Spektra multifraktalne dla $g(t)$



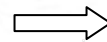
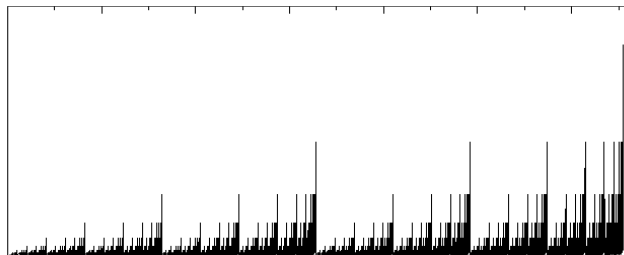
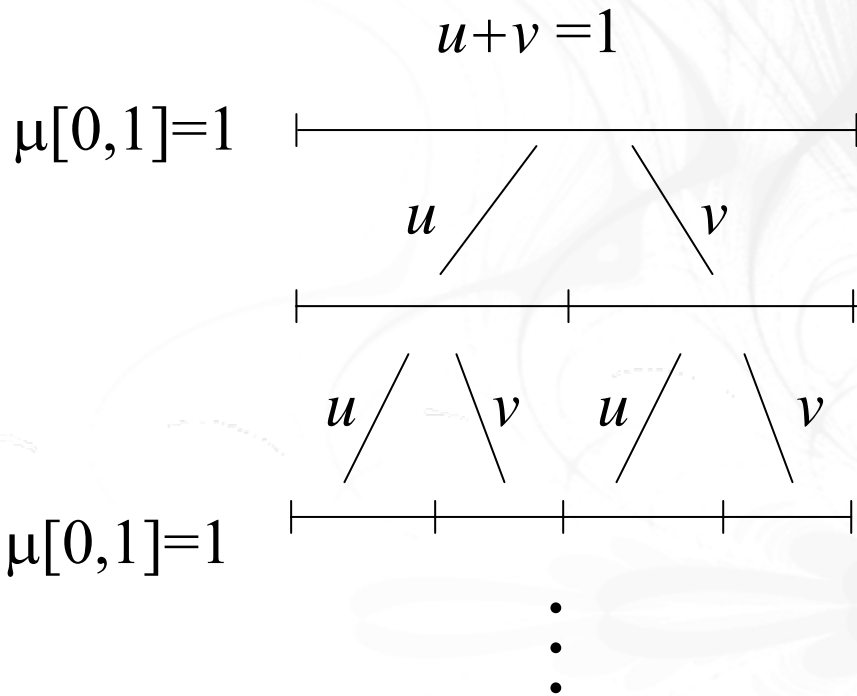
Spektra multifraktalne dla odchyleń od relacji po trójkacie



Analiza multifraktalna dla fałszywych odchyłeń od relacji po trójkacie



Multiplicative Nonrandom Cascade

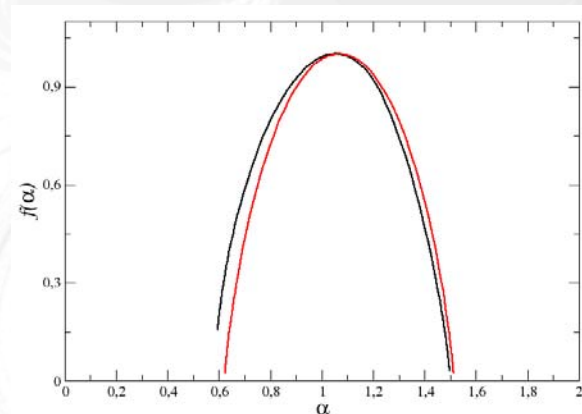
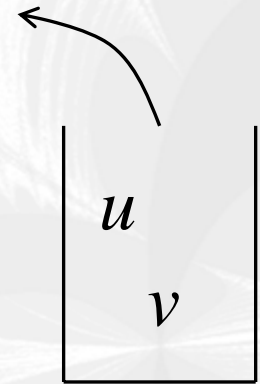


Canonical Random Cascade

$$M_1 = u \vee v$$

$$M_2 = u \vee v$$

$$\langle M \rangle = 1/2$$

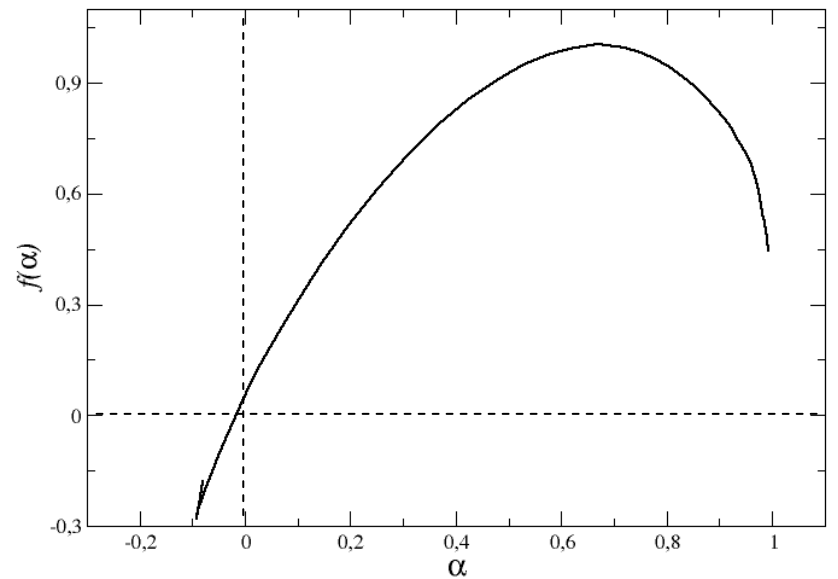
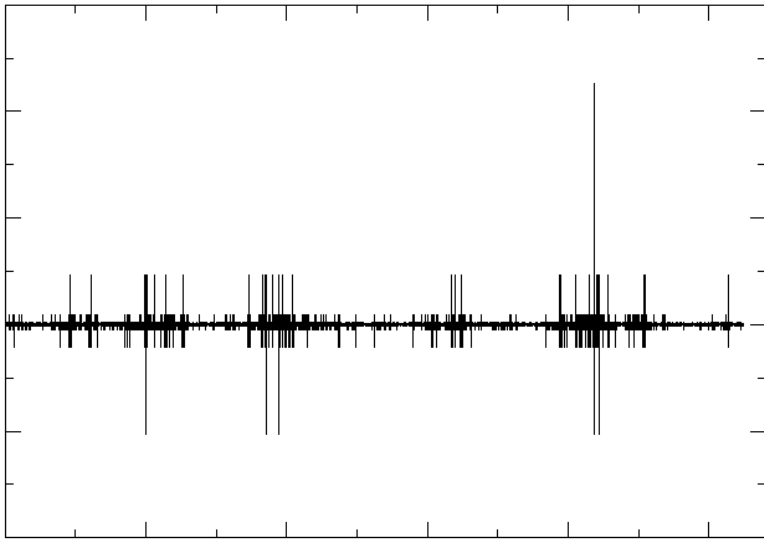


Two-Valued Canonical Multifractal

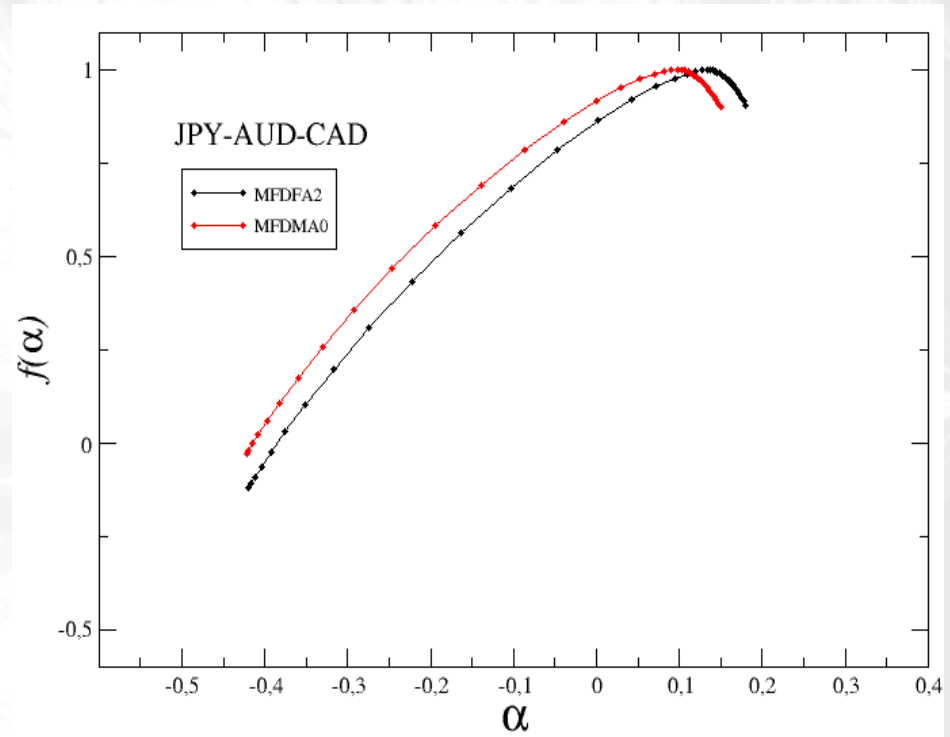
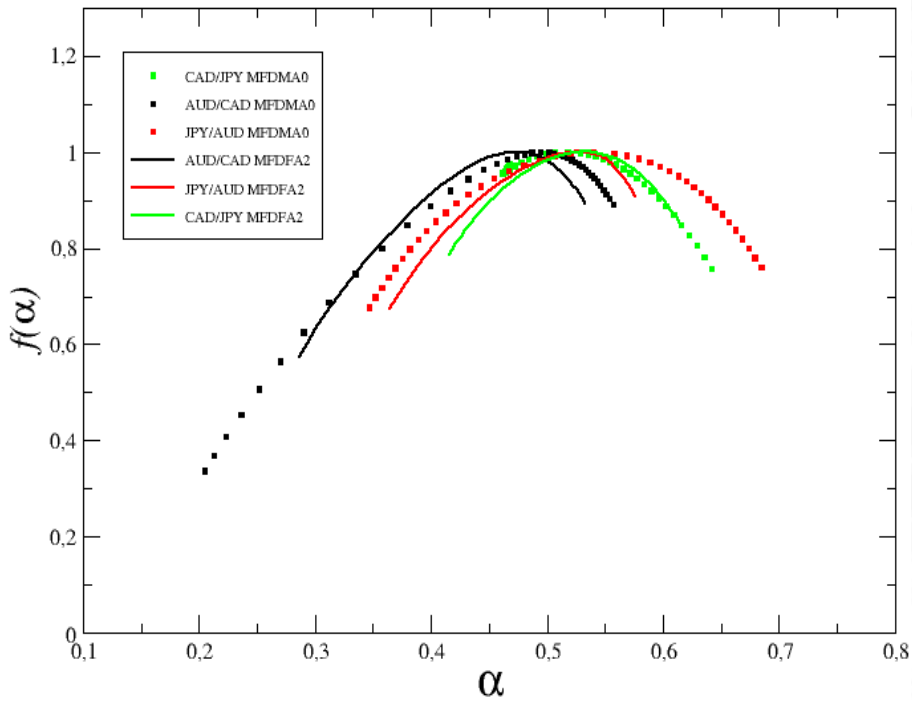
$$u + v \neq 1$$

$$\langle M \rangle = pu + (1-p)v = 1/2$$

$$p=3/4 \quad u=2.5$$

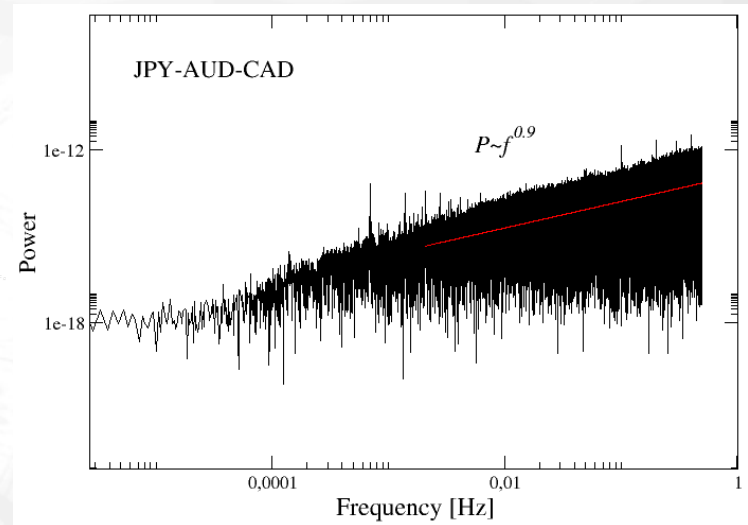
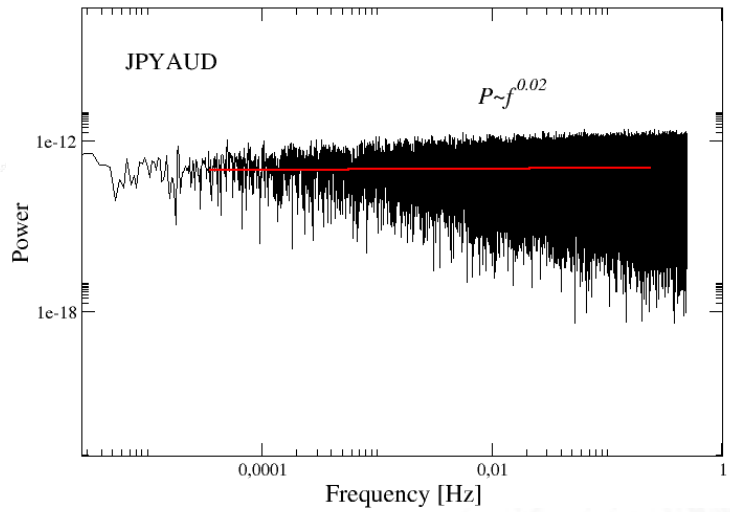
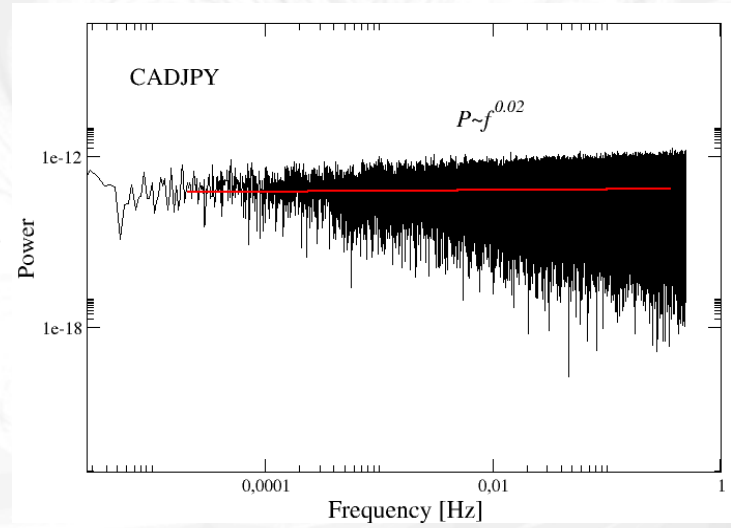
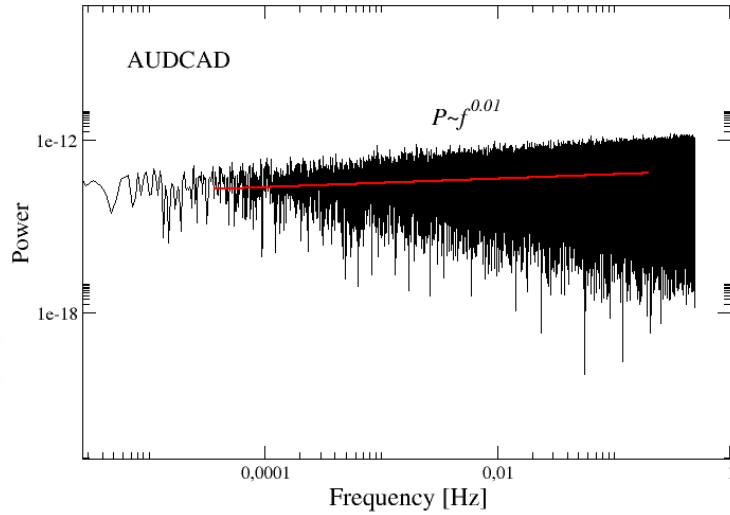


Analiza multifraktalna dla trójkąta JPY, AUD, CAD



Widmo mocy

$$\beta = 2H - 1$$





The End