U. Leiden, Feb. 22, 2010
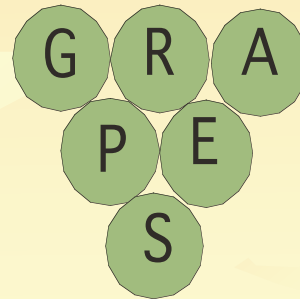# Exercice #1
Crashes: Forecasts and Postcasts

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G R A
P E
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(*) previously at GRAPES
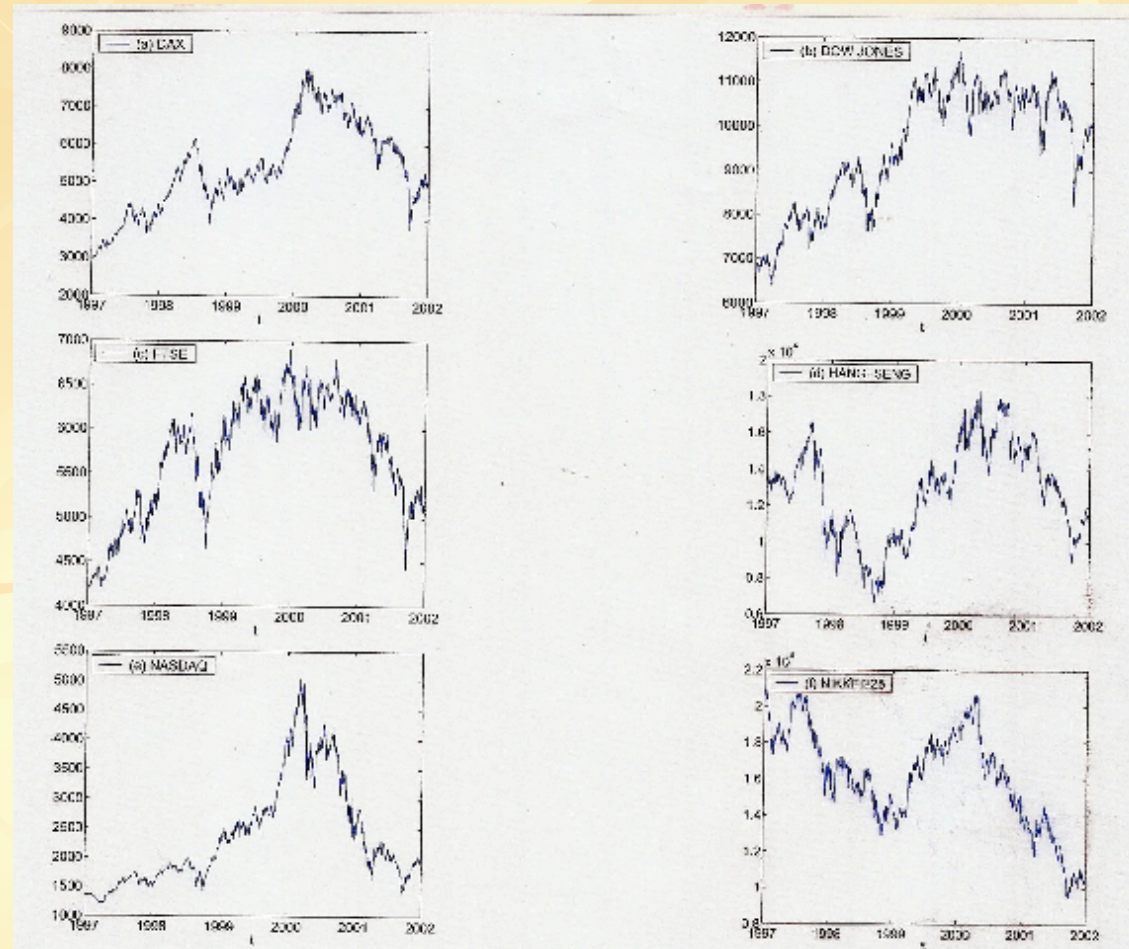(Group for Research and Applications of Physics in Economy and Sociology)

Motivation

- can one predict some crash once in a while?

- are log-periodic oscillations common in crash precursors?

- learn the double enveloppe function technique
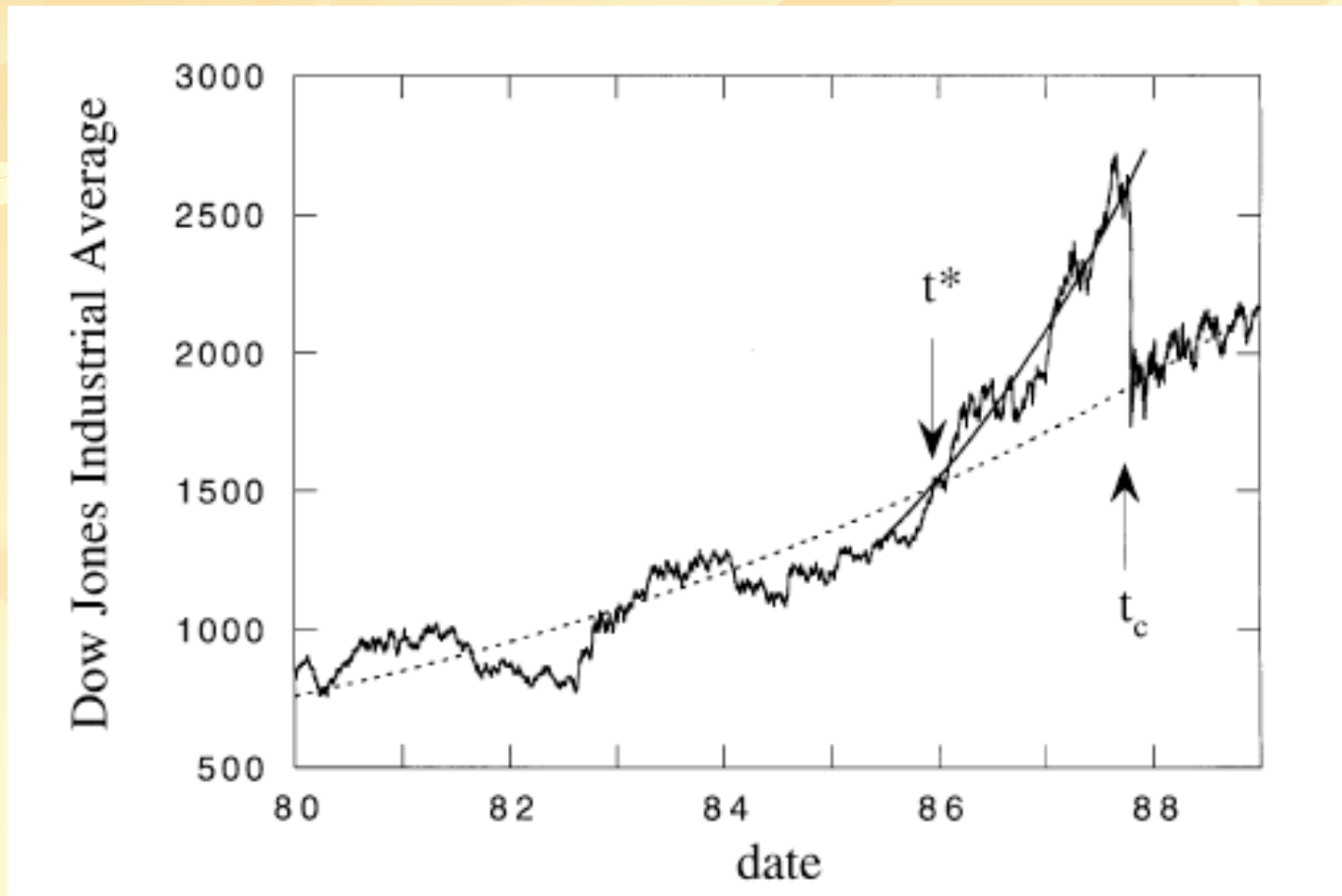
Crash danger ? (à la Ausloos)

- Get some signal from web
    - DJIA, SP500, NIKKEI, DAX, EURONEXT100, AEX,... if possible get 2500 data points (10 years) more is better
    - plot data, observe if there is some t*, some t_c
- make a direct fit to the singularity ; get t_c^d
    - $\simeq (t_c - t)^m$
    - $\simeq \ln(t_c - t)$ ..better ?
- construct the double enveloppe of the signal fluctuations
- fit with the log-periodic function; get t_c^o
- following the signal in time the evolution of t_c^d and t_c^o
    - danger ?
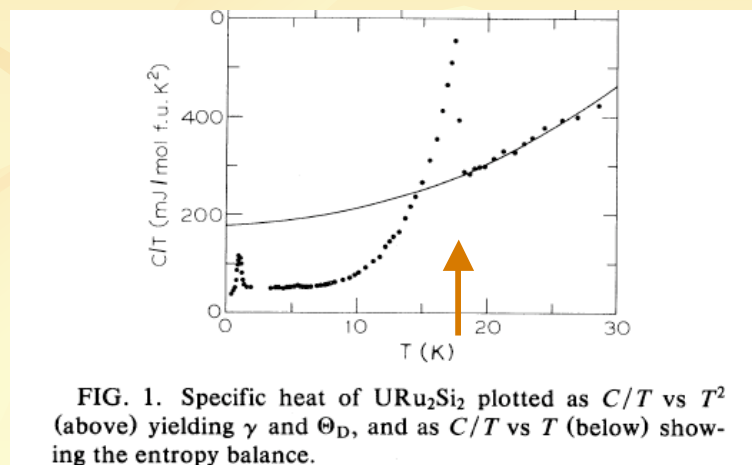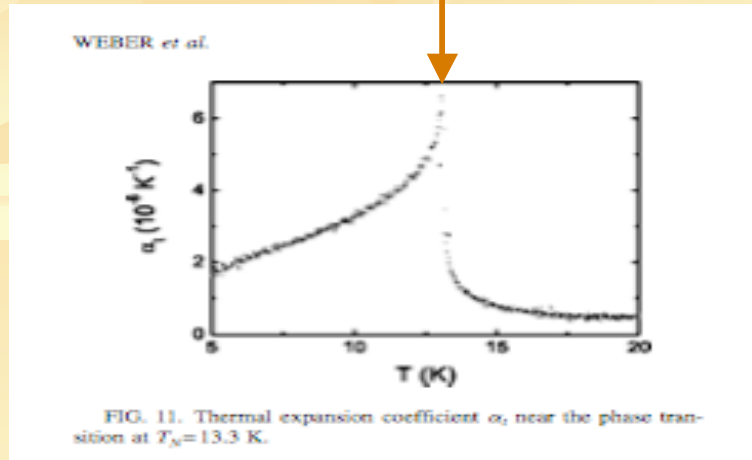- arbitrarily fit taking into account two terms, not necessarily harmonics

http://finance.yahoo.com/

1250 data points

Critical fluctuations DJIA 80-88

Phase transition(s)

WEBER et al.

FIG. 11. Thermal expansion coefficient α_l near the phase transition at $T_N = 13.3$ K.

FIG. 1. Specific heat of URu_2Si_2 plotted as C/T vs T^2 (above) yielding γ and Θ_D, and as C/T vs T (below) showing the entropy balance.
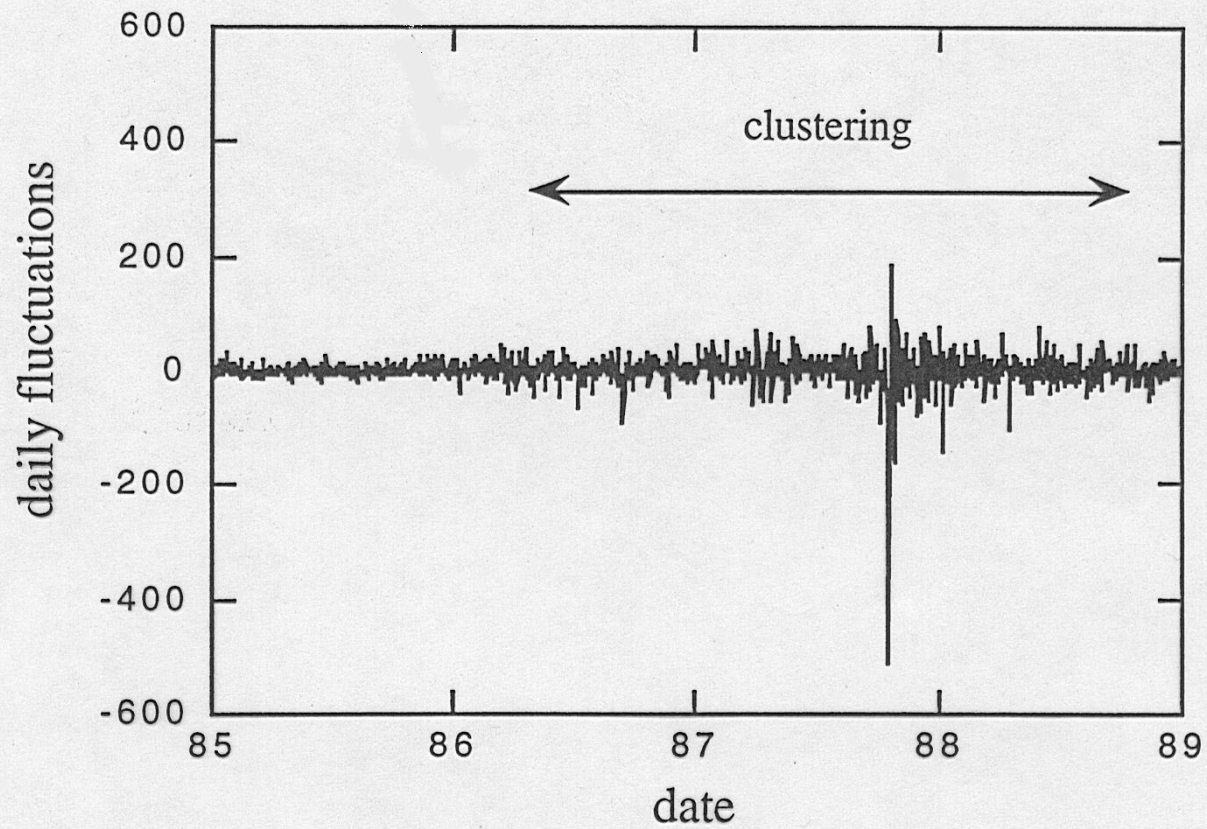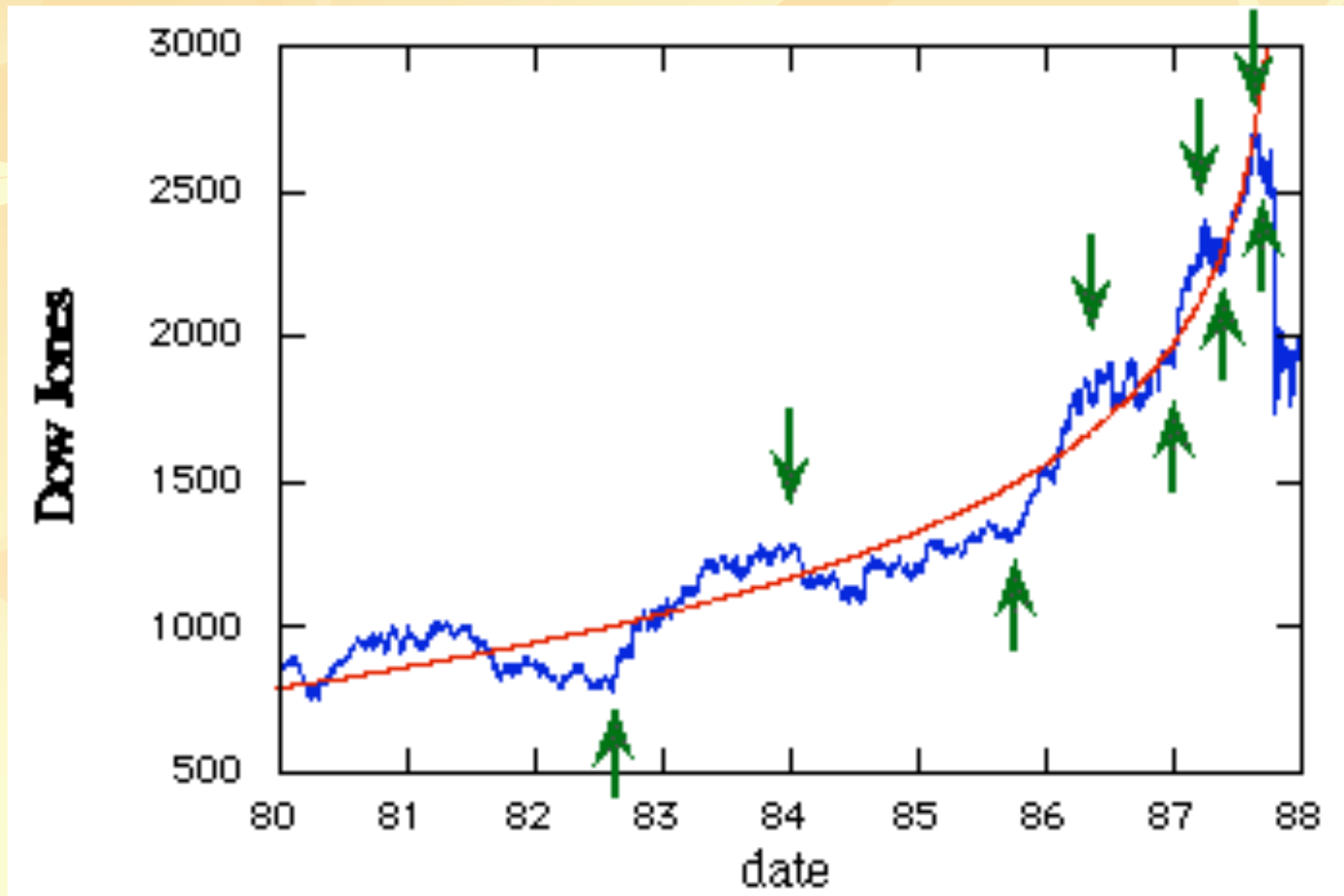
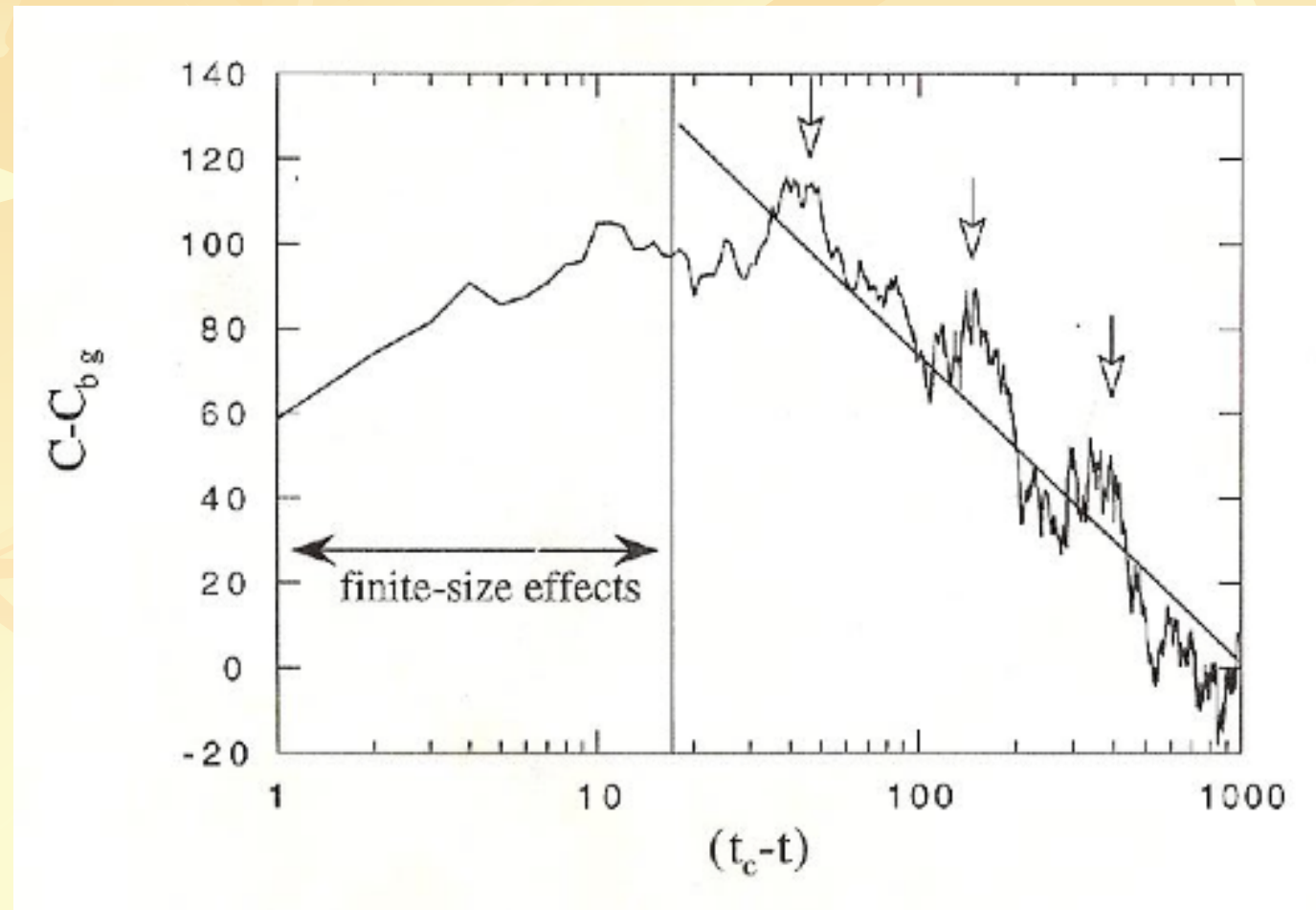$$c, \kappa, \chi, \xi, .. \simeq \left[\frac{T_c - T}{T_c}\right]^m$$

Clustering 87

DJIA 87

for fit log-P

$$y = A + B\left(\frac{t_c - t}{t_c}\right)^{-m}\left[1 + C\sin\left(\omega\ln\left(\frac{t_c - t}{t_c}\right) + \phi\right)\right] \quad \text{for} \quad t < t_c \quad (1)$$

$$y = A + B\ln\left(\frac{t_c - t}{t_c}\right)\left[1 + C\sin\left(\omega\ln\left(\frac{t_c - t}{t_c}\right) + \phi\right)\right] \quad \text{for} \quad t < t_c. \quad (2)$$
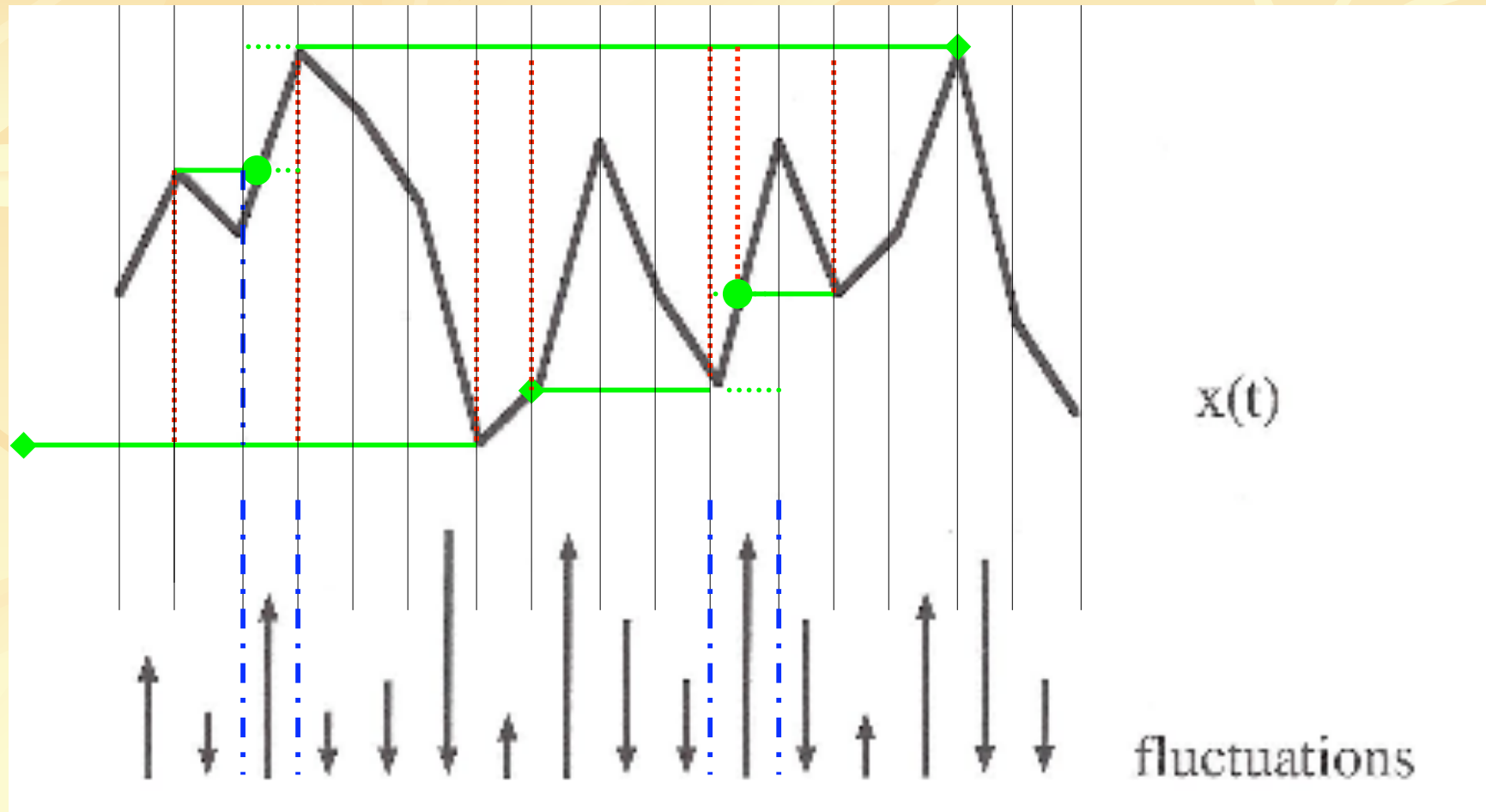
log div. specific heat SP500

log divergence parameter fits

indice - (période)	t_c^{div} (m$\neq$0)	t_c^{div} (m=0)	λ	t_c^{osc}	t_c
DJIA (80-87)	88.46$\pm$0.04	87.85$\pm$0.02	2.382$\pm$0.123	87.91$\pm$0.10	87.79
DJIA (90-97)	98.68$\pm$0.04	97.92$\pm$0.02	2.278$\pm$0.045	97.89$\pm$0.06	97.81
S&P500 (80-87)	88.78$\pm$0.05	87.89$\pm$0.03	2.528$\pm$0.127	87.88$\pm$0.07	87.79
S&P500 (90-97)	98.67$\pm$0.04	97.90$\pm$0.02	2.549$\pm$0.163	97.85$\pm$0.08	97.81

Double enveloppe technically

x(t)

fluctuations
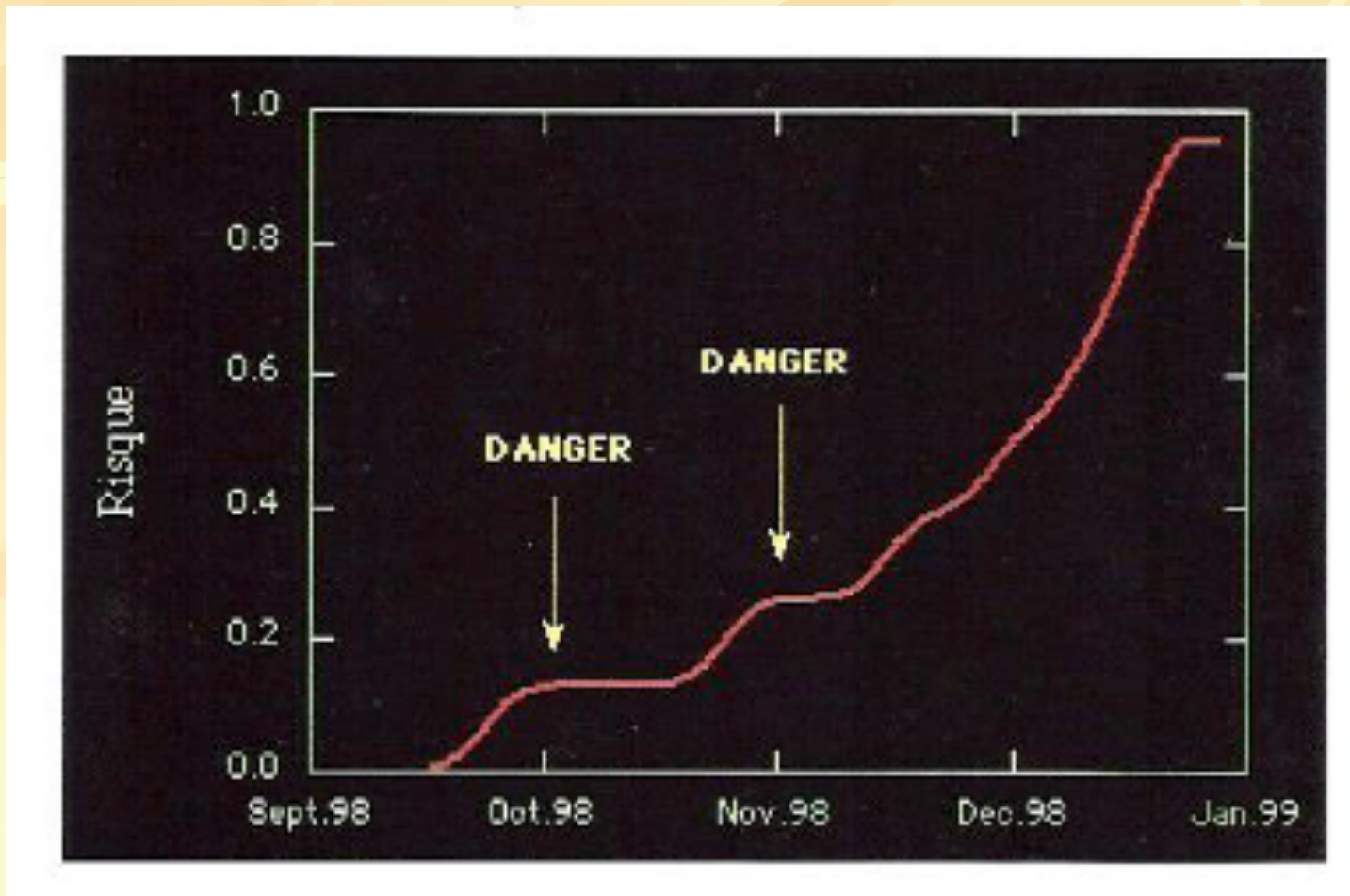
Double enveloppe pattern 82-87

Double enveloppe 97-02

CASH: Oct. 01, 98 : danger

harmonics

c3=0.002*b.*(sin(2*pi*ln(t)/ln(2.16)) + sin(2*pi*ln(t)/0.605)+1.15*pi