# Endo- Exo-genous shocks

## *in "sales"*

Marcel AUSLOOS & Renaud LAMBIOTTE

SUPRATECS, B5, U. Liège, B-4000 Euroland

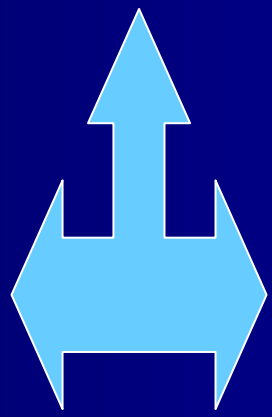
# Content

- Introduction
  - Questions : « shocks » !
  - Sales : books & records
- Data !!!
- « Theory » !!!!!!!
- Conclusions: universality ? differences ?

# Fluctuation-dissipation theorem:

Key tool of Statistical Mechanics
…. should relate 2 sorts of dynamical features.

Fluctuation phenomena, i.e. stochastic deviations from the Equilibrium State.



Dissipative response of the system to an external field

But, economical systems are far out-of-equilibrium…

# Experimental reproducibility

A first requirement in order to apply
a fluctuation-dissipation theorem
to *sales* is the existence of
a well-defined macroscopic friction (= dissipation)
process in the system

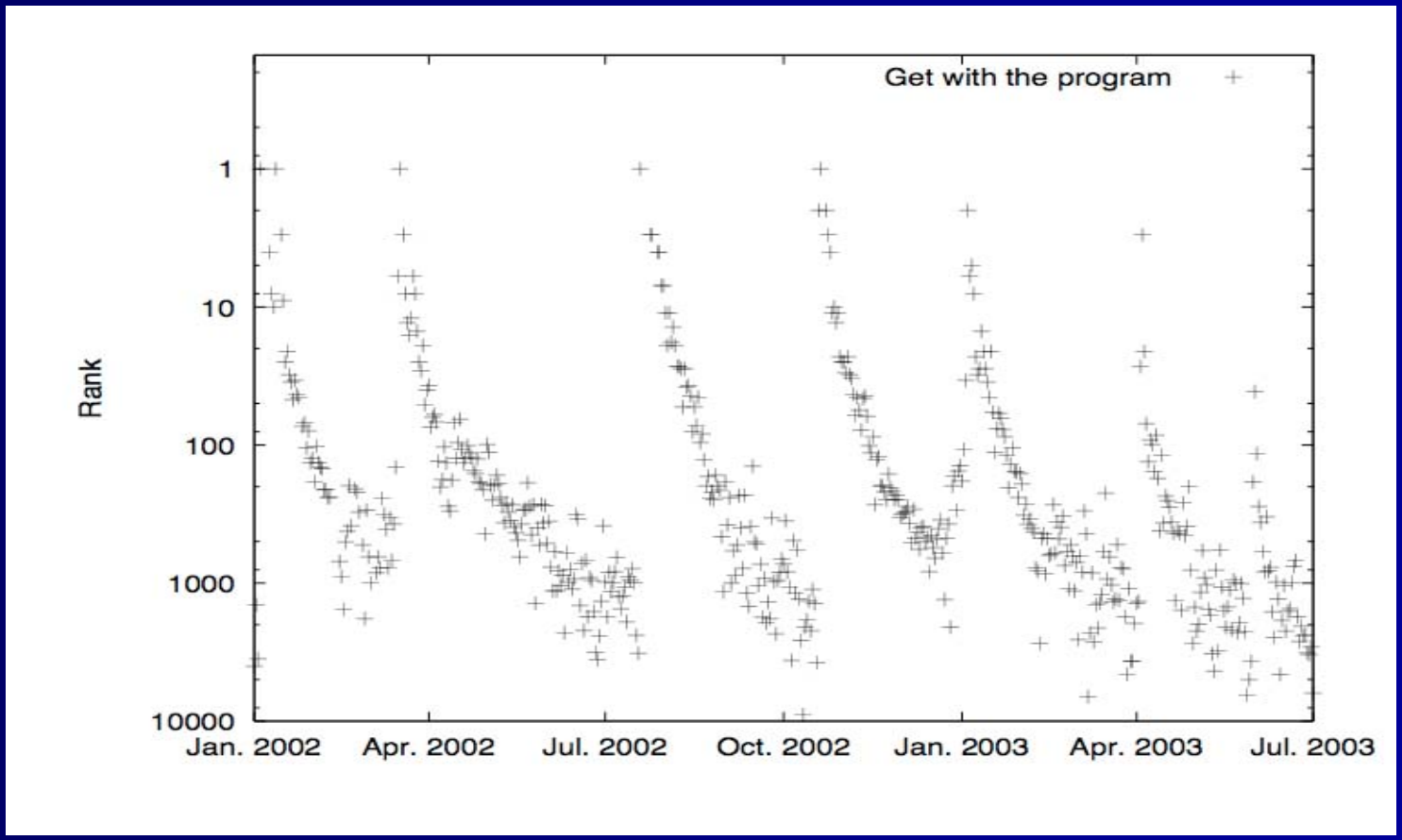
==>

*Equivalent* systems should evolve according to the
*same* macroscopic law

# Two kinds of shocks (1)

Exogenous shock:

Response to some external field: …

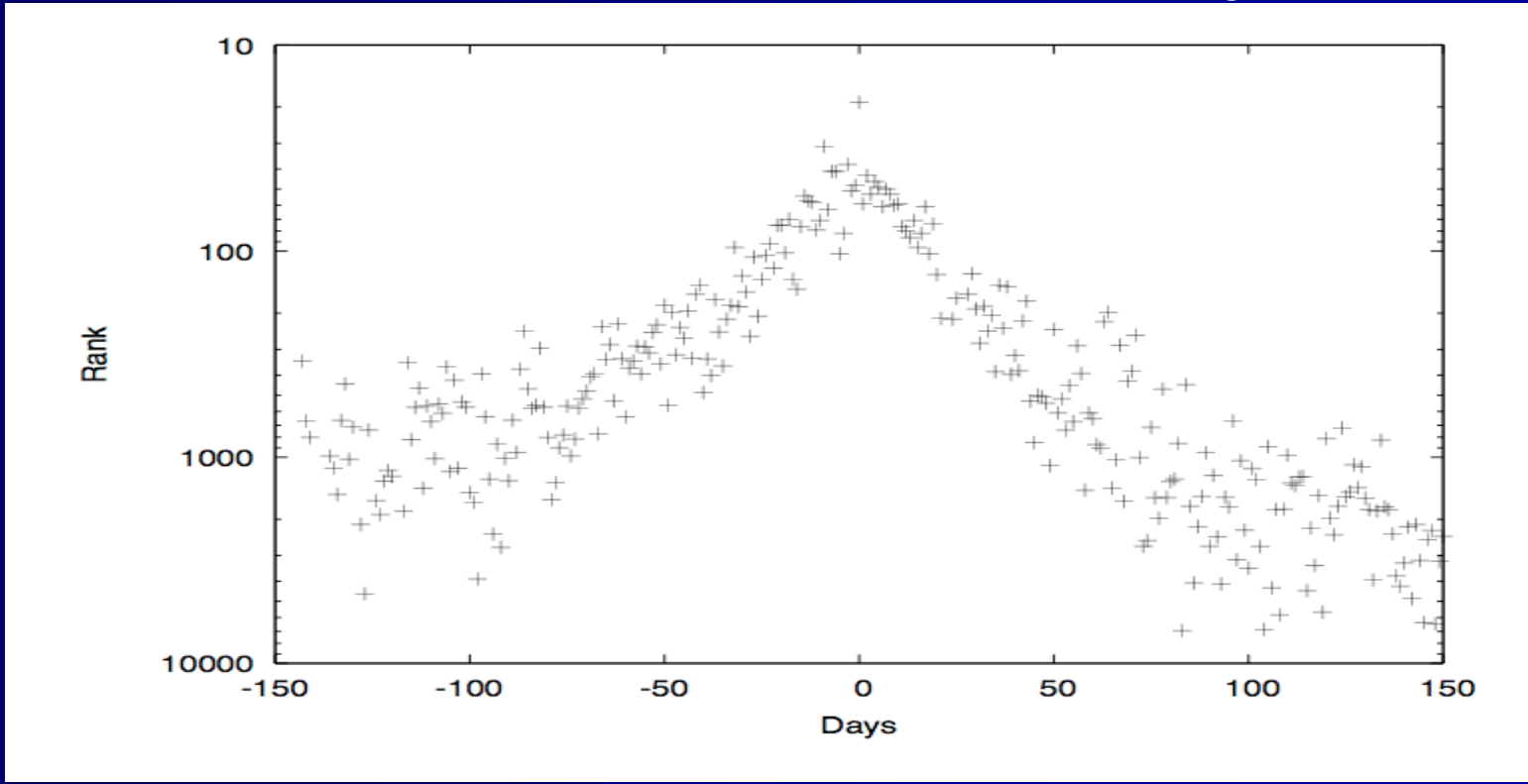


# Two kinds of shocks (2)

Endogenous shock :

Spontaneous evolution of the system (Self-Organized Criticality)

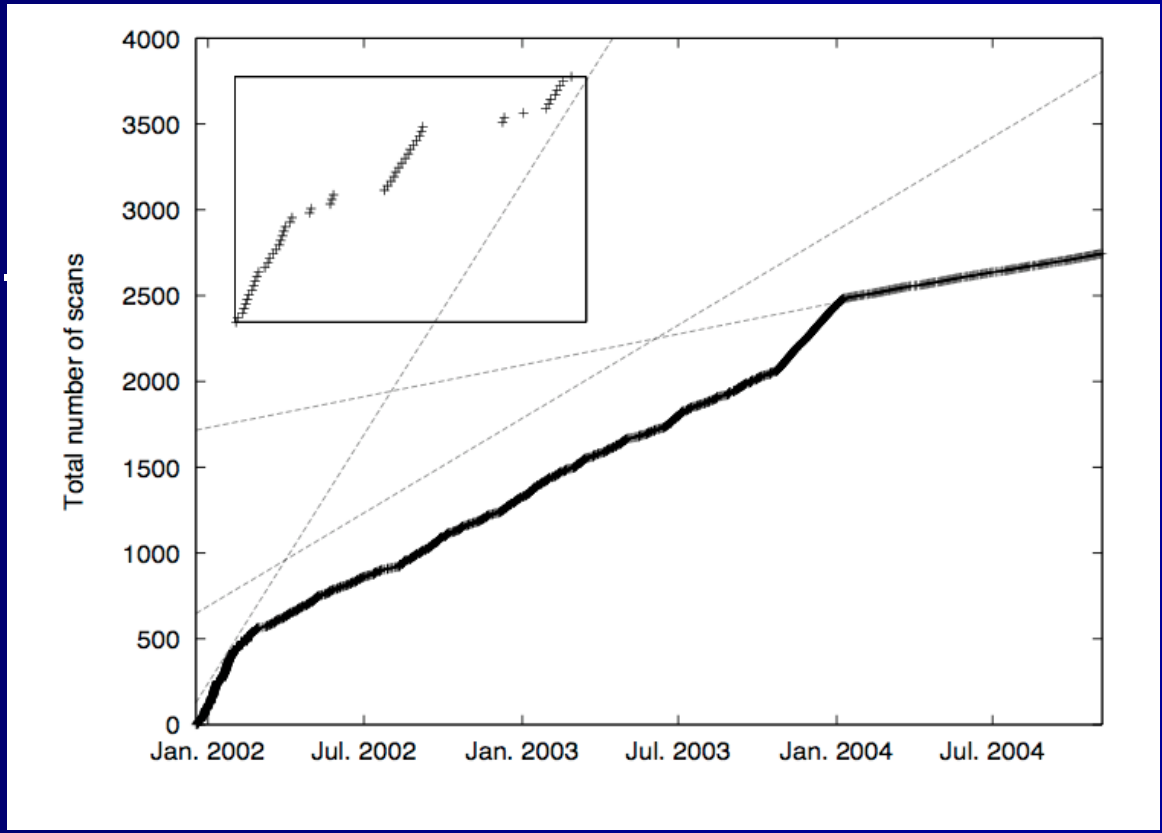
D. Brown :
Angels & Demons



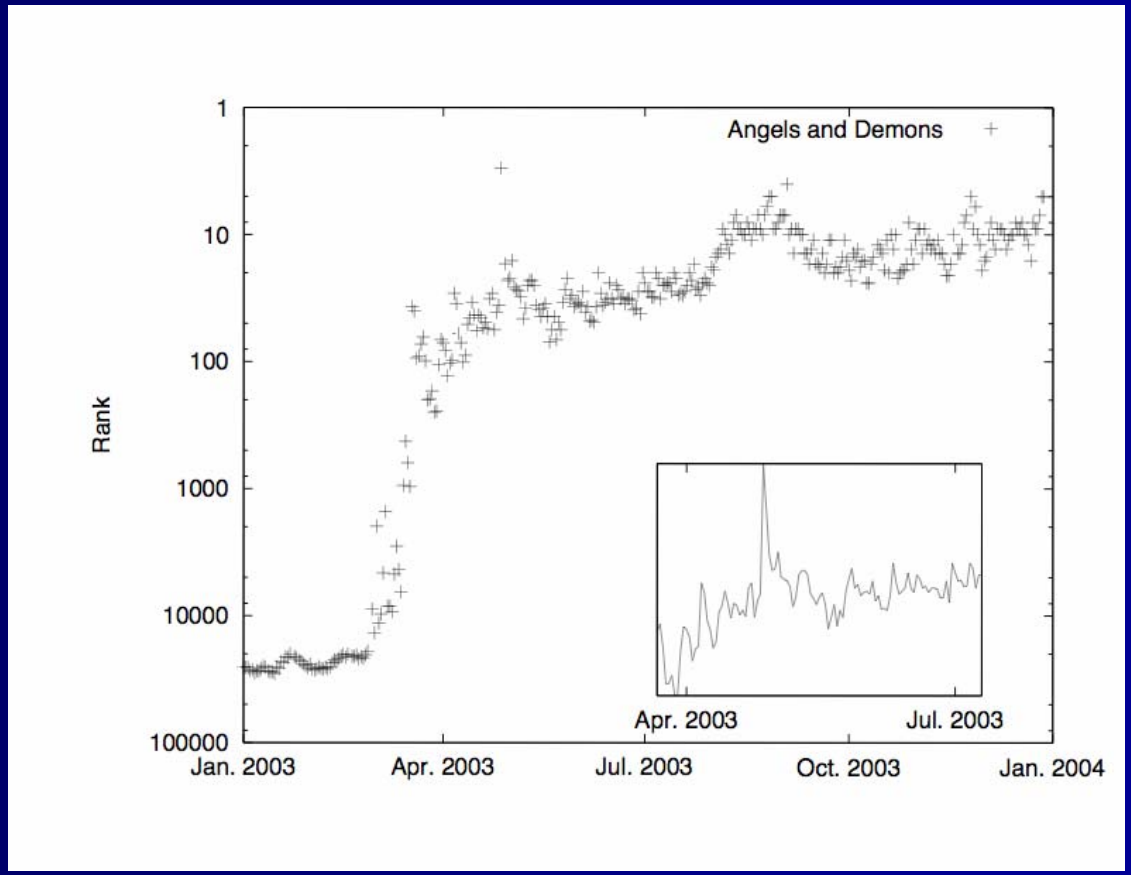
# Methodology

Junglescan.com:
time series of the (*SALE*) ranks from Amazon.com sales.

No direct access to the value of the sales. Technically, there are "problems" due to:
-rank assignment methods
-Non-constant scanning rate…

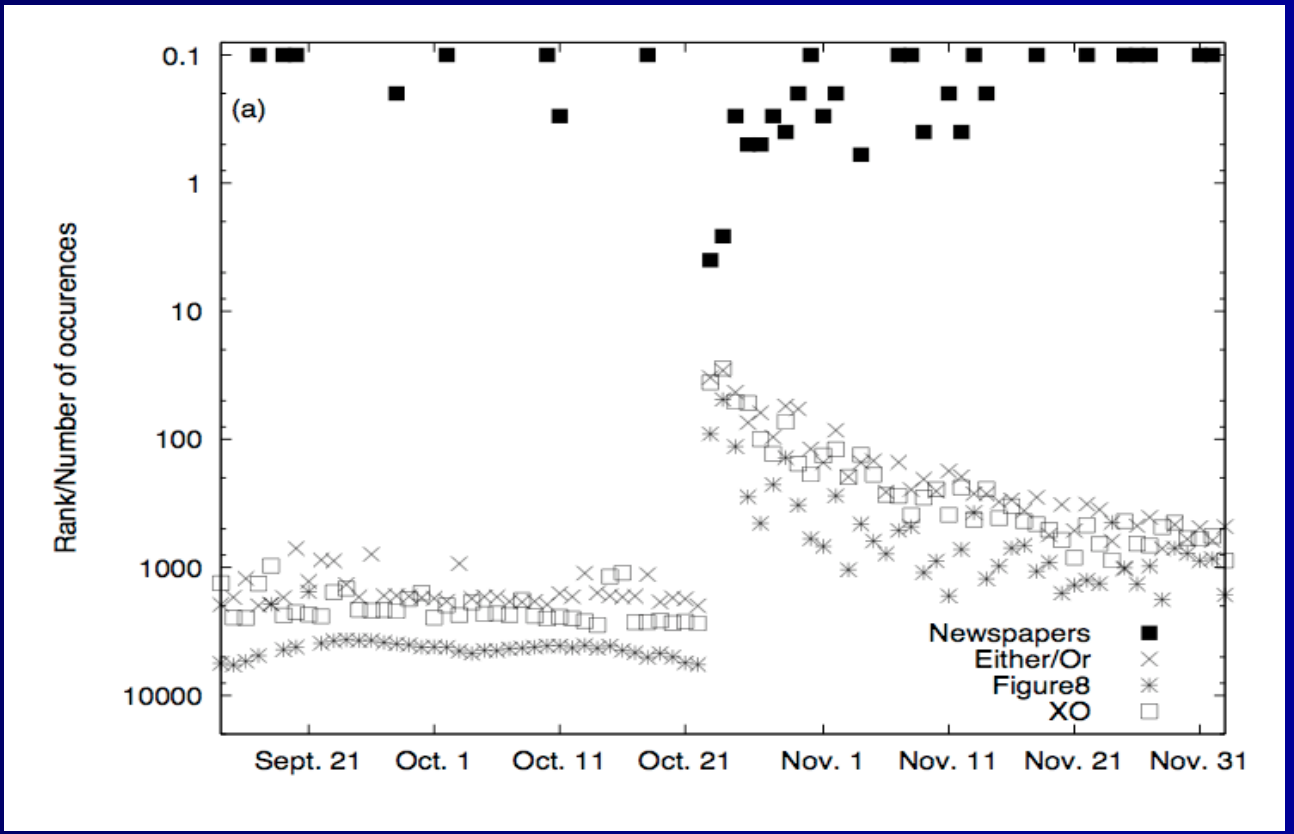


# « Ranking »


Angels and Demons
Rank
1
10
100
1000
10000
100000
Jan. 2003
Apr. 2003
Jul. 2003
Oct. 2003
Jan. 2004
Apr. 2003
Jul. 2003

# In music “sales”

Sales of 3 albums by Elliott Smith:
Figure 8 (2000), XO (1998) and Either/Or (1998)
=> Abrupt increase of sales, after his death (2002),
*followed by a slow relaxation*

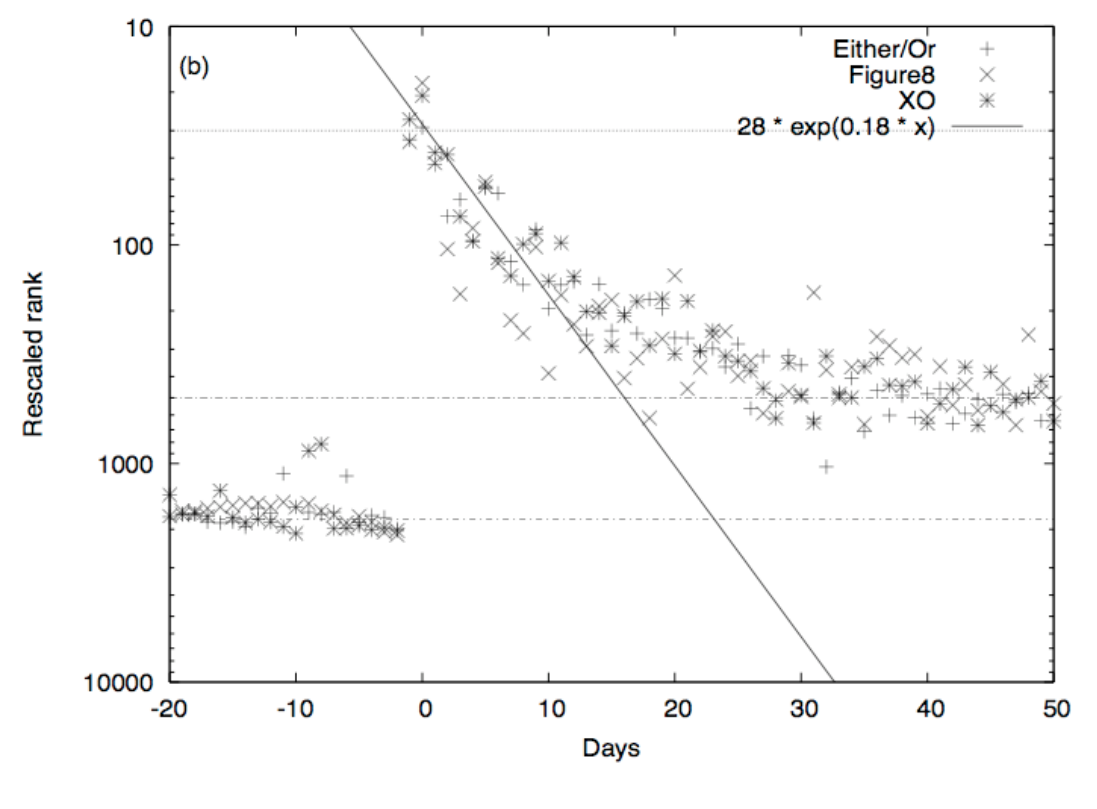


# In music sales

Rescaled ranks around the exogenous shock

$\Rightarrow$ Similar exponential relaxation

followed by a saturation toward a new stationary state

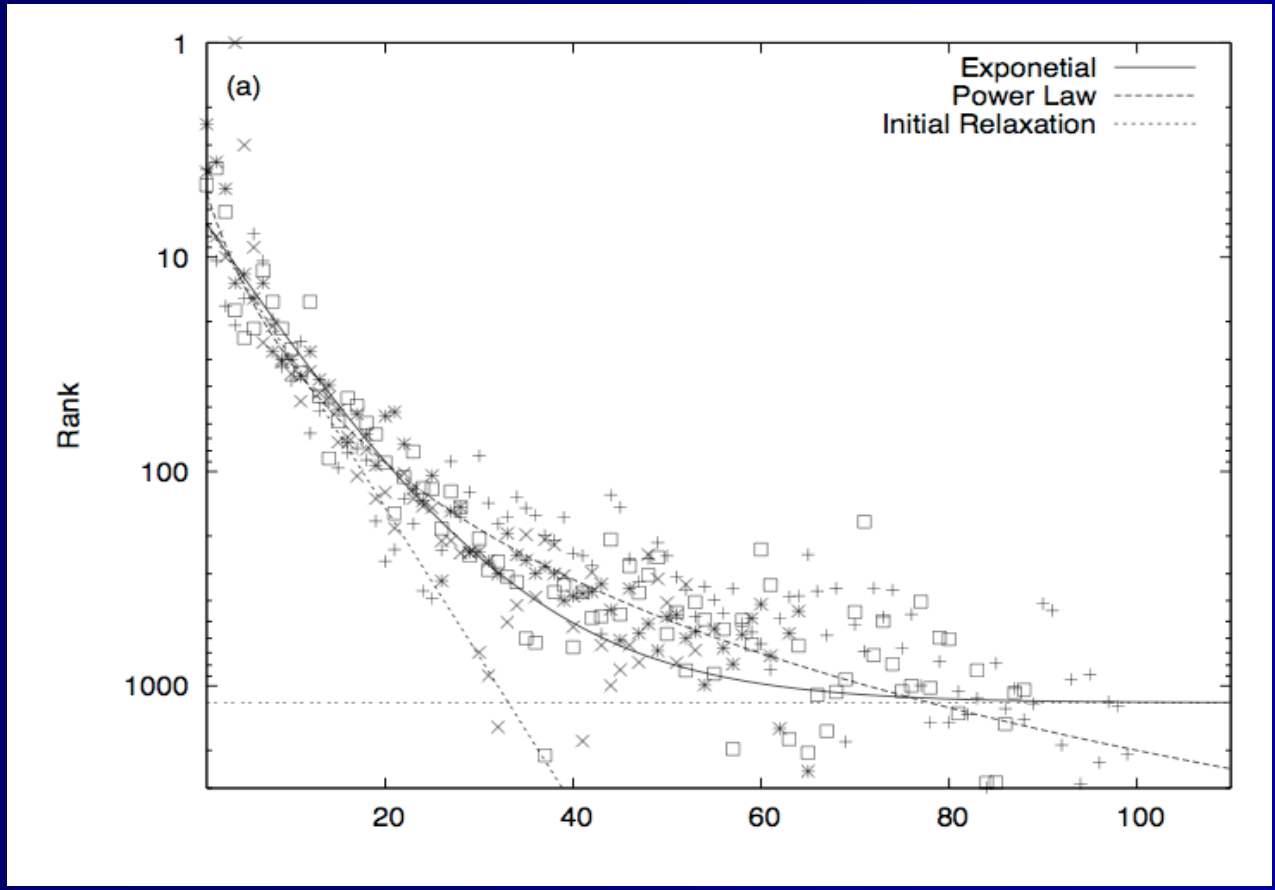



Elliott Smith

# In book “sales”

Response of one system to several ”equivalent” shocks

Jumps due to appearances at the Oprah Winfrey Show




Get with the program

# Theoretical description:

Sornette et al. (2004):
epidemic model with long time memory

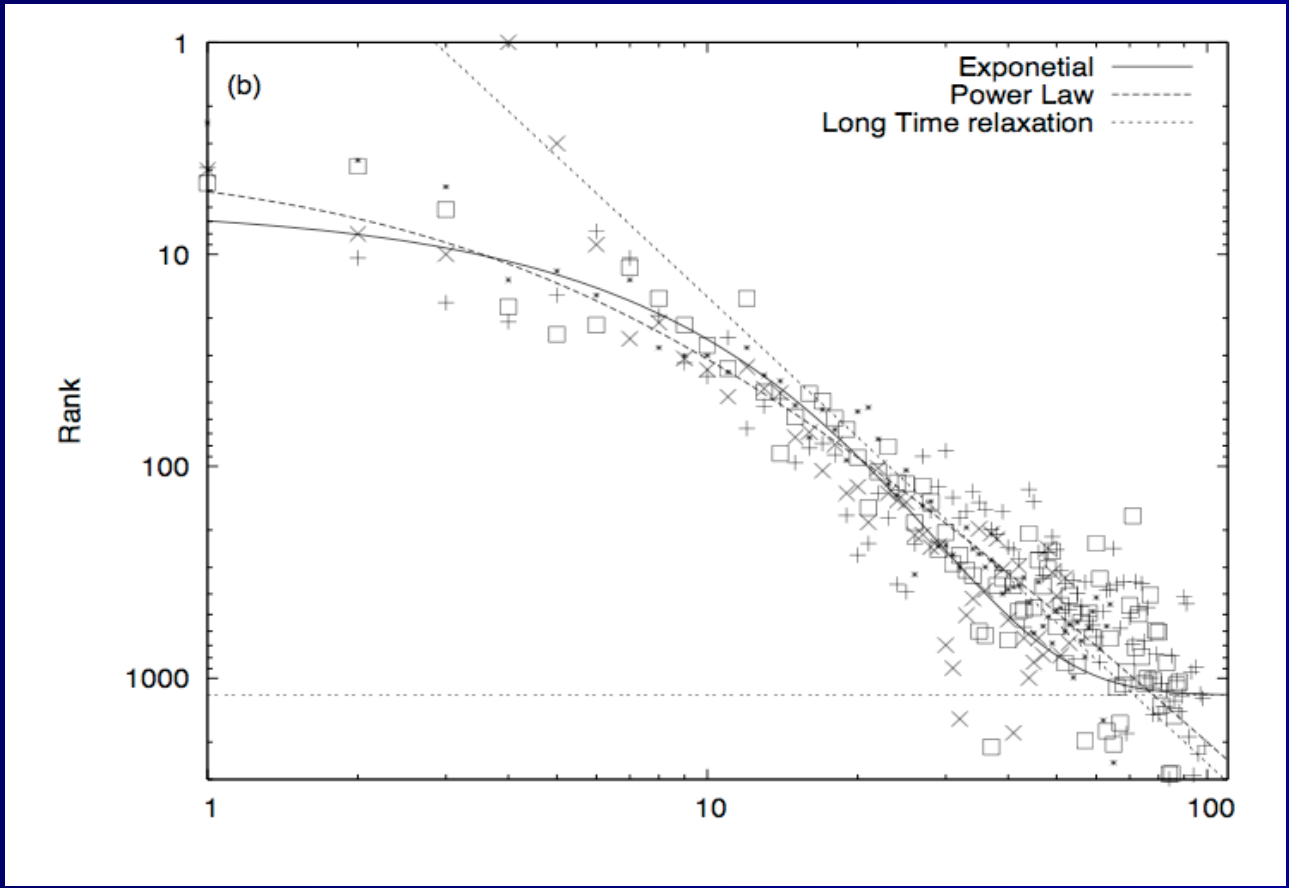
$$R \sim (t_C + t)^{\mu}$$

RL & MA (2005) :
exponential relaxation + saturation

$$R = (R_{\infty}^{-\frac{1}{2}} + (R_0^{-\frac{1}{2}} - R_{\infty}^{-\frac{1}{2}})e^{-\frac{\lambda}{2}t})^{-2}$$

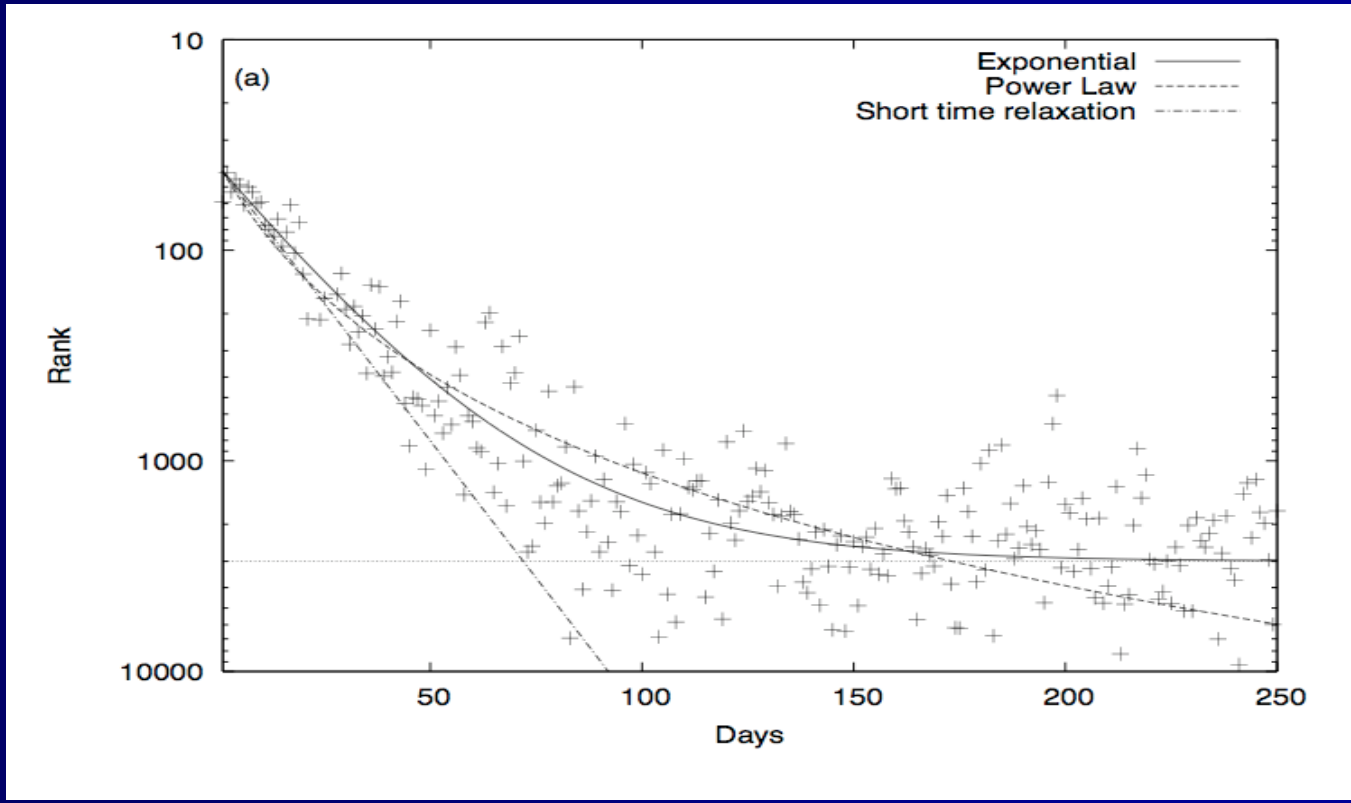
# In book sales

Over 100 days, it is difficult to discriminate between an exponential relaxation and a power-law.



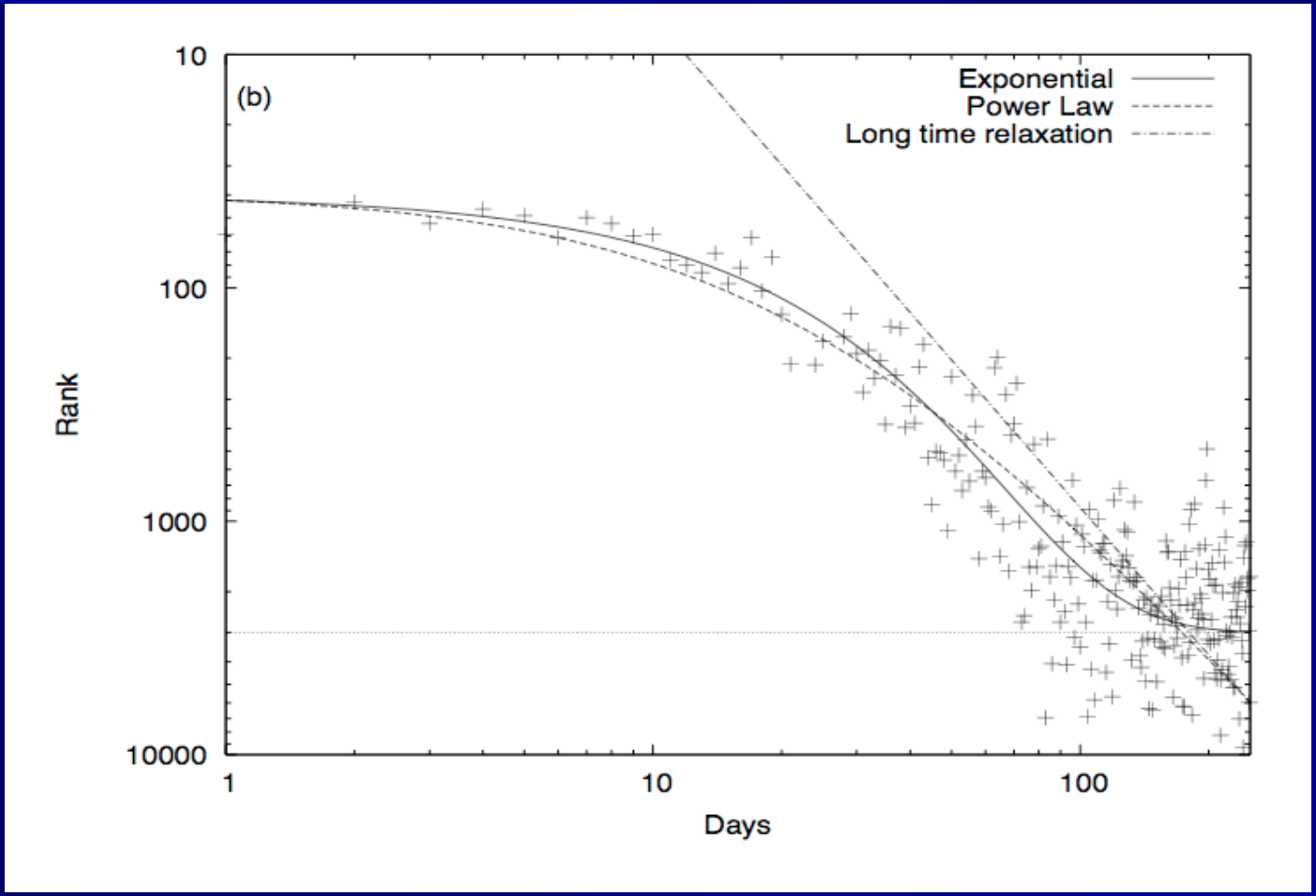
# In book sales

Focus on long(er) time relaxations :
Human and Earth by N. Roberts
Similar behaviour over 200 days.
Using the Sornette et al. description, unrealistically high value of $t_c = 25$ !!!



## but/and in log-log scales :

Human and Earth by N. Roberts



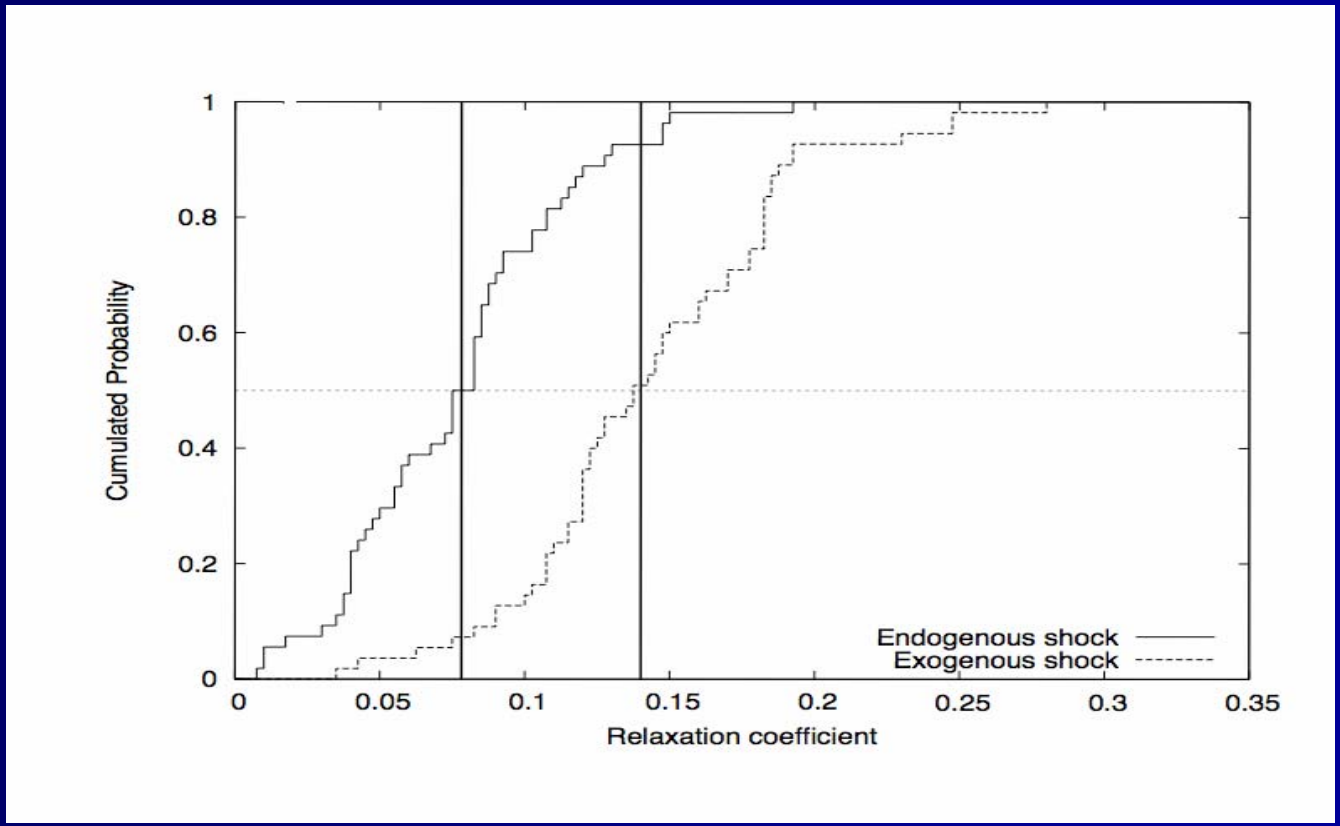
# Universal features

Sornette et al. show that
exo- and endo-genous relaxations differ
on the long time scale, i.e. different
exponents $\mu$ for the power-law relaxation

In contrast, we discriminate shocks
by their *short-time* behaviour : $\lambda$
…. the relaxation time seems to be
twice shorter
in exogenous shocks
than in endogenous ones.

# Universal features

Consider 111 shocks extracted from the *junglescan* data and visually discriminated by focusing on the pre-shock acceleration



# Risk features

***sale strategy !***

The difference between fiction and reality
is that fiction has to make sense.***Tom Clancy***

Isn't it interesting that the same people who laugh
at science fiction listen
to weather forecasts and economists?***Kelvin Throop III***

There are three kinds of lies:
Lies, Damn Lies, and Statistics.***Benjamin Disraeli***

There is no such thing as 'soft sell' and 'hard sell.'
There is only 'smart sell' and 'stupid sell.'***Charles Brower***

# Conclusions

- Empirical analysis of responses in sales shocks
- "Experimental" reproducibility suggests the existence of a well-defined *friction law*
- Endo- and Exo-genous shocks can be *discriminated by their short-time relaxation*