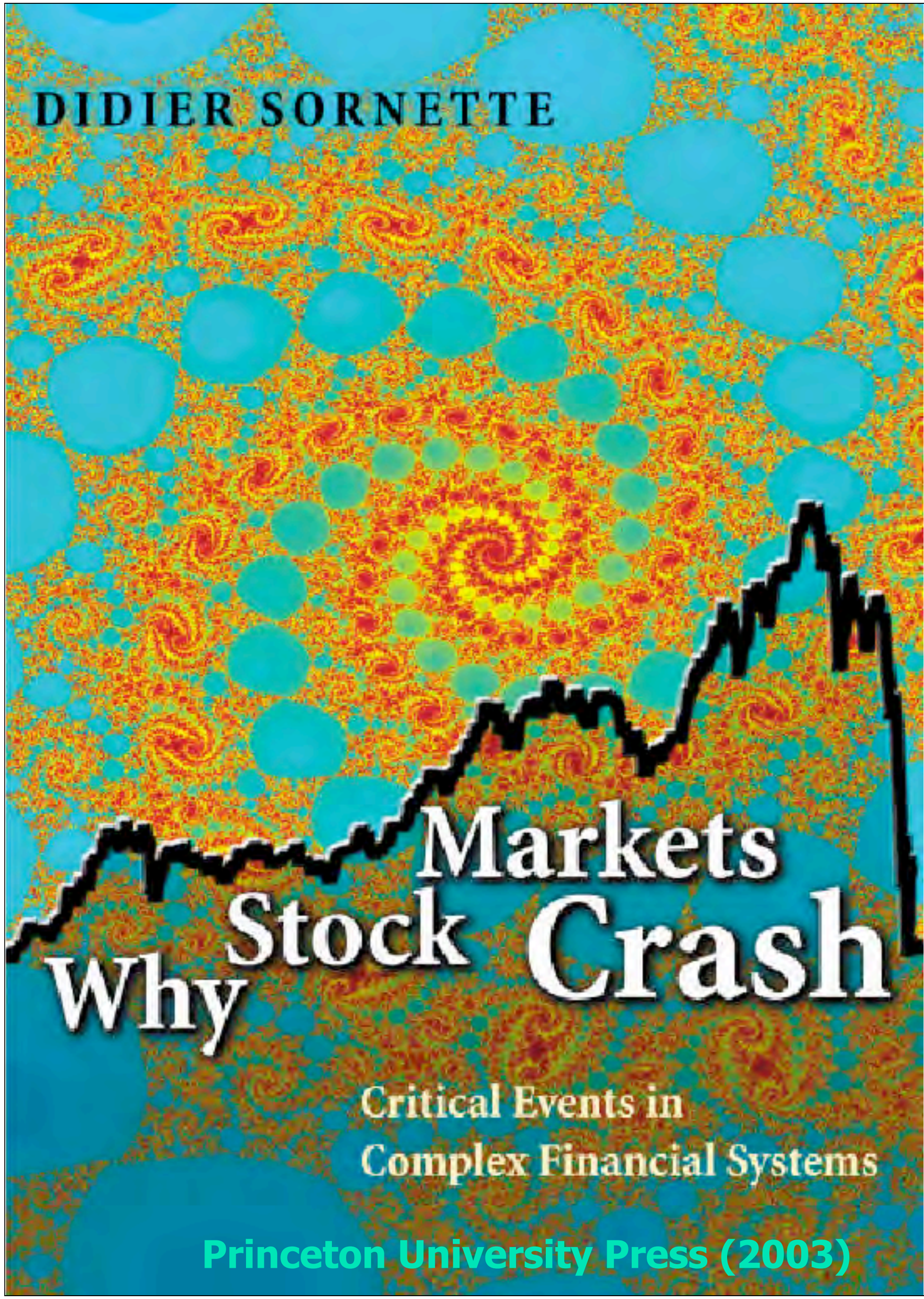

FINANCIAL CRISES SYSTEMIC RISKS

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W. Yan (ETH Zurich)

MOTIVATIONS

- Do excesses exist? Financial bubbles?
- Why are they so difficult to identify? (academic view vs. practitioners vs Fed)
- Real-estate bubble and MBS bubble
- Why are they dangerous? Systemic risks
- What can be done? Better metrics vs. moral hazard and herding

What are bubbles?
How do detect them?
How to predict them?

Academic Literature:

No consensus on what is a bubble...

Ex:
Refet S. Gürkaynak, Econometric Tests of Asset Price Bubbles: Taking Stock.

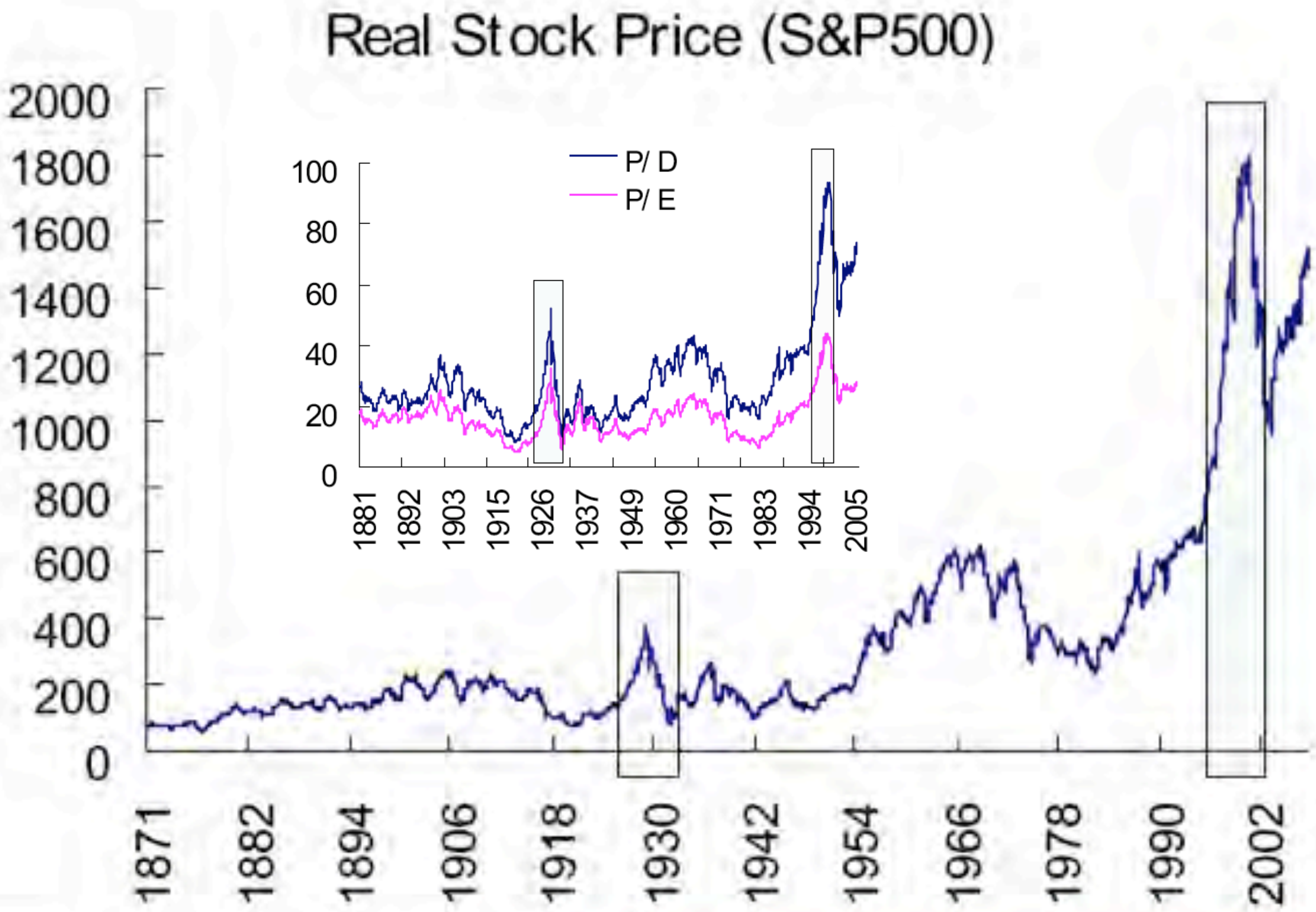
Can asset price bubbles be detected? This survey of econometric tests of asset price bubbles shows that, despite recent advances, econometric detection of asset price bubbles cannot be achieved with a satisfactory degree of certainty. For each paper that finds evidence of bubbles, there is another one that fits the data equally well without allowing for a bubble. We are still unable to distinguish bubbles from time-varying or regime-switching fundamentals, while many small sample econometrics problems of bubble tests remain unresolved.

Journal of Economic Surveys (2008)

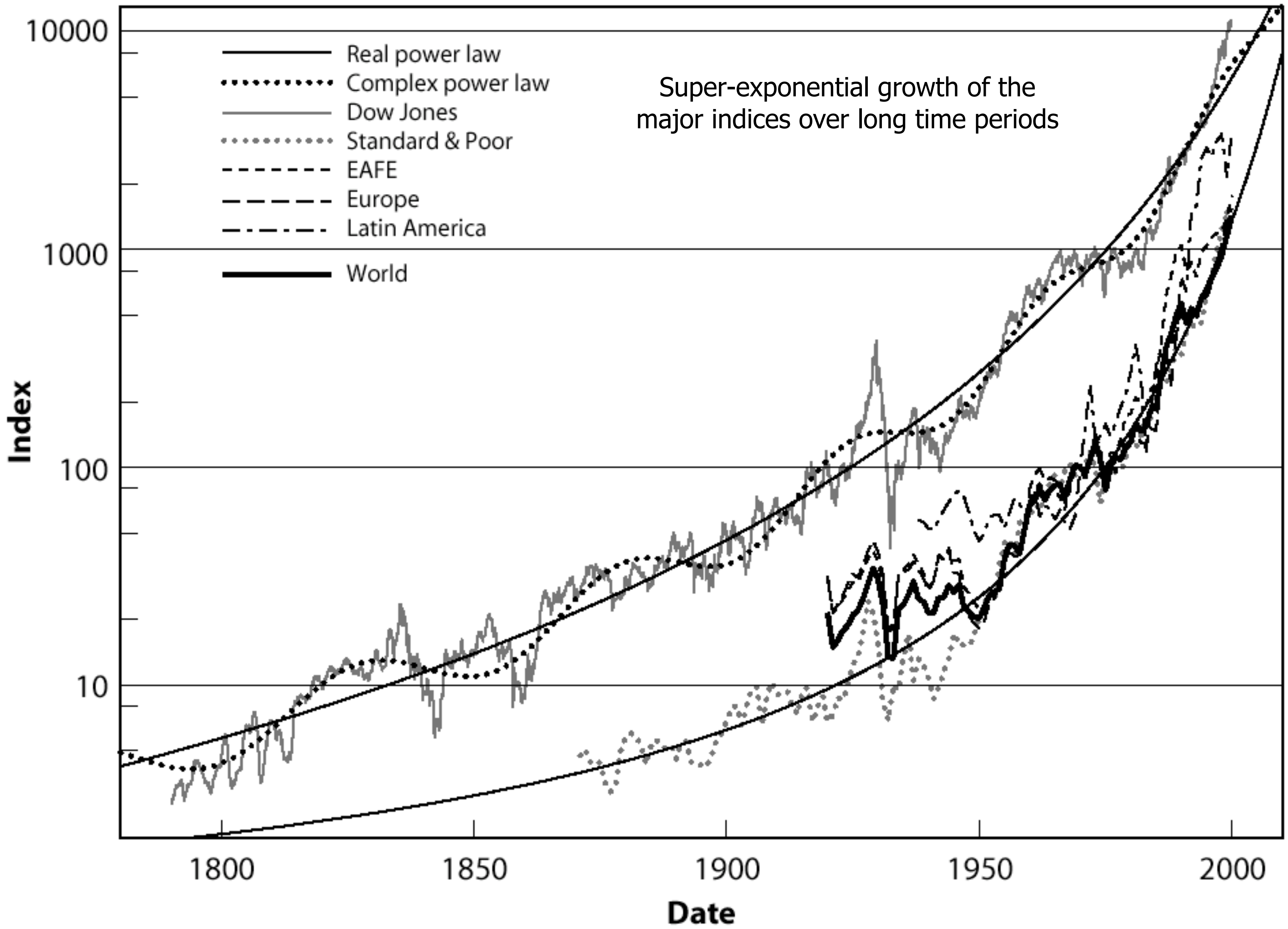
The Fed: A. Greenspan (Aug., 30, 2002):

"We, at the Federal Reserve…recognized that, despite our suspicions, it was very difficult to definitively identify a bubble until after the fact, that is, when its bursting confirmed its existence… Moreover, it was far from obvious that bubbles, even if identified early, could be preempted short of the Central Bank inducing a substantial contraction in economic activity, the very outcome we would be seeking to avoid."

An Overview of Speculative Bubbles and Market Crashes



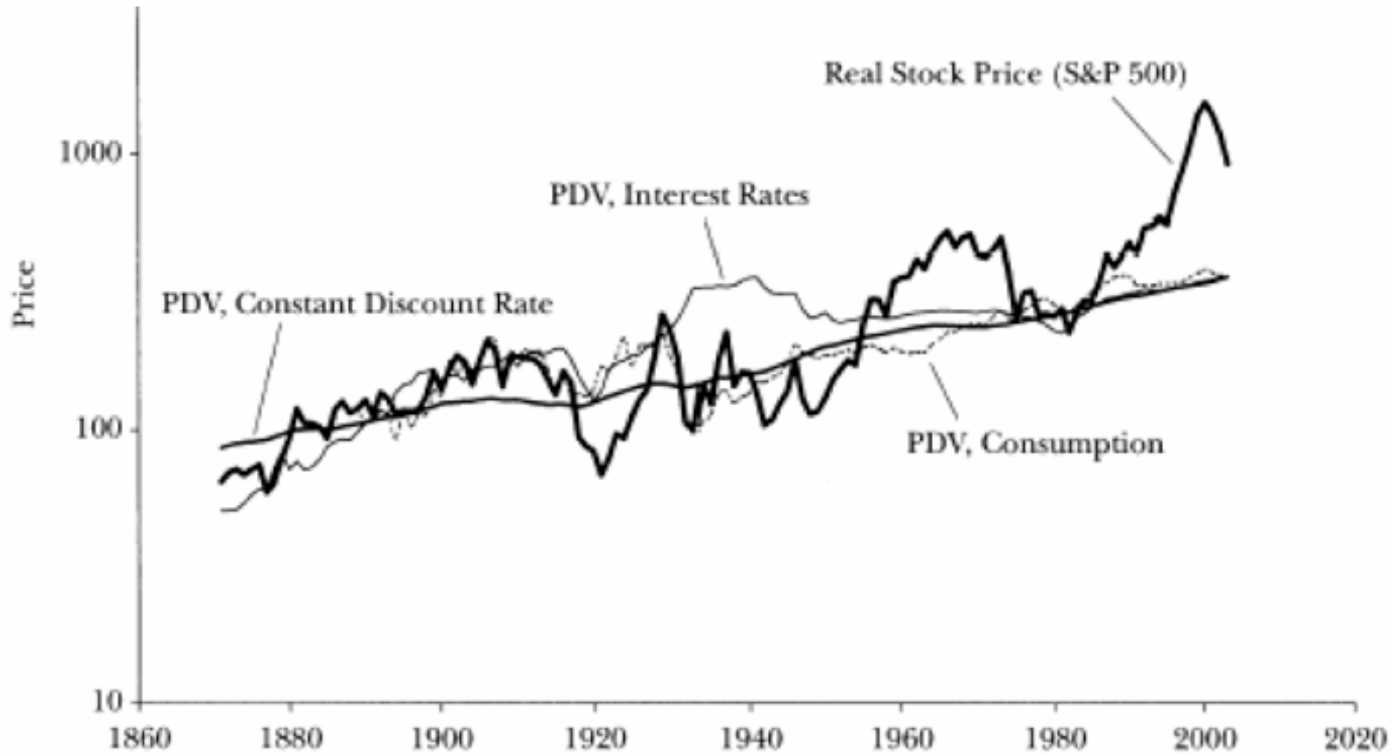
Source: Robert Shiller's webpage, http://www.econ.yale.edu/~shiller/data.htm



10000
1000
100
10
Index
1800
1850
1900
1950
2000
Date
Real power law
Complex power law
Dow Jones
Standard & Poor
EAFE
Europe
Latin America
World
Super-exponential growth of the
major indices over long time periods

Does Stock Price Move Too Much ?

Real Stock Prices and Present Values of Subsequent Real Dividends
(*annual data*)



Notes: The heaviest line is the Standard & Poor 500 Index for January of year shown. The less-heavy line is the present value for each year of subsequent real dividends accruing to the index discounted by the geometric-average real return for the entire sample, 6.61 percent. Dividends after 2002 were

Robert J. Shiller (2003): From Efficient Markets Theory to Behavioral Finance, The Journal of Economic Perspectives, Vol. 17, No. 1., pp. 83-104.

THE CRASH OF OCTOBER 1987

Proximate explanations after the fact!

Computer trading

Derivatives

Illiquidity

Trade and budget deficits

Over-valuation

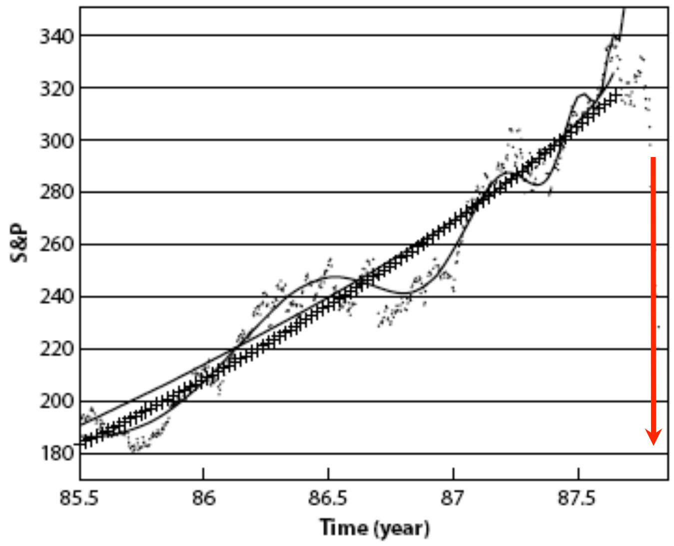
The auction system

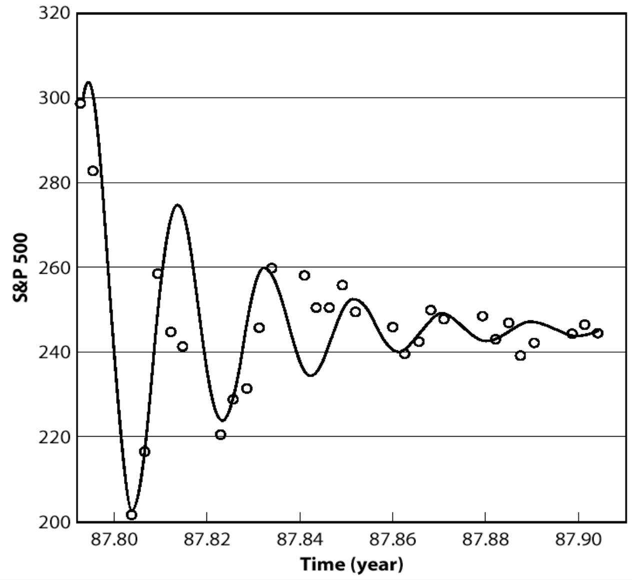
Off-market and off-hours trading

Floor brokers

Forward market effect

Different investor styles

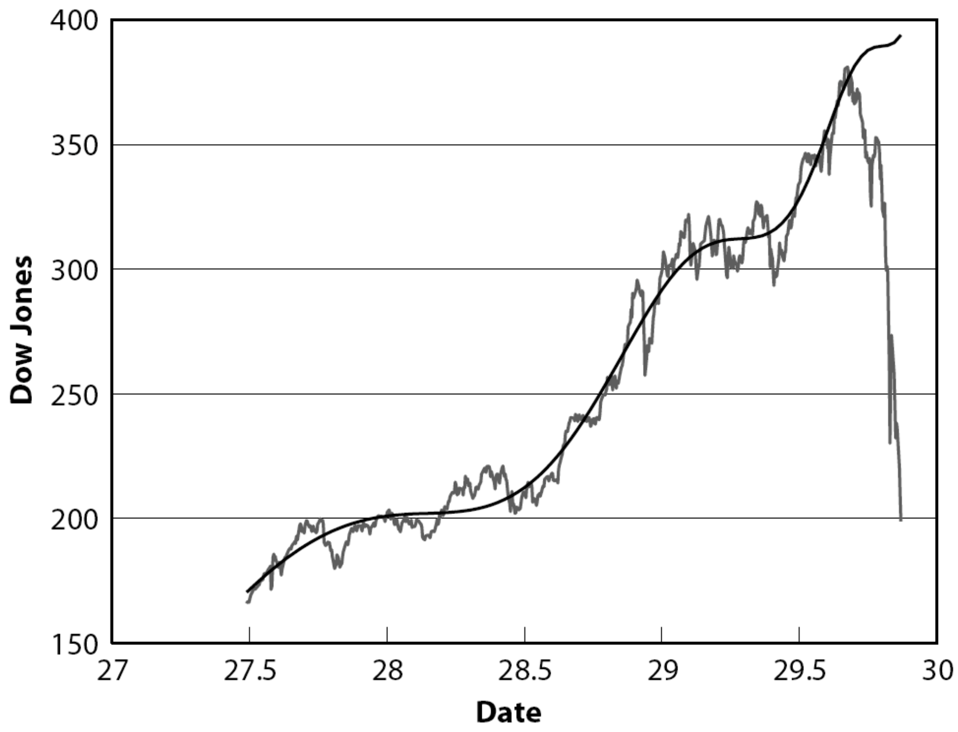




THE CRASH OF OCTOBER 1929

Stock market crashes are often unforeseen for most people, especially economists. "In a few months, I expect to see the stock market much higher than today." Irving Fisher, famous economist and professor of economics at Yale University,14 days before Wall Street crashed on Black Tuesday, October 29, 1929.

"A severe depression such as 1920–21 is outside the range of probability. We are not facing a protracted liquidation." This was the analysis offered days after the crash by the Harvard Economic Society to its subscribers… It closed its doors in 1932.

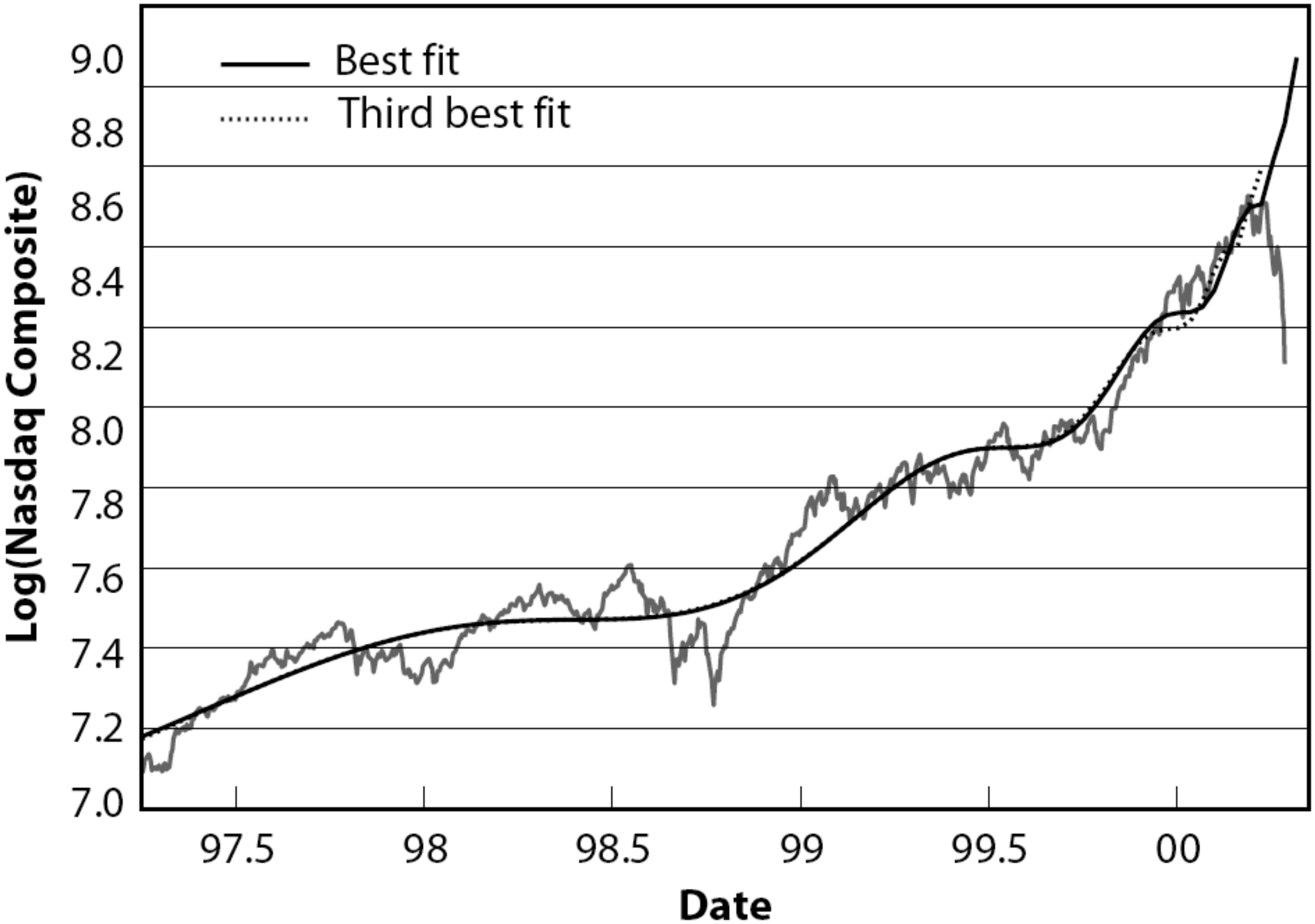


The DJIA prior to the October 1929 crash on Wall Street.

"New Economy": utilities

THE NASDAQ CRASH OF APRIL 2000

"New Economy": ICT



THE NASDAQ CRASH OF APRIL 2000

•1995-2000: growing divergence between New Economy and Old Economy stocks, between technology and almost everything else.

•Over 1998 and 1999, stocks in the Standard & Poor's technology sector rose nearly fourfold, while the S&P 500 index gained just 50%. And without technology, the benchmark would be flat.

•In January 2000 alone, 30% of net inflows into mutual funds went to science and technology funds, versus just 8.7% into S&P 500 index funds.

•The average price-over-earnings ratio (P/E) for Nasdaq companies was above 200.

•New Economy was also hot in the minds and mouths of investors in the 1920s and in the early 1960s. In 1929, it was utilities; in 1962, it was the electronic sector.

EXPECTATIONS of strong future growth

•better business models (small required capital, reduced delay in payments…)

•the network effect (positive returns and positive feedbacks)

•first-to-scale advantages

•real options (value of fast adaptation to grasp new opportunities)

Probably true… but problem of timing…

Foreign capital inflow

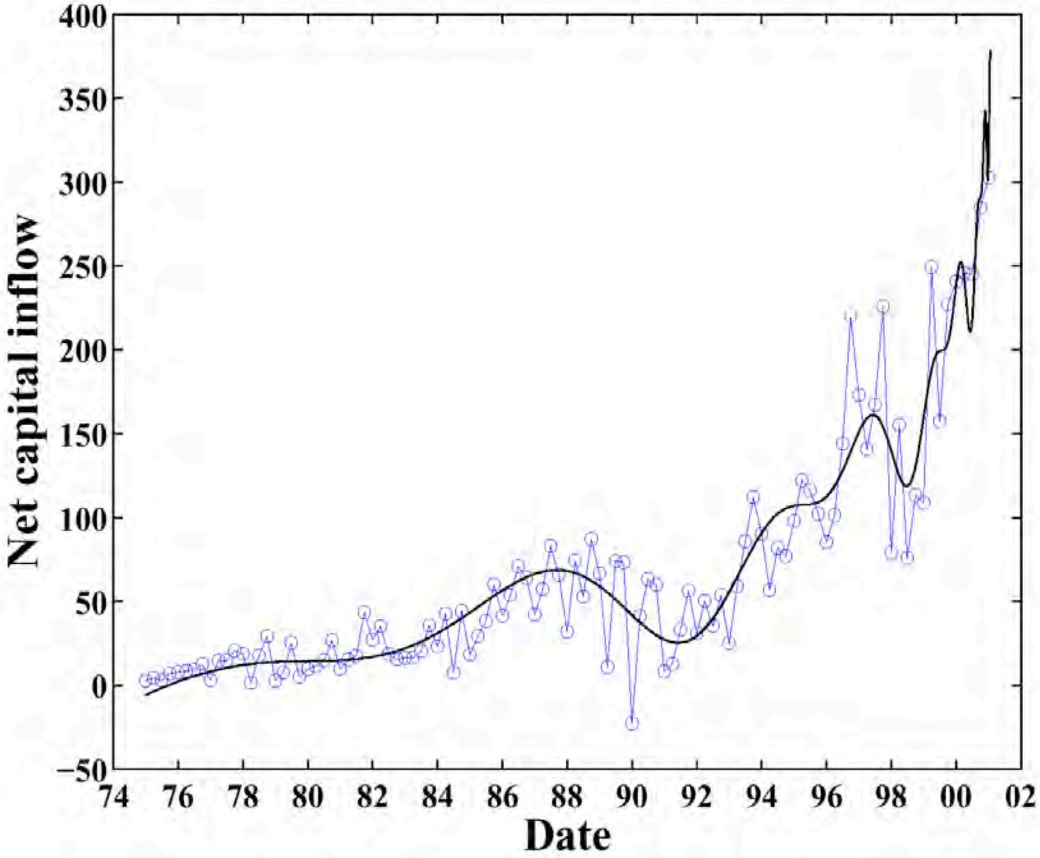
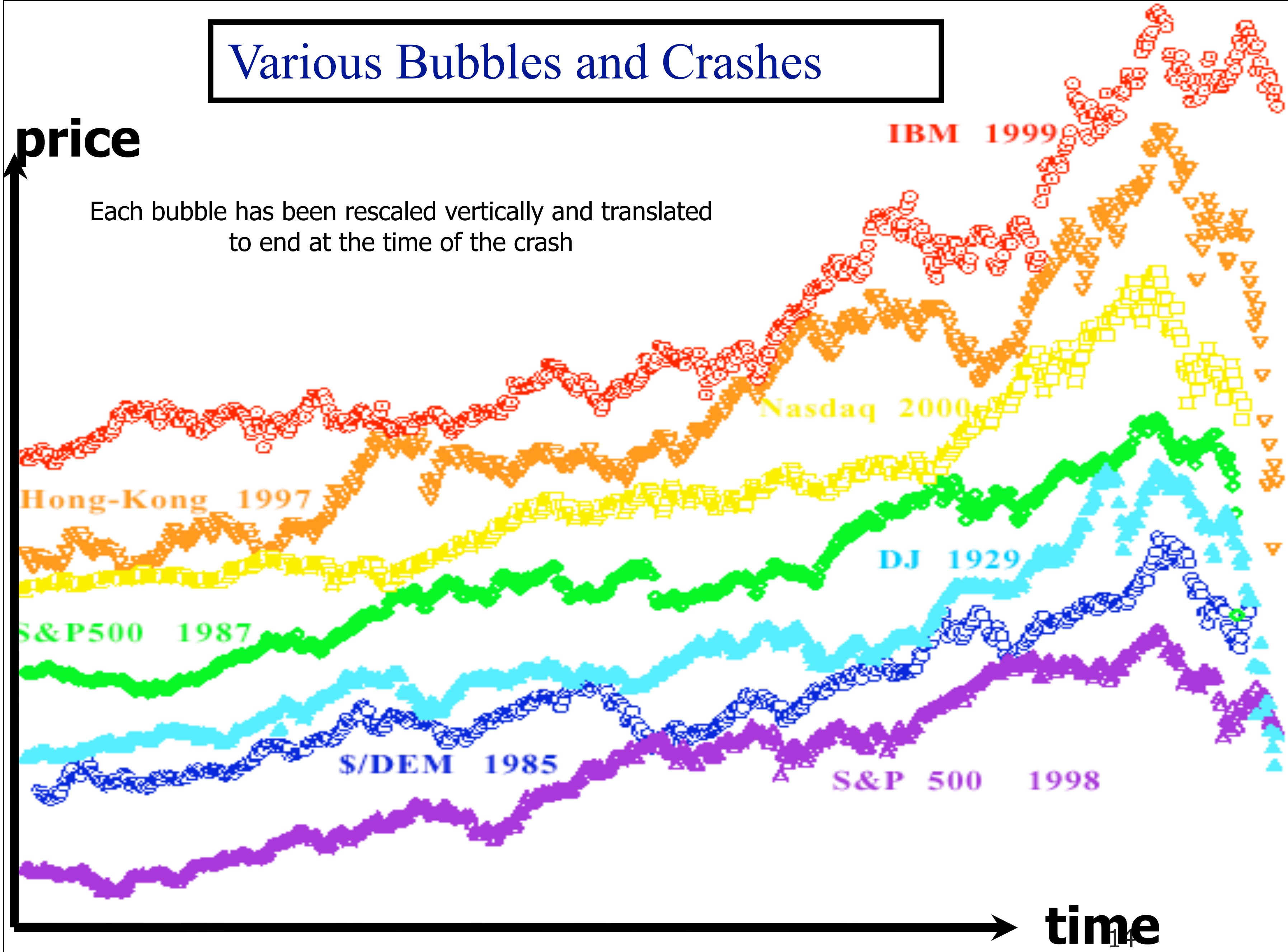


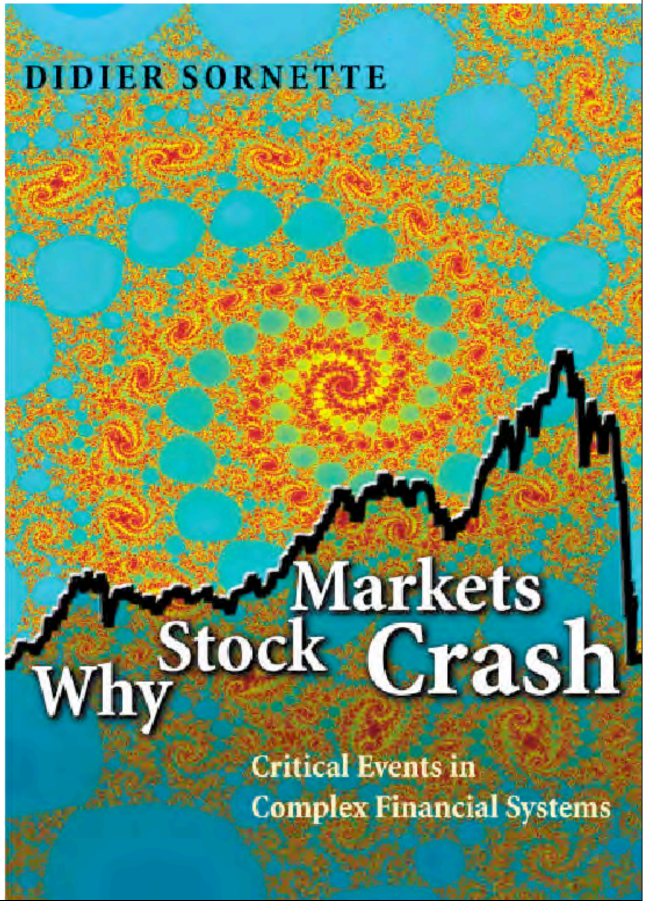
Fig. 2. Fit of the time evolution of the foreign net capital inflow $I(t)$ in the USA from 1975 till the first quarter of 2001 when it reached its maximum, by a second-order Weierstrass-type function given by expression (1). The predicted critical time is $t_c = 2001/03/12$, the power-law exponent is $m = 0.01$, and the angular log-frequency is $\omega = 4.9$. The fitted linear parameters are $A = 7355$, $B = -6719$, $C_1 = 21.5$ and $C_2 = 16.2$. The r.m.s. of the residuals of the fit is 22.810.

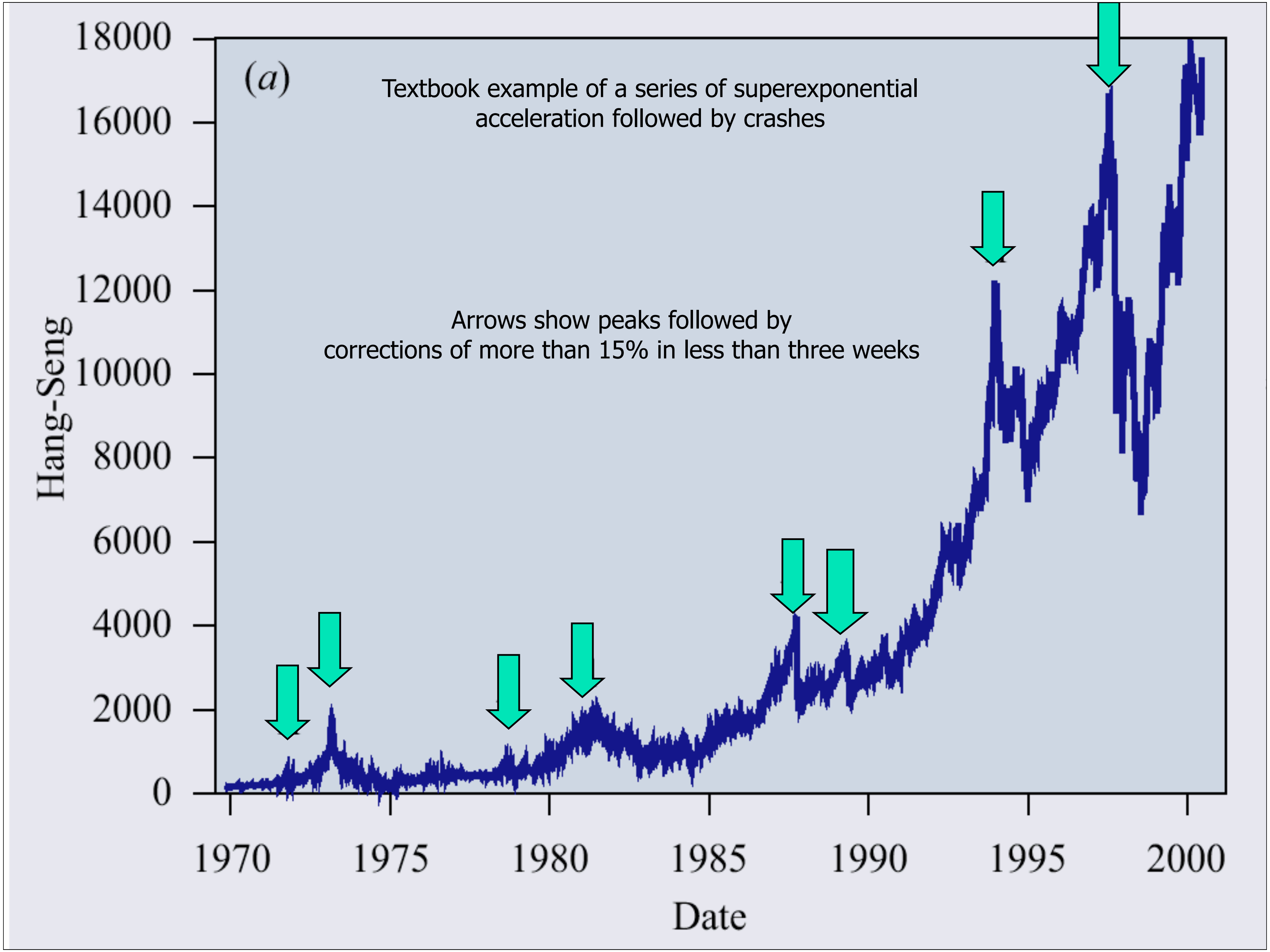
Various Bubbles and Crashes

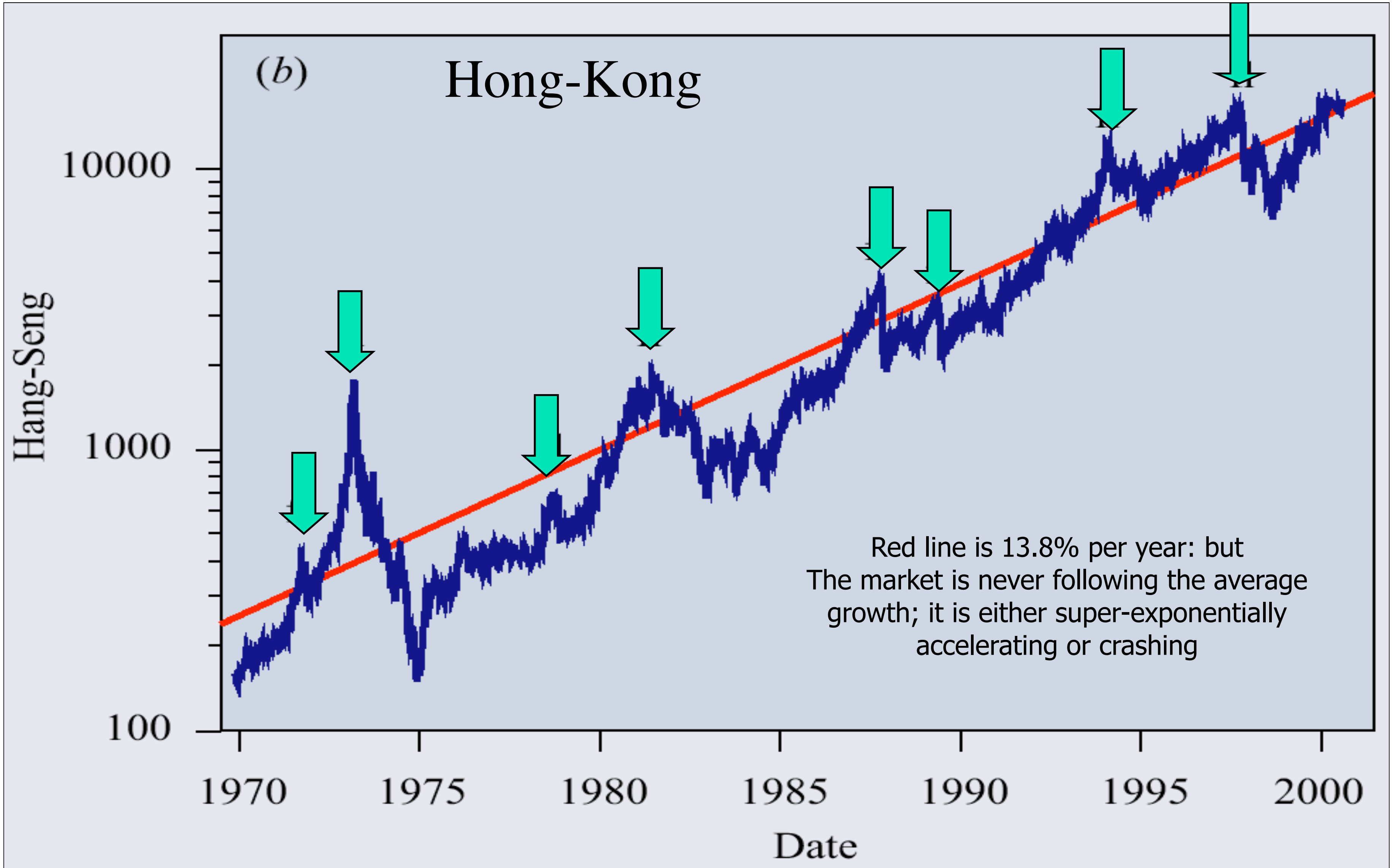


Many other bubbles and crashes

- Hong-Kong crashes: 1987, 1994, 1997 and many others
- October 1997 mini-crash
- August 1998
- Slow crash of spring 1962
- Latin-american crashes
- Asian market crashes
- Russian crashes
- Individual companies




(a)
Textbook example of a series of superexponential acceleration followed by crashes
Arrows show peaks followed by corrections of more than 15% in less than three weeks
Hang-Seng
18000
16000
14000
12000
10000
8000
6000
4000
2000
0
1970
1975
1980
1985
1990
1995
2000
Date



Patterns of price trajectory during 0.5-1 year before each peak: Log-periodic power law

Universal Bubble and Crash Scenario

1. The bubble starts smoothly with some increasing production and sales (or demand for some commodity) in an otherwise relatively optimistic market.

2. The attraction to investments with good potential gains then leads to increasing investments, possibly with leverage coming from novel sources, often from international investors. This leads to price appreciation.

3. This in turn attracts less sophisticated investors and, in addition, leveraging is further developed with small downpayment (small margins), which leads to the demand for stock rising faster than the rate at which real money is put in the market.

4. At this stage, the behavior of the market becomes weakly coupled or practically uncoupled from real wealth (industrial and service) production.

5. As the price skyrockets, the number of new investors entering the speculative market decreases and the market enters a phase of larger nervousness, until a point when the instability is revealed and the market collapses.

The upswing usually starts with an opportunity - new markets, new technologies or some dramatic political change - and investors looking for good returns.

· It proceeds through the euphoria of rising prices, particularly of assets, while an expansion of credit inflates the bubble.

· In the manic phase, investors scramble to get out of money and into illiquid things such as stocks, commodities, real estate or tulip bulbs: 'a larger and larger group of people seeks to become rich without a real understanding of the processes involved'.

· Ultimately, the markets stop rising and people who have borrowed heavily find themselves overstretched. This is 'distress', which generates unexpected failures, followed by 'revulsion' or 'discredit'.

· The final phase is a self-feeding panic, where the bubble bursts. People of wealth and credit scramble to unload whatever they have bought at greater and greater losses, and cash becomes king.

Charles Kindleberger, Manias, Panics and Crashes (1978)

- Do excesses exist? Financial bubbles?
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What is the cause of the crash?

- ✓ Proximate causes: many possibilities

- ✓ Fundamental cause: maturation towards an instability

An instability is characterized by

- large or diverging susceptibility to external perturbations or influences
- exponential growth of random perturbations leading to a change of regime, or selection of a new attractor of the dynamics.

Thomas Robert Malthus (1766–1834)

1798

autocatalitic proliferation: $\frac{dx}{dt} = a \cdot x$

with a **=birth rate - death rate**

exponential solution: $X(t) = X(0)e^{a\,t}$

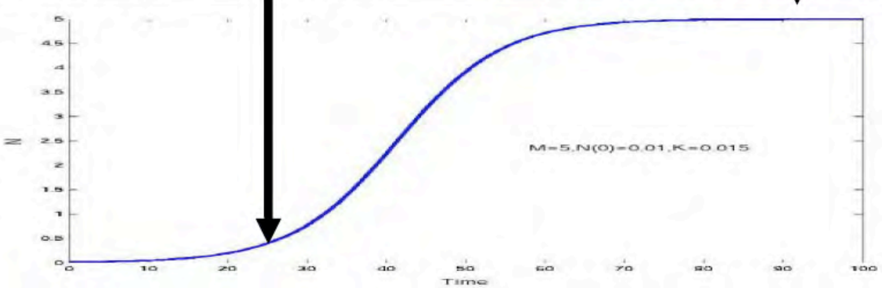
contemporary estimations= doubling of the population every 30yrs

Pierre François Verhulst (1804-1849)

way out exponential explosion:

$dX/dt = a\,X - c\,X^2$ **1838**

Solution: exponential ==========→saturation at X= a / c



Standard price dynamics: exponential growth

For humans data at the time could not discriminate between:

1. exponential growth of Malthus
2. logistic growth of Verhulst

But data fit on animal population: sheep in Tasmania

- exponential in the first 20 years after their introduction and completely saturated after about half a century. ==> Verhulst

Positive feedbacks and finite-time singularity

Super-exponential growth

Conjecture: Many systems exhibit transient FTS as "ghost-like" solutions that the system follows for a while before being attenuated.

Analogous to exponential sensitivity to initial condition with reinjection → chaos **but** here FTS blow-up.

$$\frac{dp}{dt} = rp(t)[K - p(t)]$$

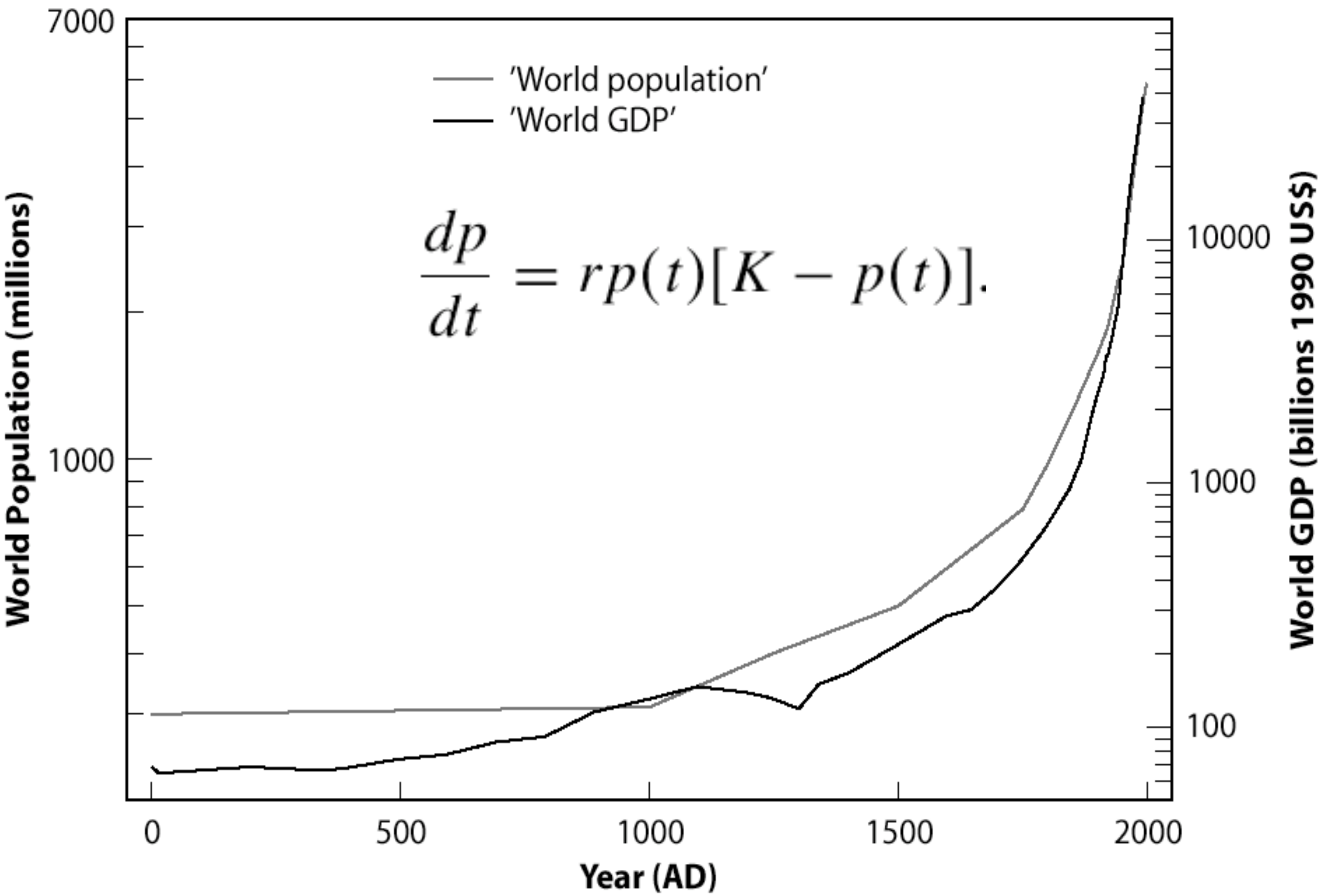
$$\frac{dp}{dt} = r[p(t)]^{1+\delta}$$

with $K \propto p^{\delta}$

$$p(t) \propto (t_c - t)^z, \text{ with } z = -\frac{1}{\delta} \text{ and } t \text{ close to } t_c.$$

Multi-dimensional generalization: multi-variate positive feedbacks

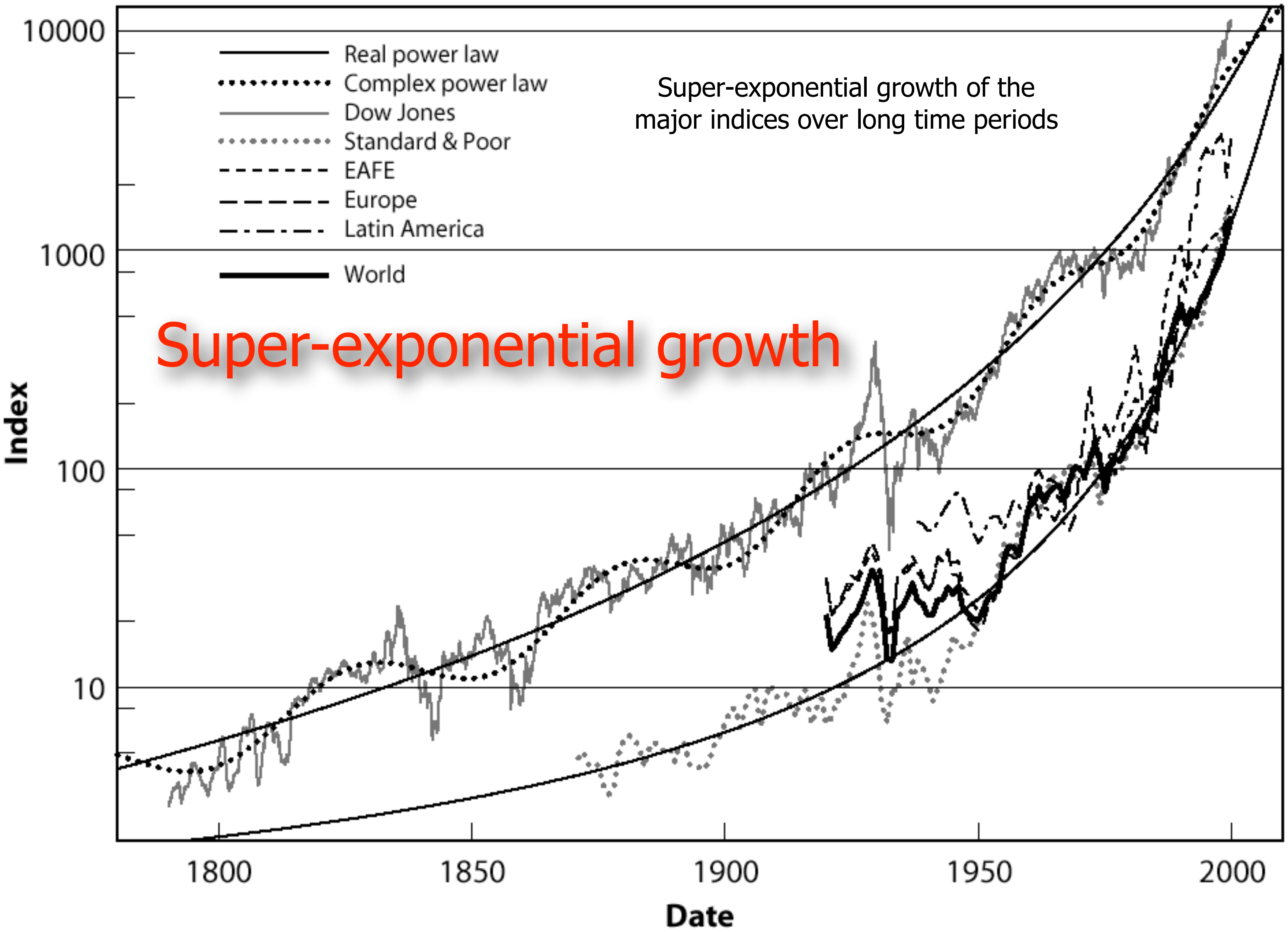
Super-exponential growth



Mechanisms for positive feedbacks in the stock market

- Technical and rational mechanisms
  1. Option hedging
  2. Insurance portfolio strategies
  3. Trend following investment strategies
  4. Asymmetric information on hedging strategies

- Behavioral mechanisms:
  1. Breakdown of "psychological Galilean invariance"
  2. Imitation(many persons)
     a) It is rational to imitate
     b) It is the highest cognitive task to imitate
     c) We mostly learn by imitation
     d) The concept of "CONVENTION" (Orléan)



10000
1000
100
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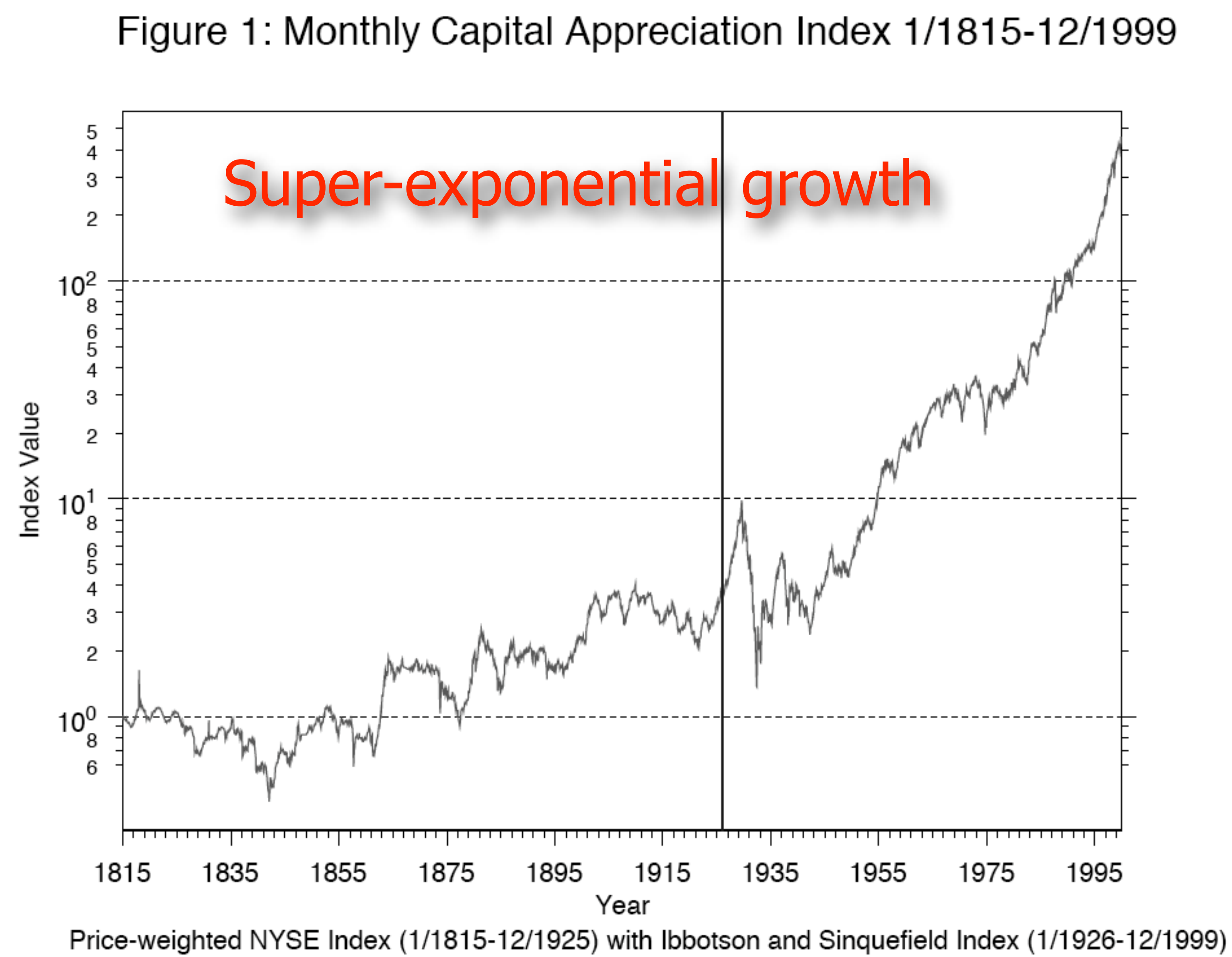
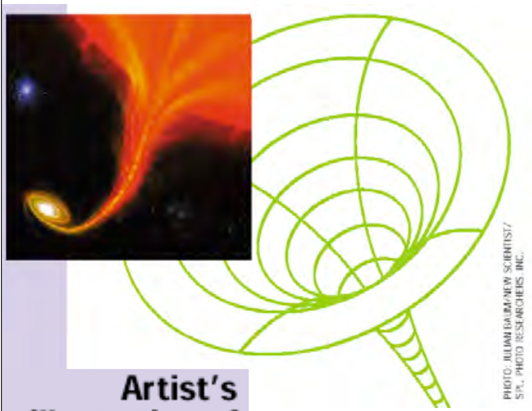
Index
Real power law
Complex power law
Dow Jones
Standard & Poor
EAFE
Europe
Latin America
World
Super-exponential growth of the
major indices over long time periods
Super-exponential growth
1800
1850
1900
1950
2000
Date



A NEW HISTORICAL DATABASE FOR THE NYSE 1815 TO 1925: PERFORMANCE AND PREDICTABILITY

W.N. Goetzmann, R.G. Ibbotson and L. Peng
Yale School of Management, July 14, 2000

Finite-time Singularity



Artist's illustration of matter from a red giant star being pulled toward a black hole.

- Planet formation in solar system by run-away accretion of planetesimals
- PDE's: Euler equations of inviscid fluids and relationship with turbulence
- PDE's of General Relativity coupled to a mass field leading to the formation of black holes
- Zakharov-equation of beam-driven Langmuir turbulence in plasma
- rupture and material failure
- Earthquakes (ex: slip-velocity Ruina-Dieterich friction law and accelerating creep)
- Models of micro-organisms chemotaxis, aggregating to form fruiting bodies
- Surface instability spikes (Mullins-Sekerka), jets from a singular surface, fluid drop snap-off
- Euler's disk (rotating coin)
- Stock market crashes...

- Do excesses exist? Financial bubbles?
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Endogenous versus exogenous origins of financial bubbles and crashes

Georges Harras & Didier Sornette

Short random runs of news can be amplified into bubbles by herding optimizing traders

http://arXiv.org/abs/0806.2989

http://papers.ssrn.com/sol3/papers.cfm?abstract_id=1156348

Opinion formation

$$opinion_i(t) = c_{1i} \cdot \sum_{j=1}^{J} k_{ij} E_i[s_j(t)] + c_{2i} \cdot u(t) \cdot news(t) + c_{3i} \cdot \epsilon_i(t)$$

imitation term — news term — idiosyncratic term

Trading decision

- if $\text{opinion}_i(t) > |\text{opinion-th}_i|$: $s_i(t) = +1$, $a_i(t) = g \cdot \frac{cash_i(t)}{price(t-1)}$
- if $\text{opinion}_i(t) < -|\text{opinion-th}_i|$: $s_i(t) = -1$, $a_i(t) = g \cdot stocks_i(t)$,

Learning and adaptation

$$k_{ij}(t) = \alpha \cdot k_{ij}(t-1) + r(t-1) \cdot E_i[s_j(t-2)] \cdot \frac{1-\alpha}{\sigma_r}$$

past news performance

$$u(t) = \alpha \cdot u(t-1) + r(t-1) \cdot news(t-2) \cdot \frac{1-\alpha^r}{\sigma_r}$$

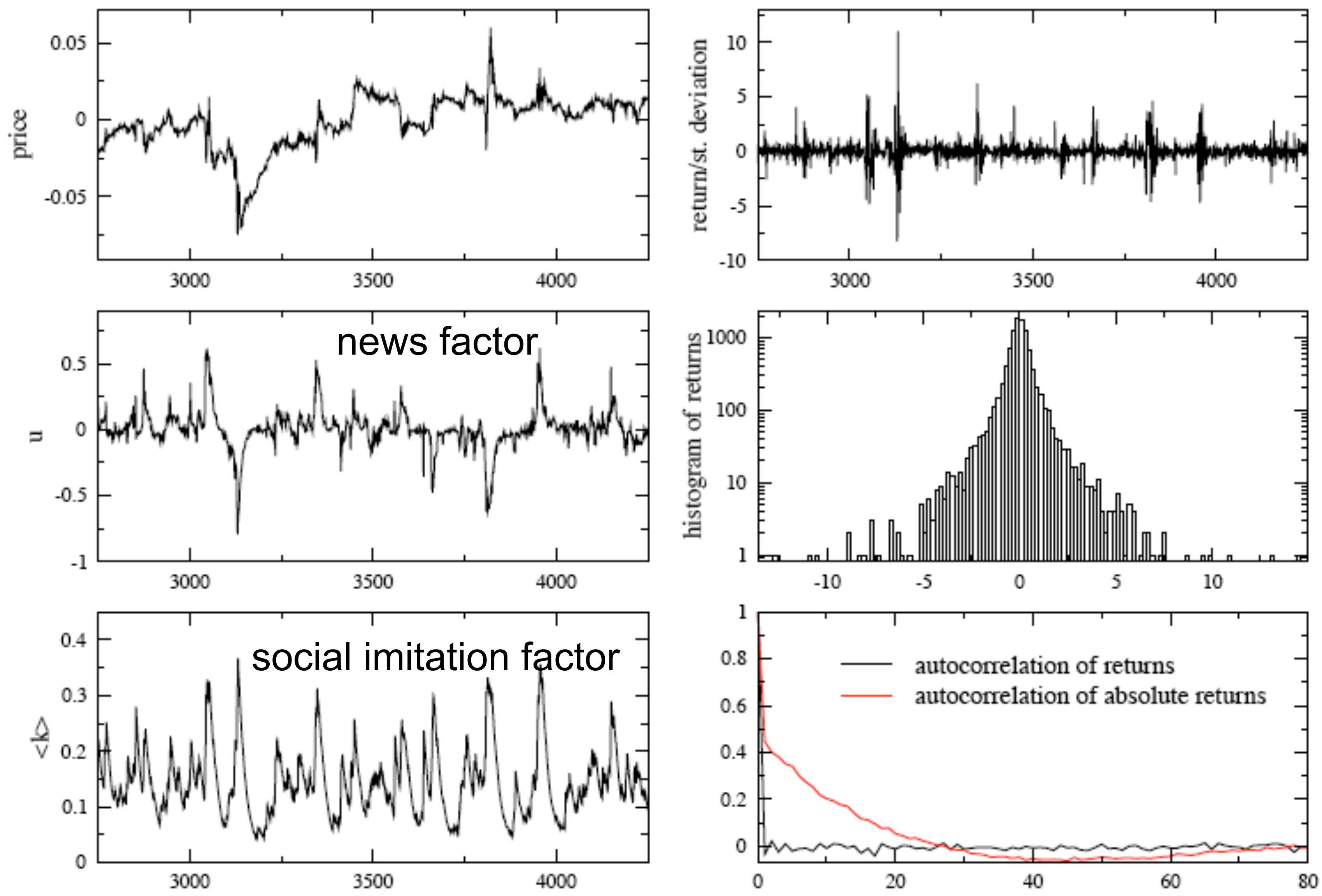
past neighbor *j* performance

Price clearing condition

$$
\begin{aligned}
r(t) &= \frac{1}{\lambda \cdot N} \sum_{i=1}^{N} s_i(t) \cdot a_i(t) \\
\log\left[\text{price}(t)\right] &= \log\left[\text{price}(t-1)\right] + r(t),
\end{aligned}
$$

Wealth evolution

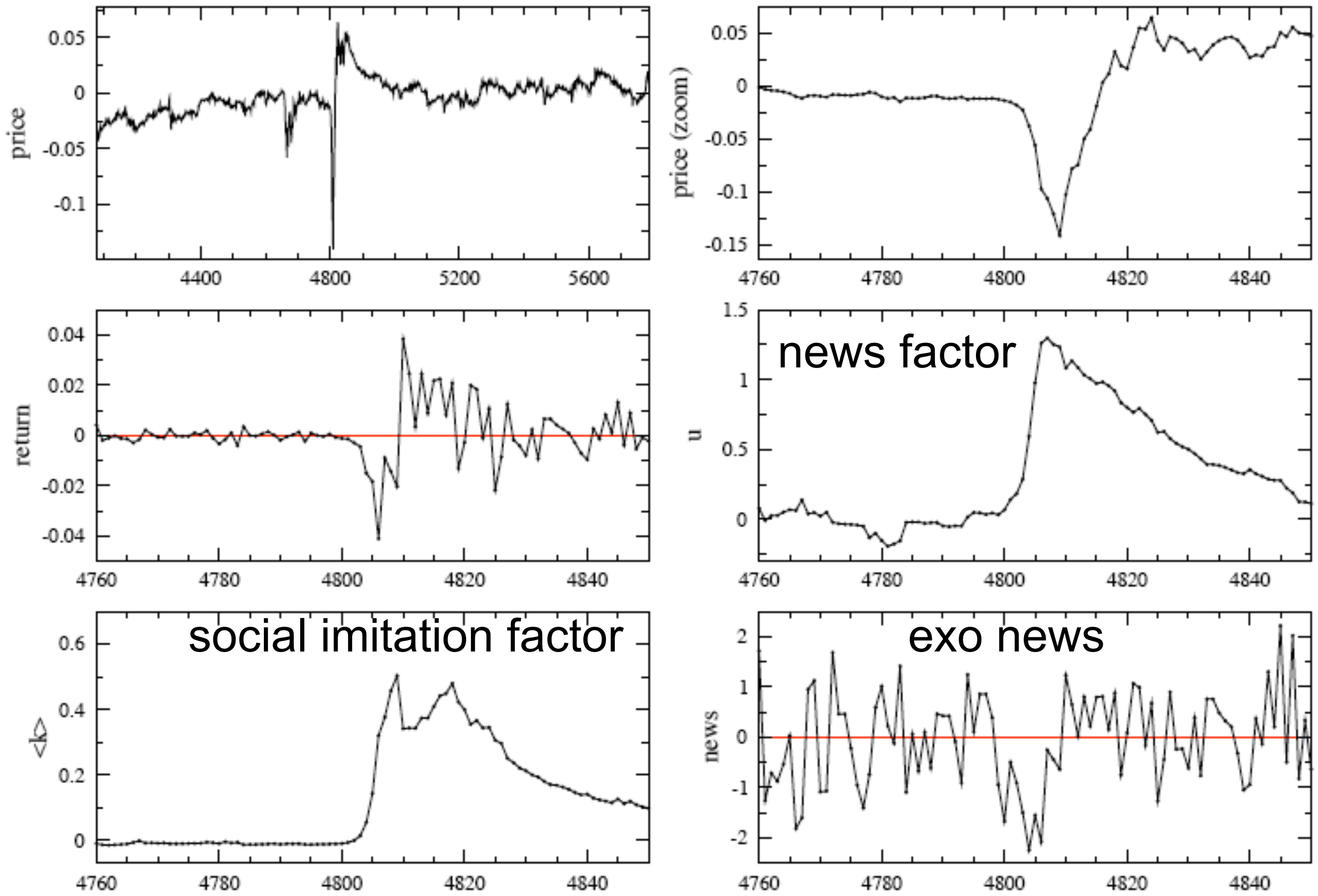
$$
\begin{aligned}
cash_i(t) &= cash_i(t-1) - a_i(t) \cdot \text{price}(t) \\
stocks_i(t) &= stocks_i(t-1) + a_i(t).
\end{aligned}
$$



price
return/st. deviation
news factor
u
histogram of returns
social imitation factor
<k>
autocorrelation of returns
autocorrelation of absolute returns

$$C_1 = C_2 = C_3 = 1.0$$

NEWS IMPACT



Impact of the news to some values, generated with $C_1 = C_2 = C_3 = 1.0$.

ENDO-EXO view of bubbles and crashes; Transient runs of news are sufficient to trigger large crashes in a system of over-learning and over-controlling agents

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Real-estate bubbles

Sources: Shiller; BIS.

Real-estate in the UK

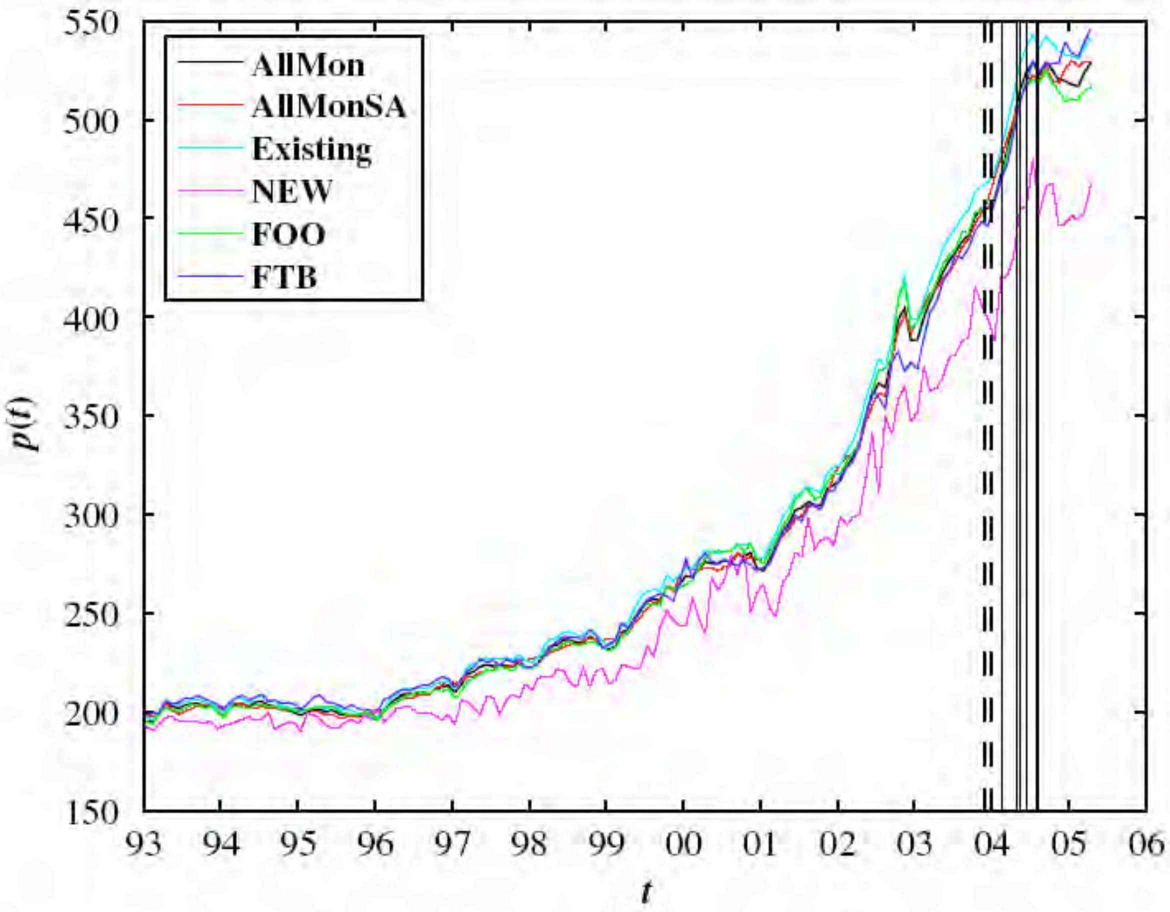


Fig. 1. (Color online) Plot of the UK Halifax house price indices from 1993 to April 2005 (the latest available quote at the time of writing). The two groups of vertical lines correspond to the two predicted turning points reported in Tables 2 and 3 of [1]: end of 2003 and mid-2004. The former (resp. later) was based on the use of formula (2) (resp. (3)). These predictions were performed in February 2003.

W.-X. Zhou, D. Sornette, 2000–2003 real estate bubble in the UK but not in the USA, Physica A 329 (2003) 249–263.

Real-estate in the USA

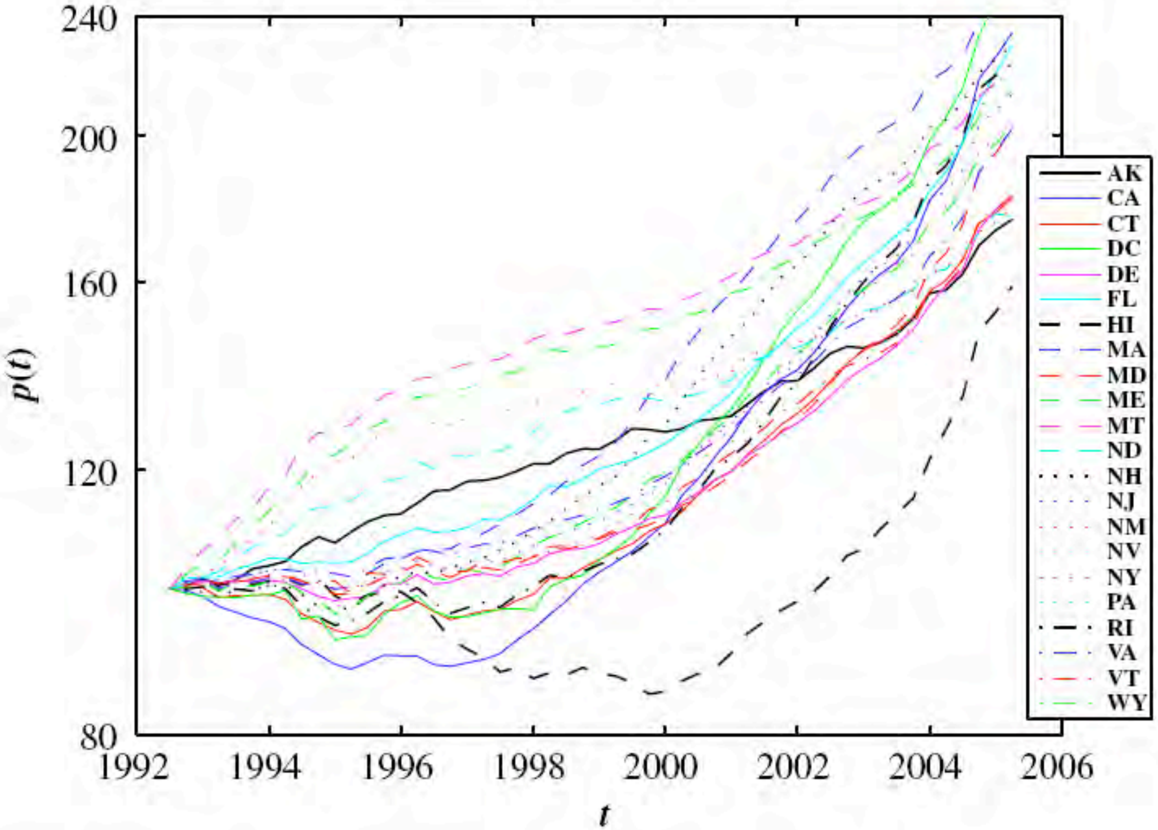
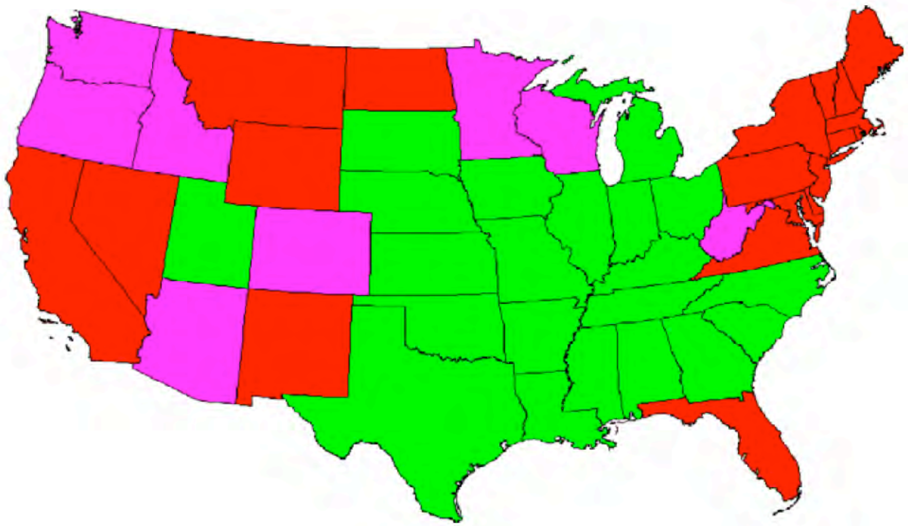


Fig. 5. (Color online) Quarterly average HPI in the 21 states and in the District of Columbia (DC) exhibiting a clear upward faster-than-exponential growth. For better representation, we have normalized the house price indices for the second quarter of 1992 to 100 in all 22 cases. The corresponding states are given in the legend.

W.-X. Zhou, D. Sornette / Physica A 361 (2006) 297–308

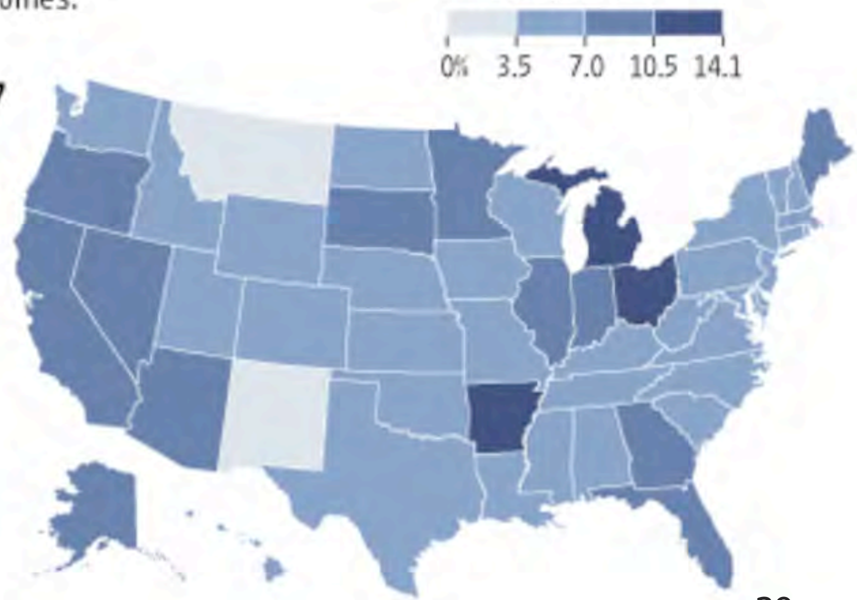
W.-X. Zhou, D. Sornette / Physica A 361 (2006) 297–308

Our study in 2005 identifies the bubble states



Hammered

Delinquency rates for construction loans for single-family homes.

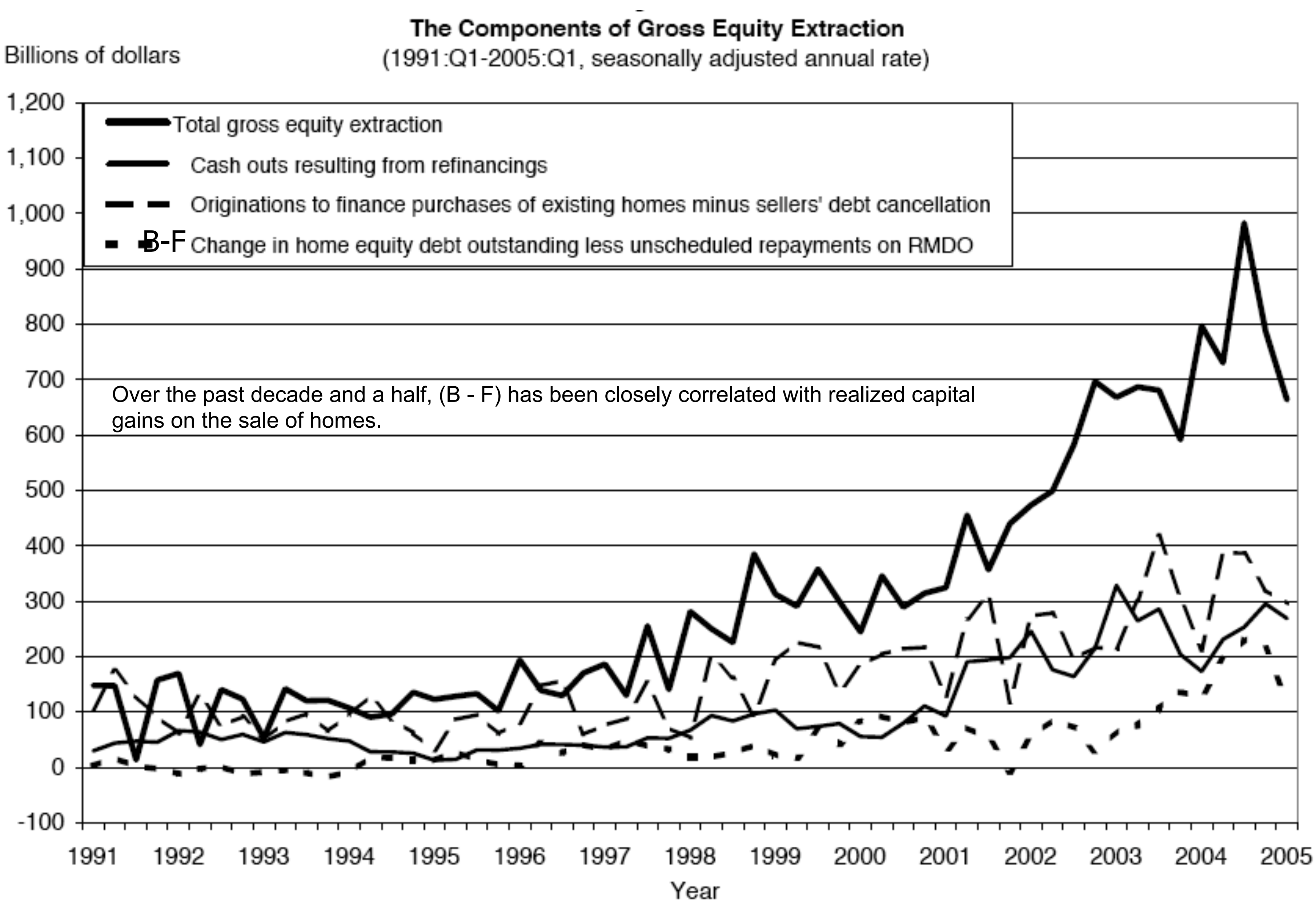


Fall 2007

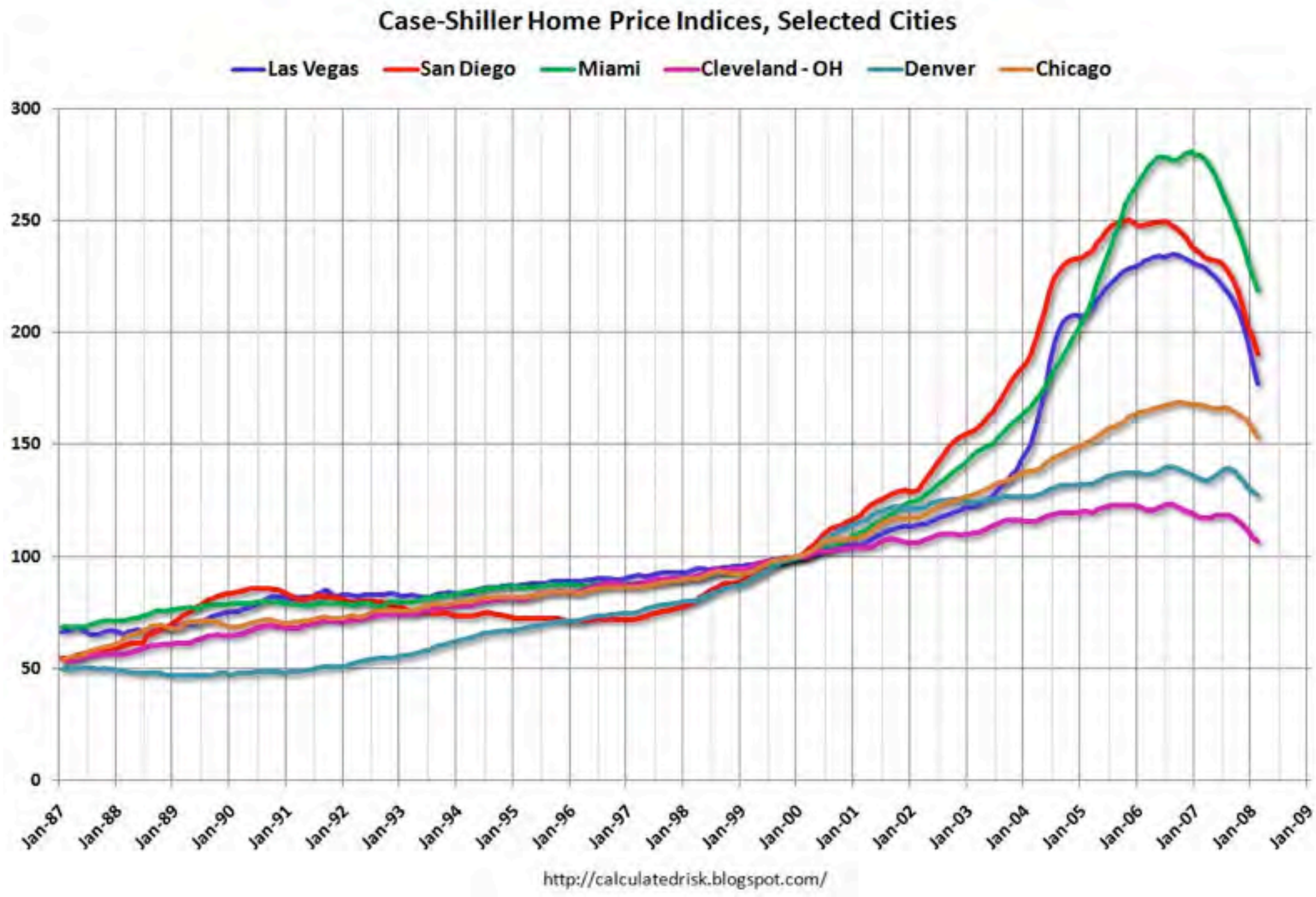
Fourth quarter 2007

Highest rates

Michigan	14.0%
Ohio	13.7
Arkansas	11.1
Arizona	10.3
Minnesota	10.0
Florida	9.9
Georgia	9.6
South Dakota	9.2



Alan Greenspan and James Kennedy (Nov. 2005)



This graph shows the year-over-year price changes for the Case-Shiller composite 10 and 20 indices (through February), and the Case-Shiller and OFHEO National price indices (through Q4 2007).

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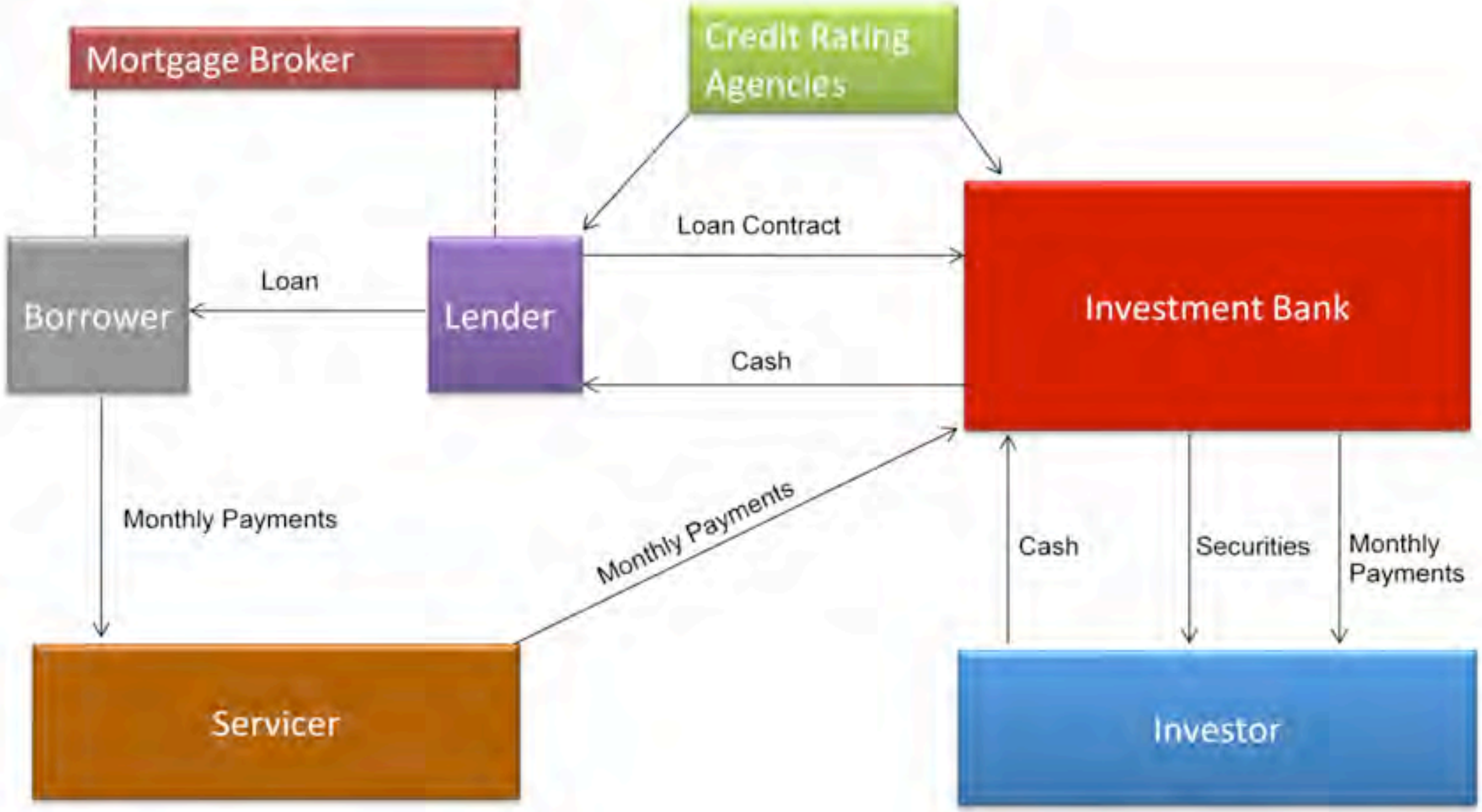
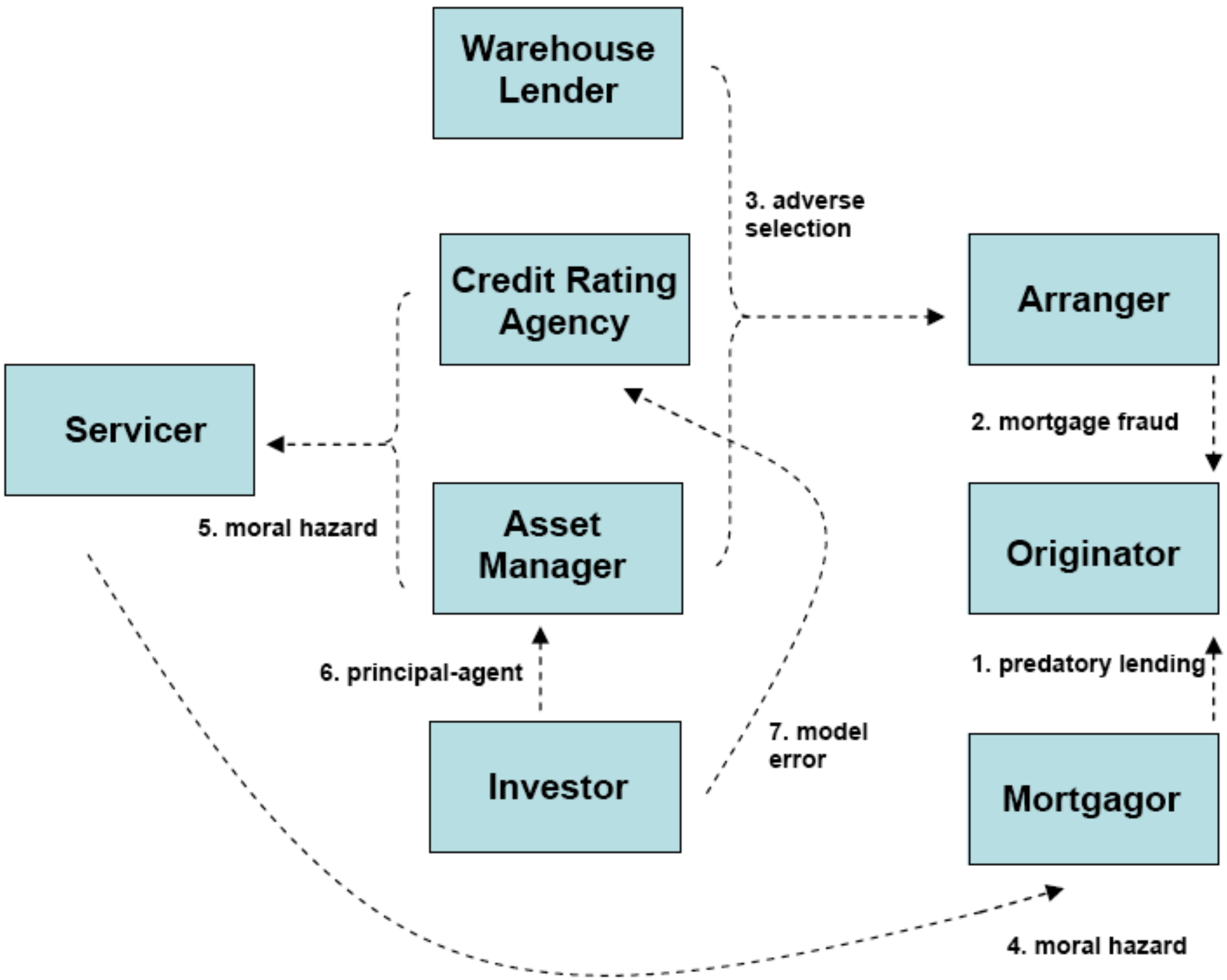
Securitisation model



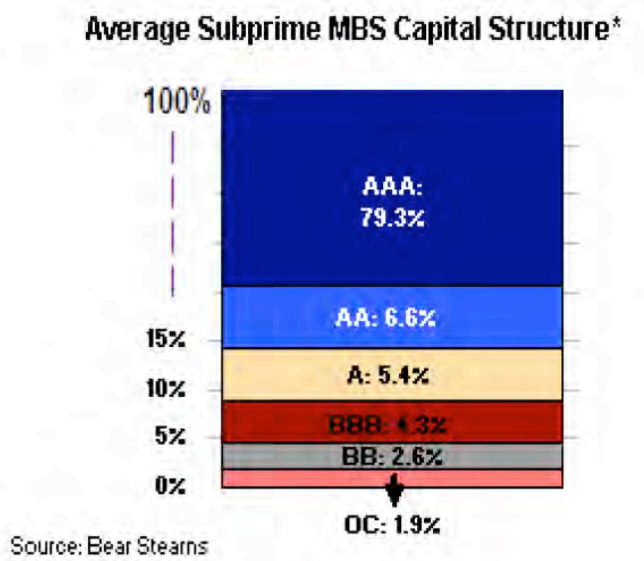
Key Players and Frictions in Subprime Mortgage Credit Securitization



Securitization of credit risks

Securitization of credit risks leads to smaller risks

But more inter-connected
$\Rightarrow$ global risk?

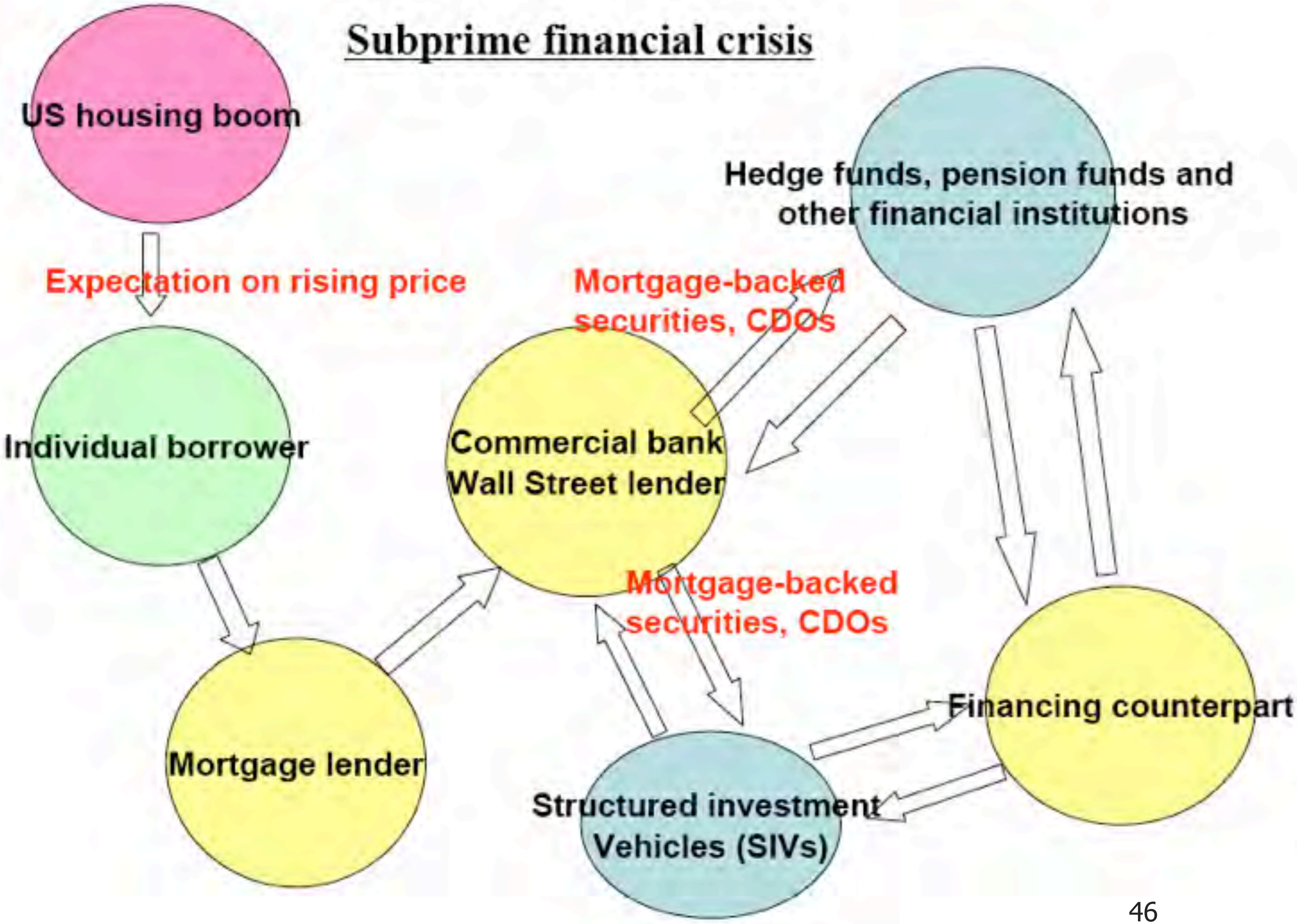


Mortgage Backed Security

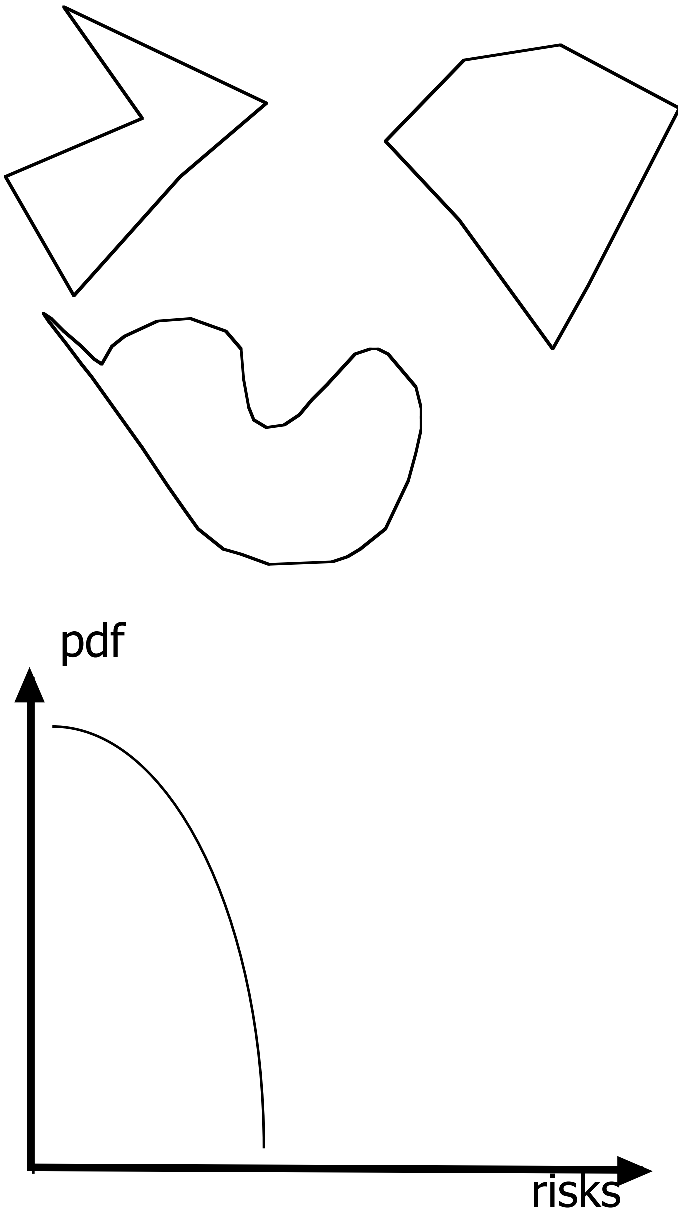
CDS and CDO: form of insurance contracts linked to underlying debt that protects the buyer in case of default.

The market has almost doubled in size every year for the past five years, reaching $20 trillion in notional amounts outstanding last June 2007, according to the Bank for International Settlements.

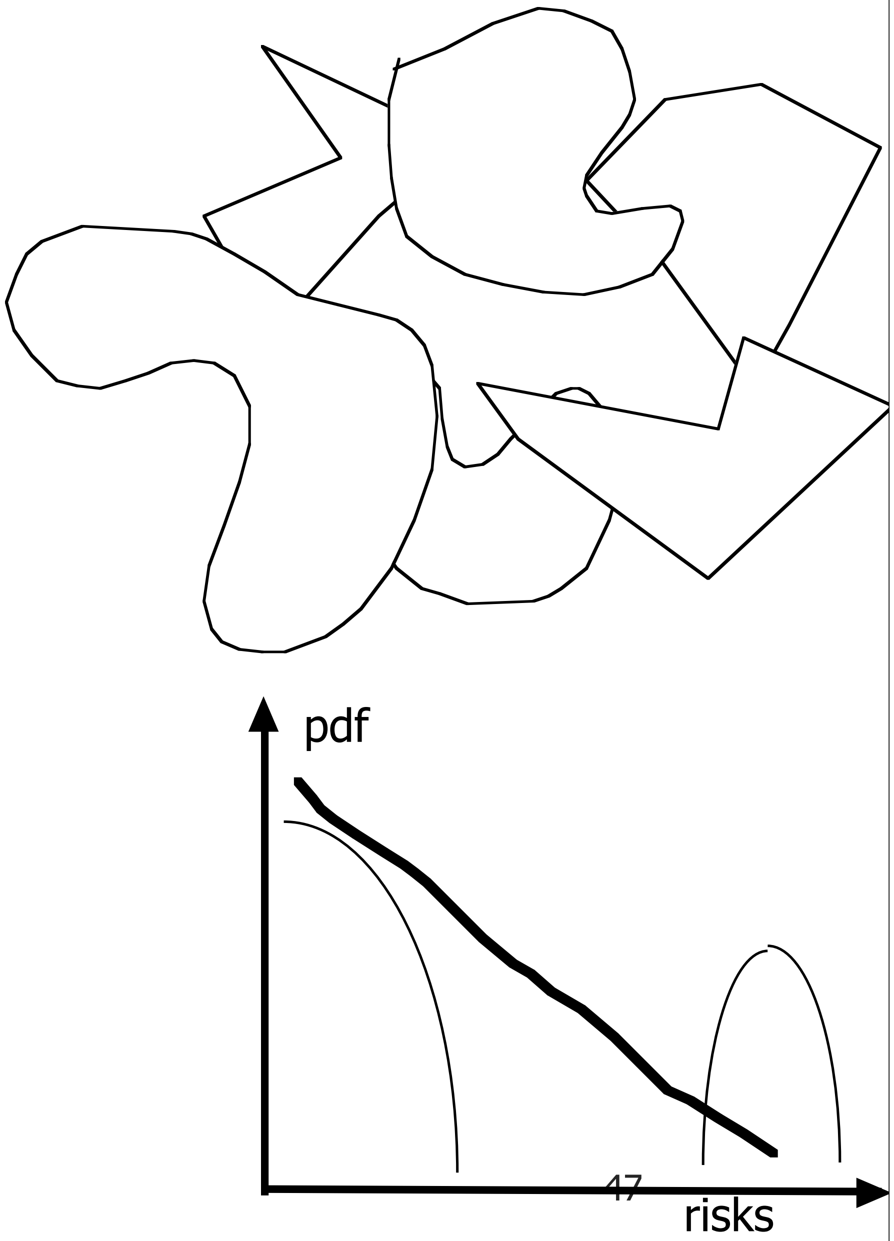
Bundling of indexes of CDSs together and slicing them into trenches, based on riskiness and return. The most toxic trench at the bottom exposes the holder to the first 3% of losses but also gives him a large portion of the returns. At the top, the risks and returns are much smaller-unless there is a systemic failure.


Subprime financial crisis
US housing boom
Expectation on rising price
Individual borrower
Mortgage lender
Commercial bank
Wall Street lender
Mortgage-backed securities, CDOs
Hedge funds, pension funds and other financial institutions
Mortgage-backed securities, CDOs
Structured investment Vehicles (SIVs)
Financing counterpart

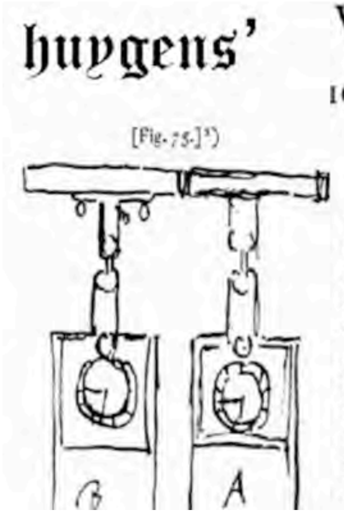
Separation of financial and credit risks



Securitization leads to larger inter-connectivity



SYNCHRONISATION AND COLLECTIVE EFFECTS IN EXTENDED STOCHASTIC SYSTEMS



22 febr. 1665.
Diebus 4 aut 5 horologiorum duorum novorum in quibus catenulæ [Fig. 75], miram concordiam obſervaveram, ita ut ne minimo quidem exceſſu alterum ab altero ſuperaretur. ſed conſonarent ſemper reciprocationes utriusque perpendiculi. unde cum parvo ſpatio inter ſe horologia diſtarent, ſympathiæ quandam ³) quaſi alterum ab altero afficeretur ſuſpicari cœpi. ut experimentum caperem turbavi alterius penduli reditus ne ſimul incederent ſed quadrante horæ poſt vel ſemihora rurſus concordare inveni.

Fireflies

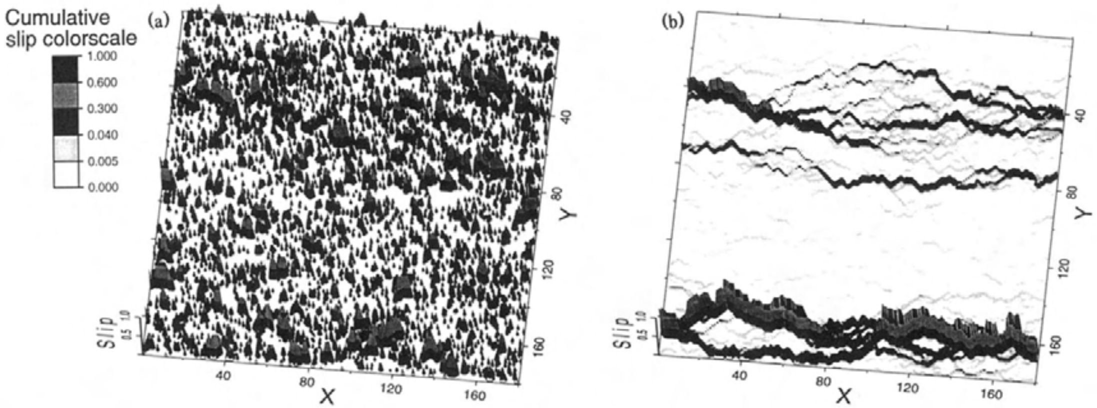
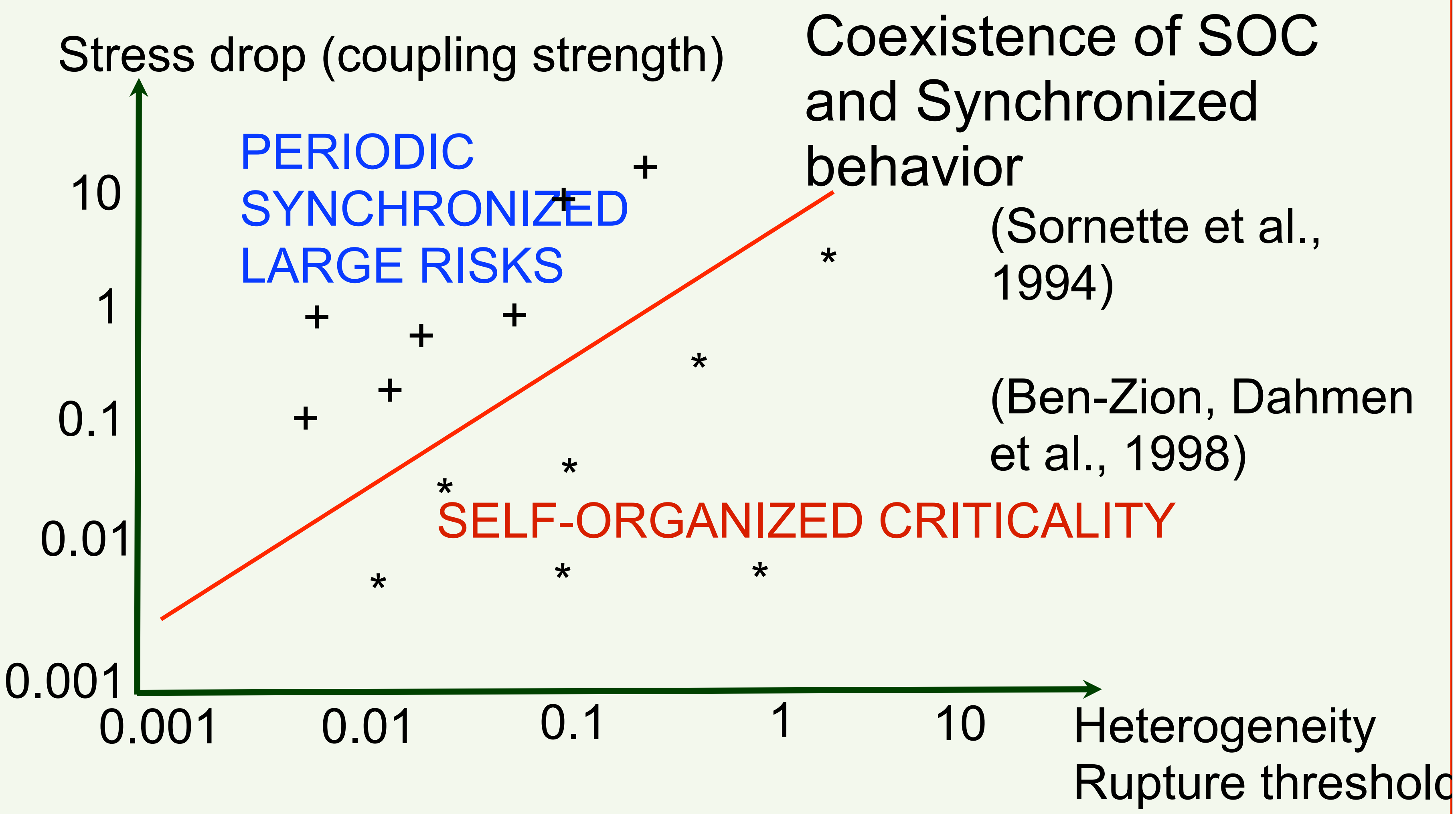


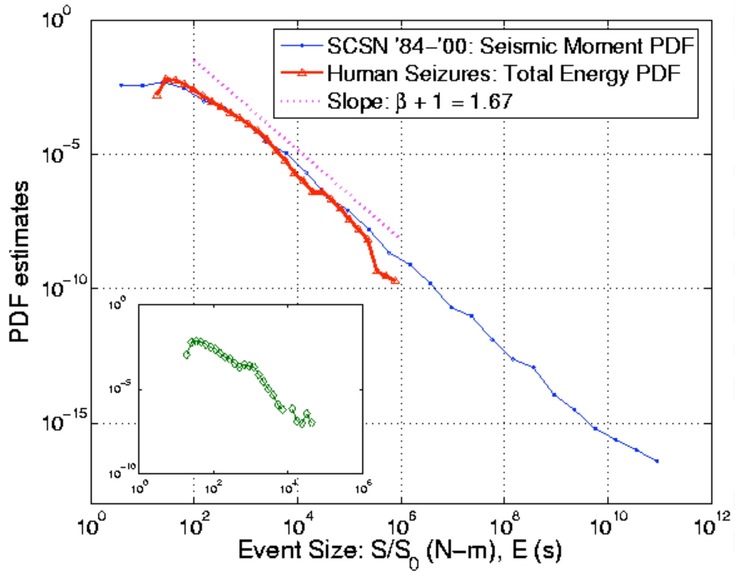
FIG. 1. Evolution of the cumulative earthquake slip, represented along the vertical axis in the white to black color code shown above the picture, at two different times: (a) early time and (b) long time, in a system of size $L=90$ by $L=90$, where $\Delta\sigma=1.9$ and $\beta=0.1$.

Miltenberger et al. (1993)

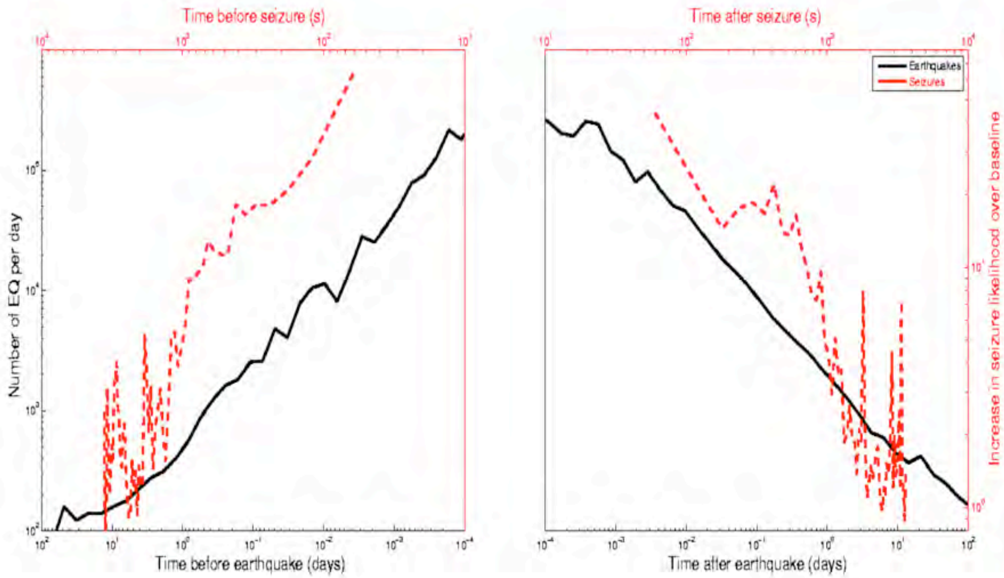


“Phase diagram” for the model in the space (heterogeneity, stress drop). Crosses (+) correspond to systems which exhibit a periodic time evolution. Stars * corresponds to systems that are self-organized critical, with a Gutenberg-Richter earthquake size distribution and fault localization whose geometry is well-described by the geometry of random directed polymers.

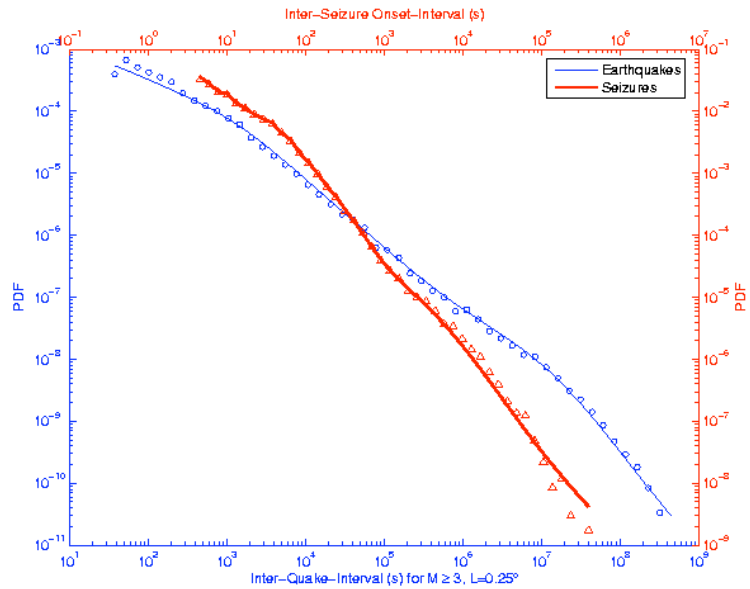
Gutenberg-Richter distribution of sizes



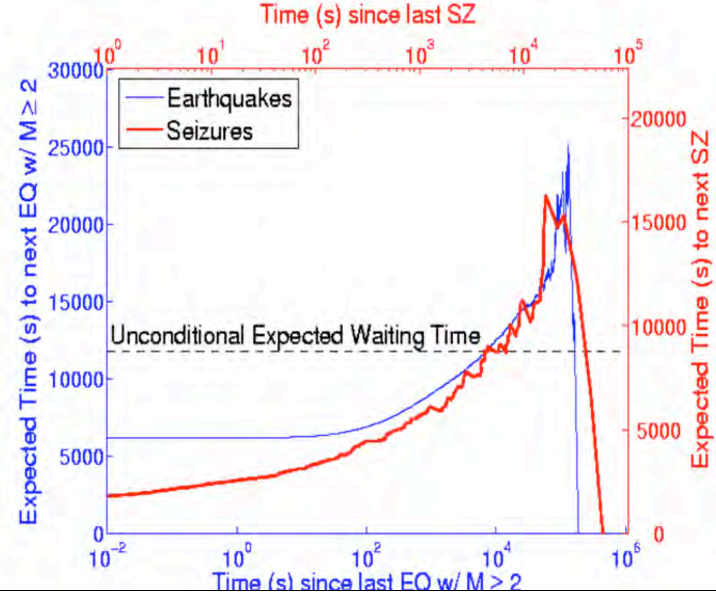
Omori law: Direct and Inverse



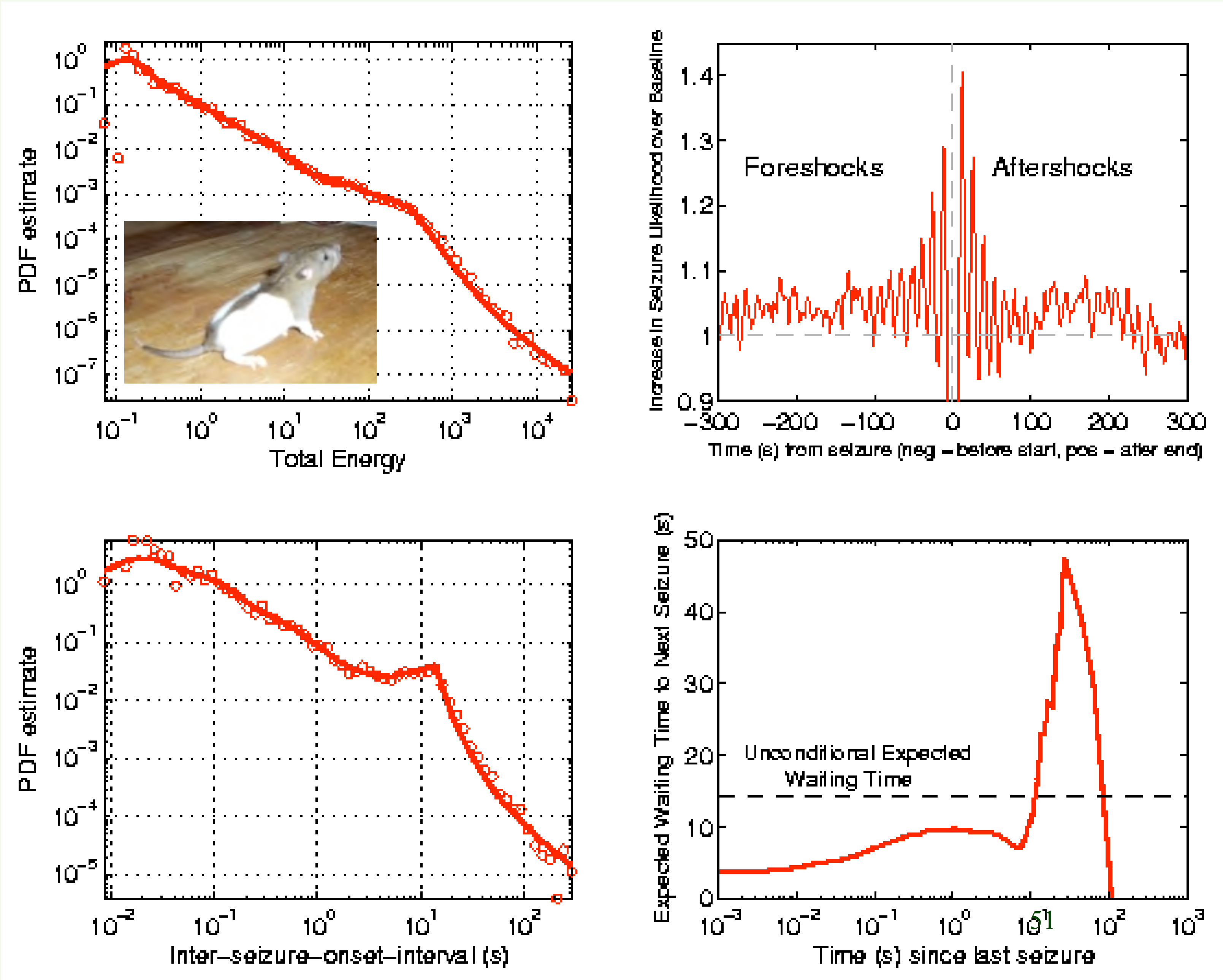
pdf of inter-event waiting times



The longer it has been since the last event, the longer it will be since the next one!

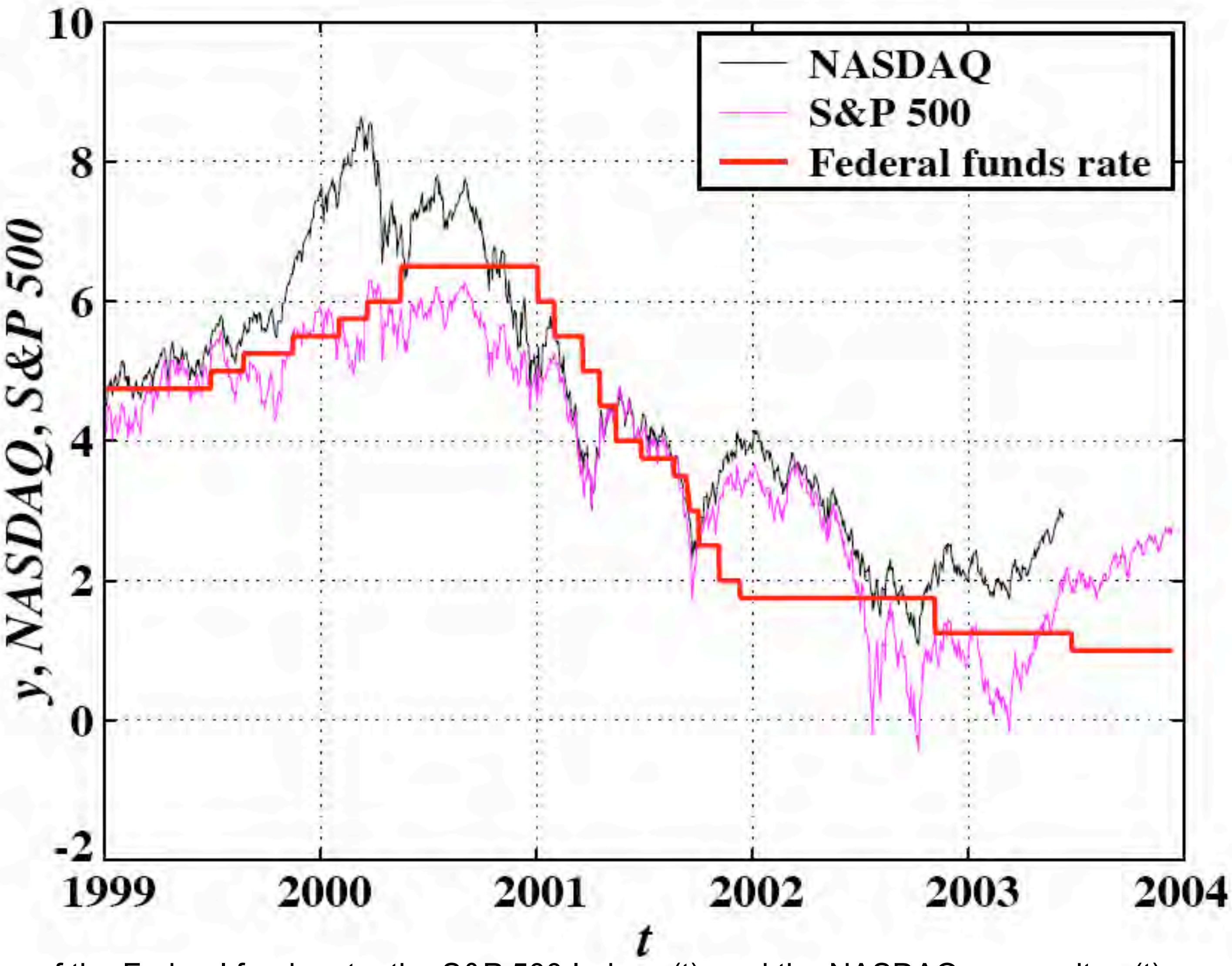


19 rats treated intravenously (2) with the convulsant 3-mercapto-proprionic acid (3-MPA)

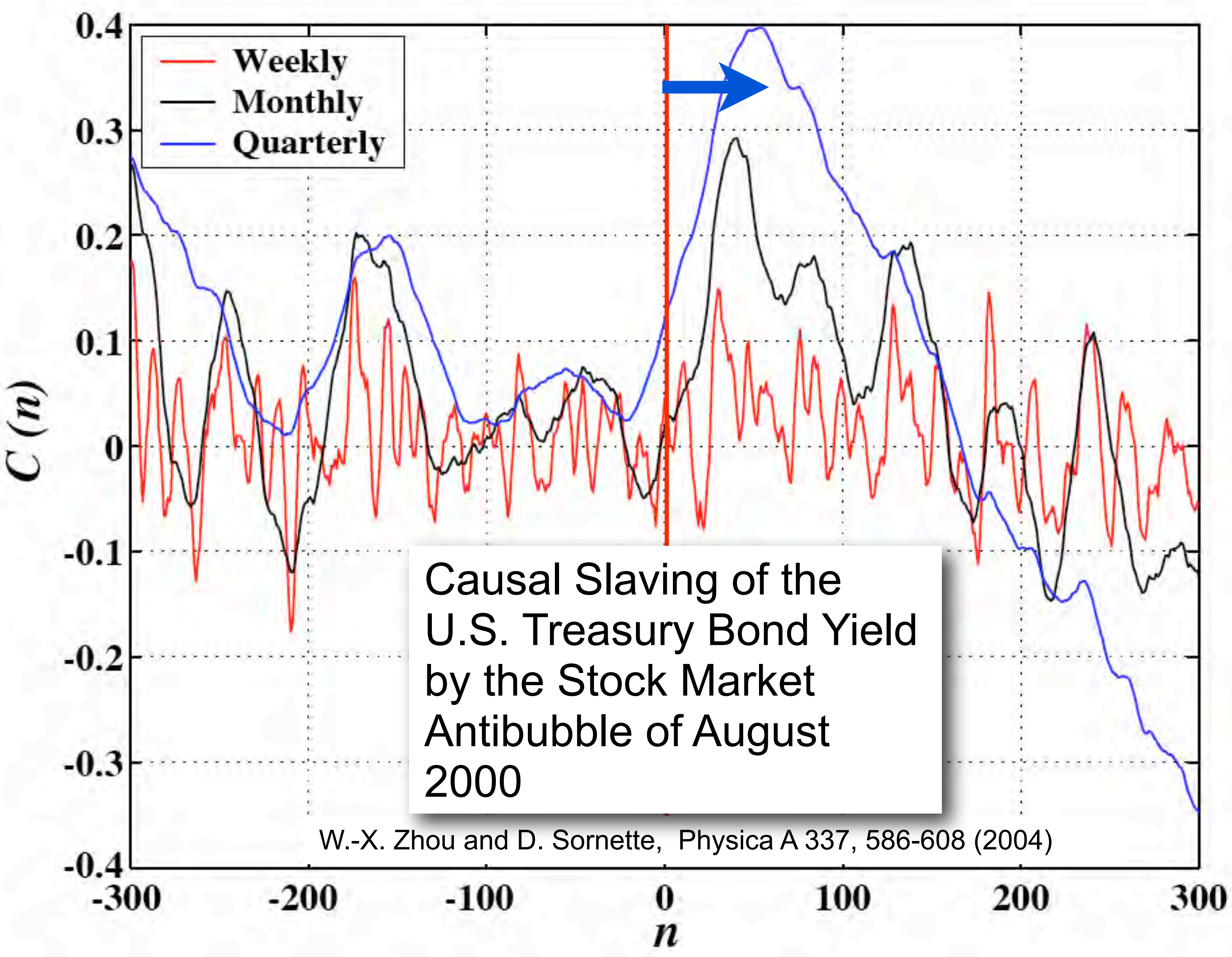


- Do excesses exist? Financial bubbles?
- Why are they so difficult to identify? (academic view vs. practitioners vs Fed)
- Real-estate bubble and MBS bubble
- Why are they dangerous? Systemic risks
- What can be done? Better metrics vs. moral hazard and herding

“SLAVING OF THE FED TO THE STOCK MARKET

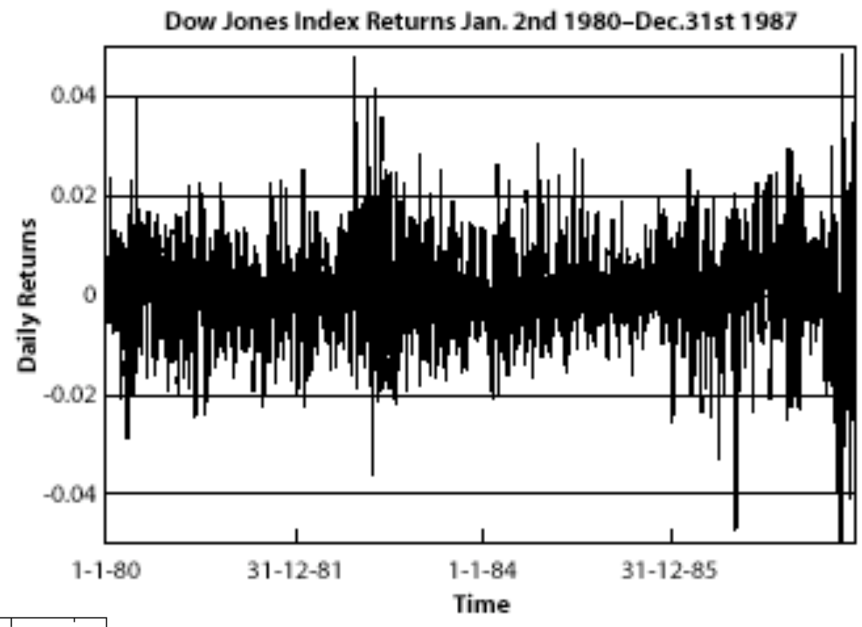


Comparison of the Federal funds rate, the S&P 500 Index x(t), and the NASDAQ composite z(t), from 1999 to mid-2003. To allow a illustrative visual comparison, the indices have been translated and scaled as follows: $x \rightarrow 5x - 34$ and $z \rightarrow 10z - 67$.

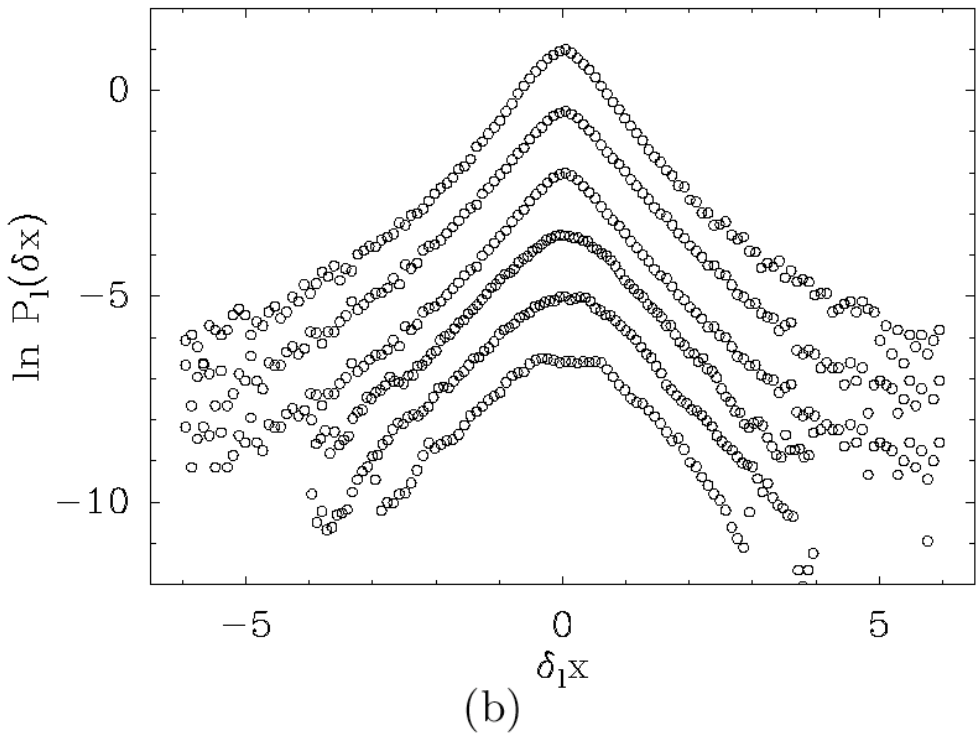


Cross-correlation coefficient C(n) between the increments of the logarithm of the S&P 500 Index and the increments of the Federal funds rate as a function of time lag n in days. The three curves corresponds to three different time steps used to calculate the increments: weekly, monthly and quarterly. A positive lag n corresponds to having the Federal funds rate posterior to the stock market.

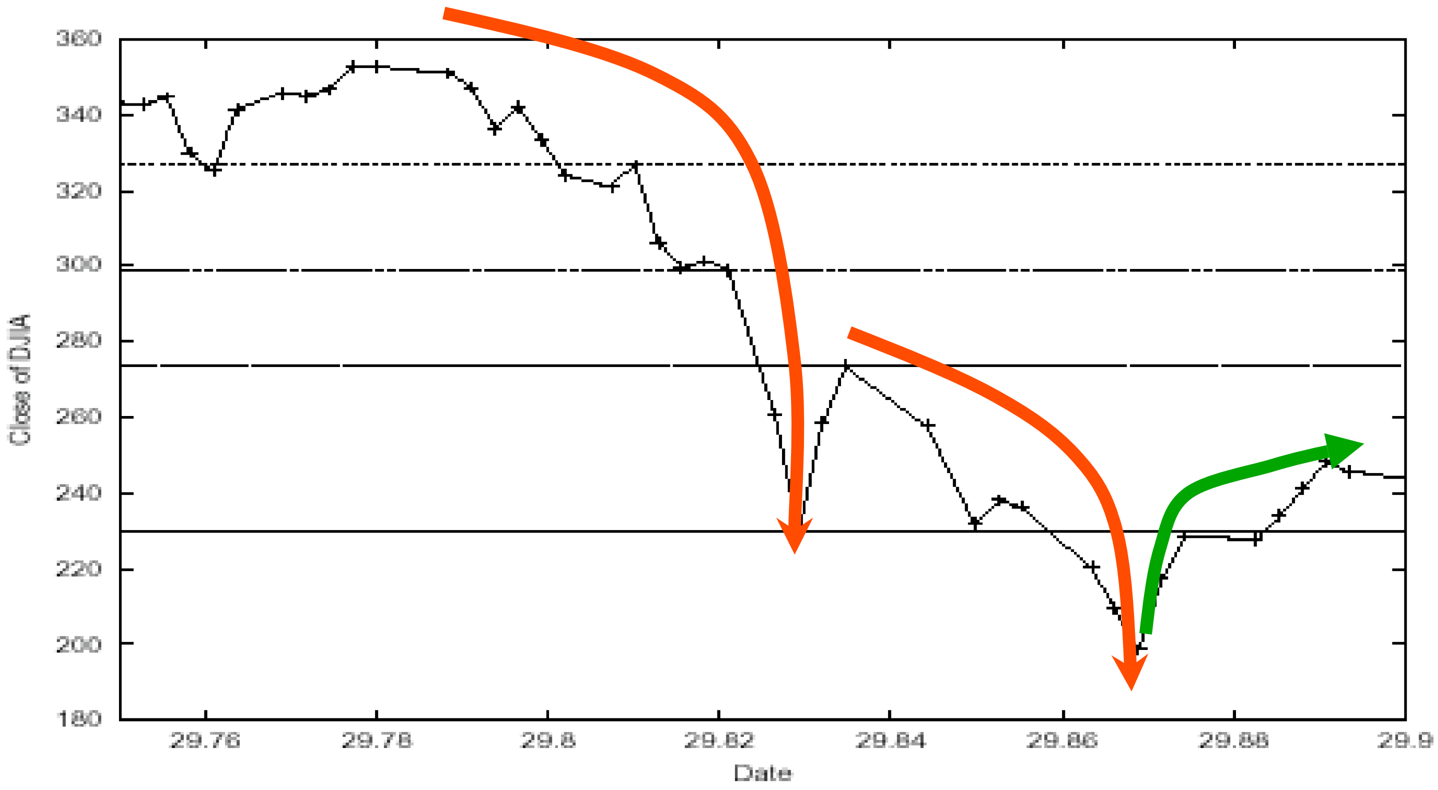
ARE CRASHES EXCEPTIONAL?

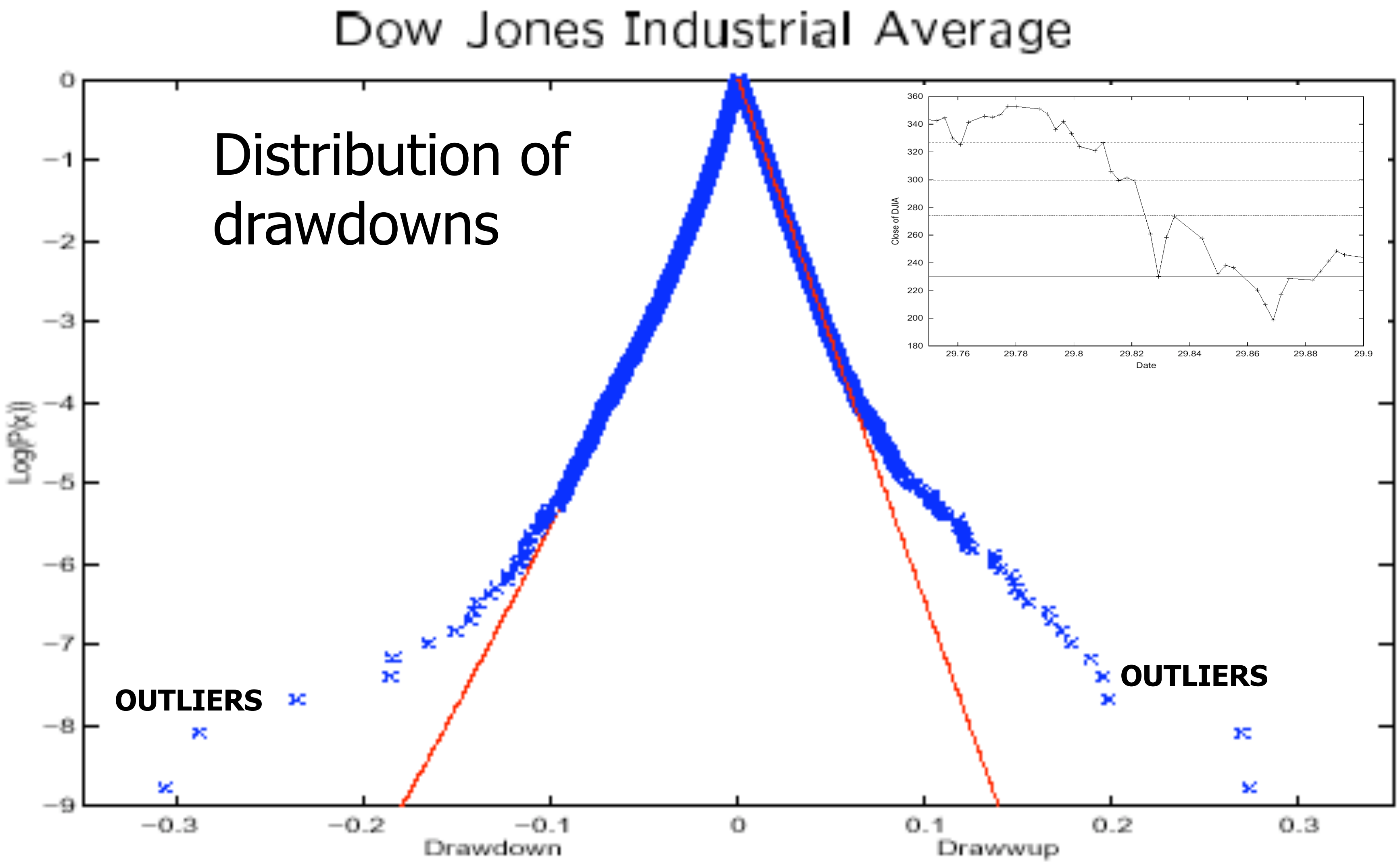


Traditional emphasis on Daily returns do not reveal any anomalous events



Better risk measure: drawdowns



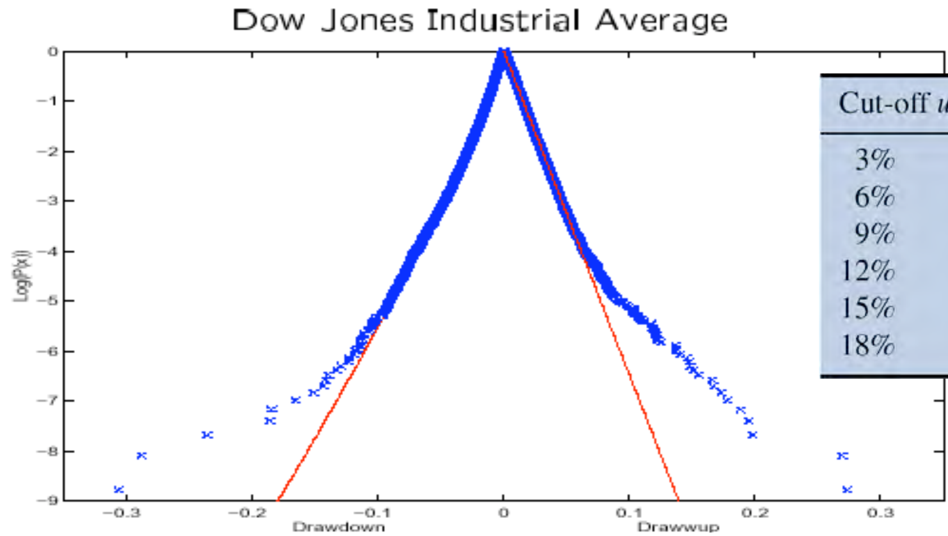


A. Johansen and D. Sornette, Stock market crashes are outliers,
European Physical Journal B 1, 141-143 (1998)

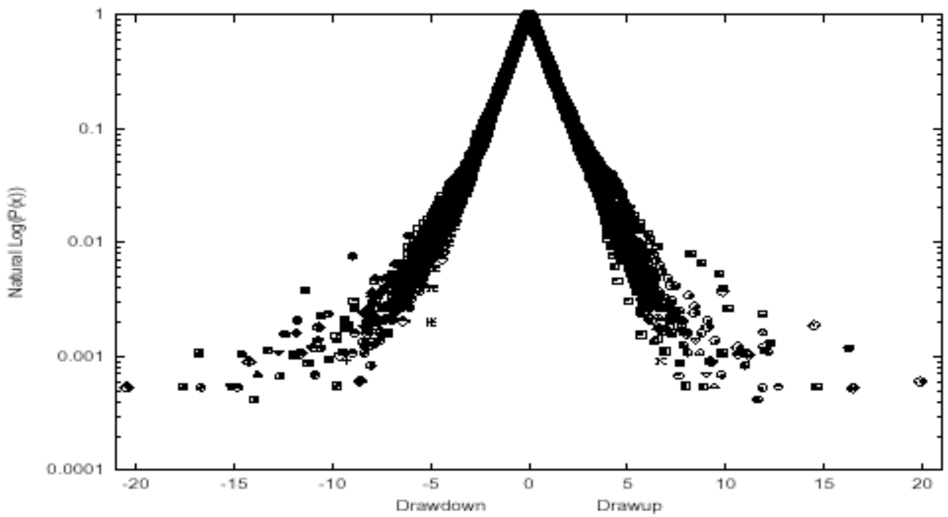
A. Johansen and D. Sornette, Large Stock Market Price Drawdowns Are Outliers,
Journal of Risk 4(2), 69-110, Winter 2001/02

Outliers, Kings

(require special mechanism and may be more predictable)



Cut-off u	Quantile	z	$\ln(L_0)$	$\ln(L_1)$	T	Proba
3%	87%	0.916, 0.940	4890.36	4891.16	1.6	20.5%
6%	97%	0.875, 0.915	4944.36	4947.06	5.4	2.0%
9%	99.0%	0.869, 0.918	4900.75	4903.66	5.8	1.6%
12%	99.7%	0.851, 0.904	4872.47	4877.46	10.0	0.16%
15%	99.7%	0.843, 0.898	4854.97	4860.77	11.6	0.07%
18%	99.9%	0.836, 0.890	4845.16	4851.94	13.6	0.02%



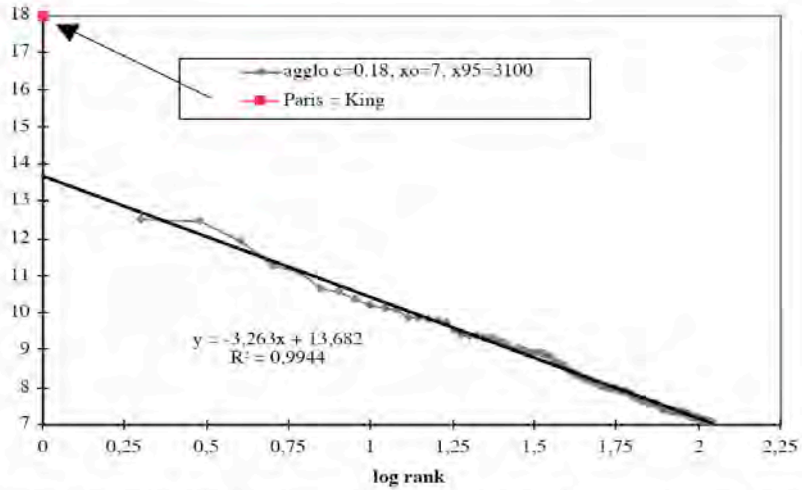


Fig. 7. French agglomerations: stretched exponential and "King effect".

Endogenous vs exogenous crashes

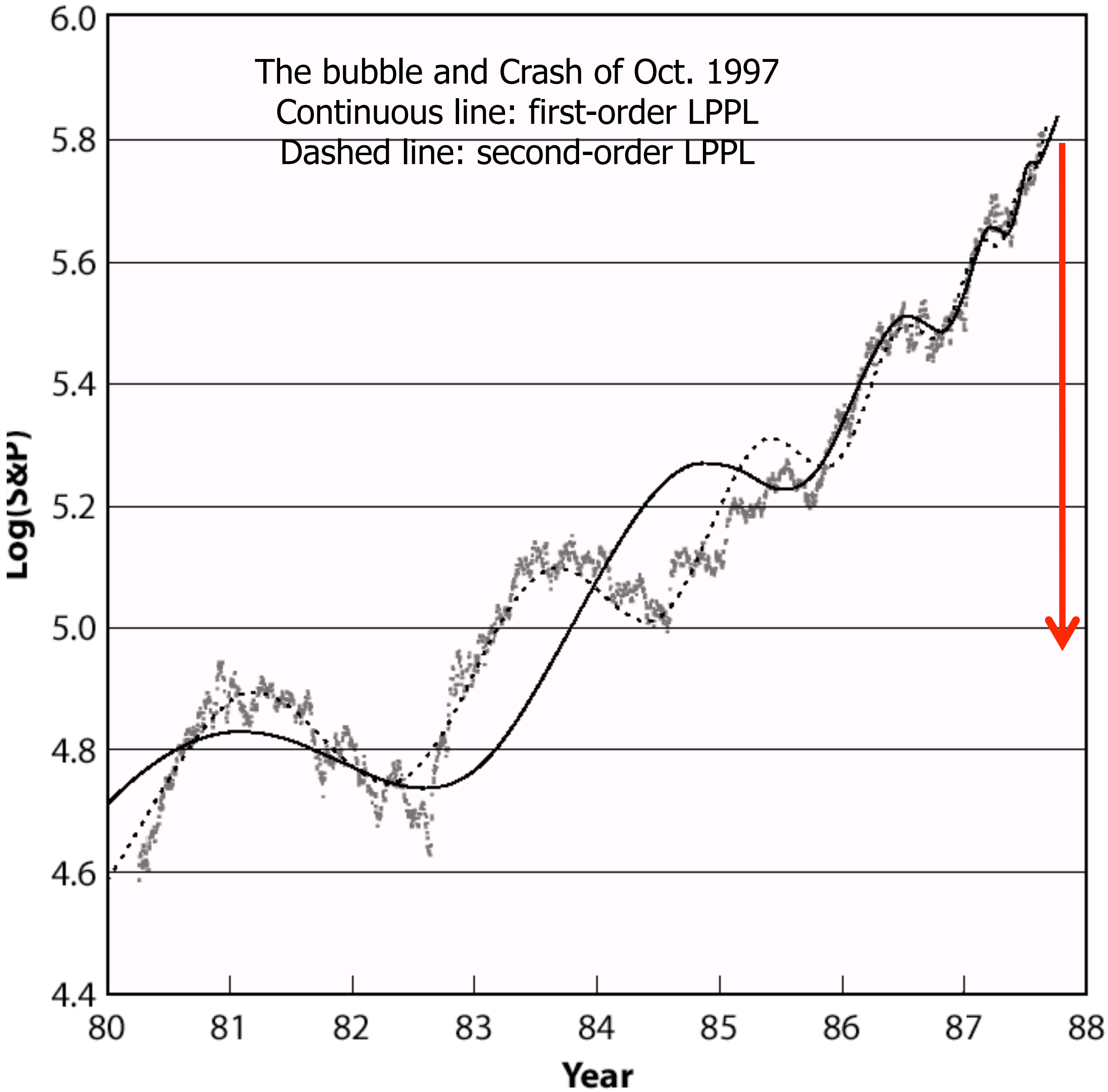
1. **Systematic qualification of outliers/kings in pdfs of drawdowns**

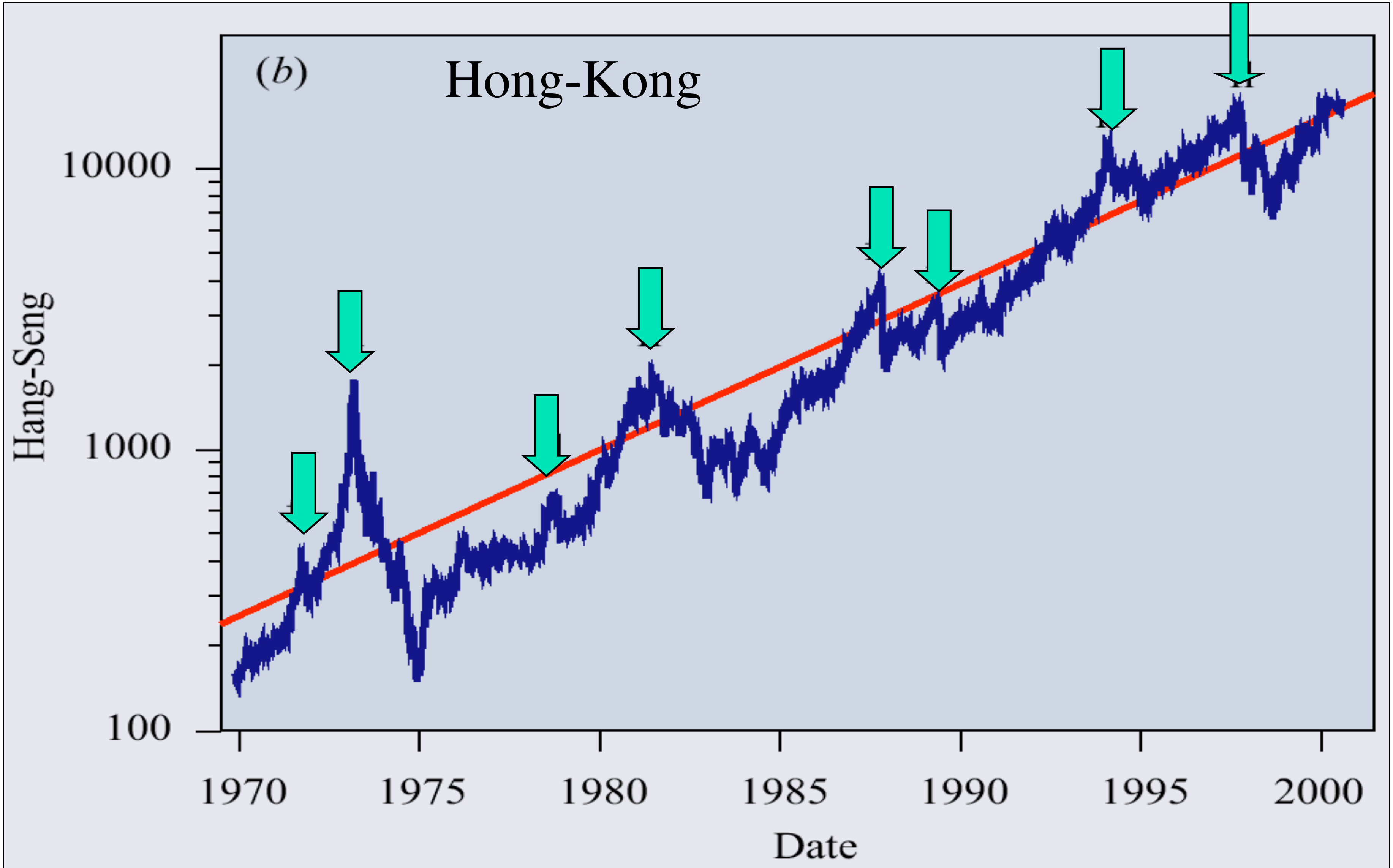
2. **Existence or absence of a "critical" behavior by LPPL patterns found systematically in the price trajectories preceding this outliers**

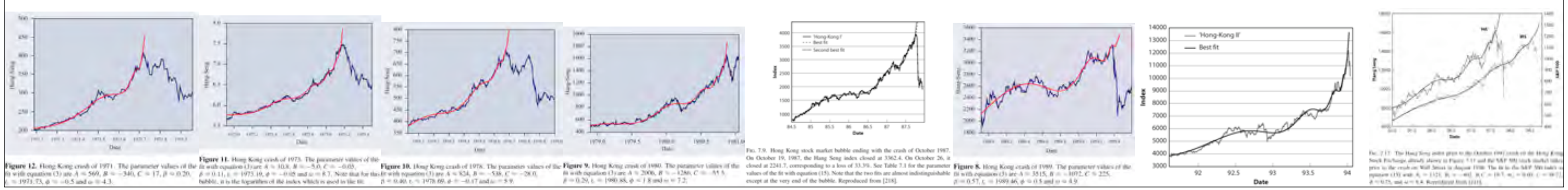
Results: In worldwide stock markets + currencies + bonds

- **21 endogenous crashes**
- **10 exogenous crashes**

A. Johansen and D. Sornette,
Endogenous versus Exogenous Crashes in Financial Markets,
in press in ``Contemporary Issues in International Finance''
(Nova Science Publishers, 2004)
(http://arXiv.org/abs/cond-mat/0210509)


The bubble and Crash of Oct. 1997
Continuous line: first-order LPPL
Dashed line: second-order LPPL
6.0
5.8
5.6
5.4
5.2
5.0
4.8
4.6
4.4
Log(S&P)
80
81
82
83
84
85
86
87
88
Year


(b)
Hong-Kong
Hang-Seng
10000
1000
100
1970
1975
1980
1985
1990
1995
2000
Date



Out-of-sample test over 20 years of the Heng Seng

Alarms were produced in the following nine time intervals containing the date of the last point used in the fit:

(a) 1981.60 to 1981.68. This was followed by a ≈ 30% decline.
(b) 1984.36 to 1984.41. This was followed by a ≈ 30% decline.
(c) 1985.20 to 1985.30; false alarm.
(d) 1987.66 to 1987.82. This was followed by a ≈ 50 % decline.
(e) 1989.32 to 1989.38. This was followed by a ≈ 35 % decline.
(f) 1991.54 to 1991.69. This was followed by a ≈ 7% single day decline; considered a false alarm, nevertheless.
(g) 1992.37 to 1992.58. This was followed by a ≈ 15% decline. This is a marginal case.
(h) 1993.79 to 1993.90. This was followed by a ≈ 20% decline. This can also be considered as a marginal case, if we want to be conservative.
(i) 1997.58 to 1997.74. This was followed by ≈ 35% decline.

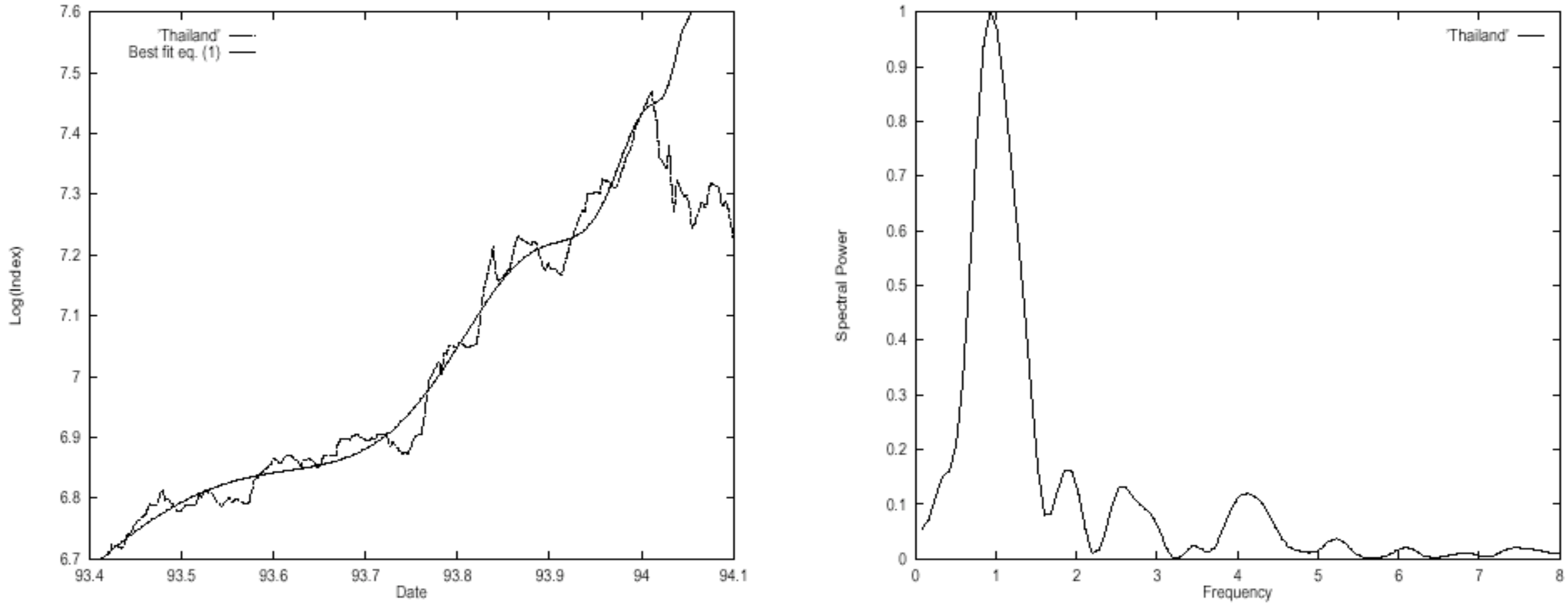


Figure 42: Thai stock market bubble ending with the crash of Jan. 94. See table 5 for the parameter values of the fit with equation (1).

$$I(t) = A + B(t_c - t)^z + C(t_c - t)^z \cos(\omega \log(t_c - t) - \phi)$$

Parameters of the log-periodic fits; z= critical exponent; omega=log-periodic frequency

Stock market	A	B	C	z	t_c	ω	ϕ
Hong-Kong I	5523; 4533	−3247; −2304	171; −174	0.29; 0.39	87.84; 87.78	5.6; 5.2	−1.6; 1.1
Hong-Kong II	21121	−15113	−429	0.12	94.02	6.3	−0.6
Hong-Kong III	20077	−8241	−397	0.34	97.74	7.5	0.8
Indonesia I	6.76	−1.11	0.039	0.44	94.09	15.6	−1.3
Indonesia II	7.38	−0.92	−0.06	0.23	98.05	10.08	5.8
Korea I	6.97	−0.28	−0.05	1.05	94.87	8.15	1.1
Malaysia I	7.61	−1.16	0.038	0.24	94.02	10.9	1.4
Philippines I	9.00	−1.74	−0.078	0.16	94.02	8.2	0.2
Thailand I	7.81	−1.41	−0.086	0.48	94.07	6.1	−0.2

$$I(t) = A + B(t_c - t)^z + C(t_c - t)^z \cos(\omega \log(t_c - t) - \phi)$$

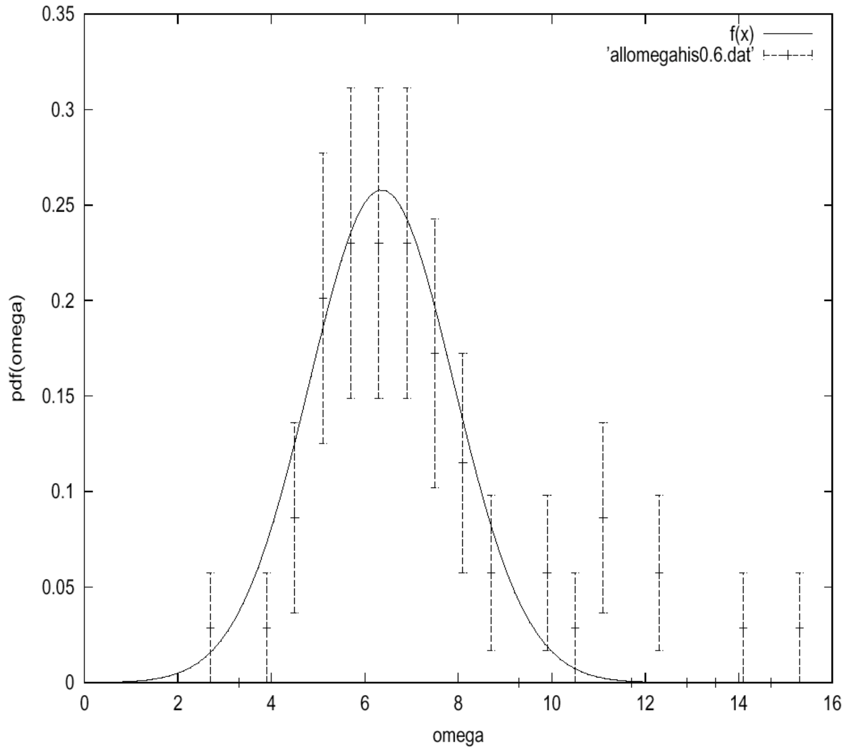


Figure 5: Empirical distribution of the log-periodic angular frequency ω in eq. (1) for over thirty case studies. The fit with a Gaussian distribution gives $\omega \approx 6.36 \pm 1.55$. The smaller peak centered on $11-12$ suggests the existence of a second discernable harmonics at $2\omega \approx 12$.

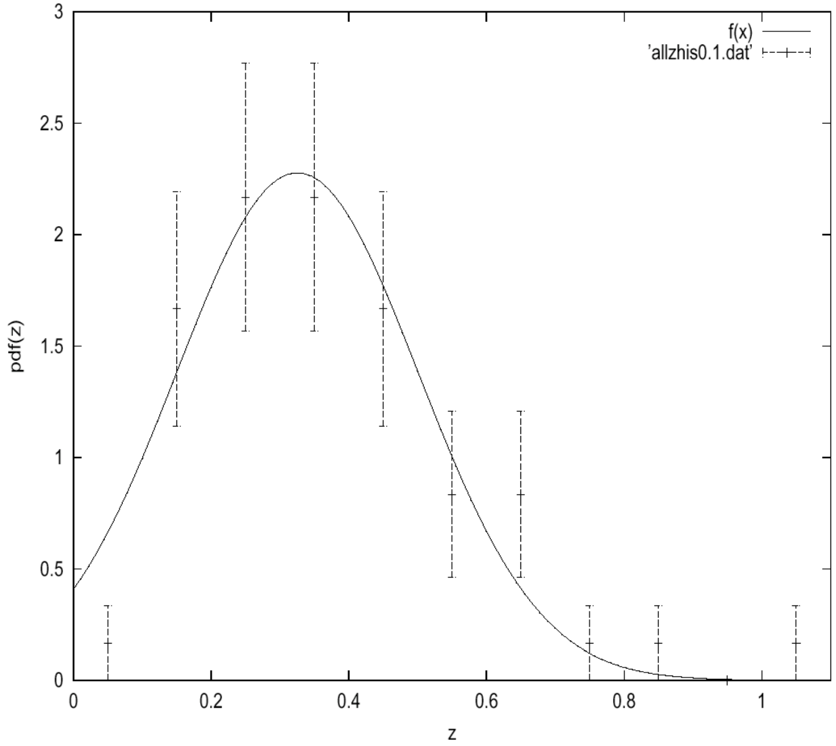


Figure 6: Empirical distribution of the exponent z of the power law in eq. (1) for over thirty case studies. The fit with a Gaussian distribution gives $\beta \approx 0.33 \pm 0.18$.

Demonstration of universal values of z and omega across many different bubbles at different epochs and different markets

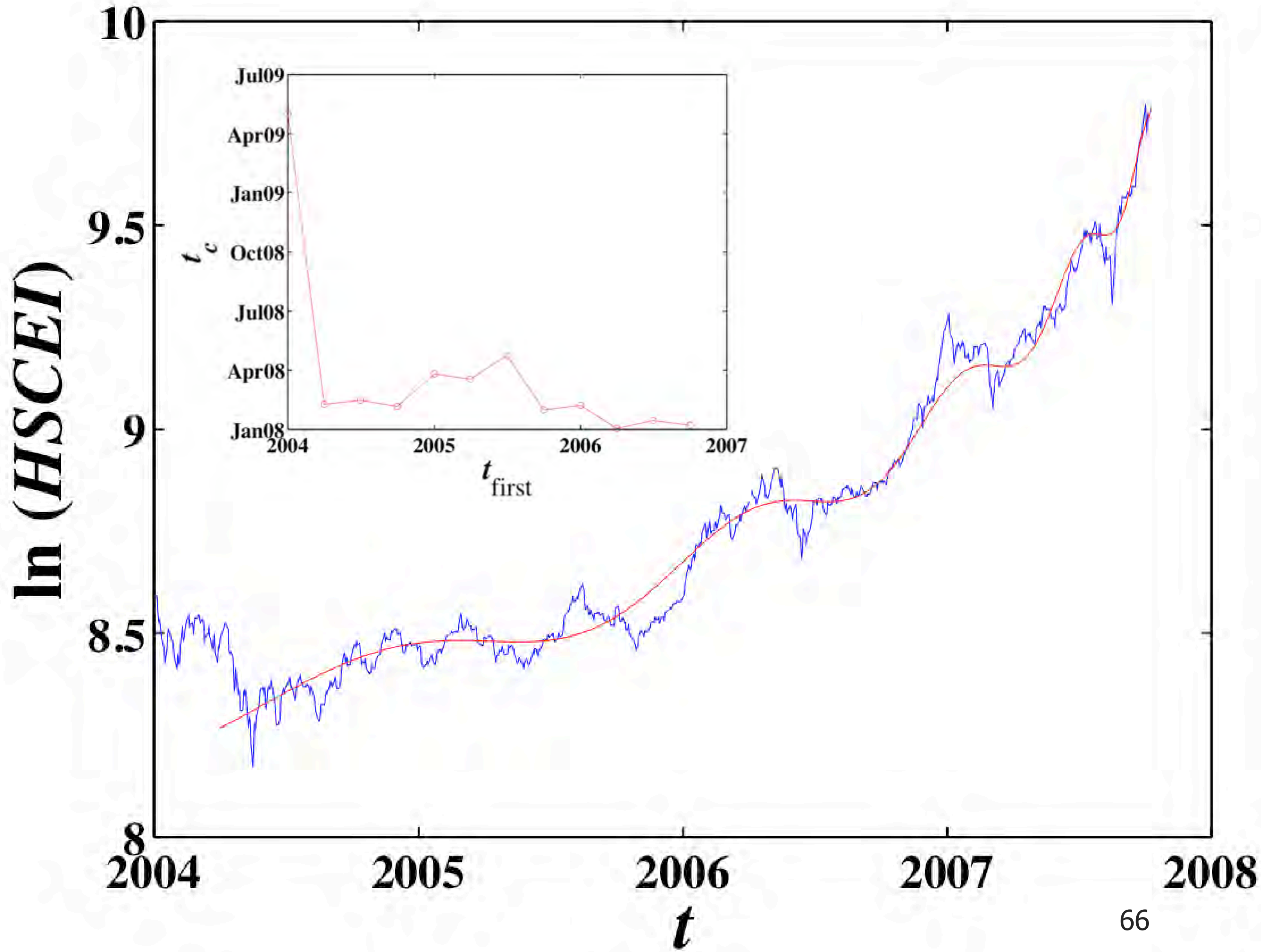
A. Johansen and D. Sornette, Shocks, Crashes and Bubbles in Financial Markets, Brussels Economic Review (Cahiers economiques de Bruxelles), 49 (3/4), (2006)

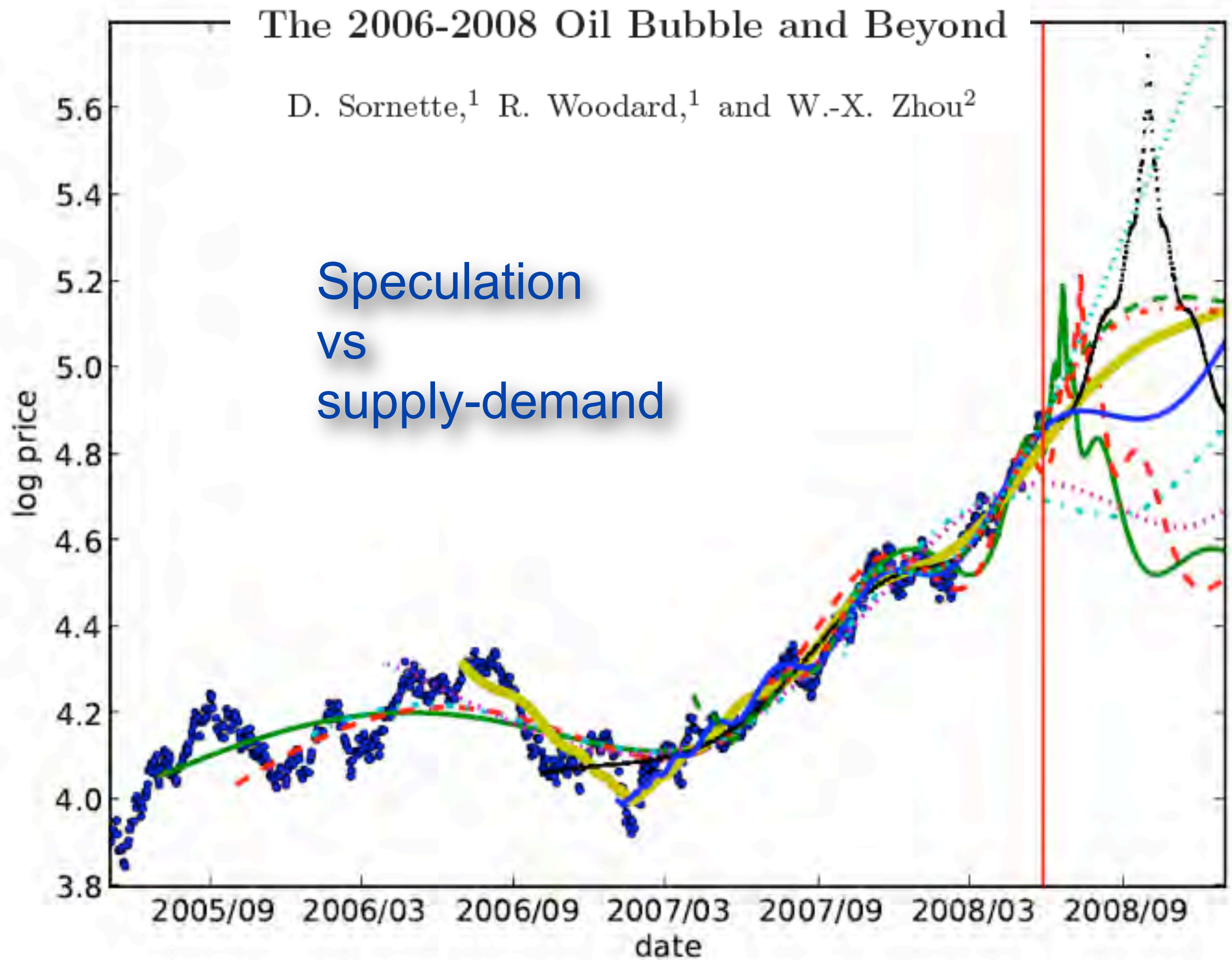
What are bubbles?
How do detect them?
How to predict them?

Our proposition to the Academic Literature:
"Super exponential price acceleration" and "king" effect

Our proposition to the Fed:
Complex system approach with emphasis on
(i) positive and negative feedback interplay ("procyclical")
(ii) collective behavior and organization lead to "EMERGENCE" of CRITICAL POINTS
(iii) novel metrics to monitor the development of bubbles
(iv) moral hazard

Hang Seng China Entreprises Index (HSCEI)





Typical result of the calibration of the simple LPPL model to the oil price in US $ in shrinking windows with starting dates t_{start} moving up towards the common last date t_{last} = May 27, 2008.

Main Messages

- Do excesses exist? Financial bubbles?
- Why are they so difficult to identify? (academic view vs. practitioners vs Fed)
- Real-estate bubble and MBS bubble
- Why are they dangerous? Systemic risks
- What can be done? Better metrics vs. moral hazard and herding

Predictions and Preparation: complexity theory applied to such collective processes provides clues for precursors and suggests steps for precaution and preparation.

Why bubbles are not arbitraged away?

1. limits to arbitrage caused by noise traders (DeLong et, 1990)
2. limits to arbitrage caused by synchronization risk (Abreu and Brunnermeier, 2002 and 2003)
3. short-sale constraints (many papers)
4. lack of close substitutes for hedging (many papers)
5. heterogenous beliefs (many papers)
6. lack of higher-order mutual knowledge (Allen, Morris and Postlewaite, 1993)
7. delegated investments (Allen and Gorton, 1993)
8. psychological biases (observed in many experiments)
9. positive feedback bubbles