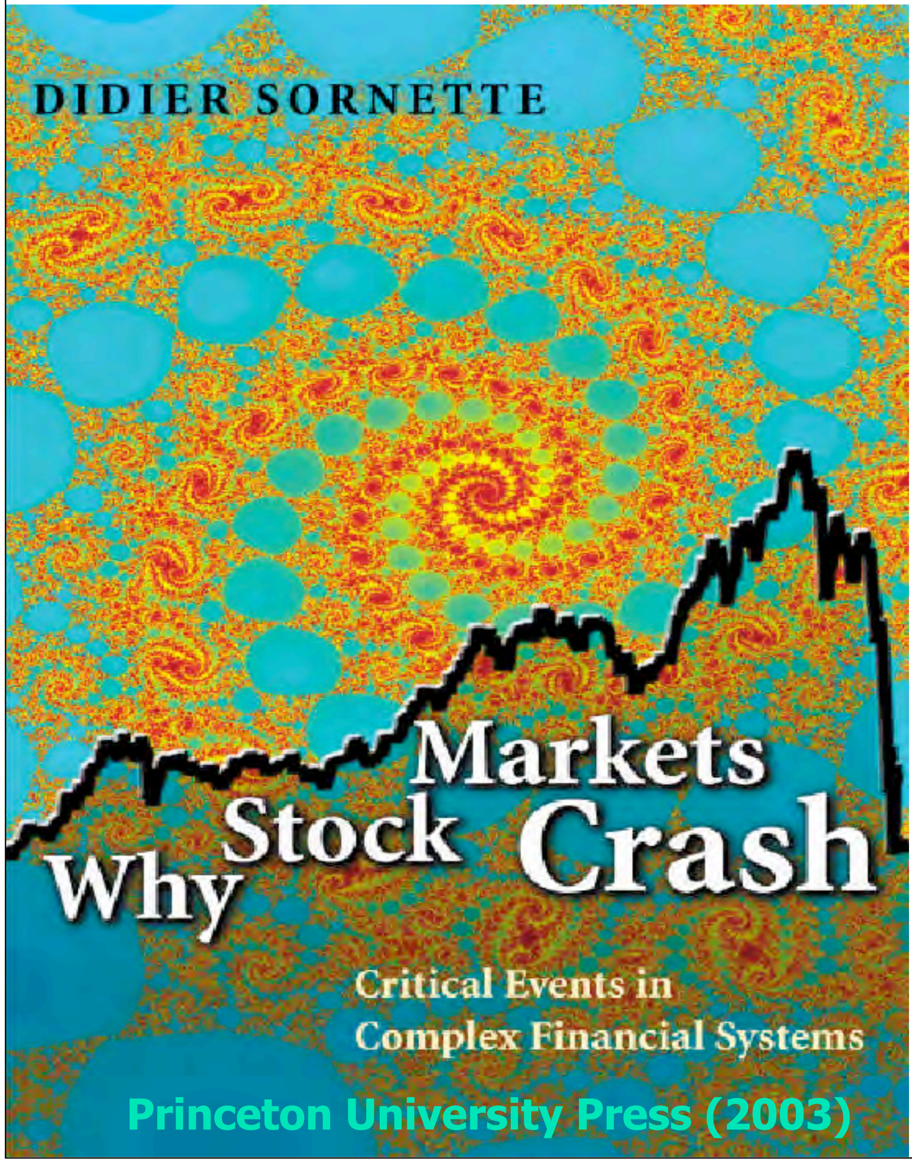
# A Complex System View on the Financial and Economic Crisis

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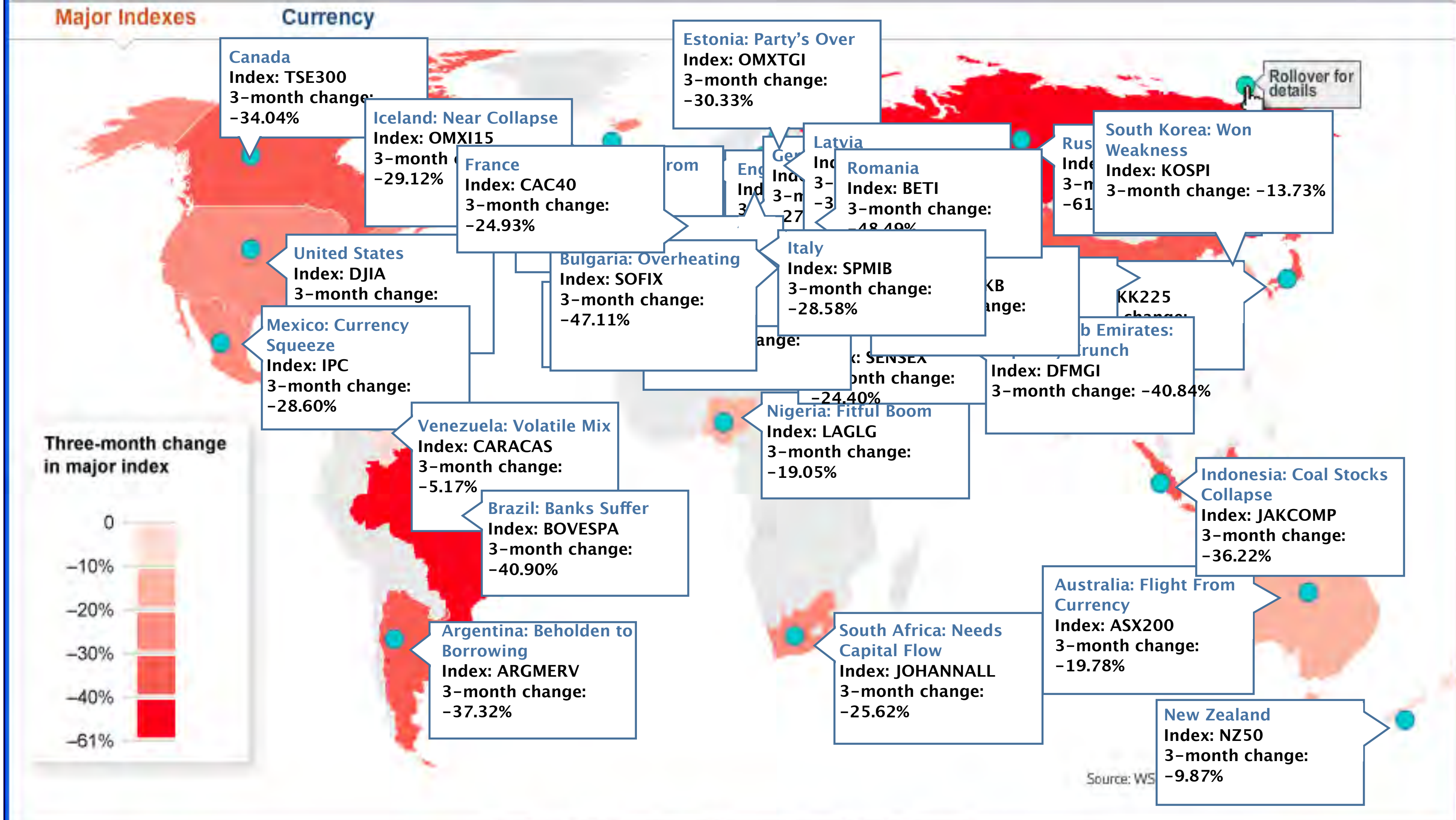
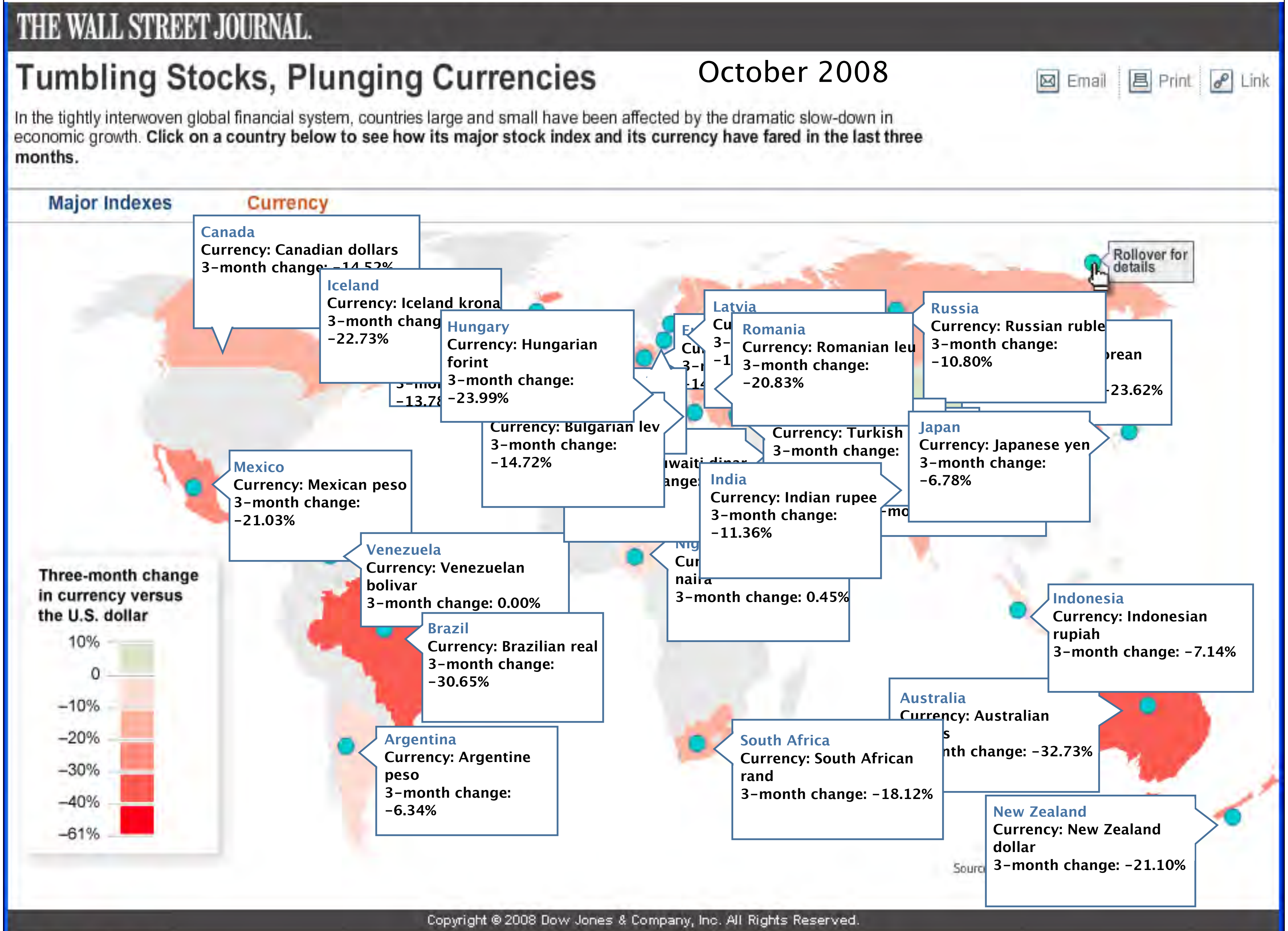
THE WALL STREET JOURNAL.

# Tumbling Stocks, Plunging Currencies

October 2008

In the tightly interwoven global financial system, countries large and small have been affected by the dramatic slow-down in economic growth. **Click on a country below to see how its major stock index and its currency have fared in the last three months.**

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Tumbling Stocks, Plunging Currencies
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In the tightly interwoven global financial system, countries large and small have been affected by the dramatic slow-down in economic growth. Click on a country below to see how its major stock index and its currency have fared in the last three months.
Major Indexes
Currency
Canada
Currency: Canadian dollars
Iceland
Currency: Iceland krona
-22.73%
Hungary
Currency: Hungarian forint
3-month change: -23.99%
Currency: Bulgarian lev
3-month change: -14.72%
Latvia
Romania
Currency: Romanian leu
3-month change: -20.83%
Russia
Currency: Russian ruble
3-month change: -10.80%
-23.62%
Rollover for details
Currency: Turkish
3-month change:
Japan
Currency: Japanese yen
3-month change: -6.78%
India
Currency: Indian rupee
3-month change: -11.36%
3-month change: 0.45%
Mexico
Currency: Mexican peso
3-month change: -21.03%
Venezuela
Currency: Venezuelan bolivar
3-month change: 0.00%
Brazil
Currency: Brazilian real
3-month change: -30.65%
Argentina
Currency: Argentine peso
3-month change: -6.34%
South Africa
Currency: South African rand
3-month change: -18.12%
Australia
Currency: Australian
Indonesia
Currency: Indonesian rupiah
3-month change: -7.14%
New Zealand
Currency: New Zealand dollar
3-month change: -21.10%
Three-month change in currency versus the U.S. dollar
10%
0
-10%
-20%
-30%
-40%
-61%
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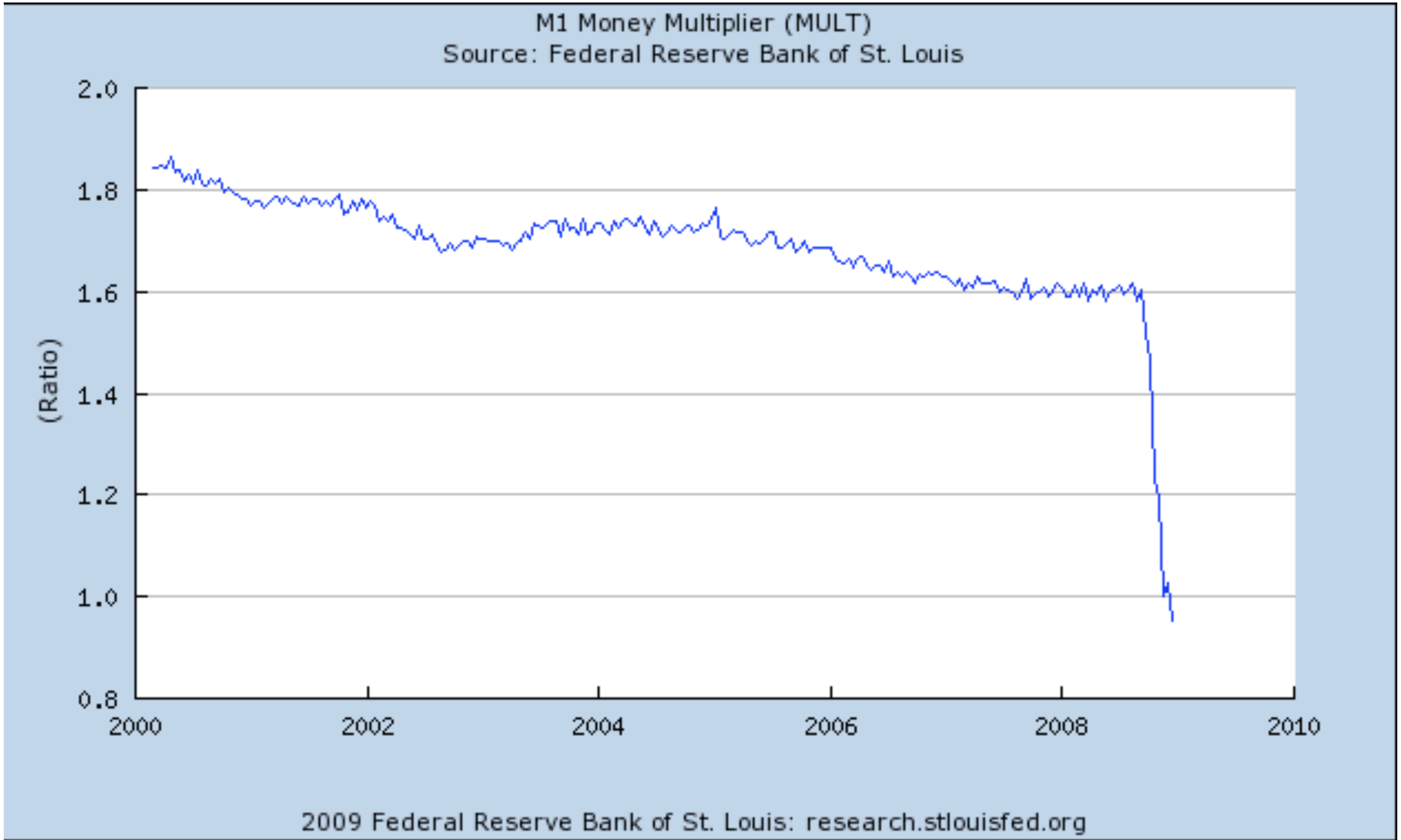
Non-Borrowed Reserves of Depository Institutions (BOGNONBR) continue to plummet. This makes sense as under capitalized banks continue to hemorrhage money via outright losses and write downs of over valued assets. The result is that these banks now have to borrow money from the Fed to maintain their reserves so that when you go to the ATM money actually comes out...

This also explains why all interbank lending rates from LIBOR and EURIBOR to HIBOR all did moonshots. You see, there were few banks capable of lending in any size, and even fewer willing.

MONDAY, JANUARY 05, 2009

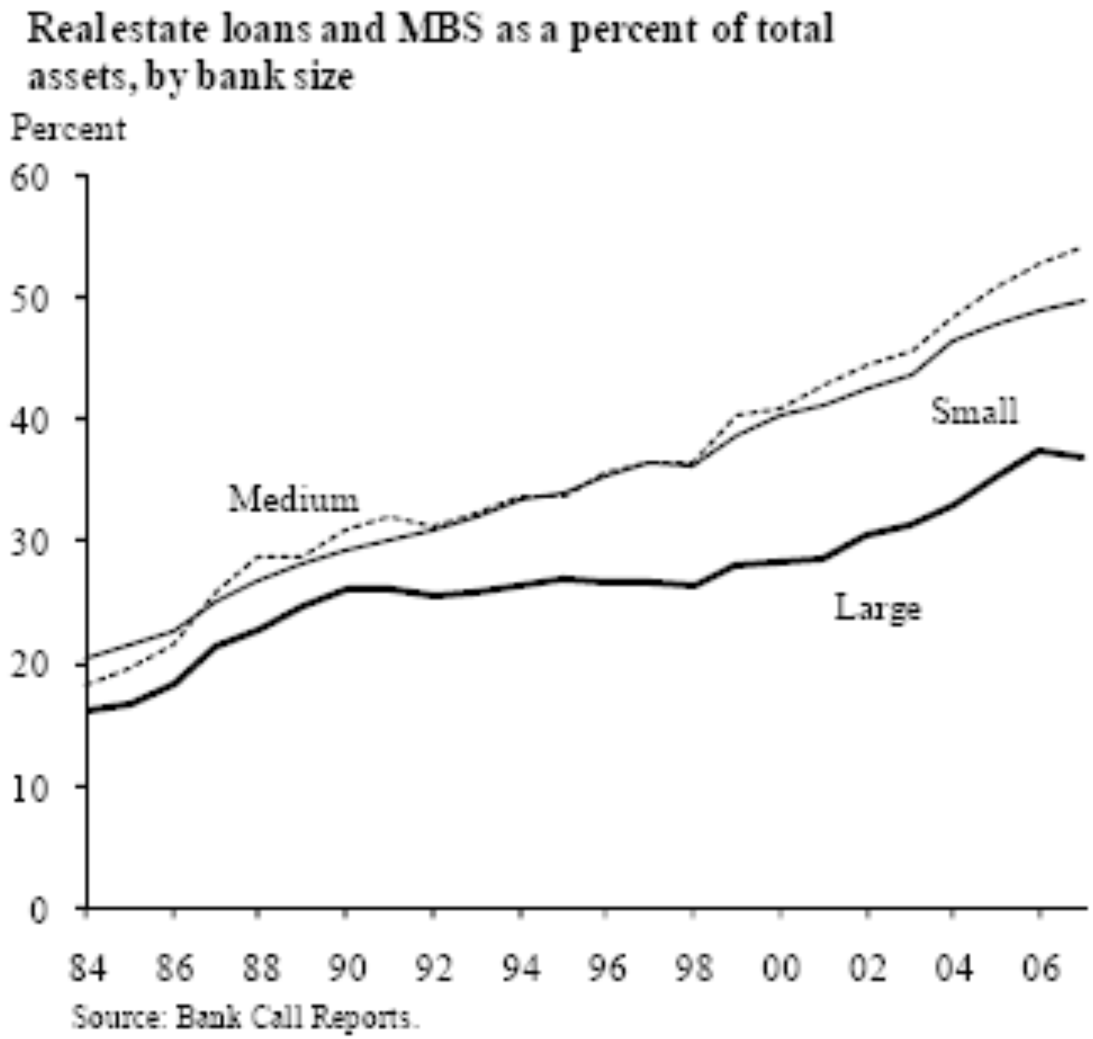
# The Disappearing Money Multiplier




Econ prof Bill Seyfried of Rollins College:

The M1 money multiplier just slipped below 1. So each $1 increase in reserves (monetary base) results in the money supply increasing by $0.95 (OK, so banks have substantially increased their holding of excess reserves while the M1 money supply hasn't changed by much).

Standard claim: The current financial crisis in the United States has its roots in falling real estate values. It is based on a number of studies that have shown a strong link between house price depreciation and defaults on residential mortgages (Doms, Furlong, and Krainer 2007).



# Another view: Causes of current crisis and trust in the stock market

Respondents were asked, “According to you, what is the MAIN cause of the current crisis?”

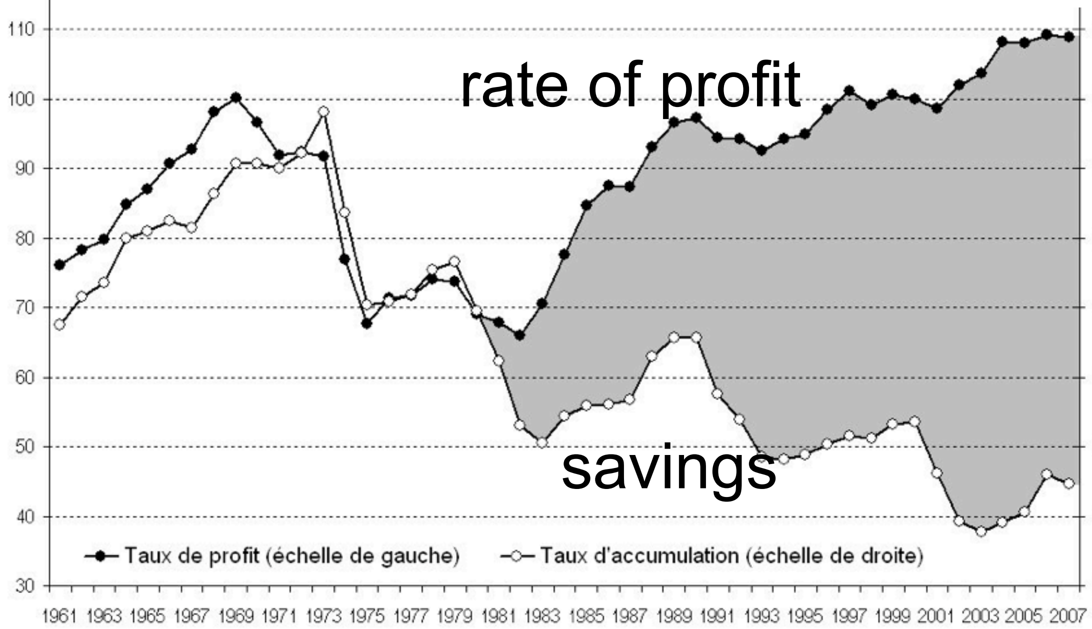

1 means “I do not trust at all”

5 means “I trust completely.”

http://financialtrustindex.org/

Source: Paola Sapienza and Luigi Zingales

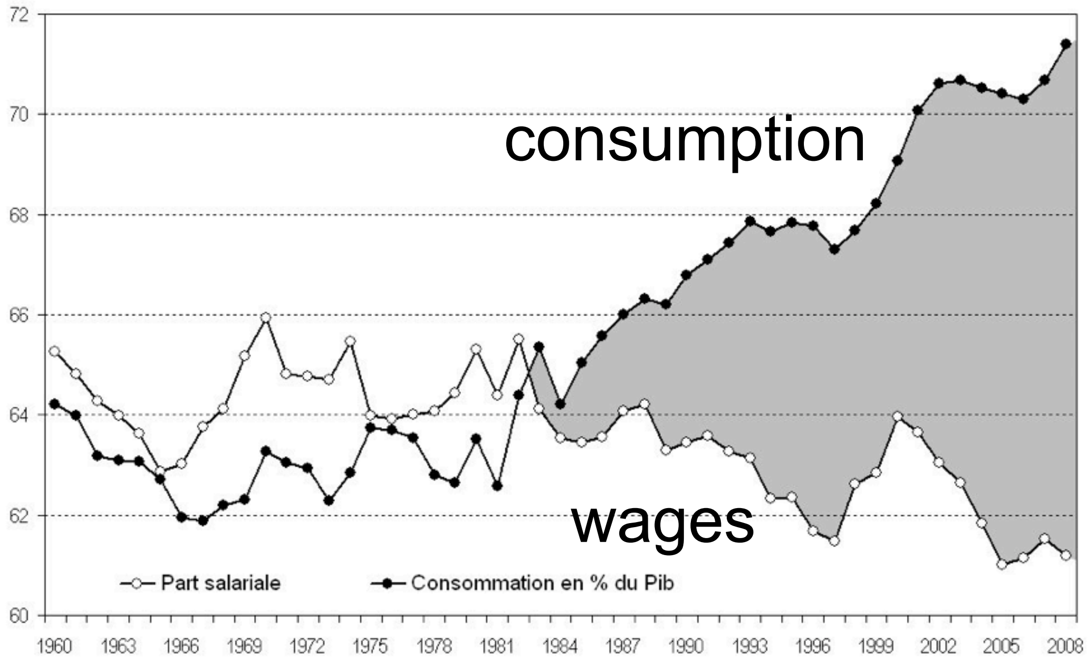
# The illusionary “PERPETUAL MONEY MACHINE”




**Rate of profit and rate of accumulation: The United States + European Union + Japan**

* Rate of accumulation = rate of growth rate of the net volume of capital * Rate of profit = profit/ capital (base: 100 in 2000)

Sources and data of the graphs: http://hussonet.free.fr/toxicap.xls




Thee gap widens between the share of wages and the share of consumption (gray zones), so as to compensate for the difference between profit and accumulation. FINANCE allows increasing debt and virtual wealth growh... which can only be transitory (even if very long).

**United States Share of wages and of private consumption in Gross Domestic Product (GDP)**

Source of data and graphics: http://hussonet.free.fr/toxicap.xls

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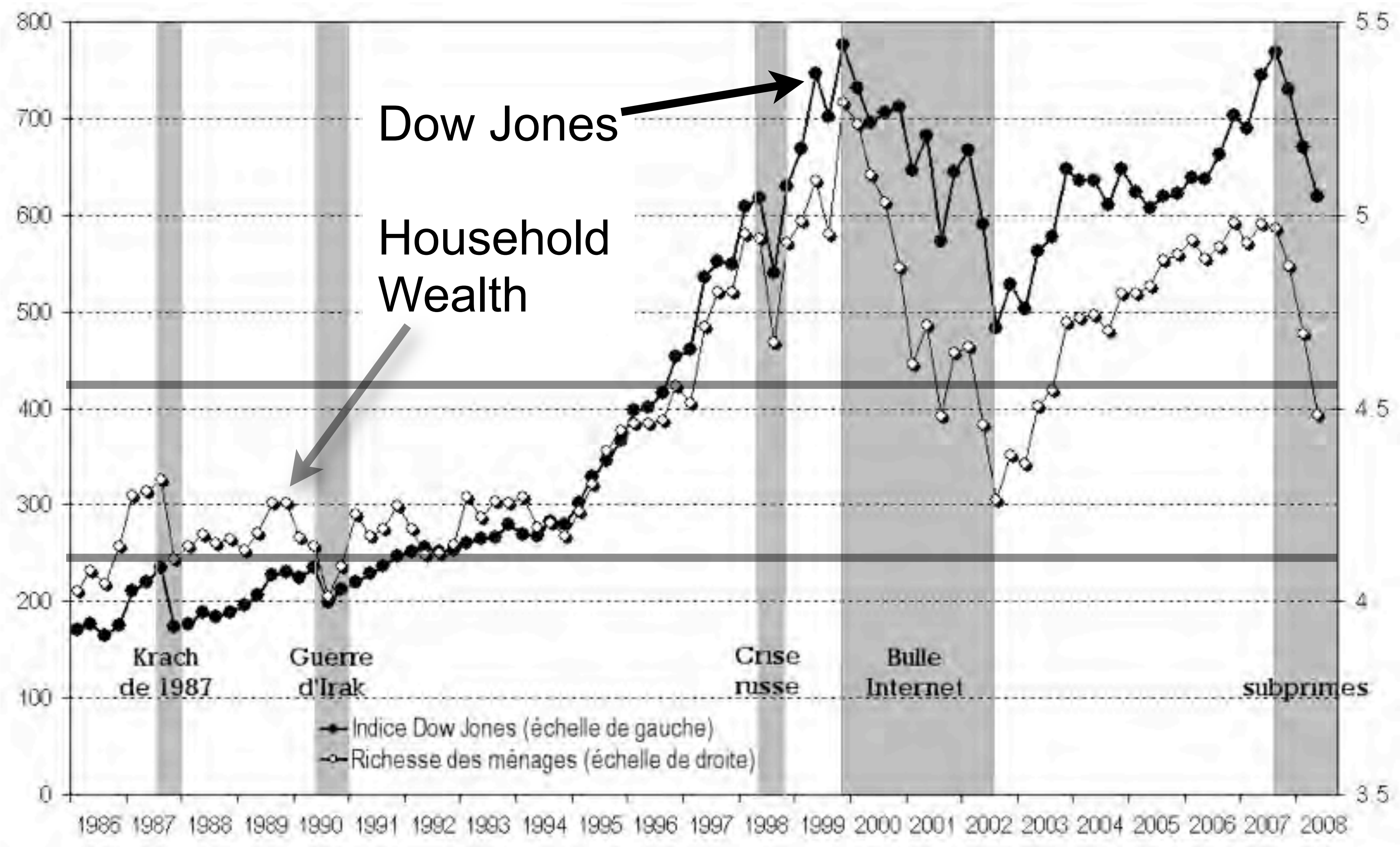


1: The Stock Exchange and household wealth in the United States

▸ The Dow Jones index at current prices (base: 100 in 1960)

▸ Net wealth of households as a multiple of their current income Sources and data for the graphs: http://hussonet.free.fr/toxicap.xls

source: Michel Husson

## The illusionary “PERPETUAL MONEY MACHINE”

- An economy which grows at 2 or 3 per cent cannot provide a universal profit of 15 per cent, as some managers of equities claim and many investors dream of.
- As long as the incomes drawn from financial assets are re-invested, the fortunes increase independently of any material link with the real sphere and the variation can potentially become infinite.
- Financial assets represent the right to a share of the surplus value that is produced. As long as this right is not exercised, it remains virtual. But as soon as anyone exercises it, they discover that it is subject to the law of value, which means, quite simply, that you cannot distribute more real wealth than is produced.

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- The ITC “new economy” bubble (1995-2000)
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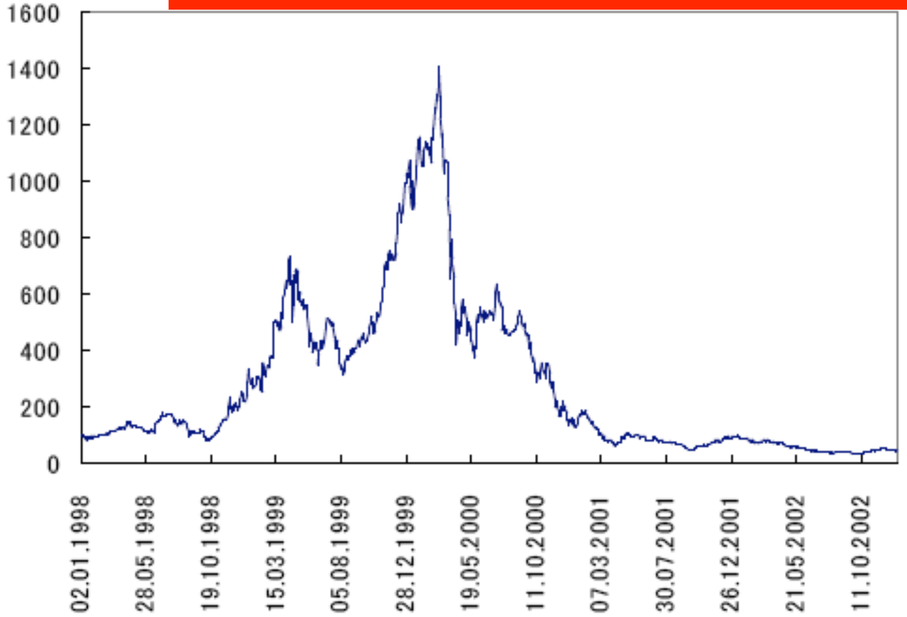
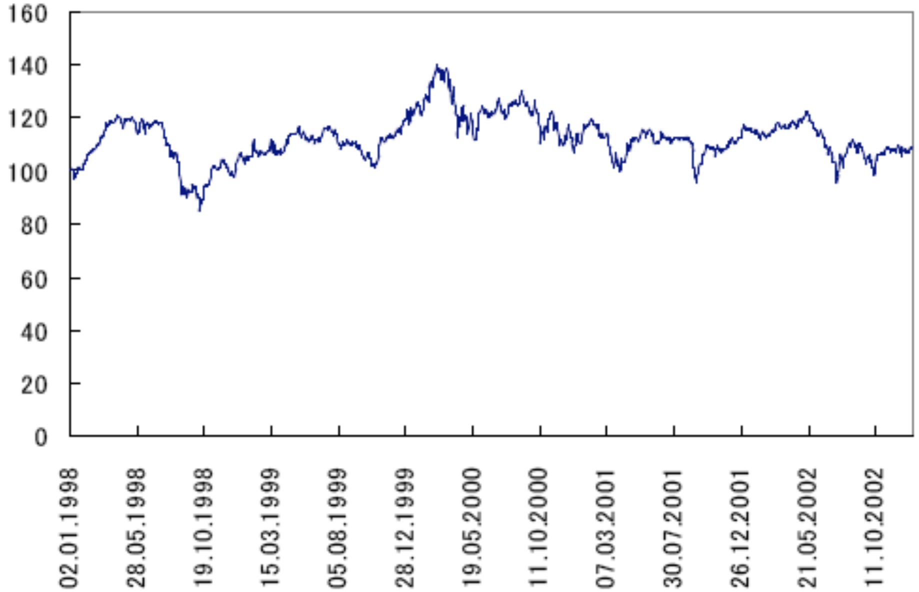
- Real-estate bubbles (2003-2006)
- MBS, CDOs bubble (2004-2007) and stock market bubble (2004-2007)
- Commodities and Oil bubbles (2006-2008) Consequences (deep loss of trust, systemic instability)
- Solution?

# THE NASDAQ CRASH OF APRIL 2000




Internet stocks

Non-Internet Stock Price Index




The Internet stock index and non-Internet stock index which are equally weighted. Comparison of index levels of the Internet index and the non-Internet Stock index, and the Nasdaq composite index for the period 1/2/1998-12/31/2002. The two indexes are scaled to be 100 on 1/2/1998.

non-Internet stocks

# 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.

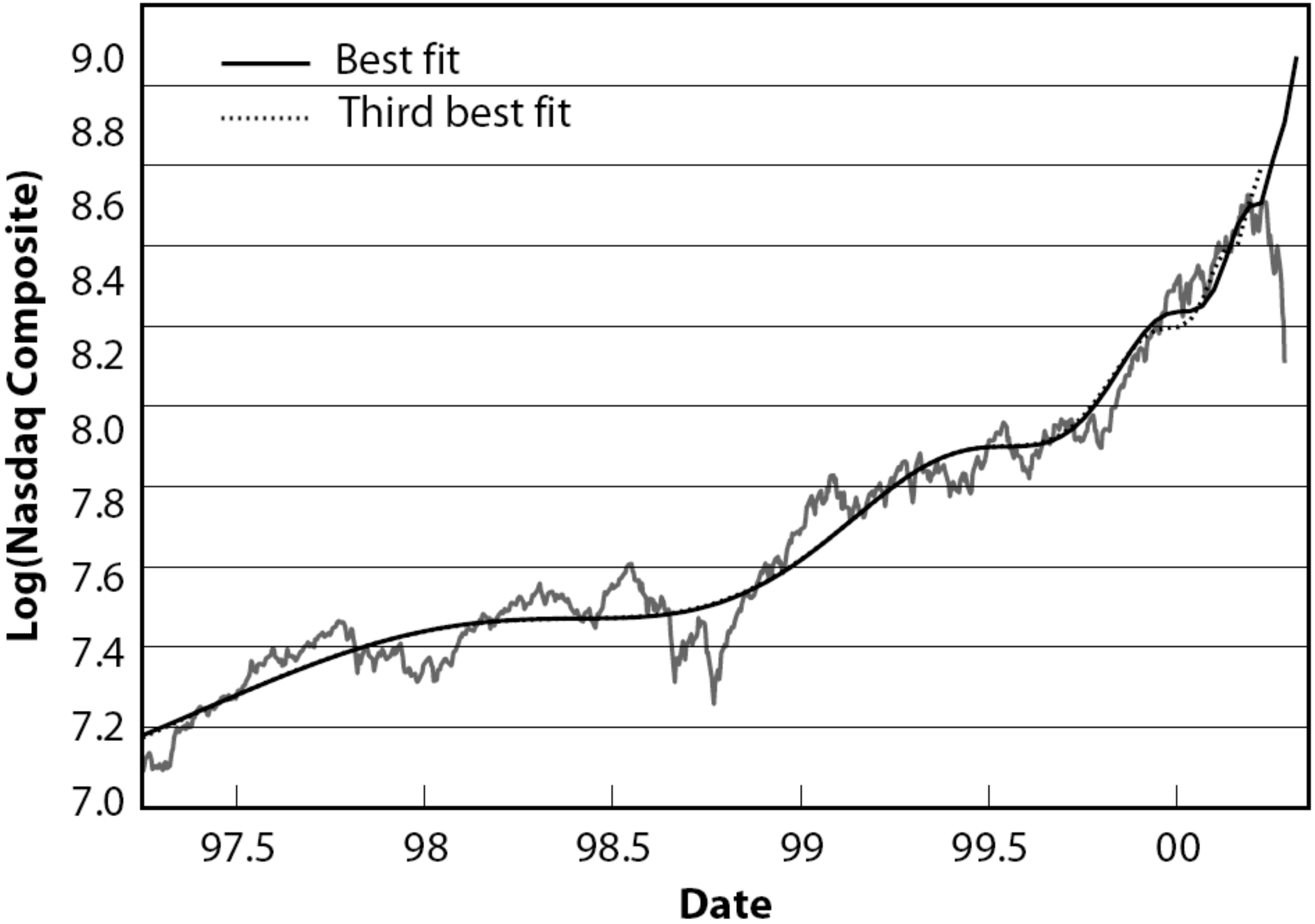
•In January 2000 alone, 30% of net inflows into mutual funds went to science and technology funds, versus just 8.7% into S&P 500 index funds.

•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.

# THE NASDAQ CRASH OF APRIL 2000

"New Economy": ICT



# THE NASDAQ CRASH OF APRIL 2000

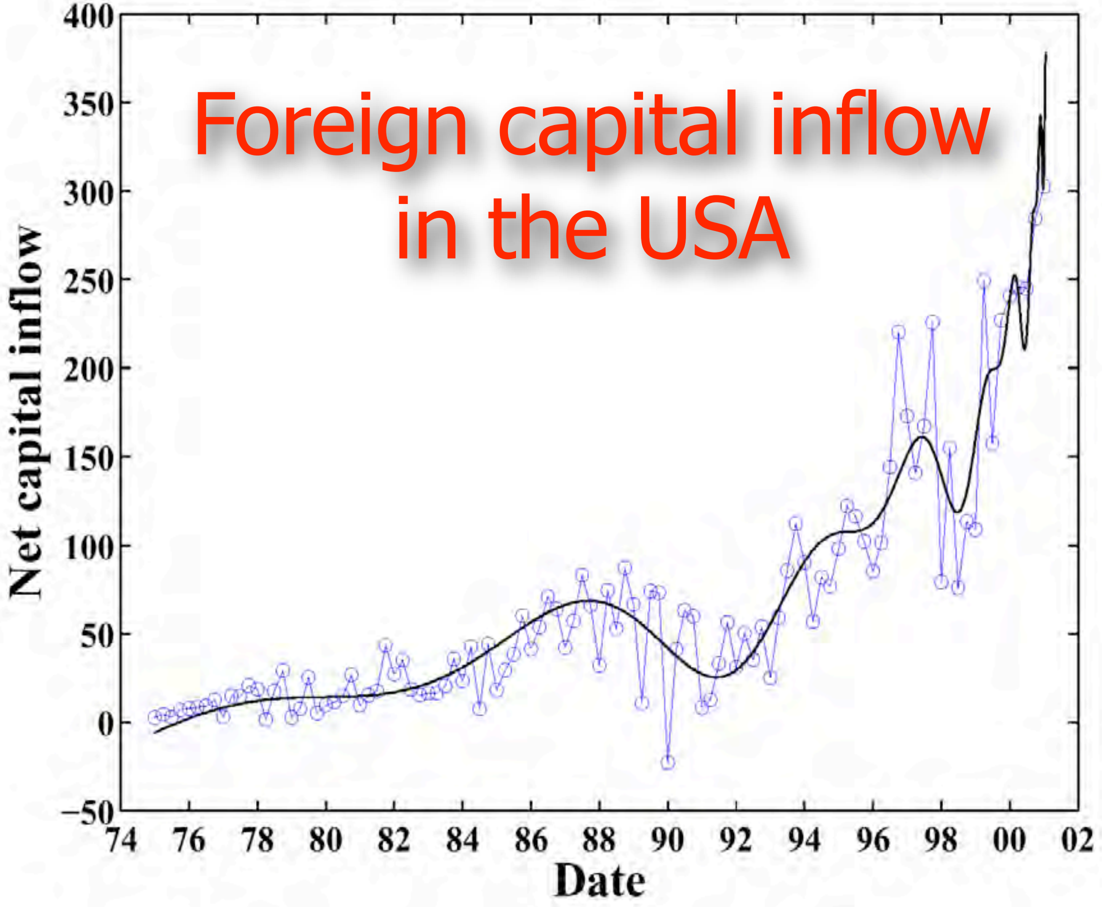



Fig. 2. Fit of the time evolution of the foreign net capital inflow $I(t)$ in the USA from 1975 till the first quarter of 2001 when it reached its maximum, by a second-order Weierstrass-type function given by expression (1). The predicted critical time is $t_c = 2001/03/12$, the power-law exponent is $m = 0.01$, 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.

# 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…**

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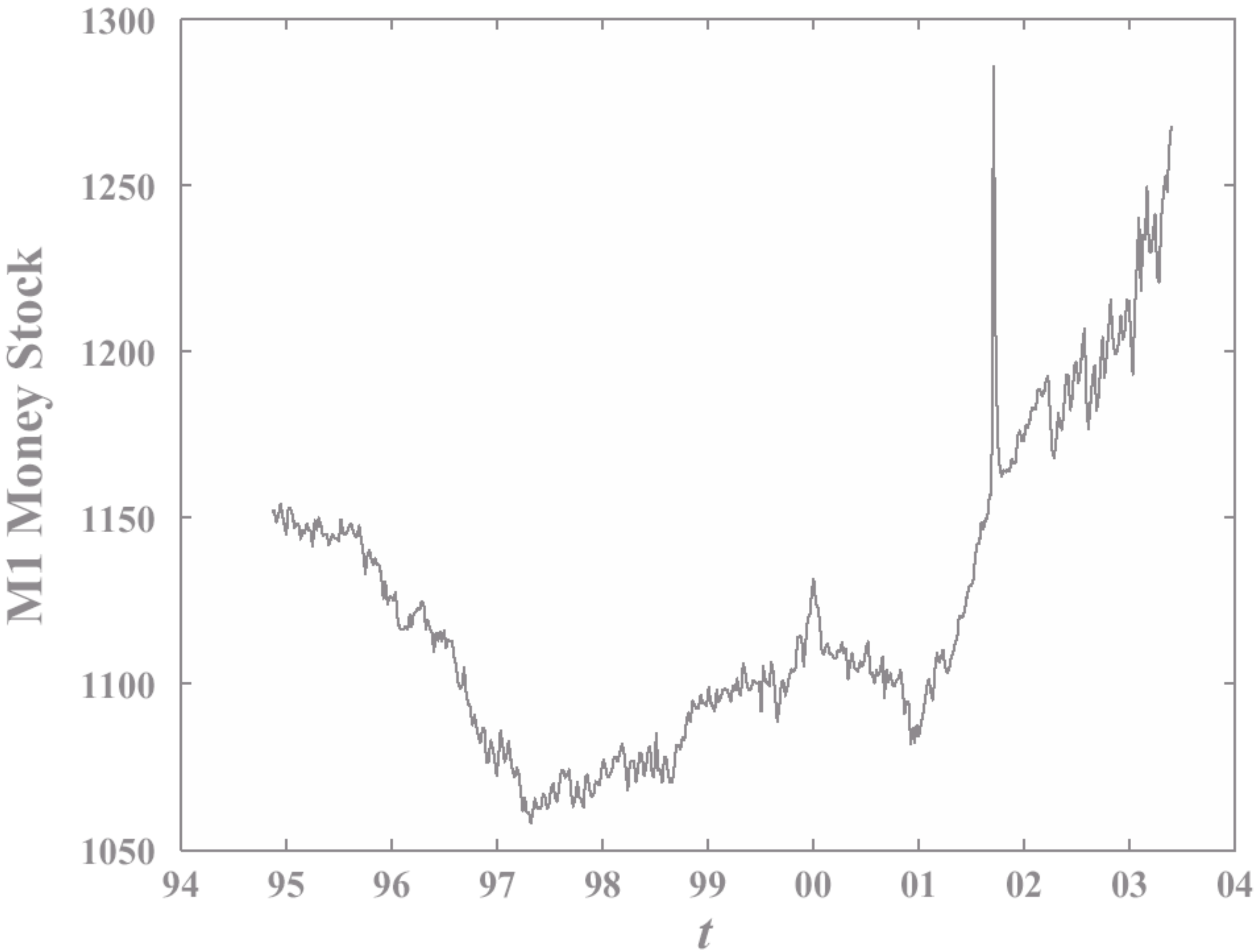
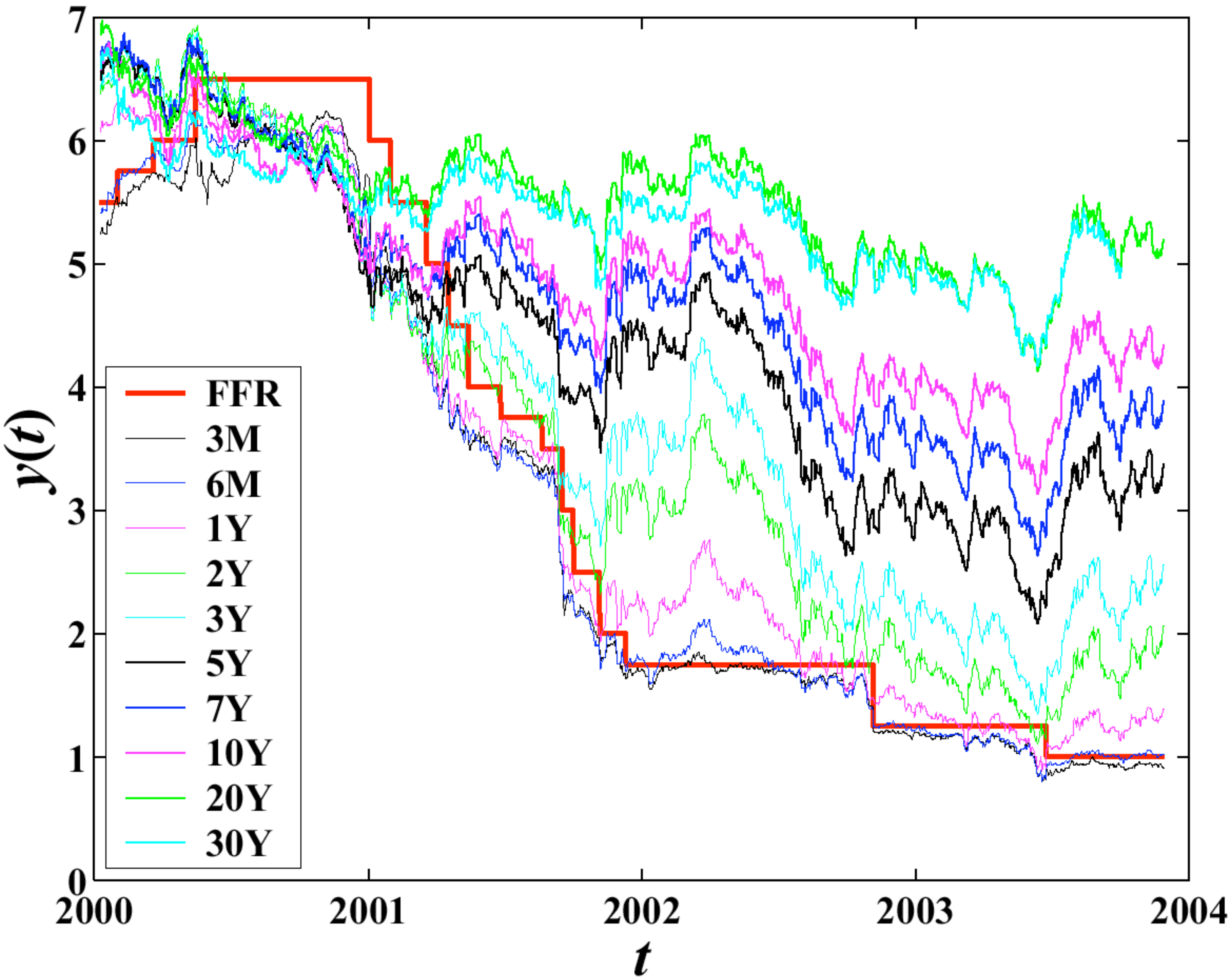
# Growth of Money supply (M1)

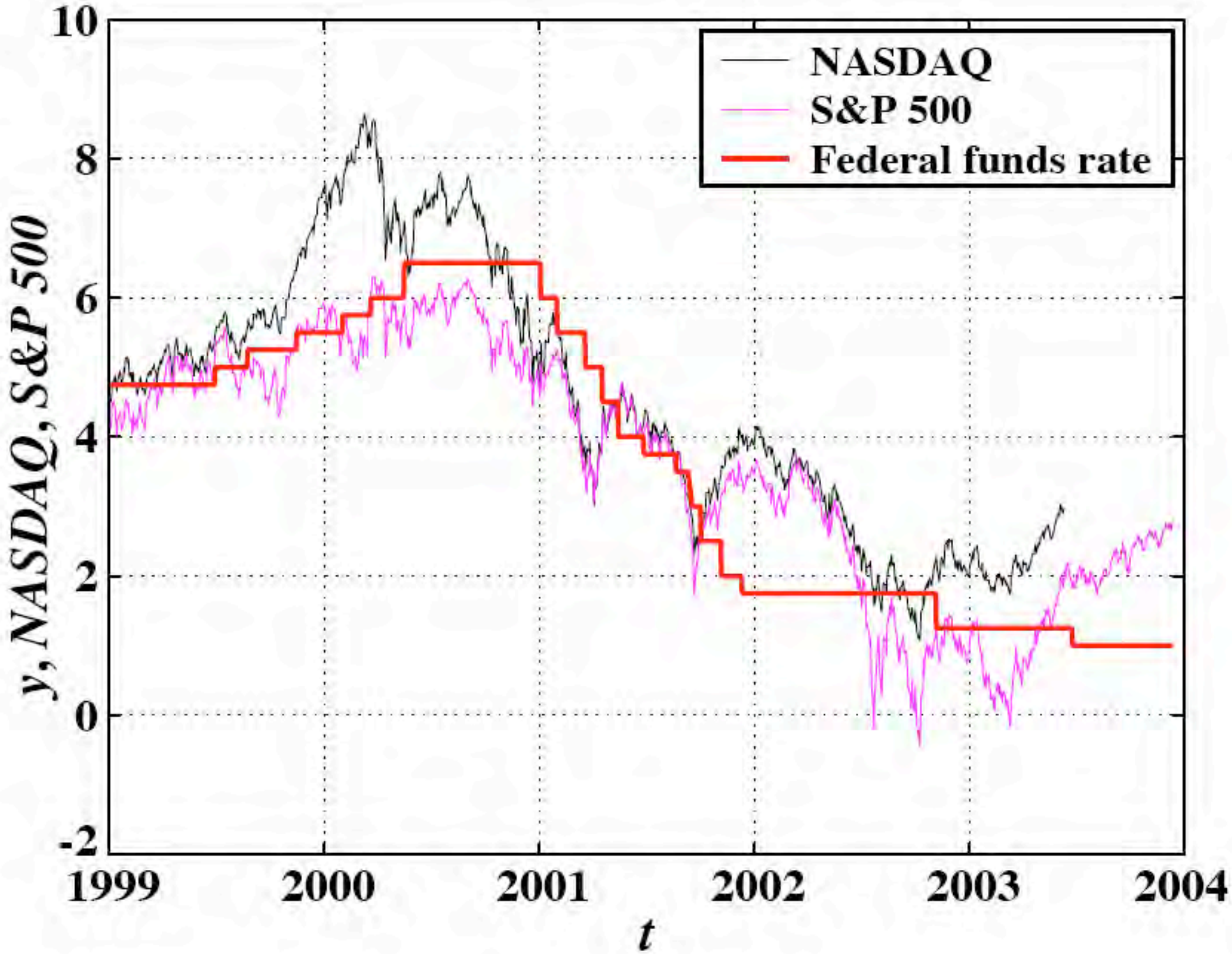


# Causal slaving of the US Treasury Bond yields to the stock market

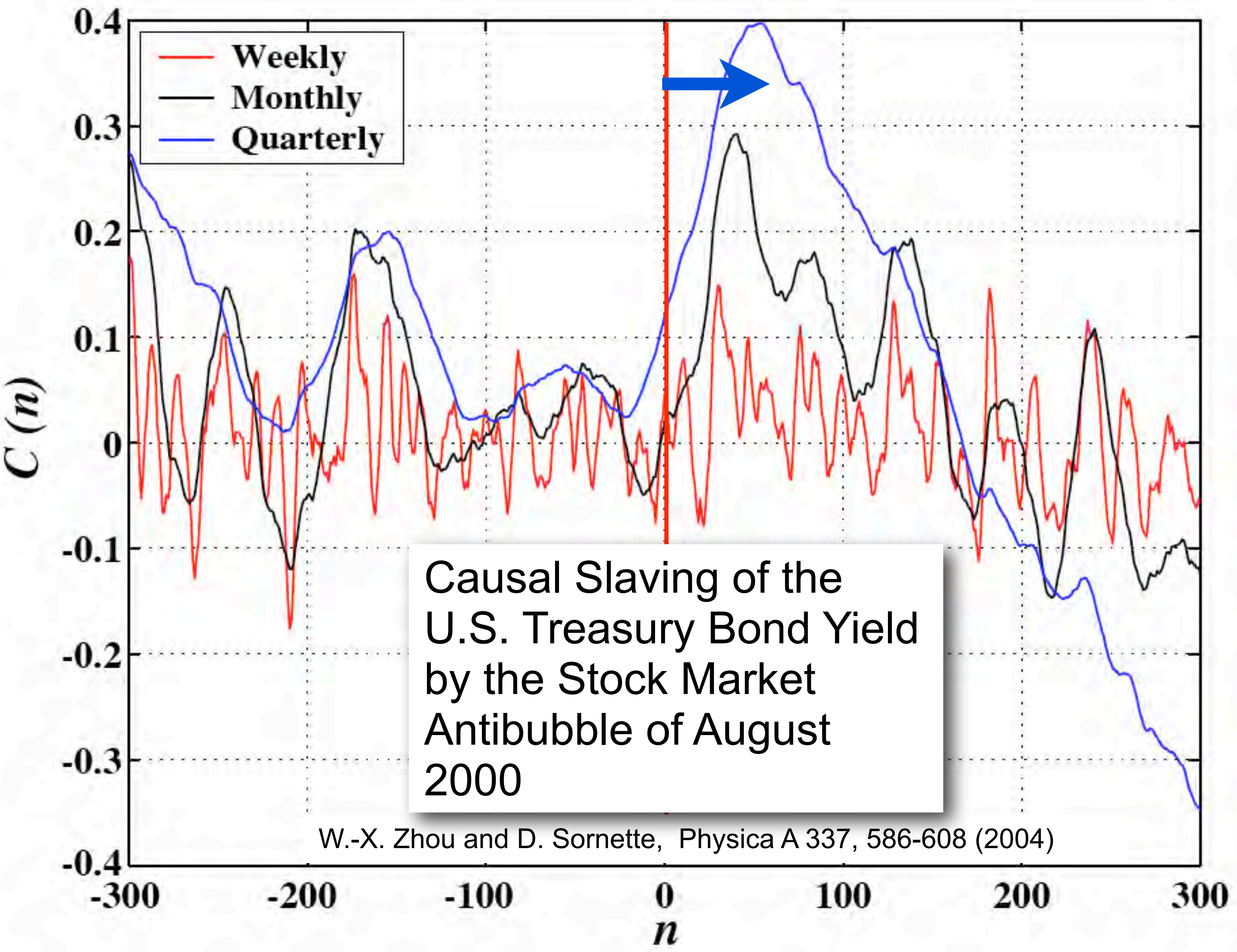



W.-X. Zhou, D. Sornette / Physica A 337 (2004) 586–608

# “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: $x \to 5x - 34$ and $z \to 10z - 67$.




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.

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# Real-estate bubbles


*Sources:* Shiller; BIS.

# Real-estate in the UK

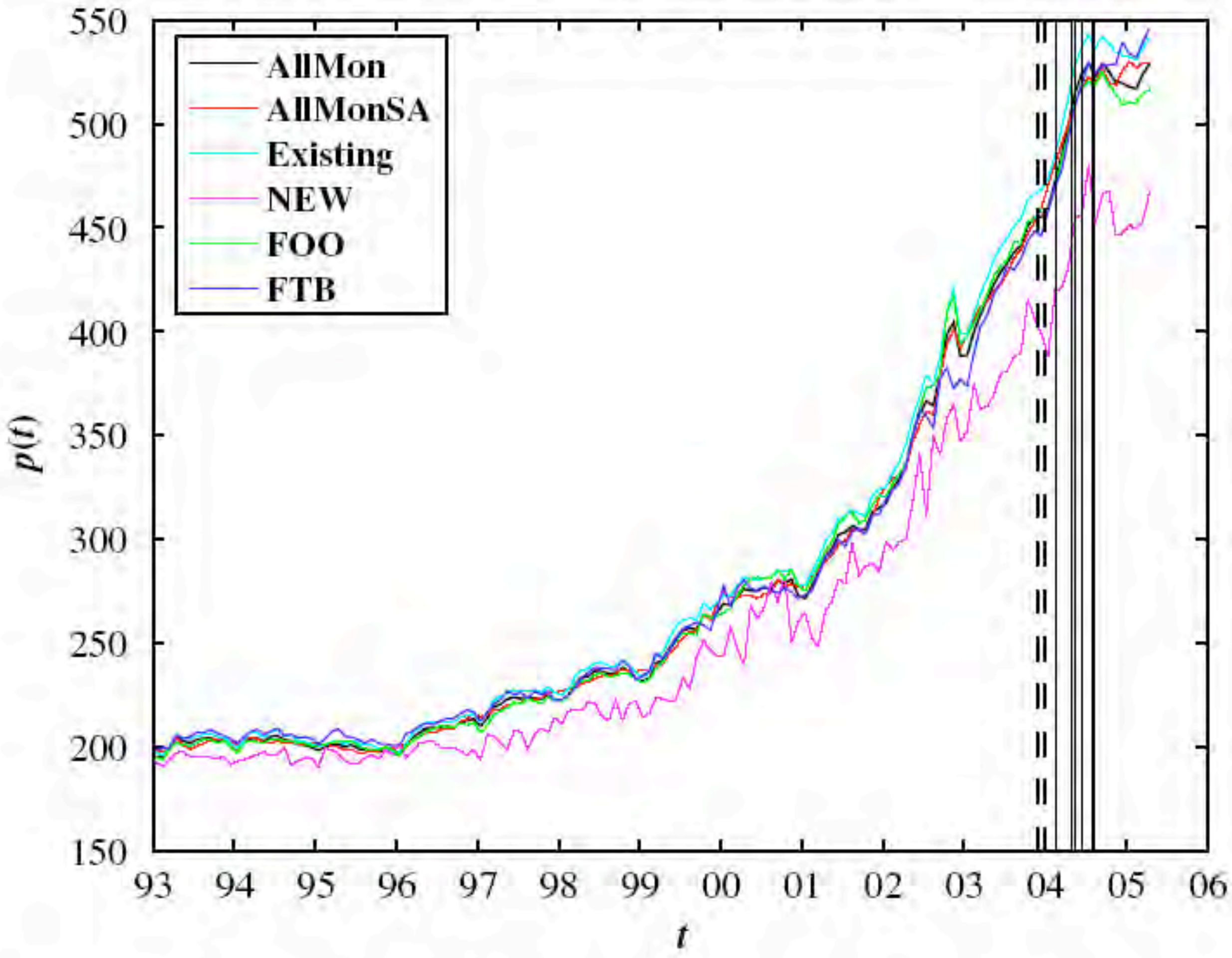



Fig. 1. (Color online) Plot of the UK Halifax house price indices from 1993 to April 2005 (the latest available quote at the time of writing). The two groups of vertical lines correspond to the two predicted turning points reported in Tables 2 and 3 of [1]: end of 2003 and mid-2004. The former (resp. 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 bubble (USA)


Total new privately-owned housing starts and new one-family houses sold in the U.S (in ‘000). January 1990 – June 2008 series

# Real-estate in the USA

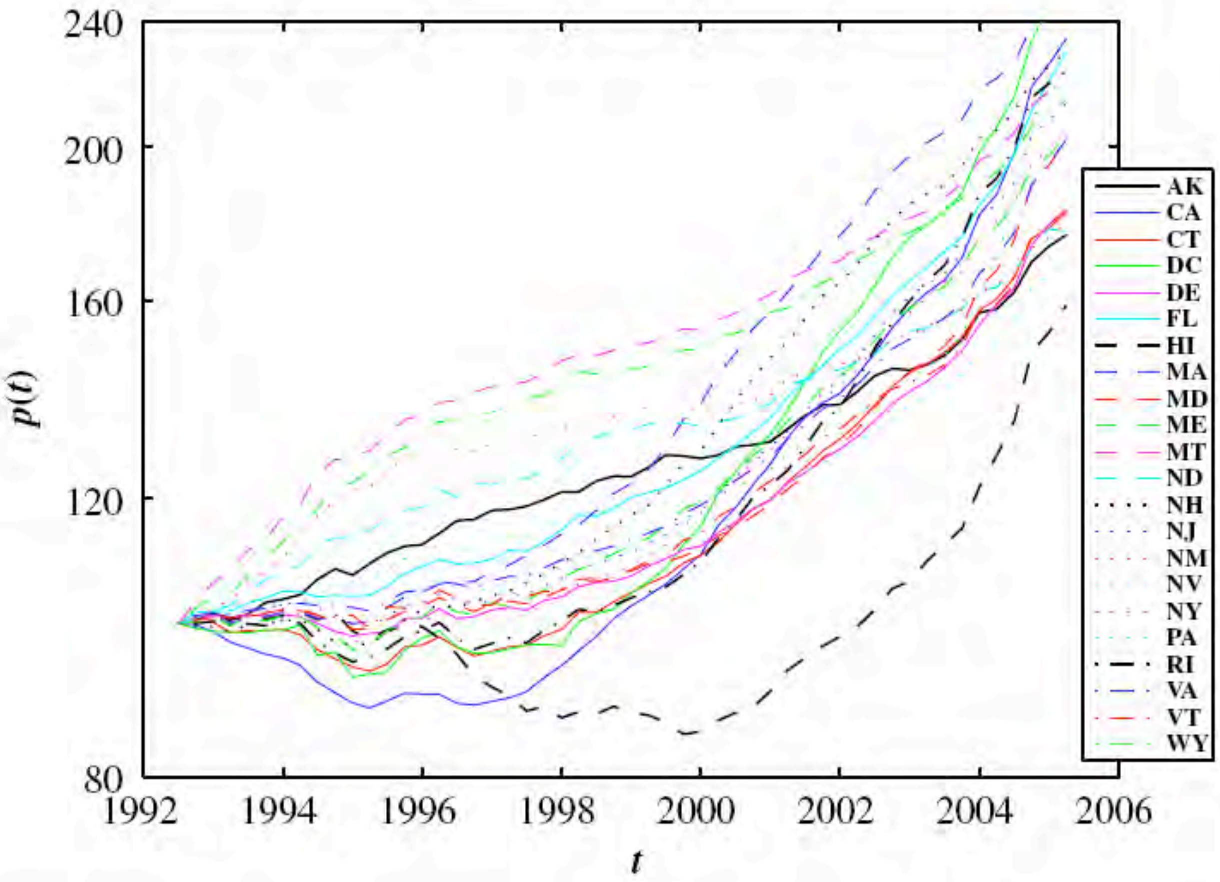



Fig. 5. (Color online) Quarterly average HPI in the 21 states and in the District of Columbia (DC) exhibiting a clear upward faster-than-exponential growth. For better representation, we have normalized the house price indices for the second quarter of 1992 to 100 in all 22 cases. The corresponding states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

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

**717 VERNON WY**
**BURLINGAME, CA 94010**

(2005)

**2** Bedrooms, **1** Bath(s)
**1,310** Estimated Sq. Ft.

Listing #: 620130

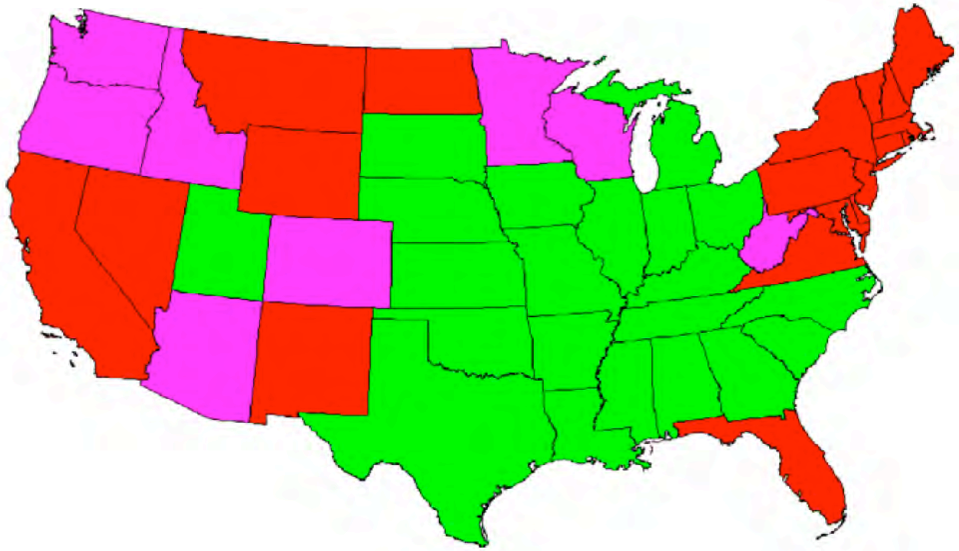
**$1,049,000**

And this with the median household income in San Mateo County of ~$70,000. With 20% down, the mortgage for a "starter" $1M house would be 11-12 times the median income. Even if one were "buying up" to one of these houses, say, with equity of 50%, the mortgage/median income ratio would be 7:1!!!

From late '02 and early '03 to date--the bubbliest phase--the value of the property below is estimated to have more than DOUBLED, peaking at an estimated $1.16M in summer-fall '05, an annualized increase in value of ~14% from '96. However, before the one order of magnitude of exponential growth of the bubble commenced in late '02, the rate of growth of the value of this property was ~6.9%/yr. Were the value to regress to the pre-bubble trend, the estimated value would be $620,000-$820,000 over the course of the next 4 years or a 30% to 40-45% nominal decline and -11% to -18%/yr. in real terms (at the trend 2.7% CPI).

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.

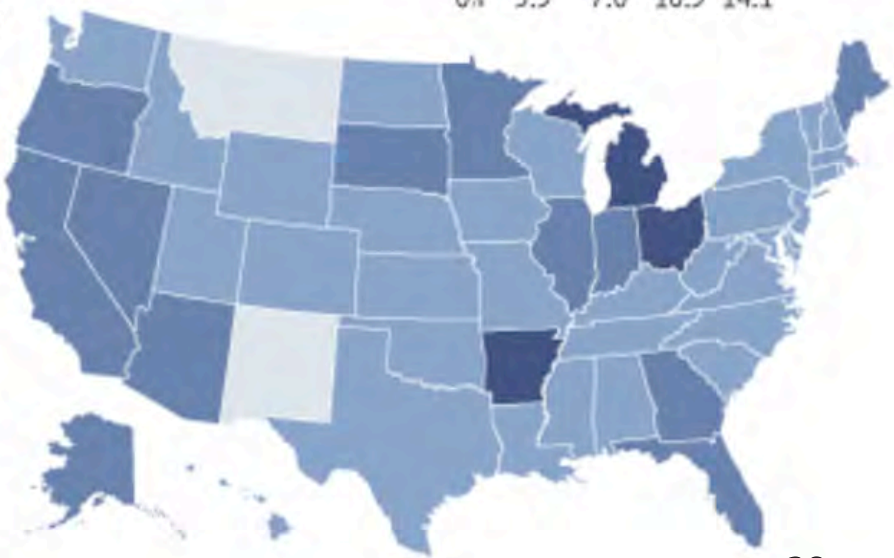
Loans at least 30 days past due

0% 3.5 7.0 10.5 14.1

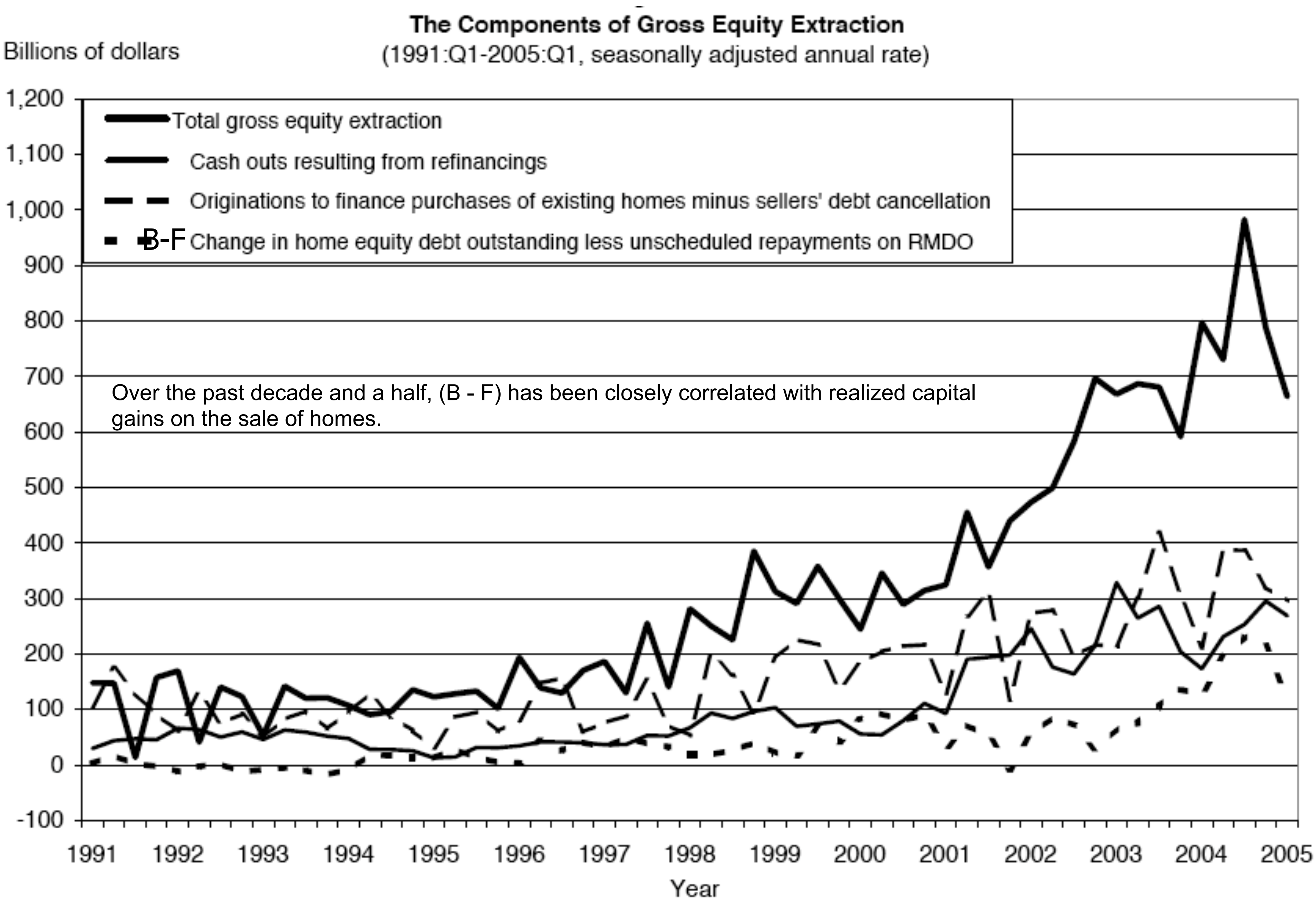
### Fourth quarter 2007

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 |

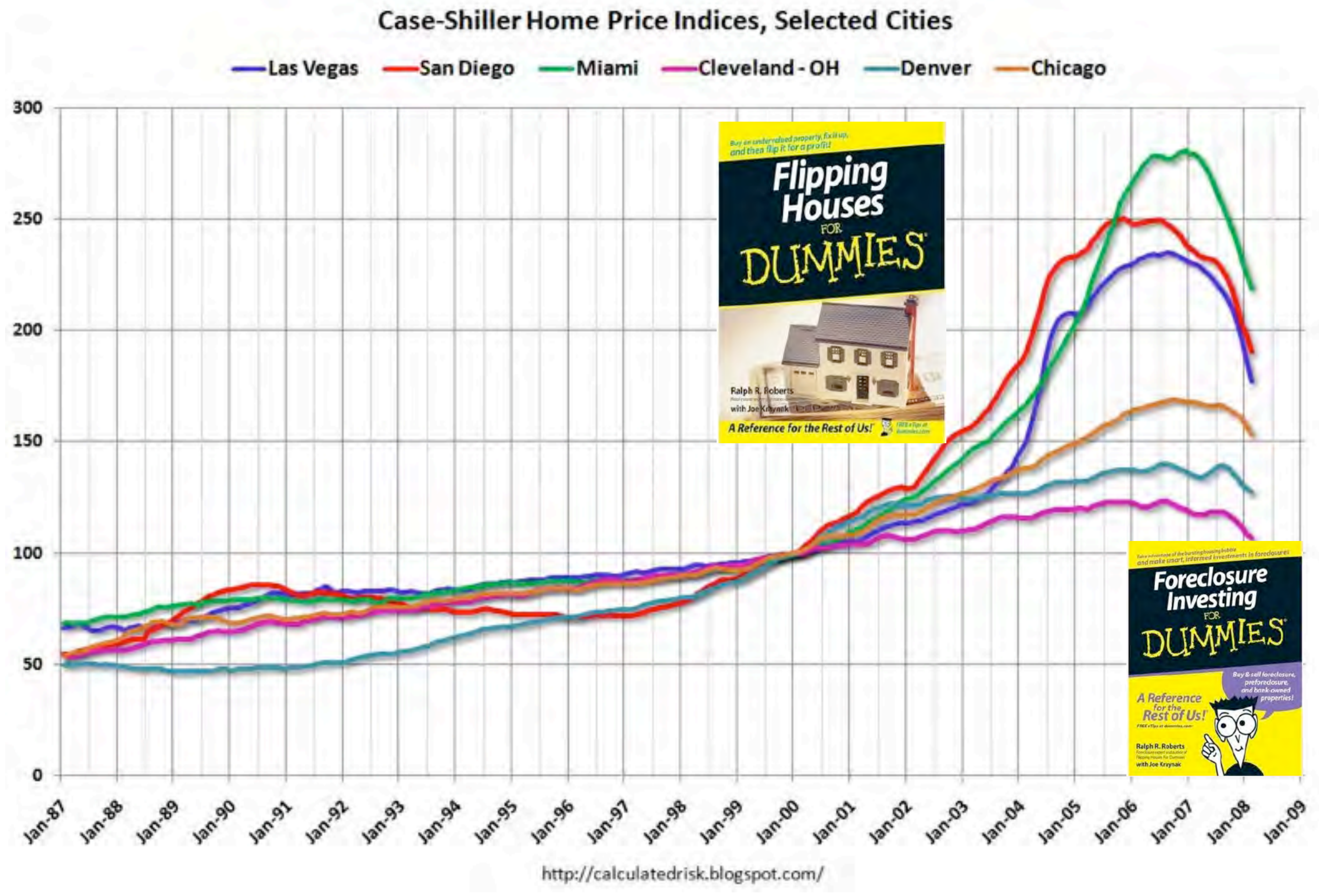


Fall 2007






**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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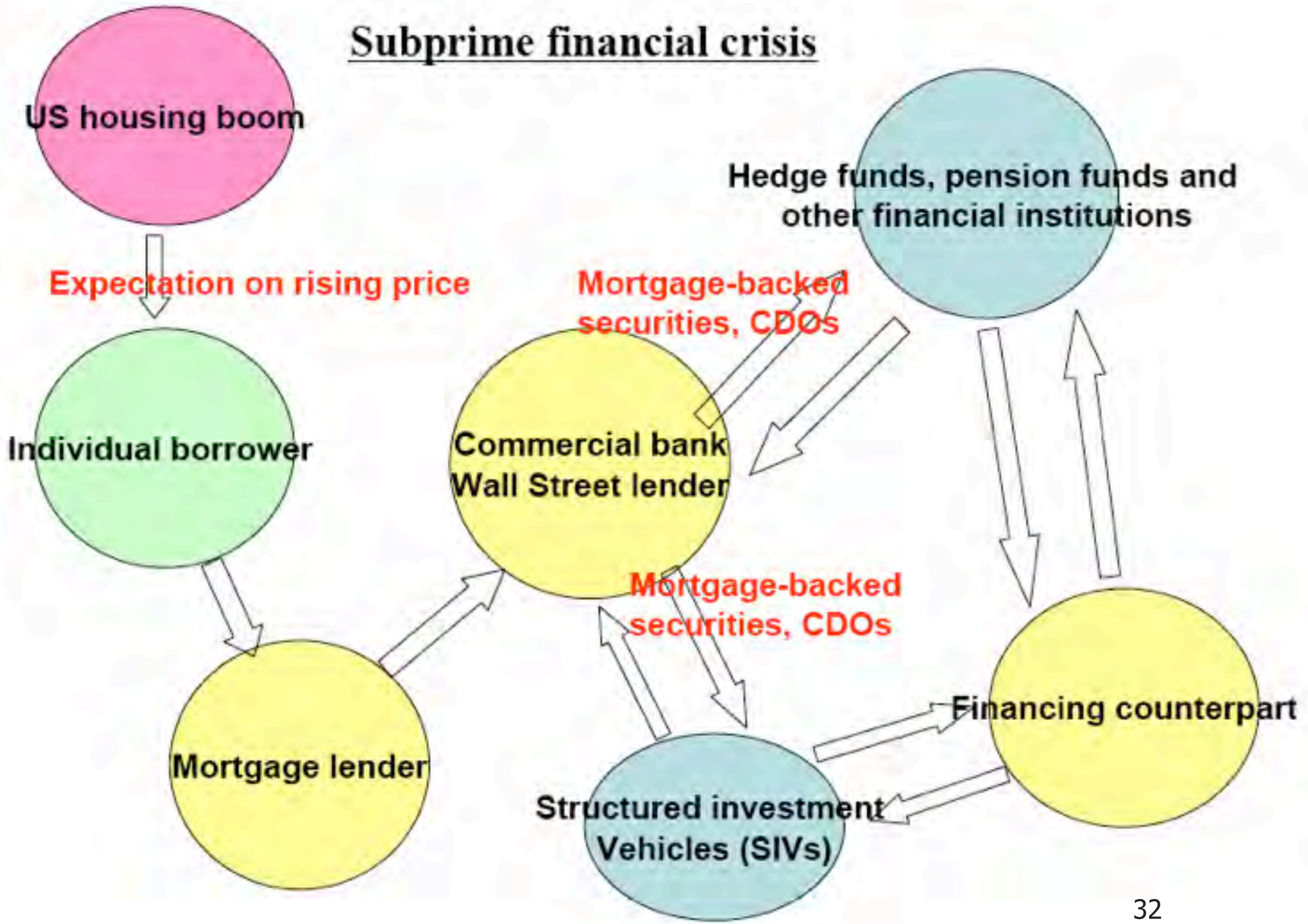
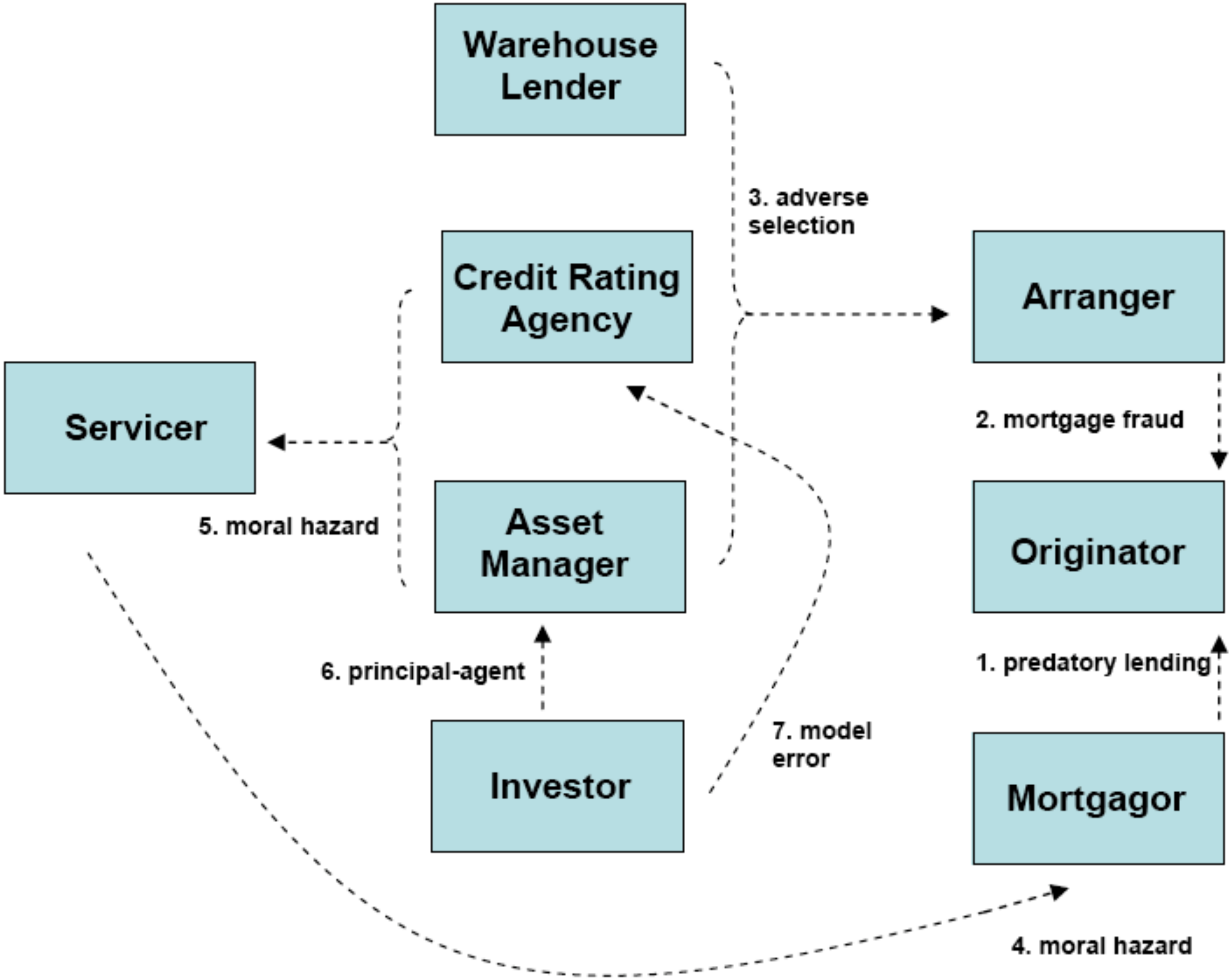
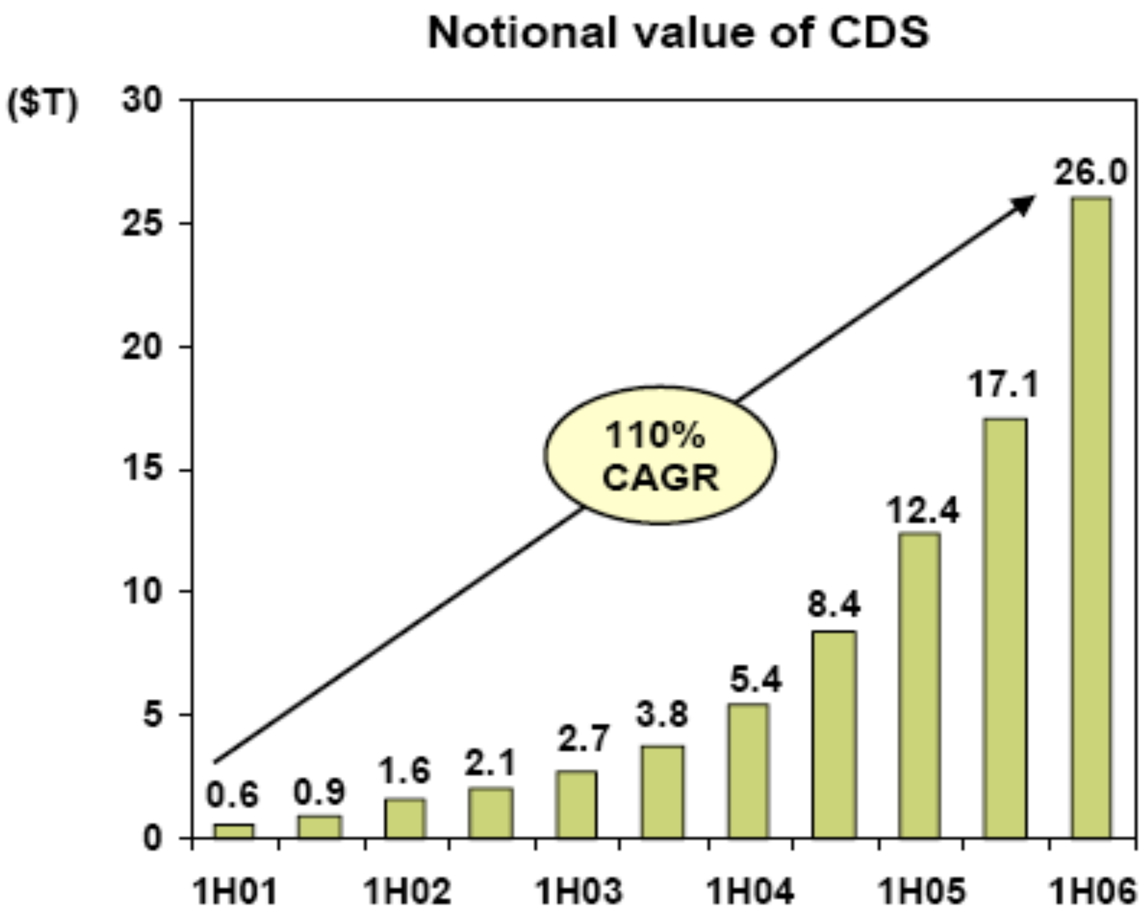
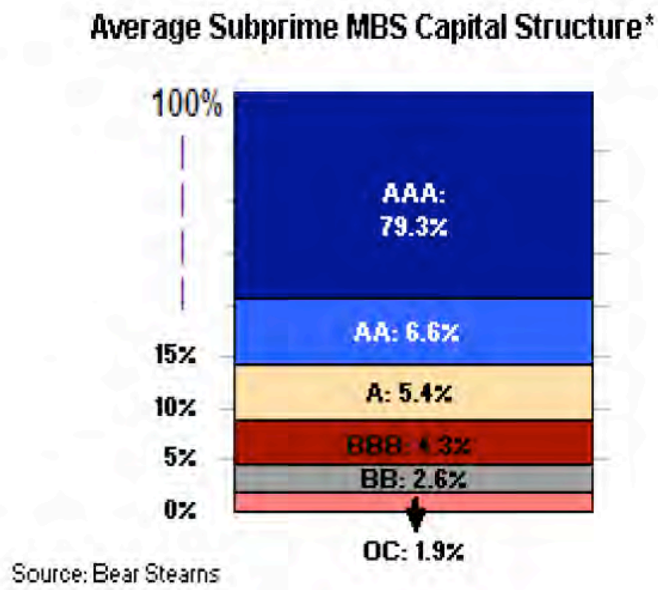

Subprime financial crisis
US housing boom
Expectation on rising price
Individual borrower
Mortgage lender
Commercial bank
Wall Street lender
Mortgage-backed
securities, CDOs
Hedge funds, pension funds and
other financial institutions
Mortgage-backed
securities, CDOs
Structured investment
Vehicles (SIVs)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

# Key Players and Frictions in Subprime Mortgage Credit Securitization



# Securitization of non-financial assets (commodities, real-estate, credit)



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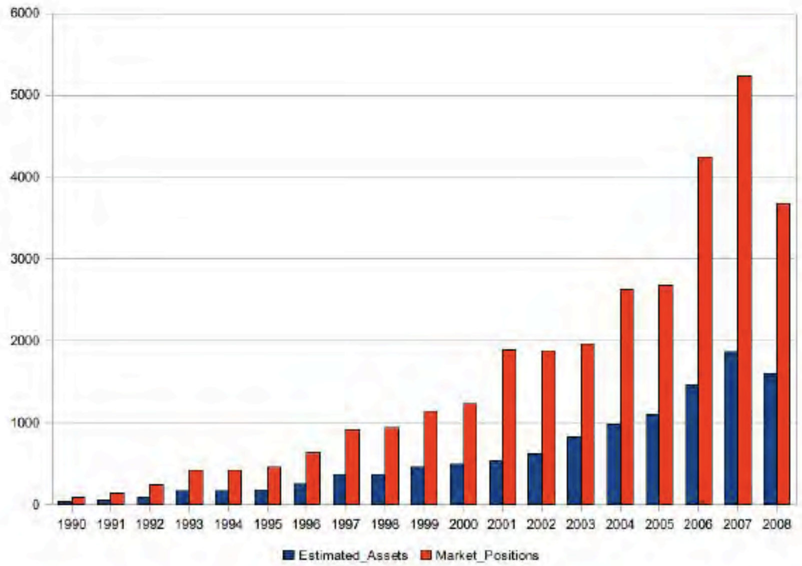
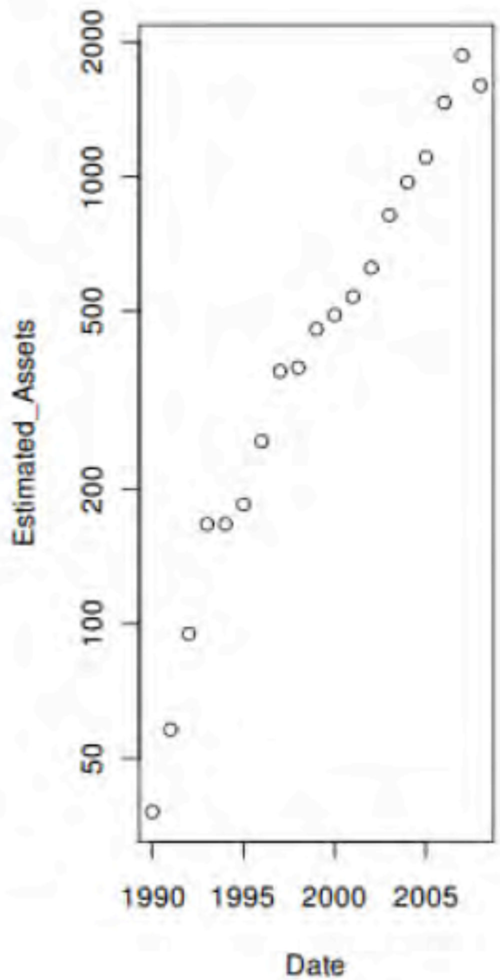
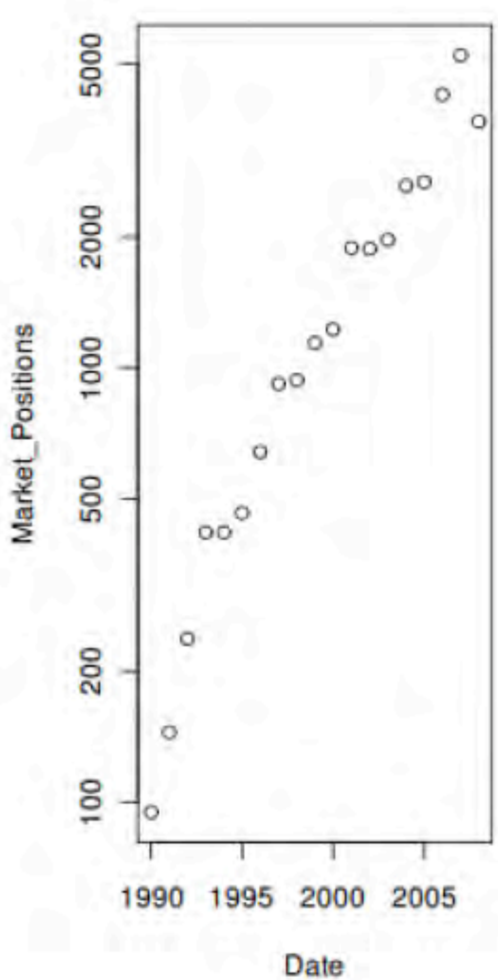


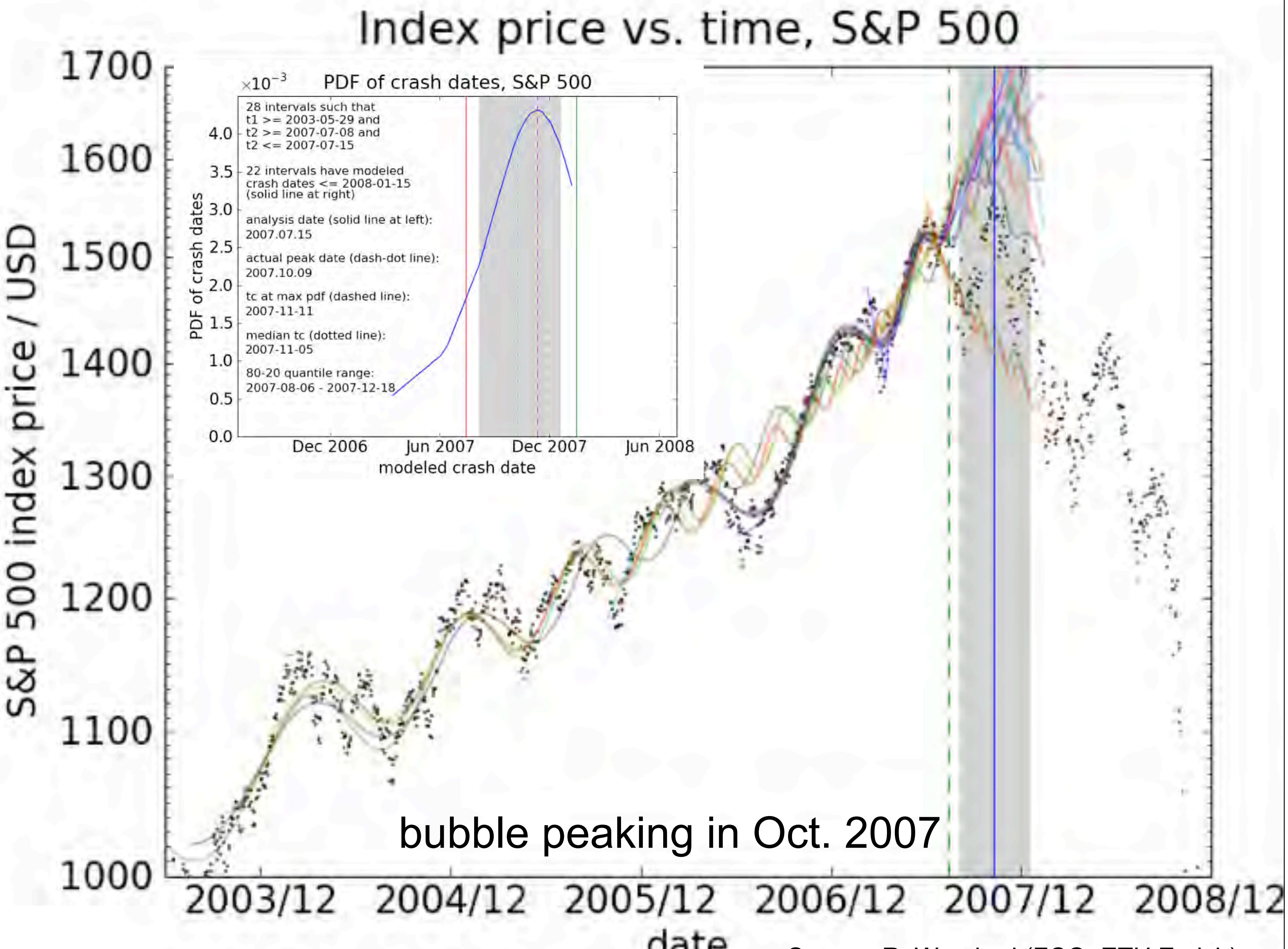

Estimated assets and market positions in the hedge-fund industry from 1990 to 2008




Source: A. Huesler and D. Sornette

Lo, A. W. Hedge funds, systemic risk, and the financial crisis of 2007- 2008: Written testimony for the house oversight committee hearing on hedge funds. Social Science Research Network Working Paper Series (November 2008).




Source: R. Woodard (FCO, ETH Zurich)

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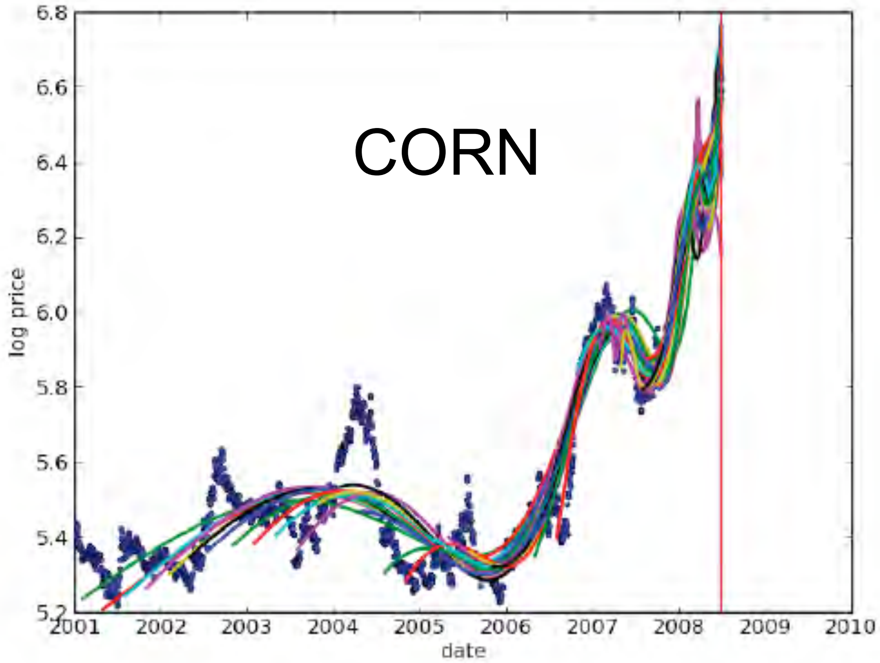
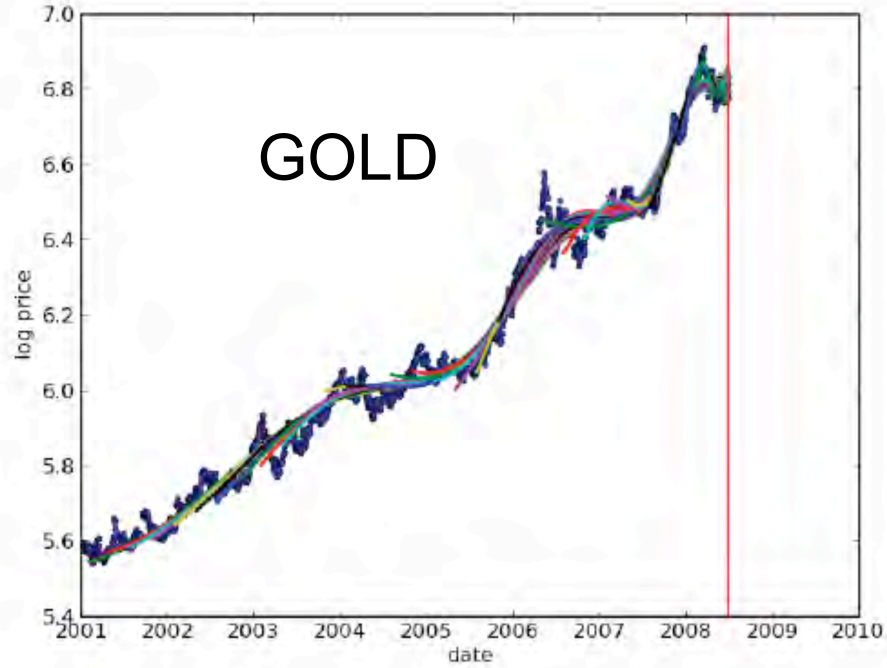
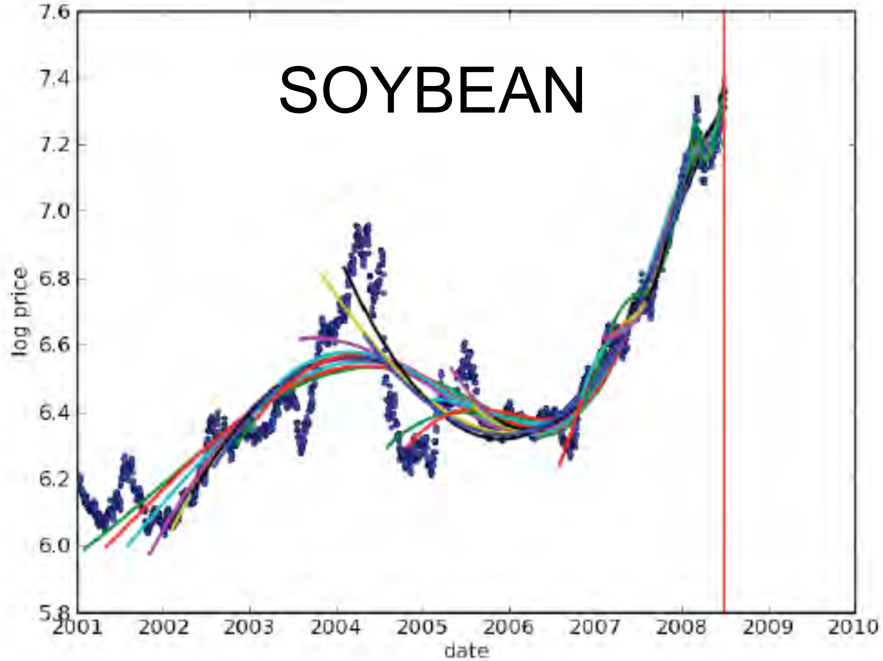
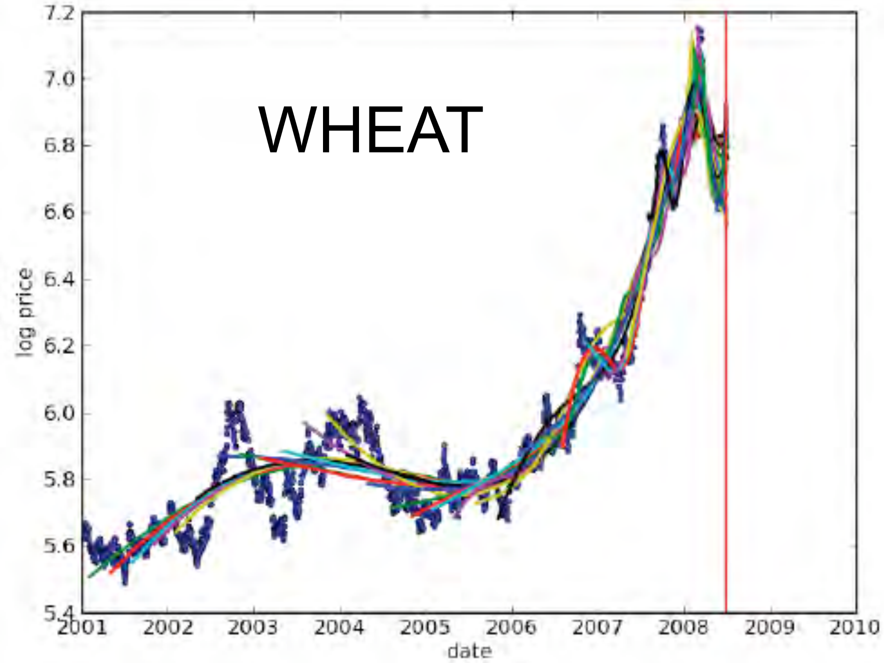


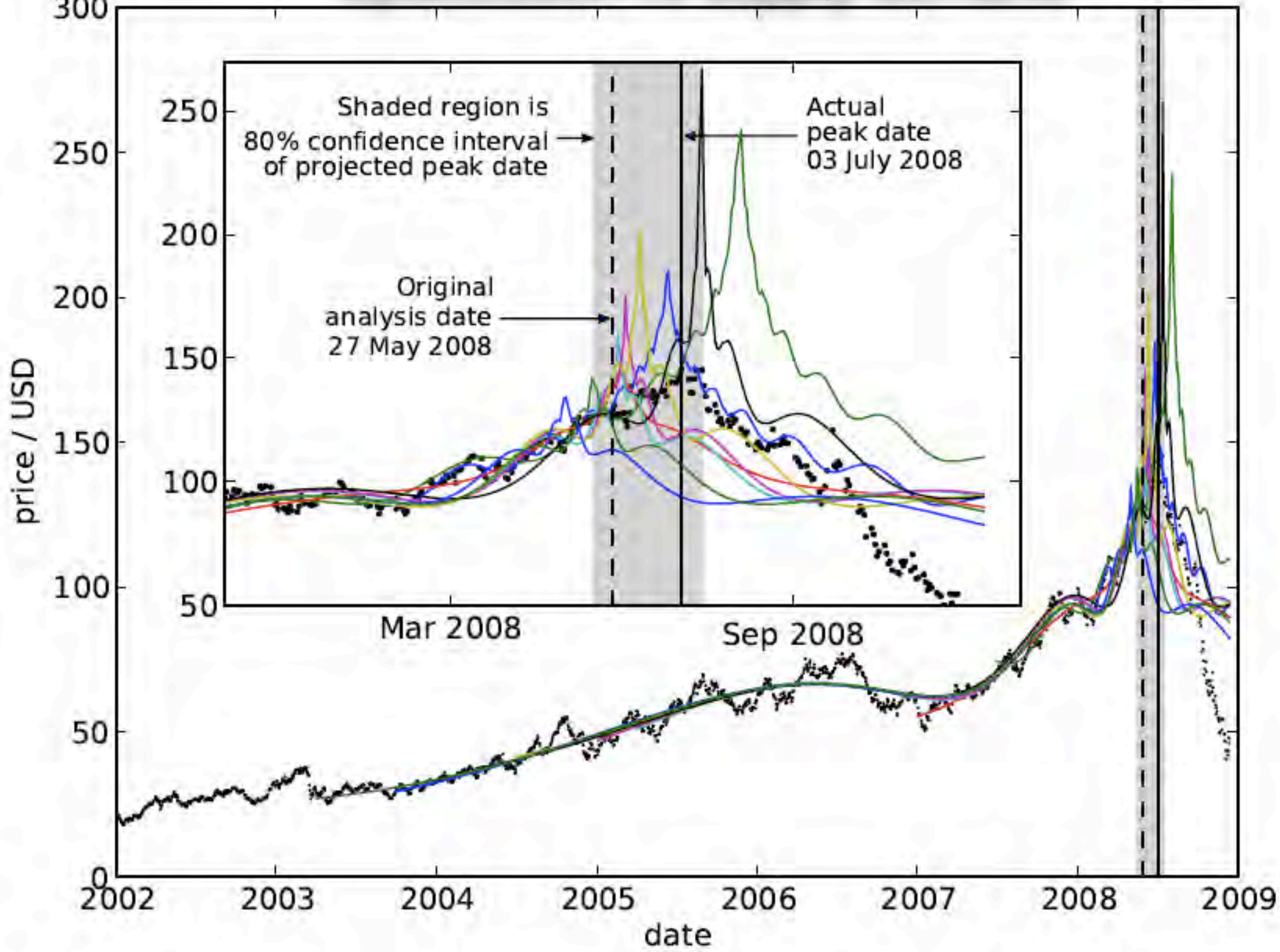




R.Woodard and D.Sornette (2008)



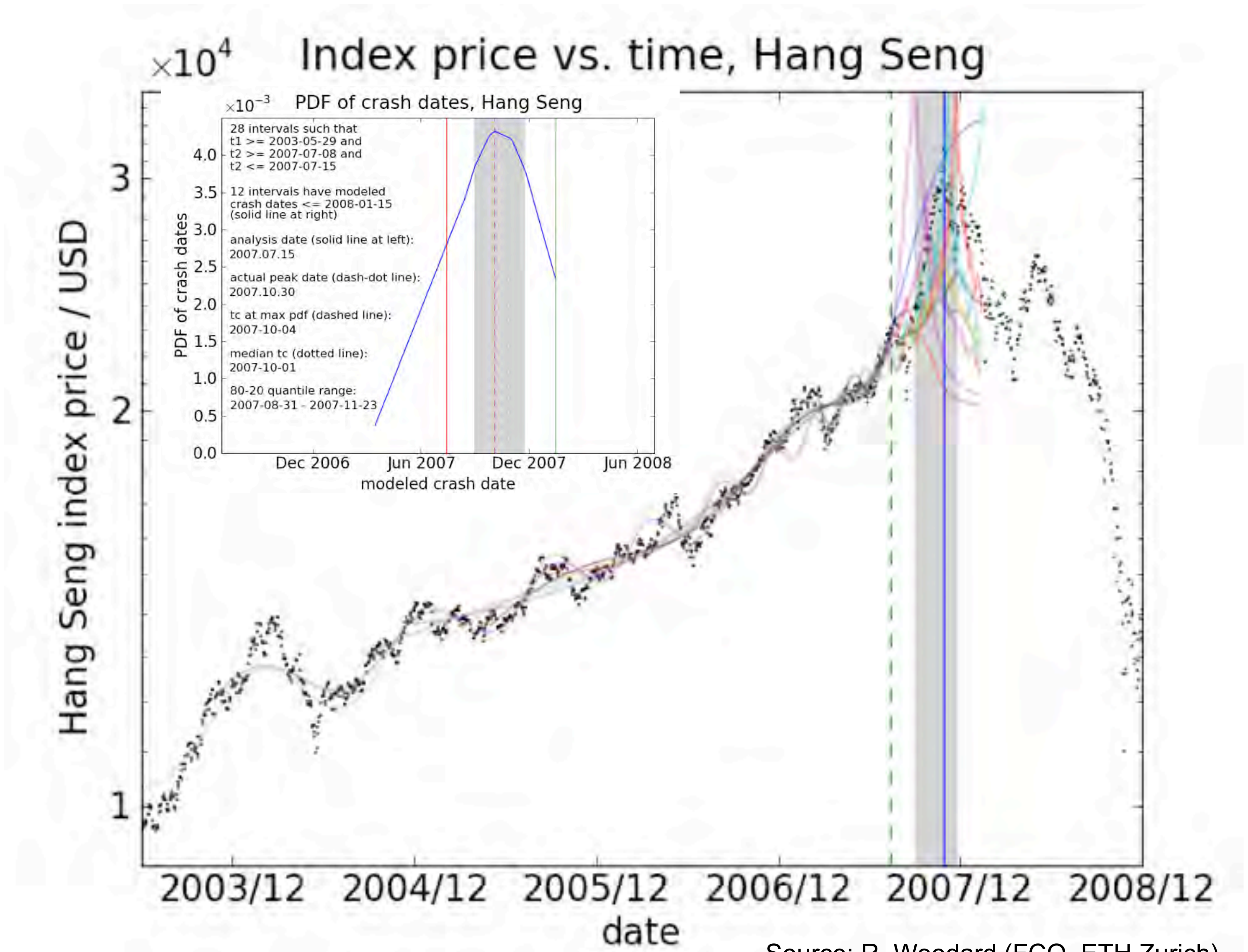



# 2006-2008 Oil bubble
## Speculation vs supply-demand

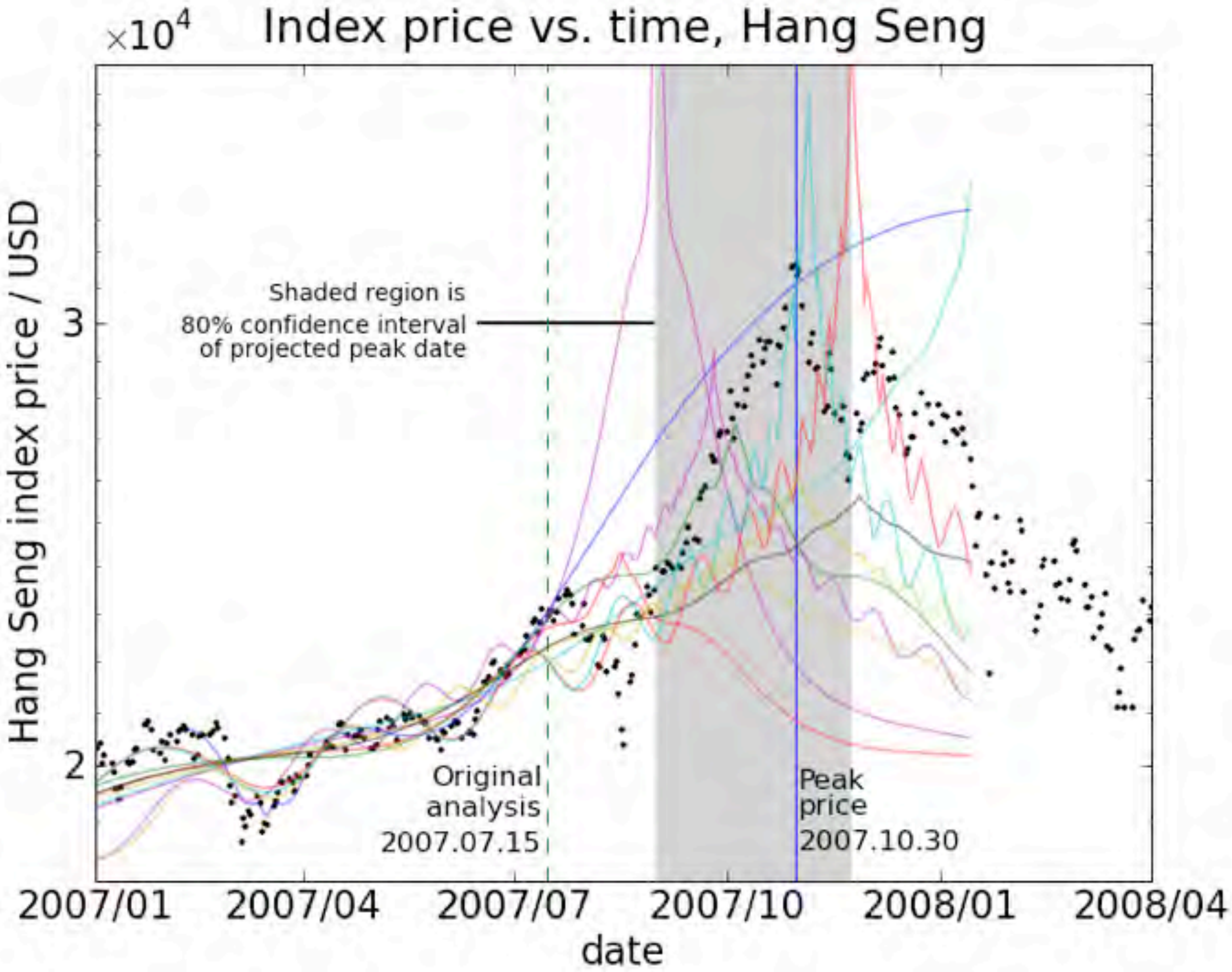



D. Sornette, R. Woodard and W.-X. Zhou, The 2006-2008 Oil Bubble and Beyond, Physica A 388, 1571-1576 (2009) (arXiv.org/abs/0806.1170)

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.




Source: R. Woodard (FCO, ETH Zurich)



Source: R. Woodard (FCO, ETH Zurich)

# In summary

Each excess is partially “solved” by the subsequent excess... leading to a succession of
-unsustainable wealth growth
-instabilities

The present crisis+recession is the consolidation after this series of unsustainable excesses.

One could conclude that the extraordinary severity of this crisis is not going to be solved by the same of implicit or explicit “bubble thinking”.

"The problems that we have created cannot be solved at the level of thinking that created them." Albert Einstein

# Recession-Plagued Nation Demands New Bubble To Invest In

The Onion, JULY 14, 2008 | ISSUE 44•29 (satirical american journal)



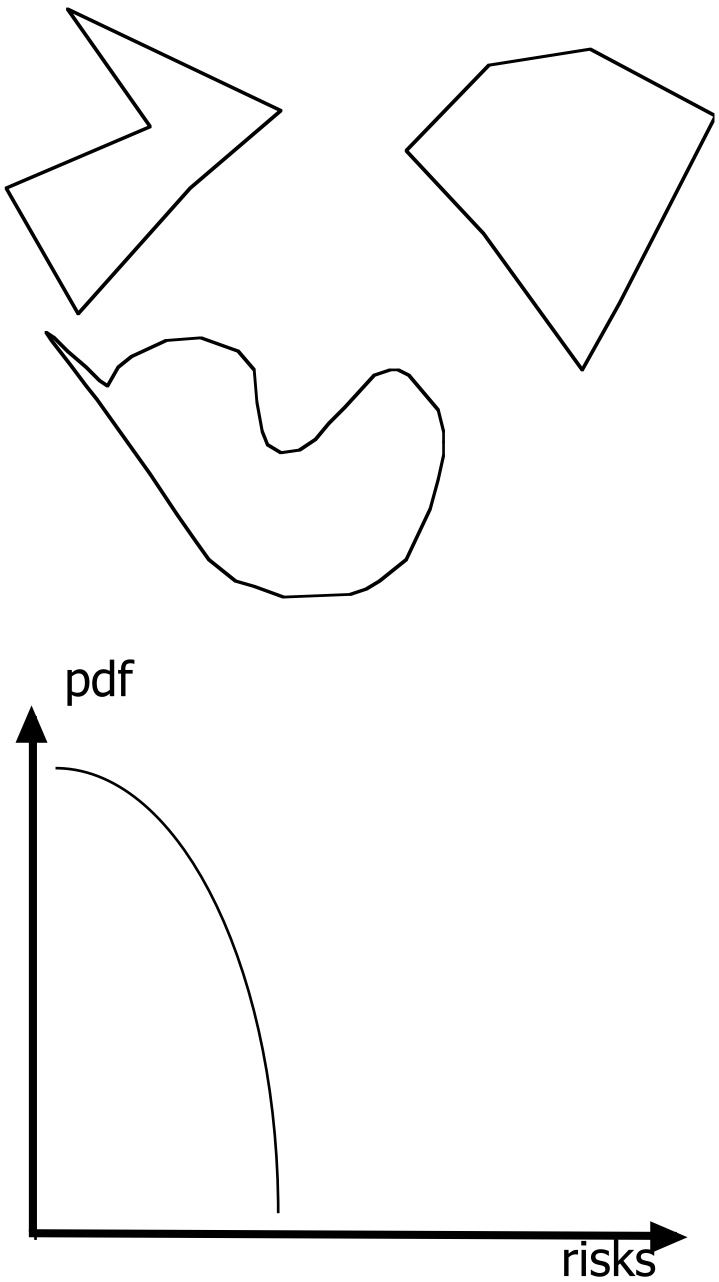
A prominent finance expert asks Congress to help Americans rebuild their ficticious dreams.

"Every American family deserves a false sense of security," said Chris Reppto, a risk analyst for Citigroup in New York. "Once we have a bubble to provide a fragile foundation, we can begin building pyramid scheme on top of pyramid scheme, and before we know it, the financial situation will return to normal."

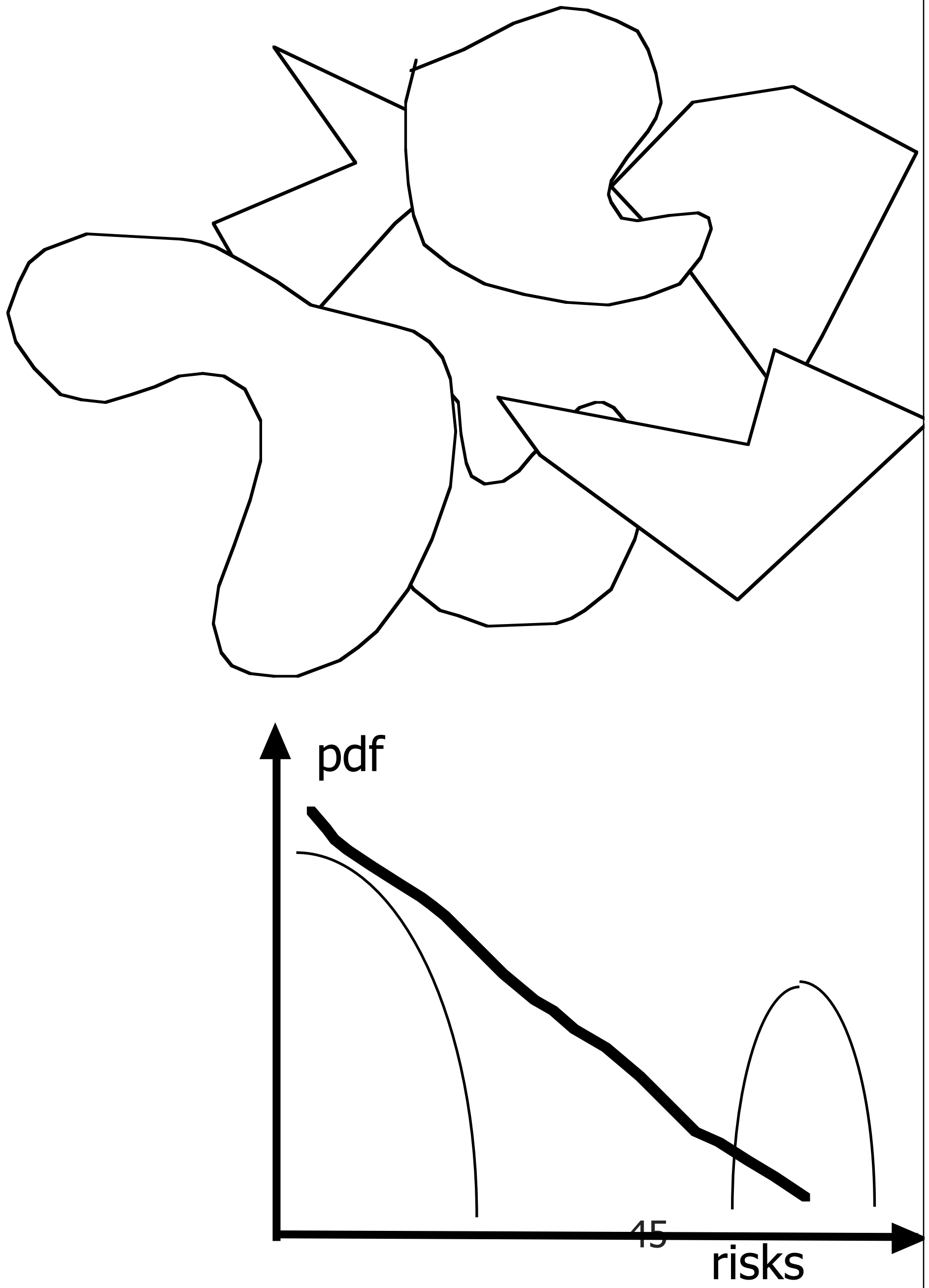
# A 15y History of the 2008- crisis

- The ITC “new economy” bubble (1995-2000)
- Slaving of the Fed monetary policy to the stock market descent (2000-2003)
- Real-estate bubbles (2003-2006)
- MBS, CDOs bubble (2004-2007)
- Commodities and Oil bubbles (2006-2008)
- Consequences (deep loss of trust, systemic instability)
- Solutions?

Separation of financial and credit risks




Securitization leads to larger inter-connectivity

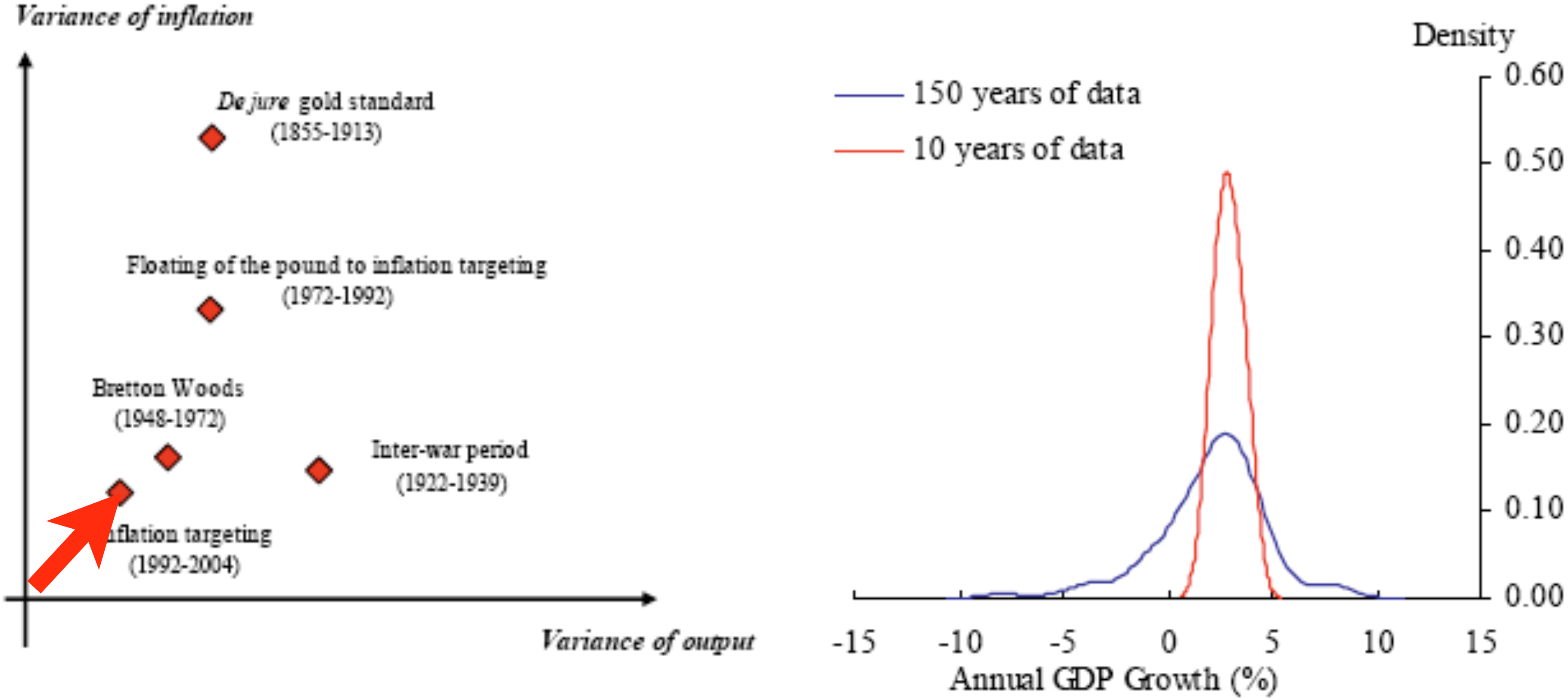


# THE GREAT MODERATION


This figure shows the rolling 10-year average real GDP growth rate along with one-standard deviation bands. These standard deviation bands provide a sense of how much variation or volatility there has been around the 10-year average real GDP growth rate. The figure shows a marked decline in the real GDP volatility beginning around 1983.

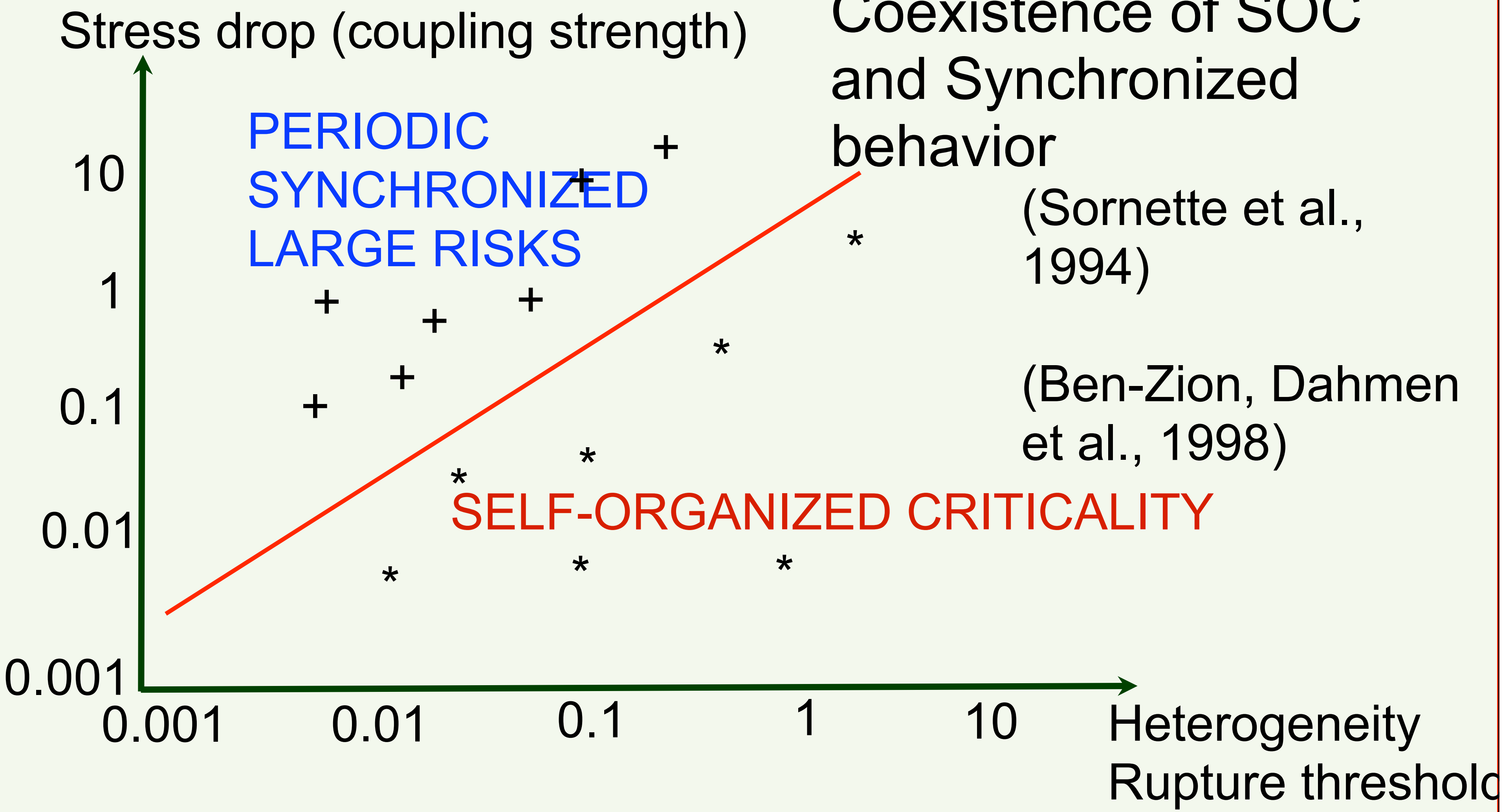
1992 to July 2007: Great Stability, a period of continuous growth, low inflation, and falling unemployment.

They were guided by and reinforced a wide consensus that economics had discovered the right way to manage the economy and that the UK and US were a good model of how to put it into effect.




**Source: SIR JOHN GIEVE, Deputy Governor, Bank of England, Feb 2009**

## Coexistence of SOC and Synchronized behavior




(Sornette et al., 1994)

(Ben-Zion, Dahmen et al., 1998)

“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.

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- Fundamental error: “perpetual money machine”
- Encouraging over-spending to solve a crisis due to over-spending?
- Melting the cash-flow freeze (ex: WIR direct network banking in Switzerland (www.wir.ch))
- Long-term growth based on returning to fundamentals
- Novel opportunities for innovation and Earth sustainability
- Preventing other financial bubbles: a new definition of inflation
- Over-pessimism following over-optimism

- Intelligence of the crowd: general loss of trust can be restored by removing uncertainty through frank clarification
- Fight moral hazard (ex: clawback permission...)
- Regulations (illusion of control and the law of unintended consequences)
- Development of culture of integrity and ethical behavior (informed by behavioral psychology)
- “Robust Investment” approach (W. Buffet)
- The overgrowth of the “financial economy” versus the “real economy”
- Financial Ratio Index (FRI) (total fixed assets + working capital,  excess supply of money...) : extend definition of INFLATION