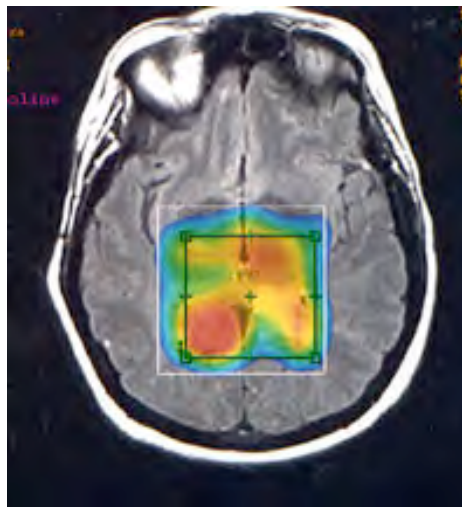


Taming Manias

Origin, inevitability, prediction and regulation of financial instabilities



Didier SORNETTE

+key senior collaborators:

Joern Berninger (ETH Zurich)

Ryan Woodard (ETH Zurich)

Wei-Xing Zhou (ECUST, Shanghai)

ETH Zurich

**Department of Management, Technology and
Economics, Switzerland**

Member of the Swiss Finance Institute

**co-founder of the Competence Center for Coping with
Crises in Socio-Economic Systems, ETH Zurich
(<http://www.ccss.ethz.ch/>)**

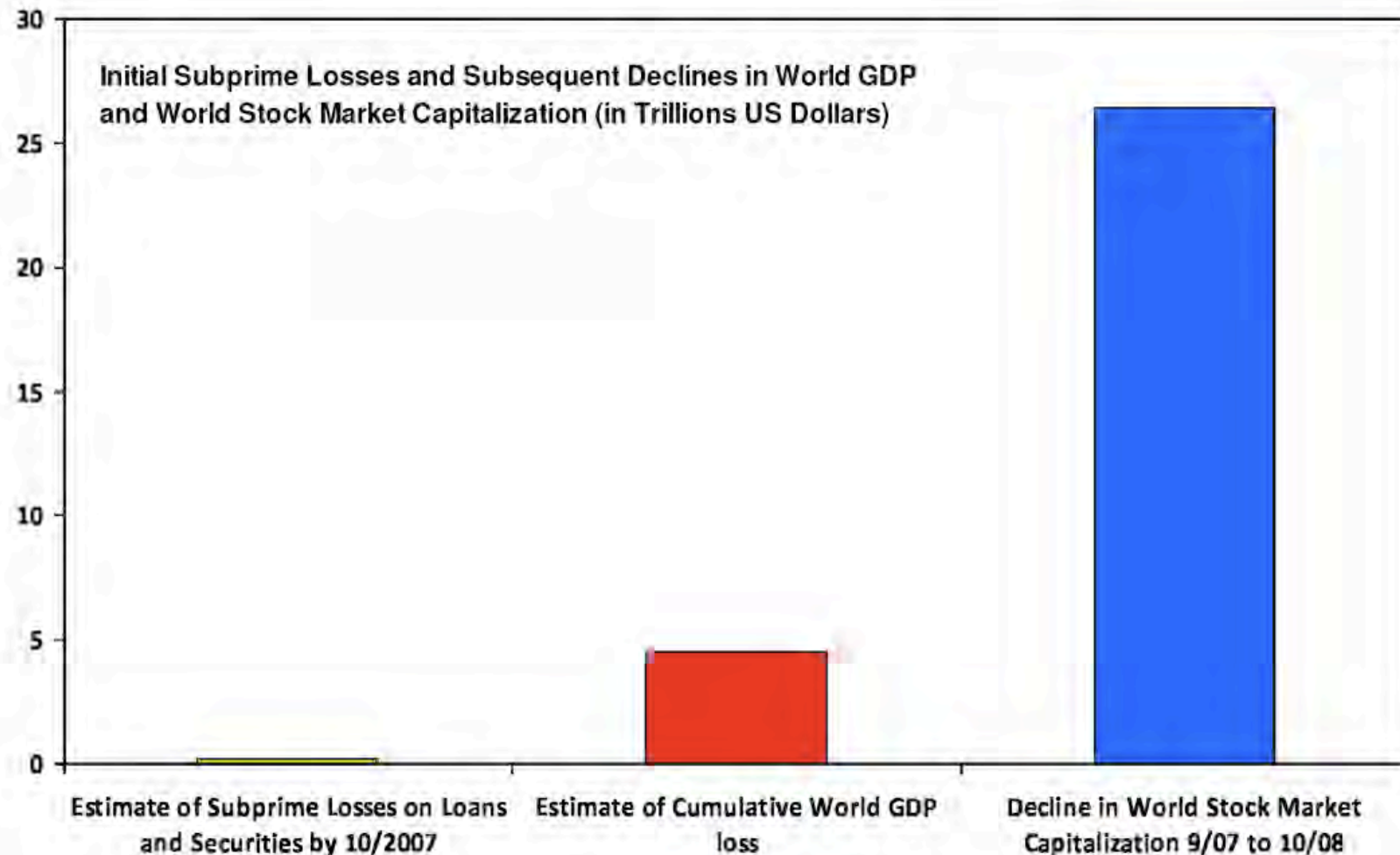
**Professor of Physics associated with the Department
of Physics (D-PHYS), ETH Zurich**

**Professor of Geophysics associated with the
Department of Earth Sciences (D-ERWD), ETH Zurich**

www.er.ethz.ch

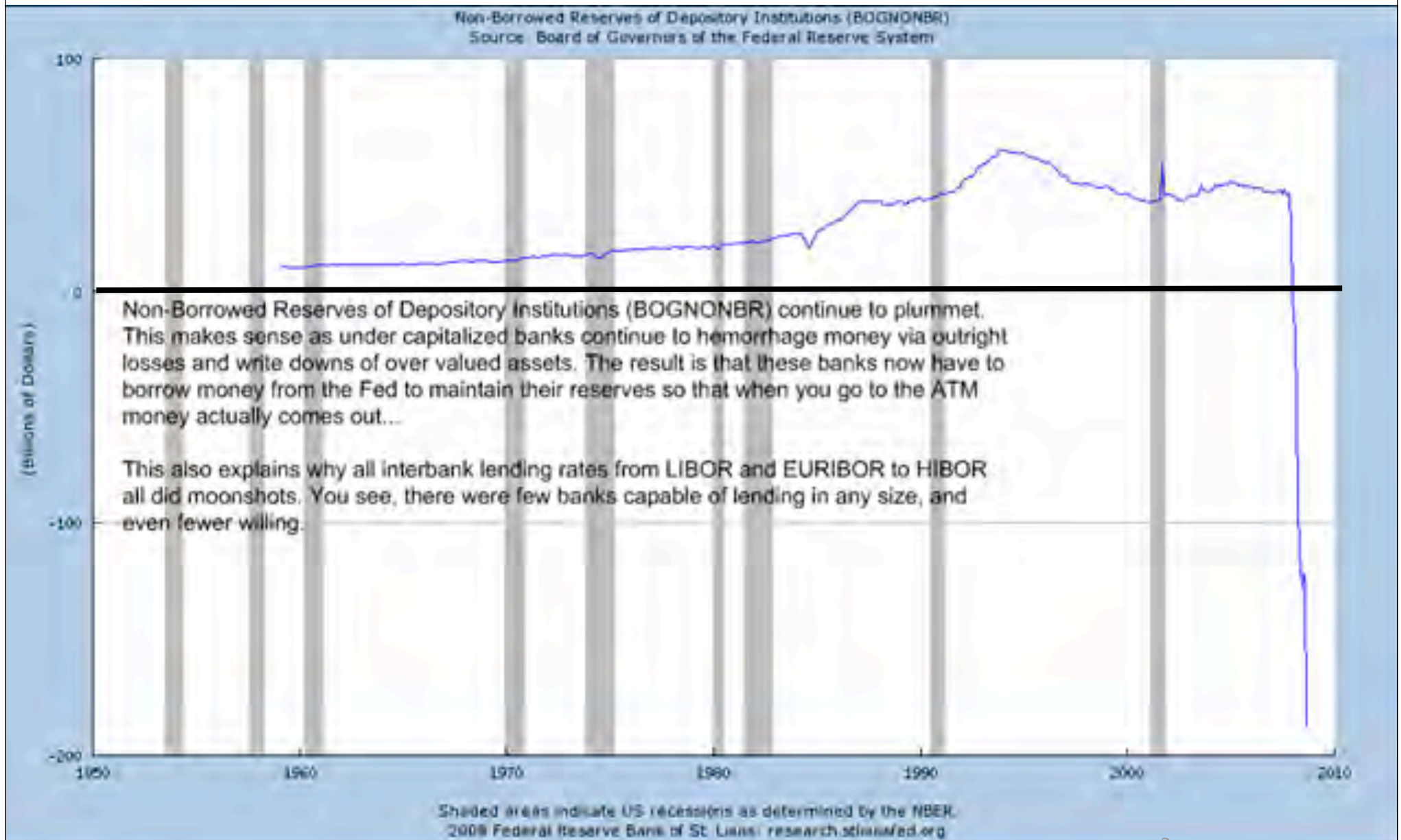
The Paradox of the 2007-20XX Crisis

(trillions of US\$)



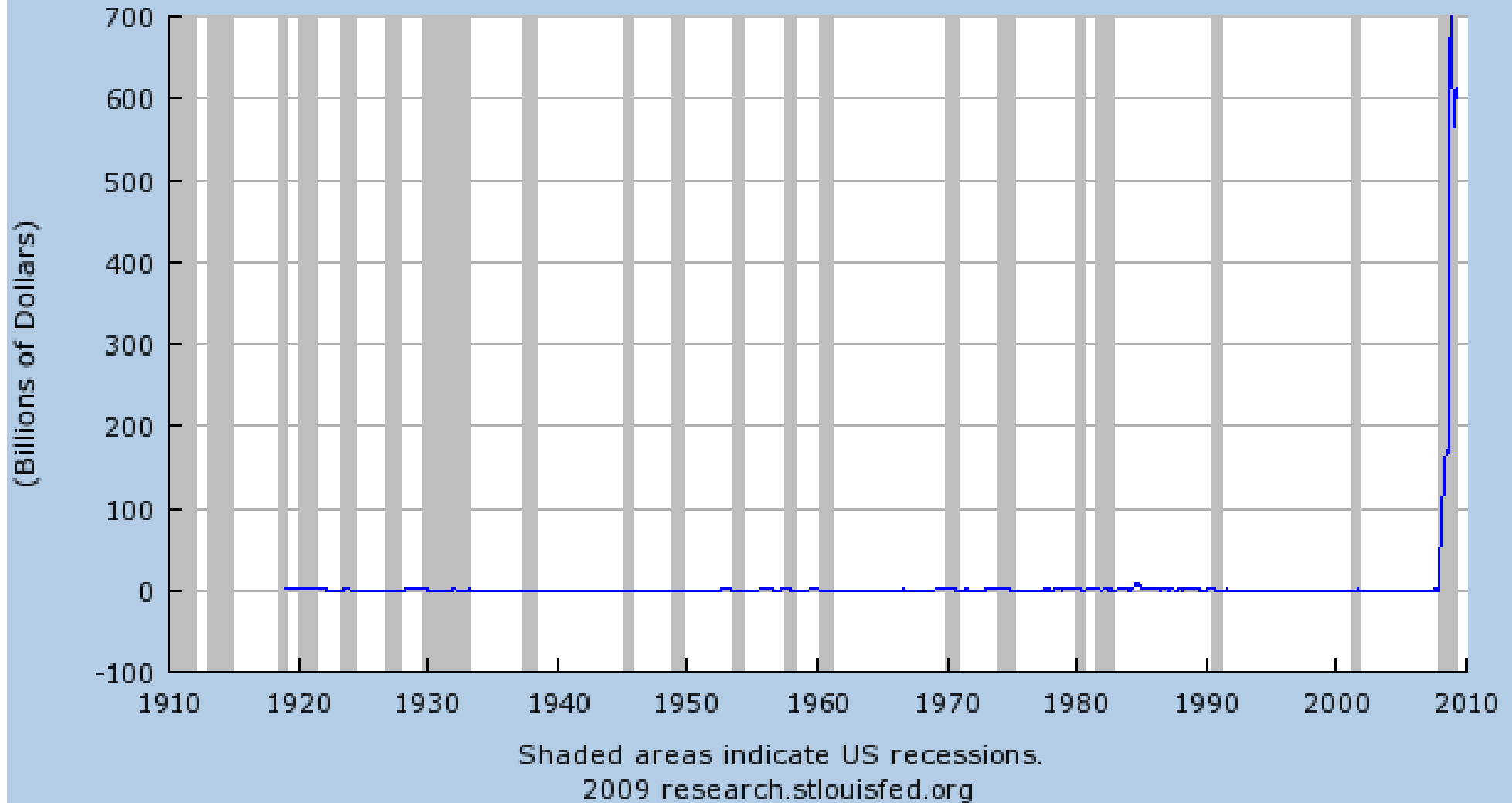
Source: IMF Global Financial Stability Report; World Economic Outlook November update and estimates; World Federation of Exchanges.

2008 FINANCIAL CRISIS



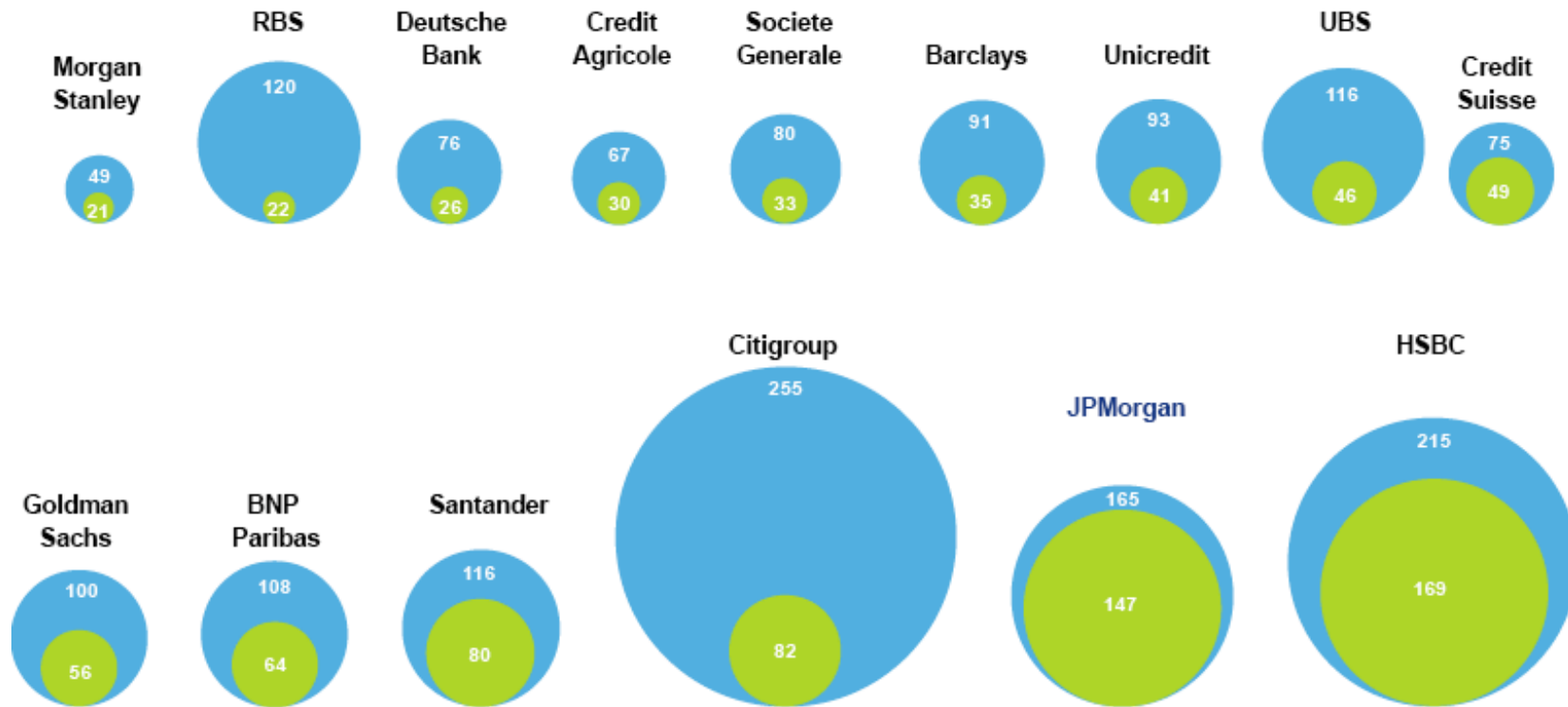
2008 FINANCIAL CRISIS

Total Borrowings of Depository Institutions from the Federal Reserve (BORROW)
Source: Board of Governors of the Federal Reserve System



March 2009

Crises are the bursts of “bubbles”



Current Status of the World Economy

Crisis not over



- World Trade slumps
- China Bubble risk
- US FED plans \$ 5t Stimulus
- European debts

- Political Crisis emerges
- Banking Crisis returns
- Sovereign Debt crisis

Causes of the 2007-20XX crisis?

● Financial innovations

- * Real-estate loans and MBS as fraction of bank assets
- * Securitization of finance
- * Leverage
- * Under-estimating aggregate risks

● Outsourcing of risks

- * Deregulation and lack of oversight
- * Bad quantitative risk models in banks (Basel II)
- * Rating agency failures
- * Lowering of lending standards
- * Managers greed and poor corporate governance problem

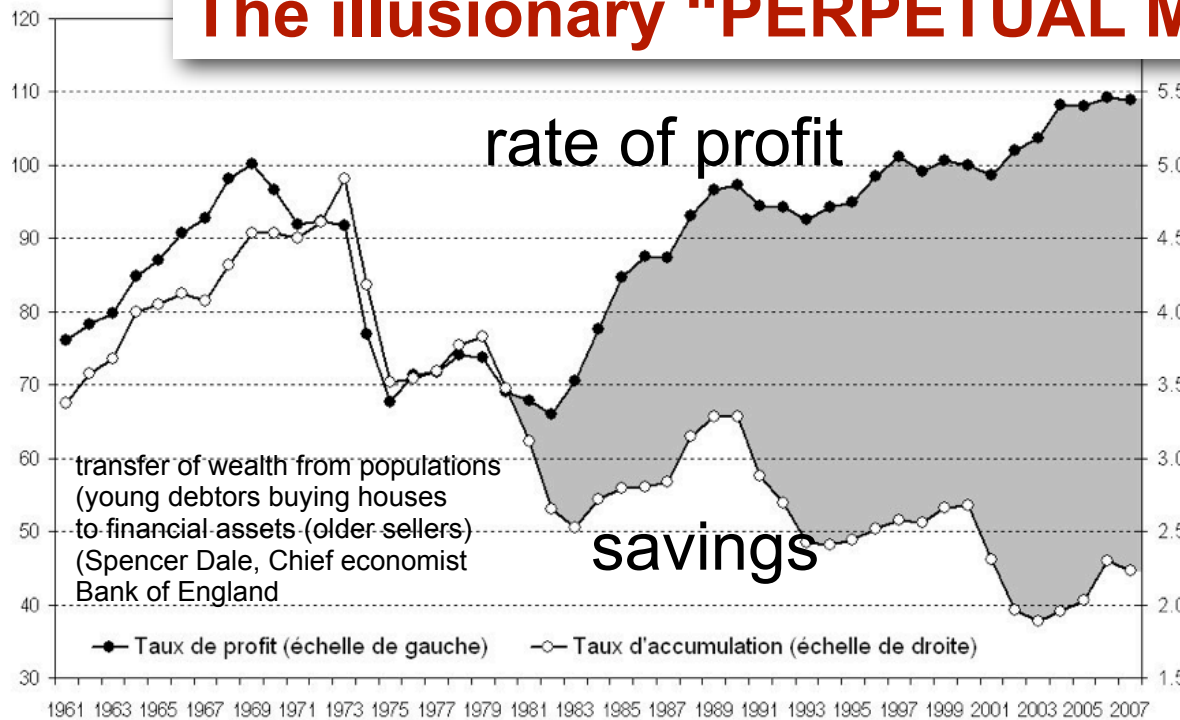
● Facilitating factors

- ◆ Loans to poor's
- ◆ Freddy Mac and Fanny Mae...
- ◆ Growth of over-capacity
- ◆ Moral hazards

Predictability of the 2007-XXXX crisis: 15y History of bubbles and Dragons

- 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) and stock market bubble (2004-2007)
- Commodities and Oil bubbles (2006-2008)

The illusory "PERPETUAL MONEY MACHINE"

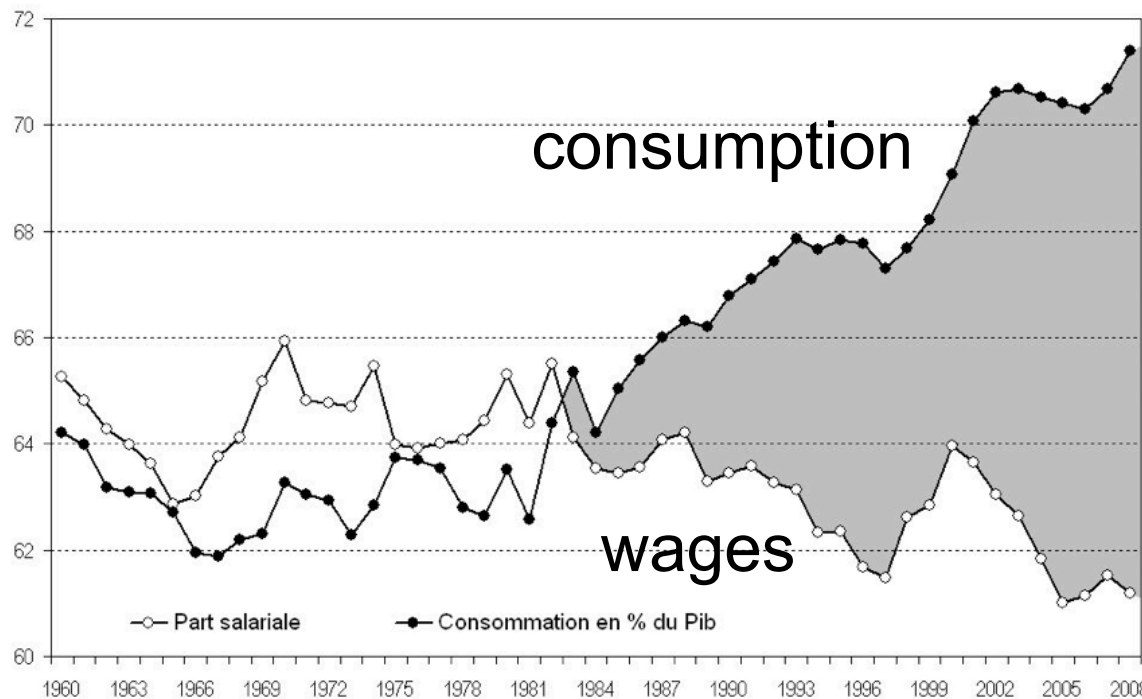


Rate of profit and rate of accumulation: The United States + European Union + Japan

* 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>

The 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 growth... which can only be transitory (even if very long).

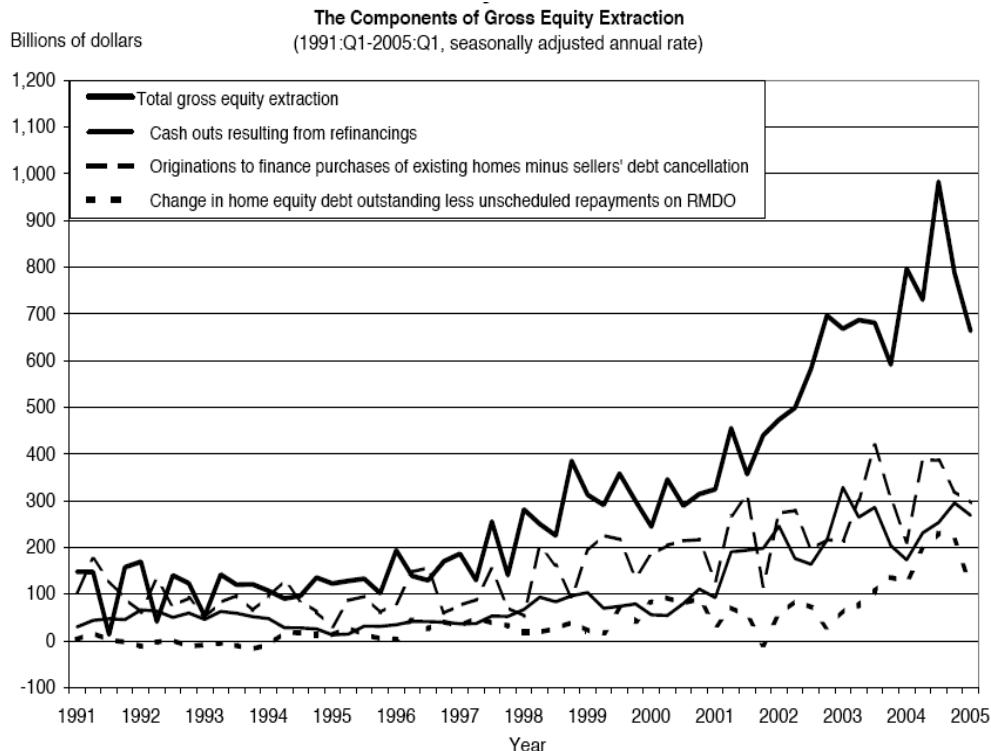


United States Share of wages and of private consumption in Gross Domestic Product (GDP)

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

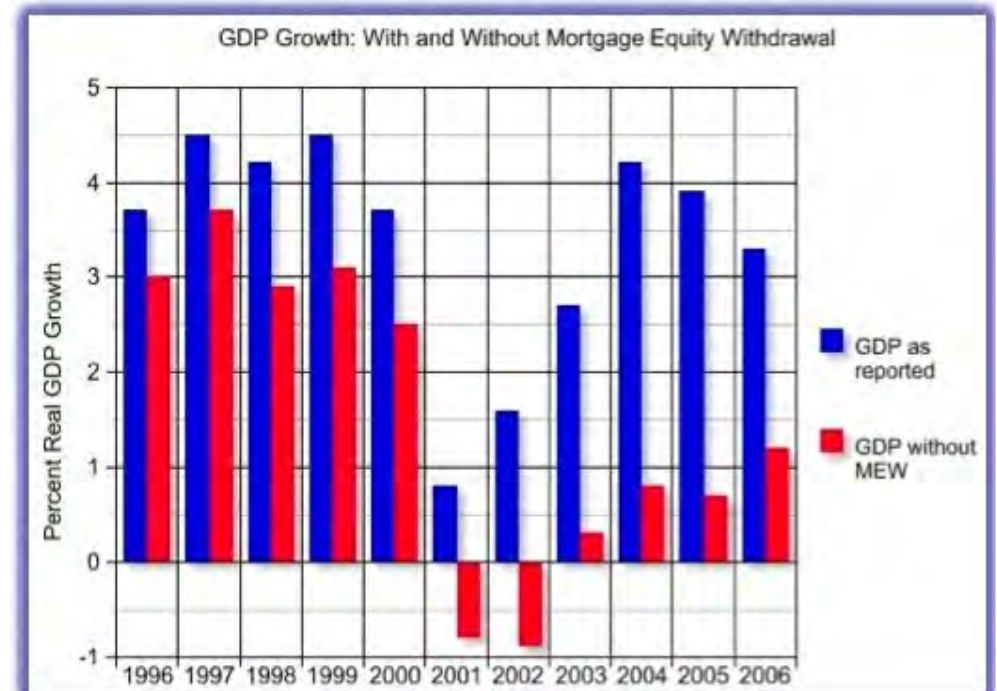
Wealth Extraction

Over the past decade and a half, (B - F) has been closely correlated with realized capital gains on the sale of homes. B-F=change in home equity debt outstanding less unscheduled repayment on RMDO



Alan Greenspan and James Kennedy (Nov. 2005)

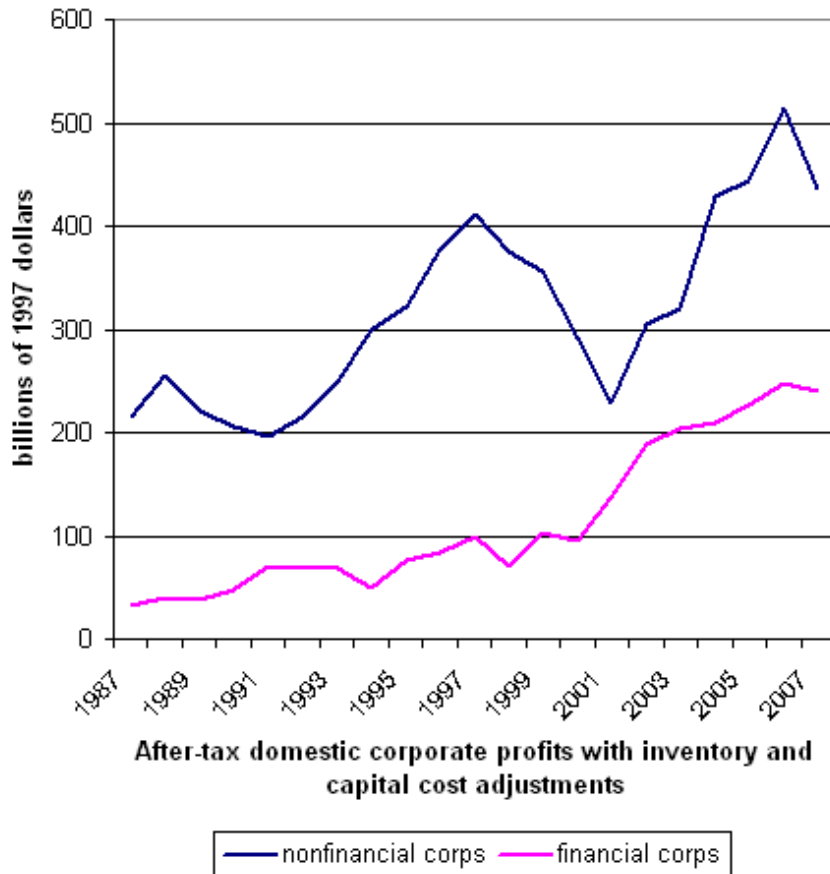
Mortgage Equity Withdrawal impact on GDP



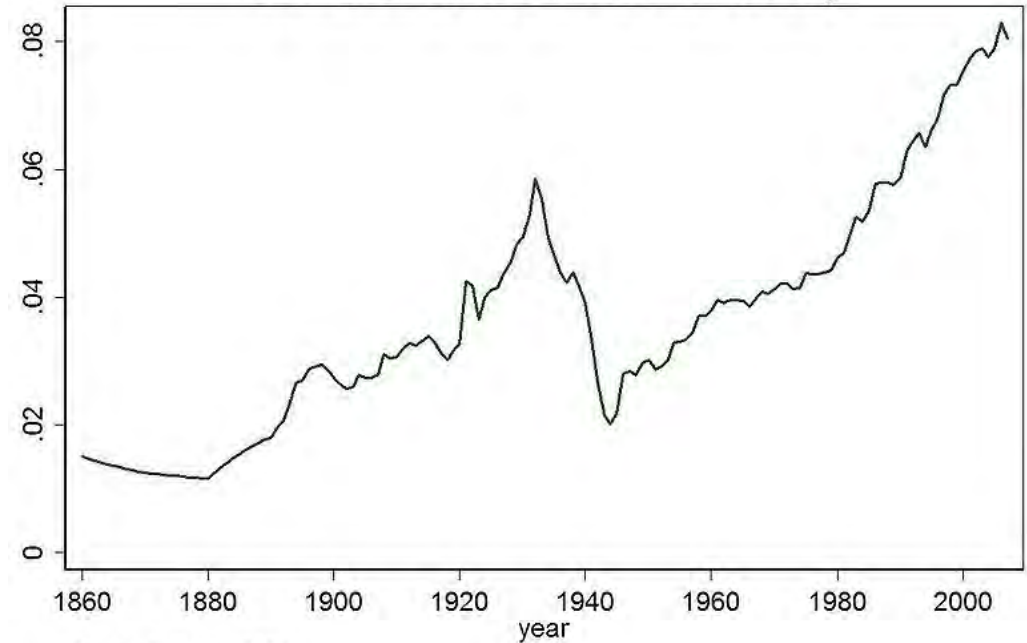
source: John Mauldin (April 09)

Financial investments accounted for > 1/3 of corporate profits

Real Corporate Profits

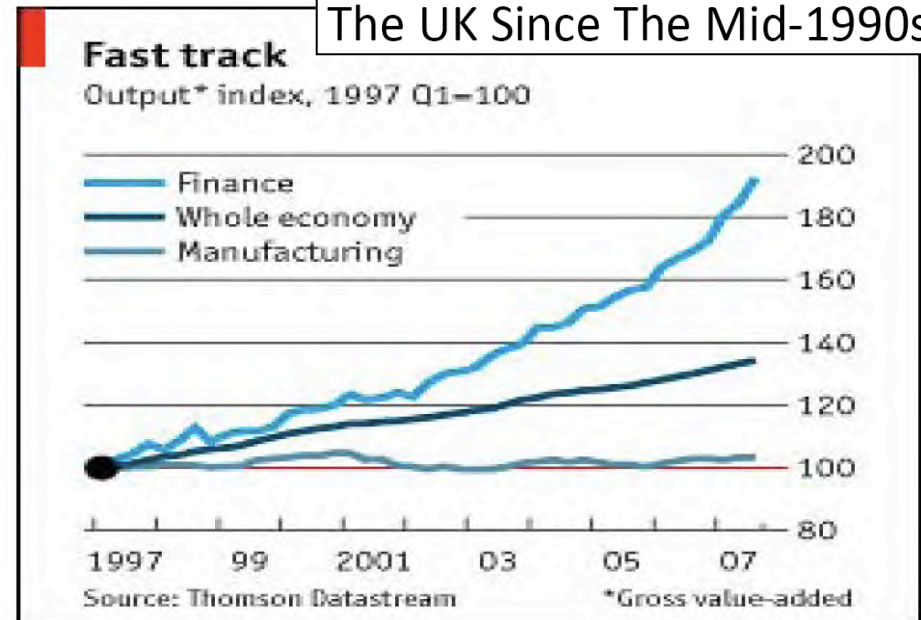


GDP share of US Financial Industry



Source: Philippon, 2008

The UK Since The Mid-1990s



http://www.businessweek.com/the_thread/economicsunbound/archives/2009/03/a_bad_decade_fo.html

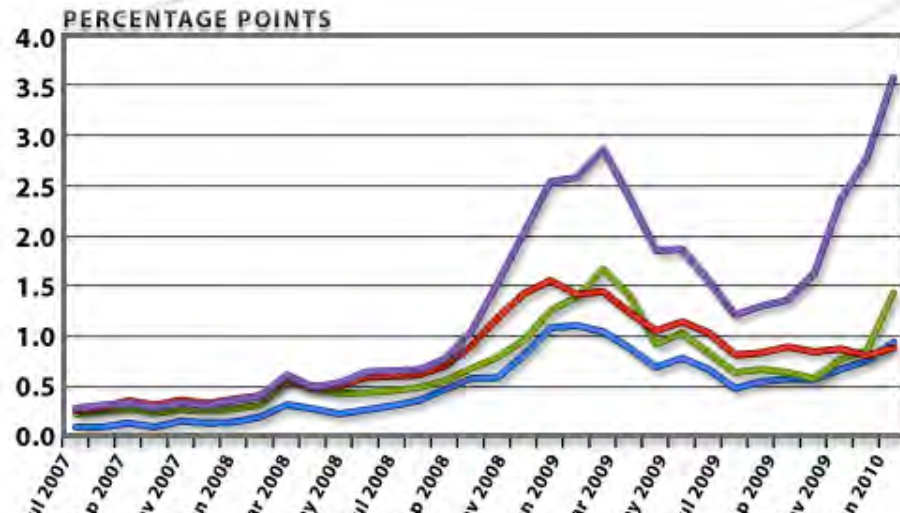
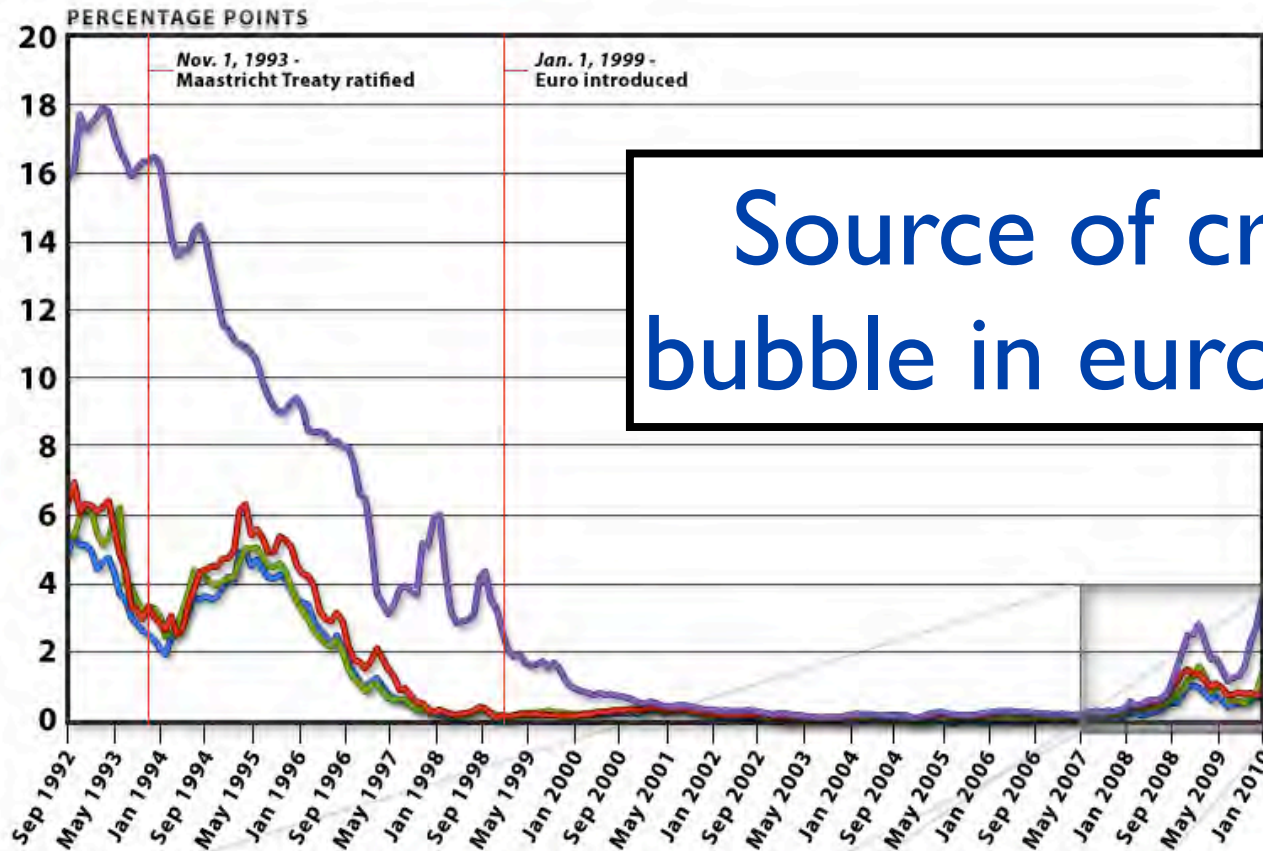
“Lies, damned lies and Gov. Statistics”

GDP downward revisions

12-Month Running Totals of the Number of Downward Revisions to Originally Reported Data for Selected U.S. Government-Reported Economic Statistics
(Relative to May-02 Totals; Data Source: Bloomberg)



CLUB-MED SPREAD: government bonds - German bund yield



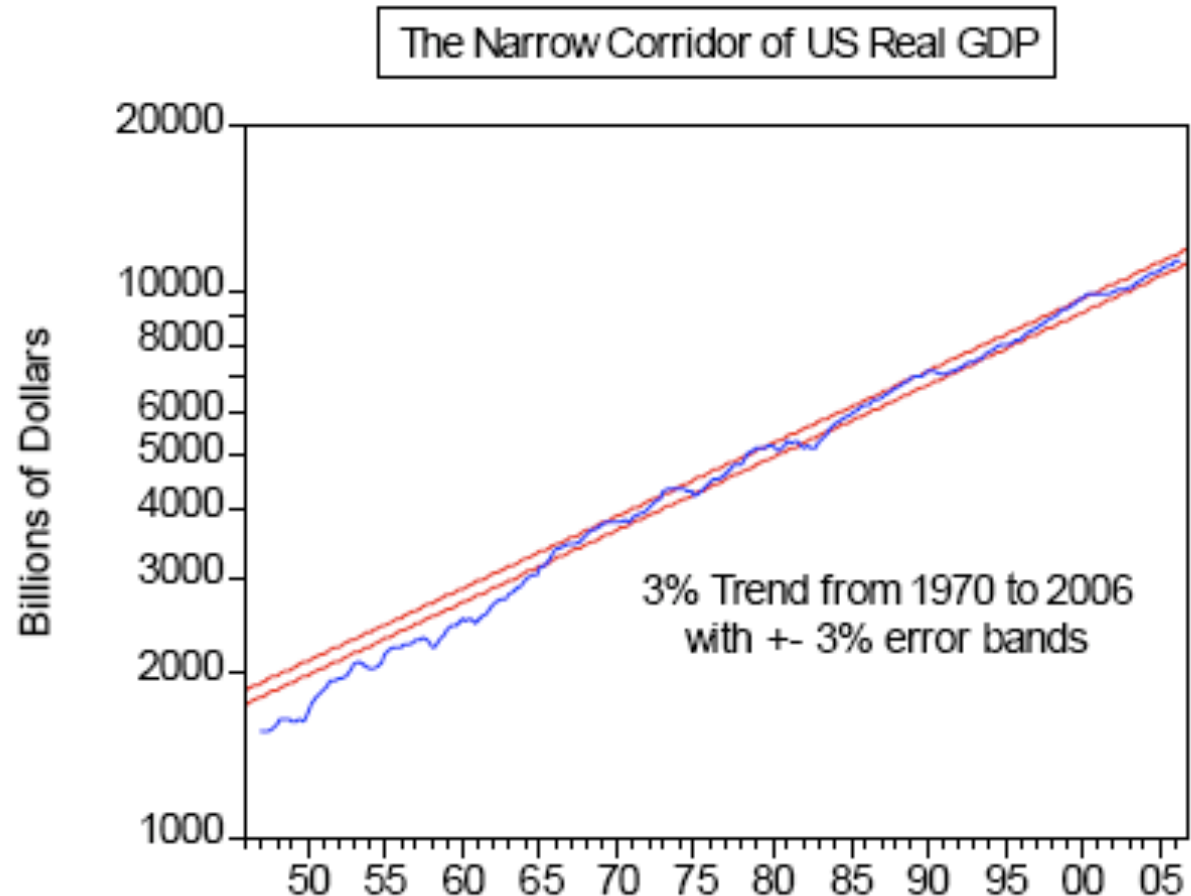
Spain Portugal
Italy Greece

SOURCE: International Monetary Fund

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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.
- 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.



From 1982 until 2007, the U.S. only experienced two shallow recessions that each lasted just 8 months. This stretch of 25 years may be the best 25 years in the US economic history. But much of this prosperity was bought with debt, as the ratio of debt to GDP rose from \$1.60 to \$3.50 for each \$1.00 of GDP.

Fundamental origin of the crisis

- US policy to give access to ownership (Freddie Mac, Fannie Mae...)
- The illusionary quest of society-at-large, pensions funds, mutual funds... to gain more than 2% return in real terms (above inflation)
- Bankers are sellers of “dreams”
- Bankers exploit our illusions and cognitive limitations... like casinos and lotteries... and the pharmaceutical industry

Absence of fundamental change

-Equities rally esp. based on financials that have reported excellent Q1 figures based on trading (root of the actual problem), there is a lot to be told about that...

- financial institutions accounting is more opaque and creative as ever, just look at the recent changes, launched, actually in order to solve the problem (which roots again in creativity of frying air).

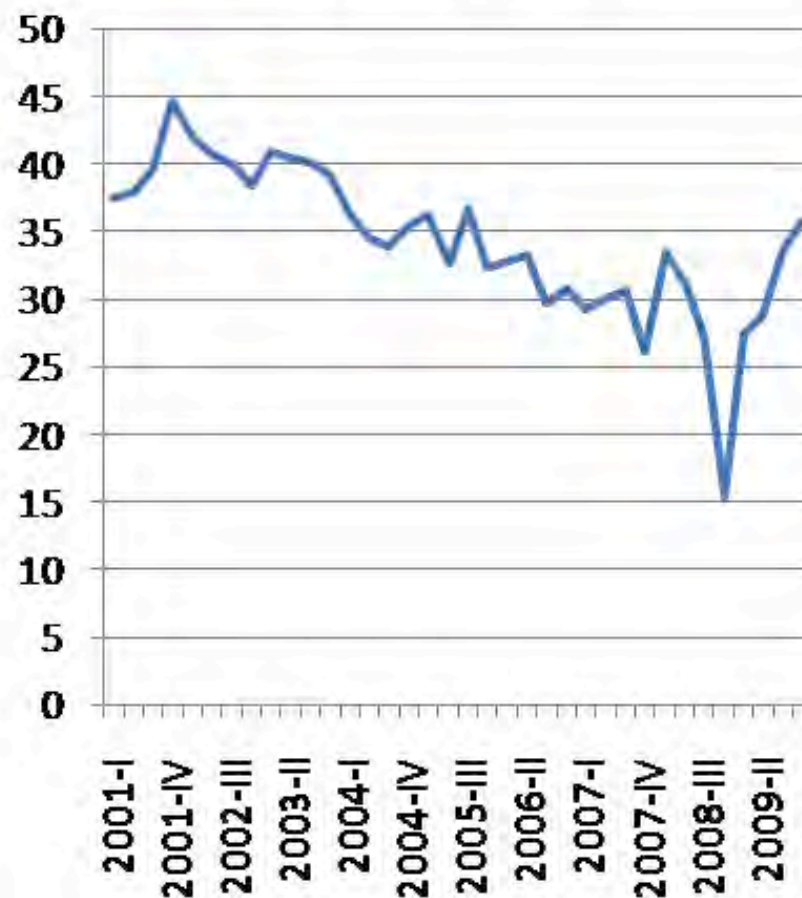
- TARP and PPIP are launched in order to artificially pump up asset prices based on leverage and asymmetric upside downside risk taking (investors vs tax payers) - again the roots of the current crisis.

Still on-going logic of the “perpetual money machine”

TARP: trouble asset release program

PPIP: public-private investment program

Financial industry share of domestic profits



Bureau of Economic Analysis

Solutions?

The problem of institutional and academic memory loss

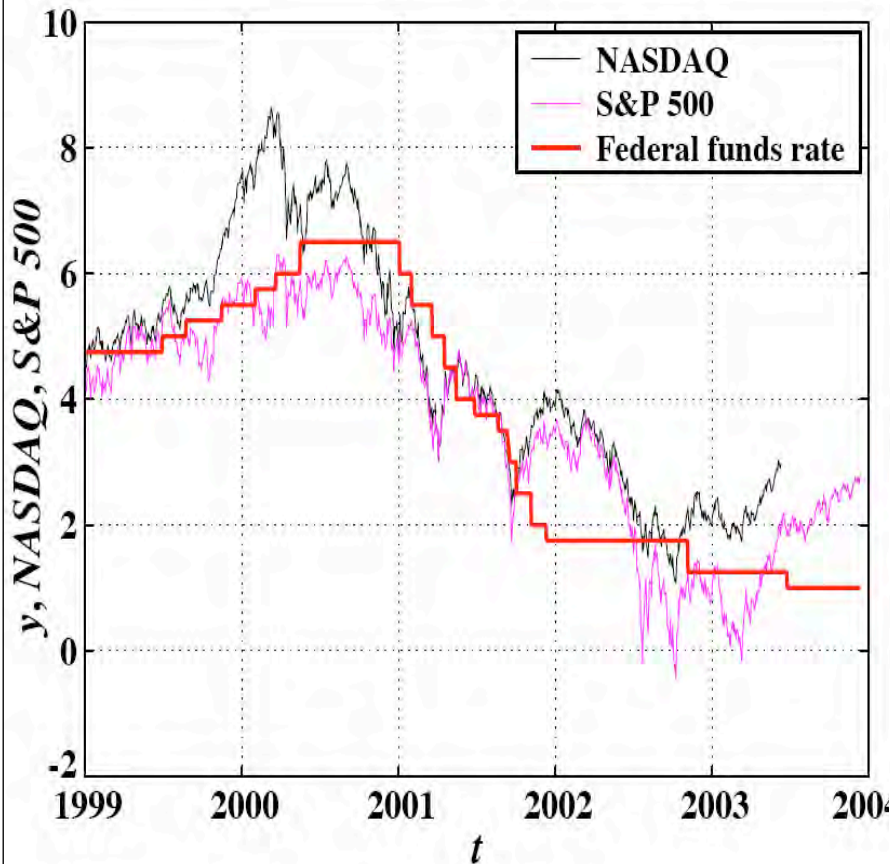
- Glass-Steagall act (1933)
- Credit creation by banks (R. Werner)

The key question: is there evidence that the new financial innovations and a much expanded bank system has brought any real gain for innovations, economic development, employment?

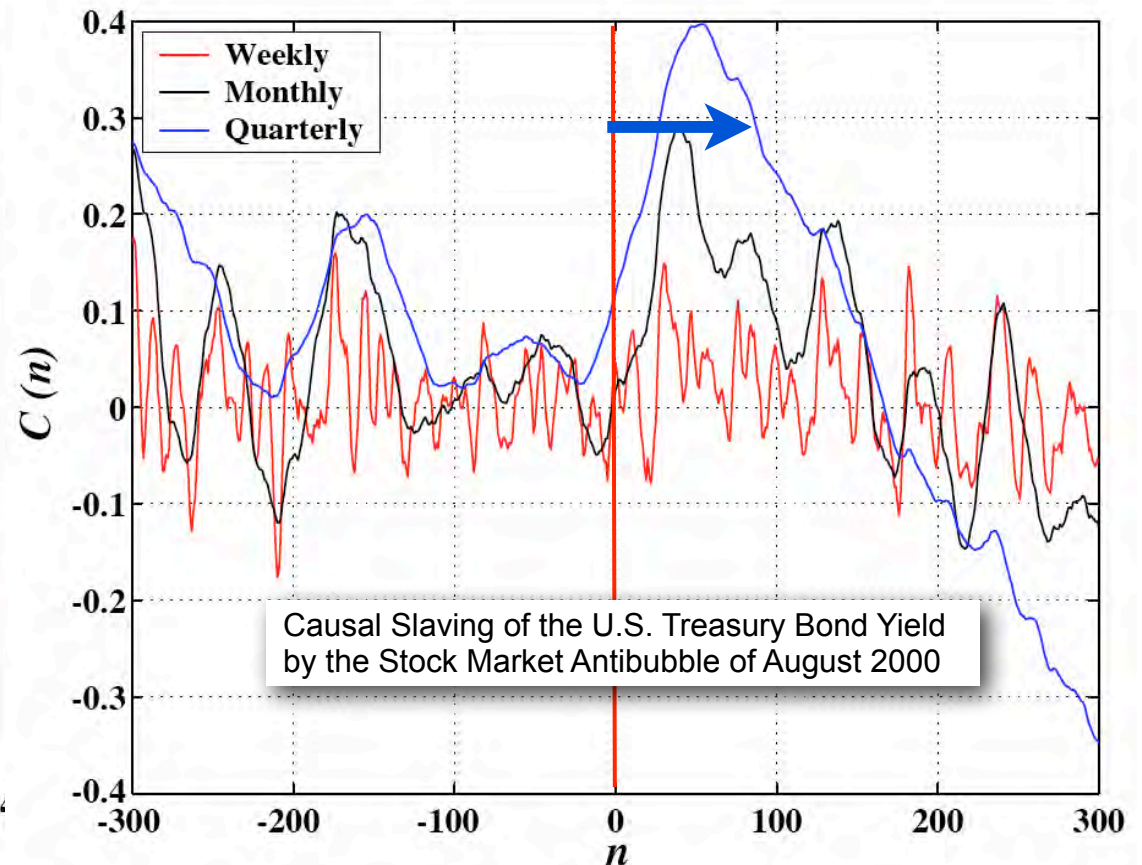
As Krugman suggested, is “boring banking” sufficient?

Monetary policy vs economic growth (R. Werner)

“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.



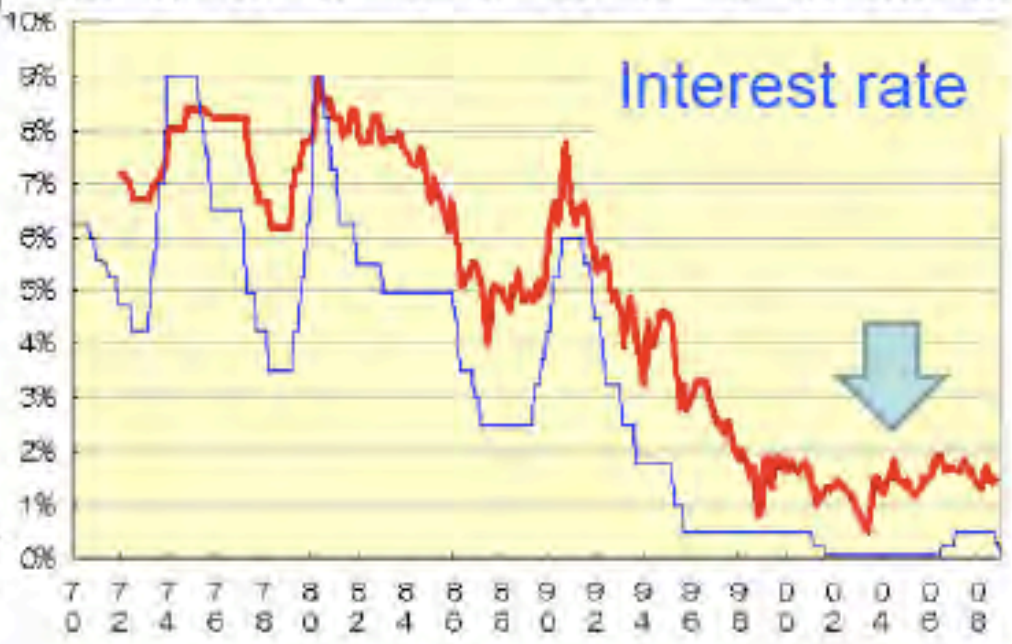
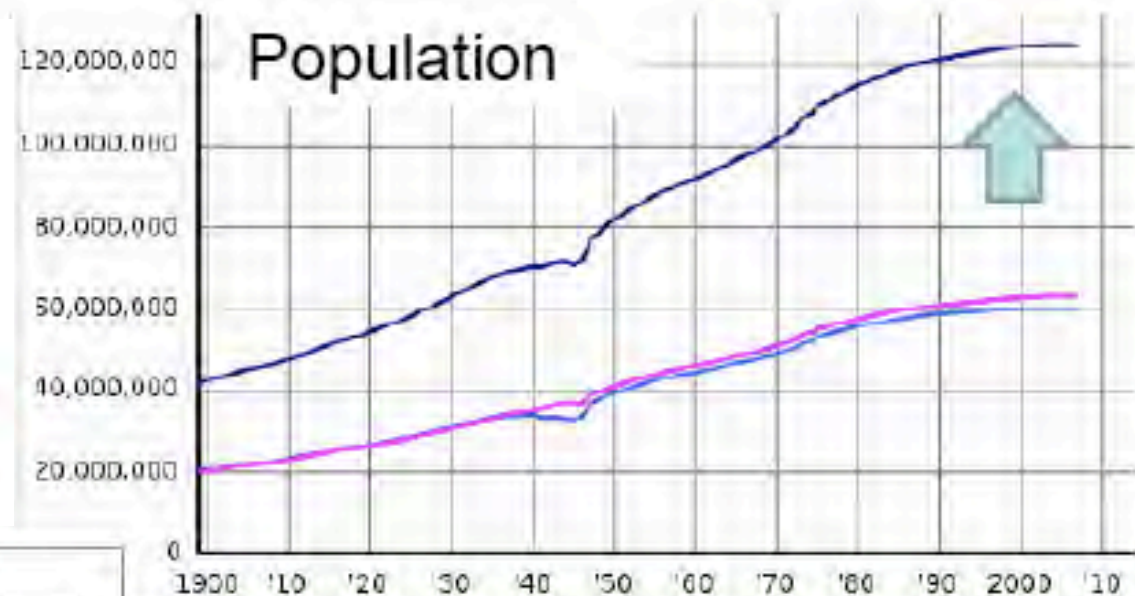
Cross-correlation coefficient $C(n)$ between the increments of the logarithm of the S&P 500 Index and the increments of the Federal funds rate as a function of time lag n in days. The three curves corresponds to three different time steps used to calculate the increments: weekly, monthly and quarterly.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

Future Scenarios

- “Best case” scenario: Japan “lost decade”... or tectonic regime shift

The next 15 years?

US and Japanese land prices



(Hideki Takayasu, APFA7)

Future Scenarios

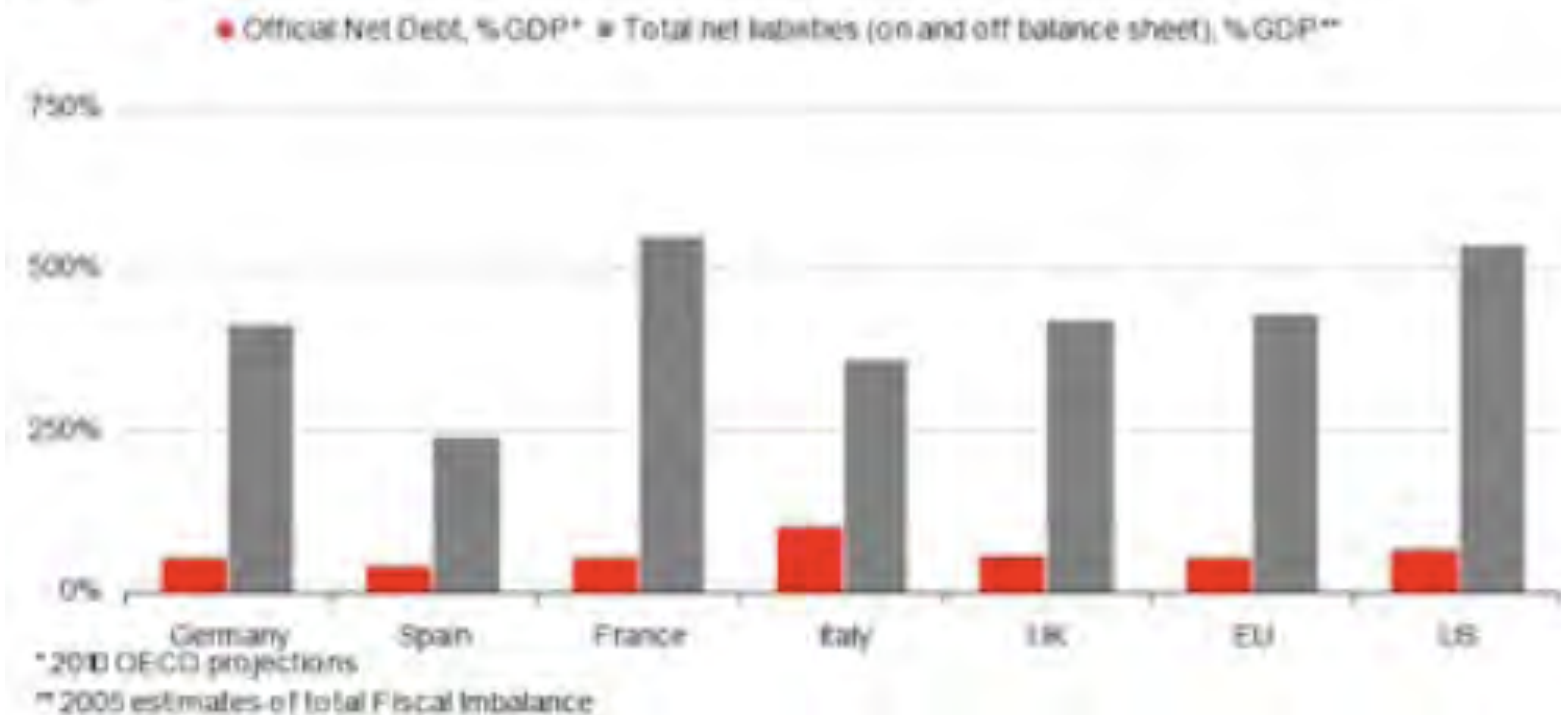
- Best case scenario: Japan “lost decade”
- European scenarios:



Future Scenarios

- Best case scenario: Japan “lost decade”
- European scenarios:

Chart 4: Are our governments solvent?



Source: Societe Generale, *Popular Delusions*, 12th November, 2009

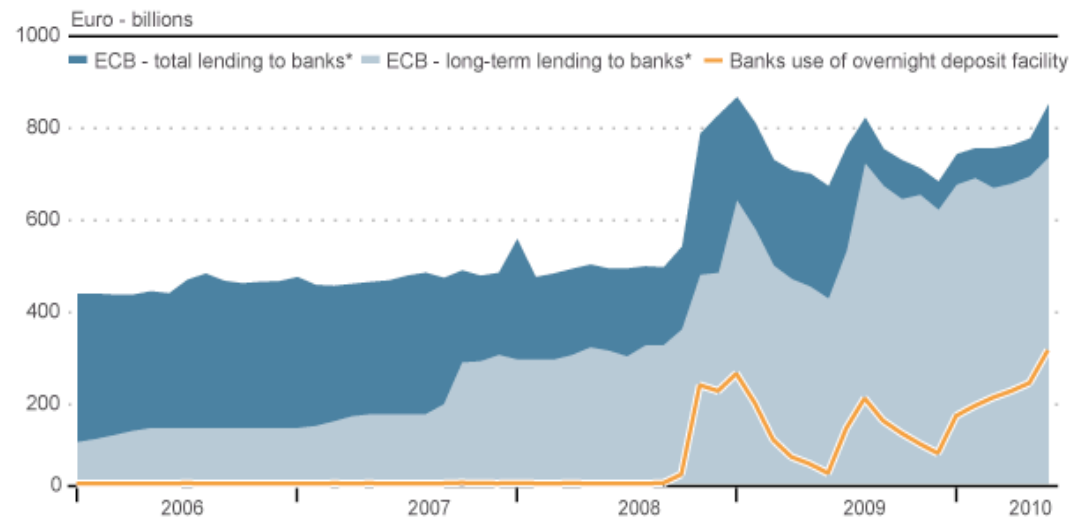
European scenarios

Banking crisis continues

- ECB still needs to inject money into banking system
 - Spanish banks became partly illiquid in crisis
 - Transparency in risk exposure is still missing (see discussion on stress test publishing)
- Risk of bank failures increases as investors have no data to make good decisions

Disfunctional Money Markets

ECB lending to banks



* ECB refinancing operations (long-term - 4 weeks or longer)

Sources: Thomson Reuters, ECB

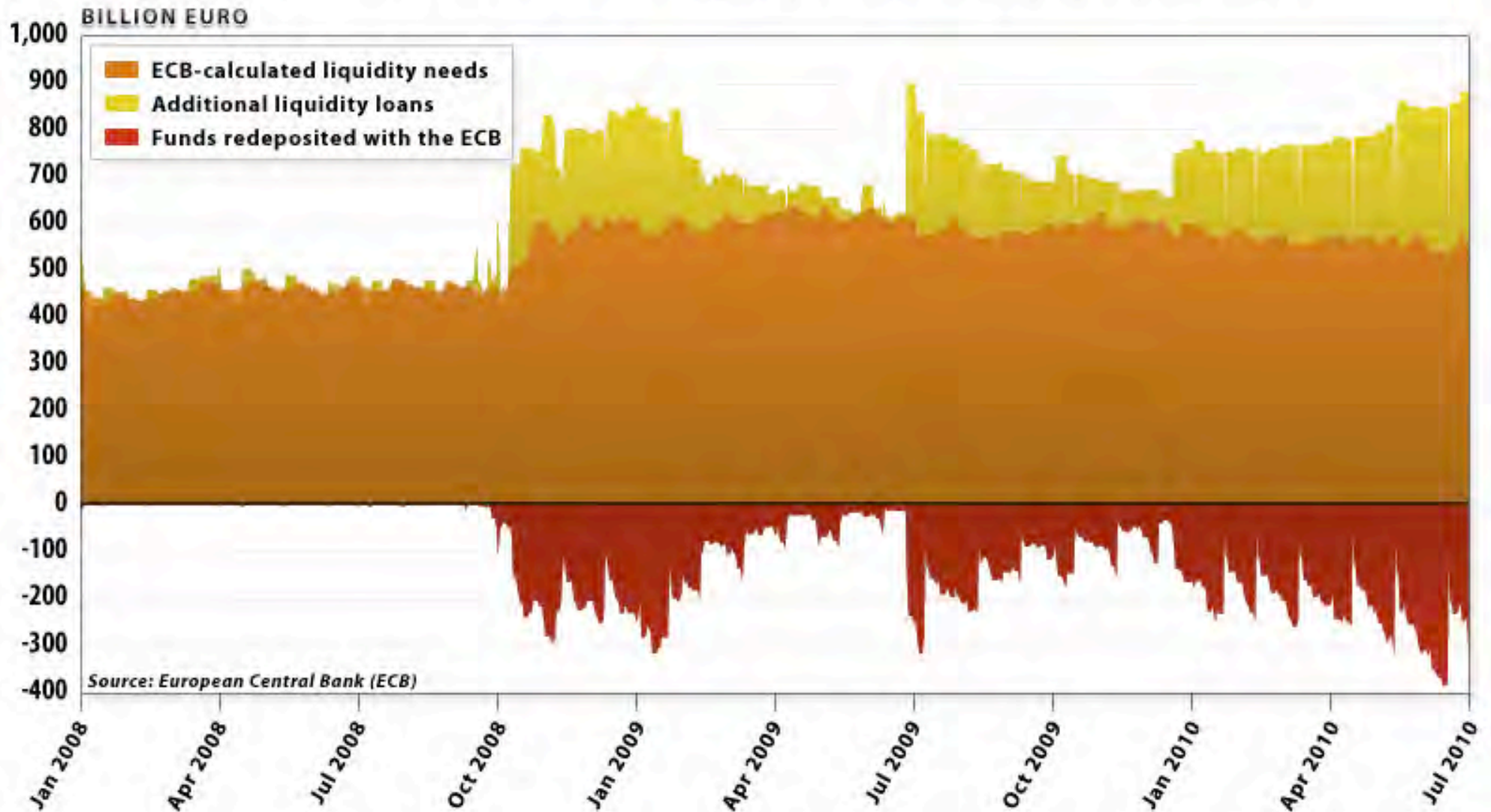
Reuters graphic/Scott Barber

REUTERS

29/06/10

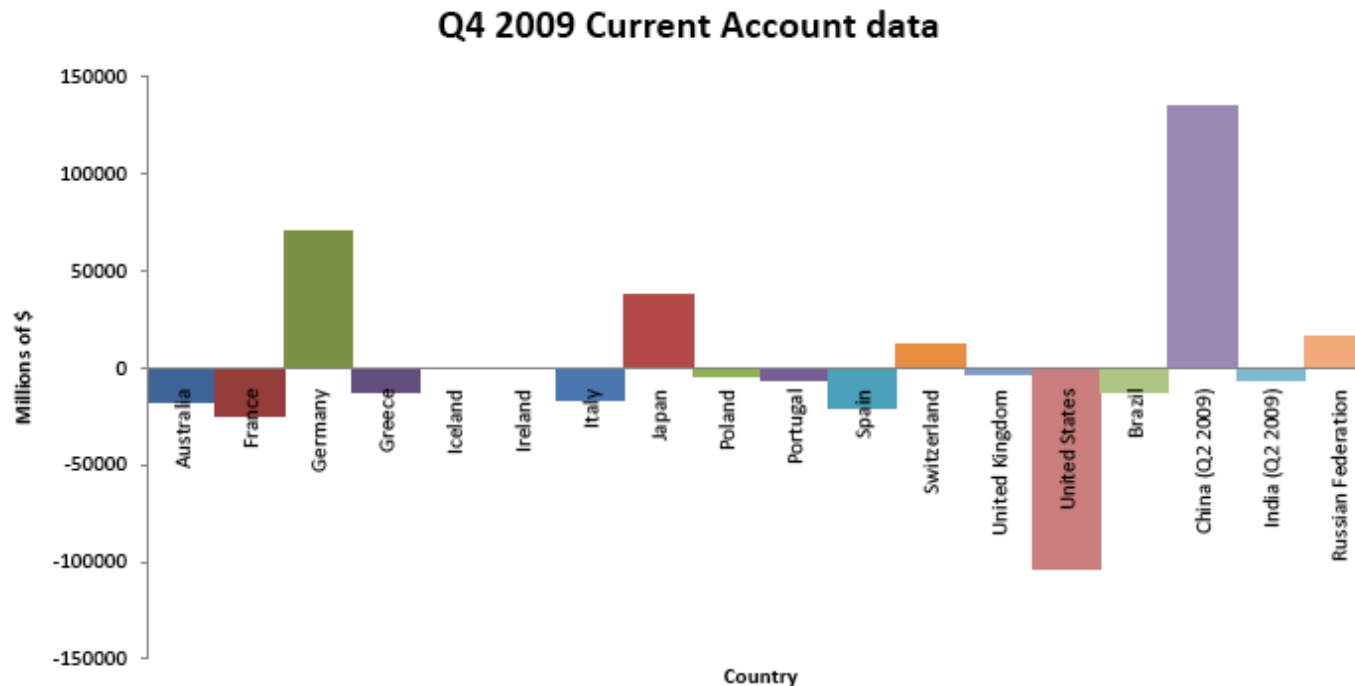
Two Mammoth European problems: bank exposures and Sovereign debts

EUROZONE BANKS: LIQUIDITY SUPPLY AND DEMAND



Future Scenarios

- Best case scenario: Japan “lost decade”
- European scenarios
- USA scenarios
 - *US consumers still the “big spenders” → Default risk is increasing → interest rates will have to rise at a certain point of time or US has to stop importing*
 - *Dollar risk versus Euro, Yen and Yuan risks*

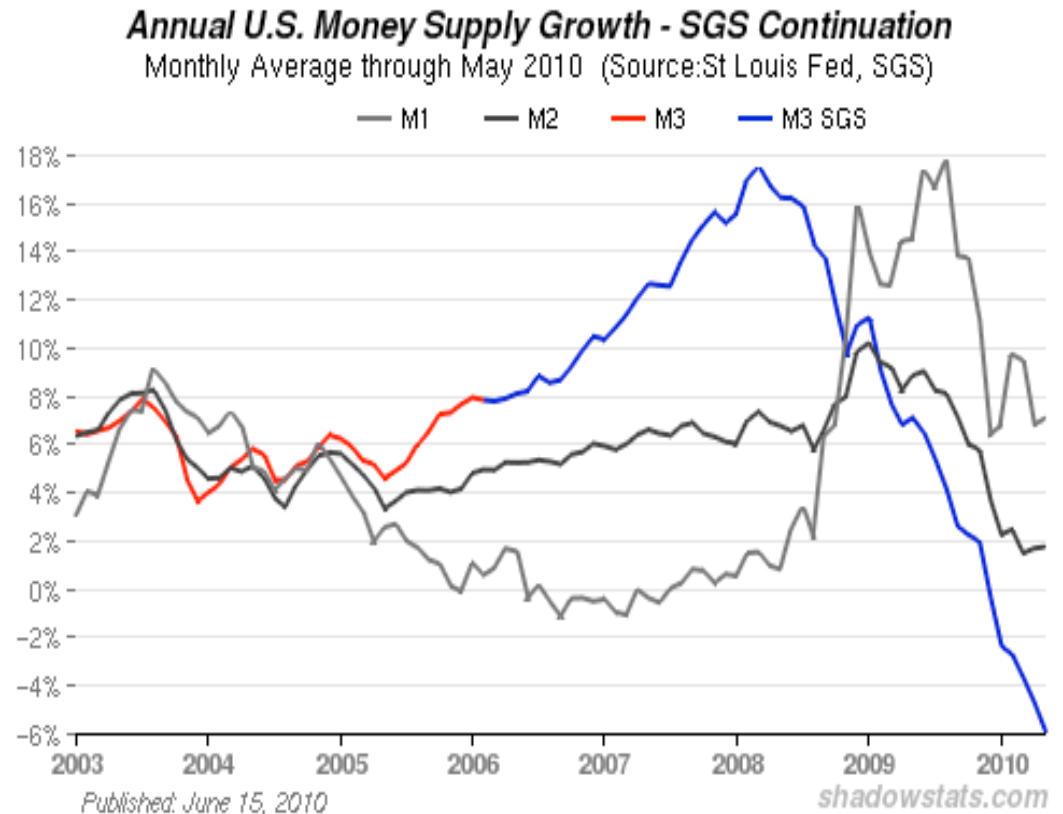


Inflation and Deflation Risks

Money Bubble is collapsing

US Money Supply

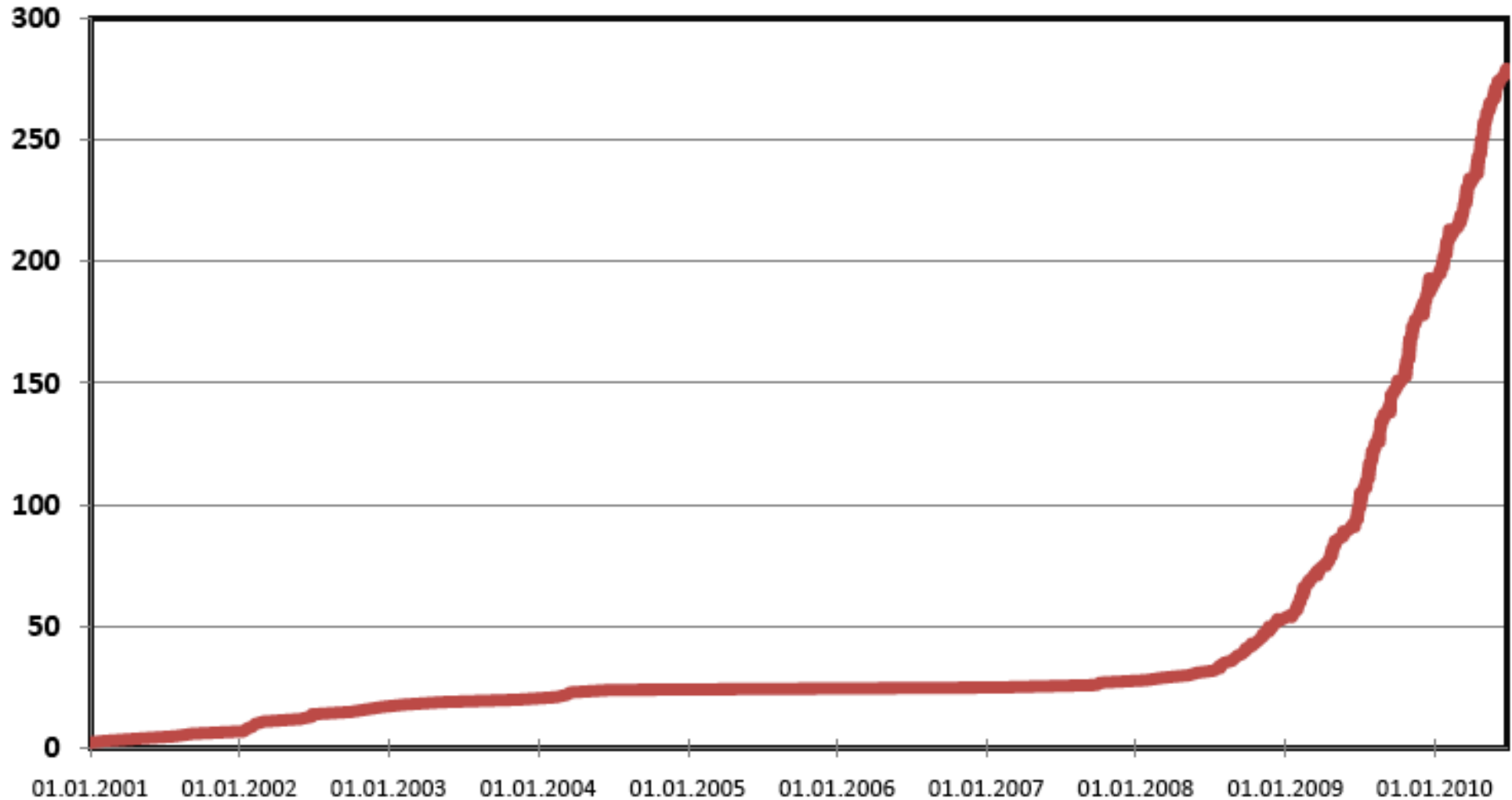
- US M3 is now decreasing for the first time in decades
 - Dollar appreciates
 - Deflation
 - FED action still not effective in creating short term inflation



How will banks deal with this?

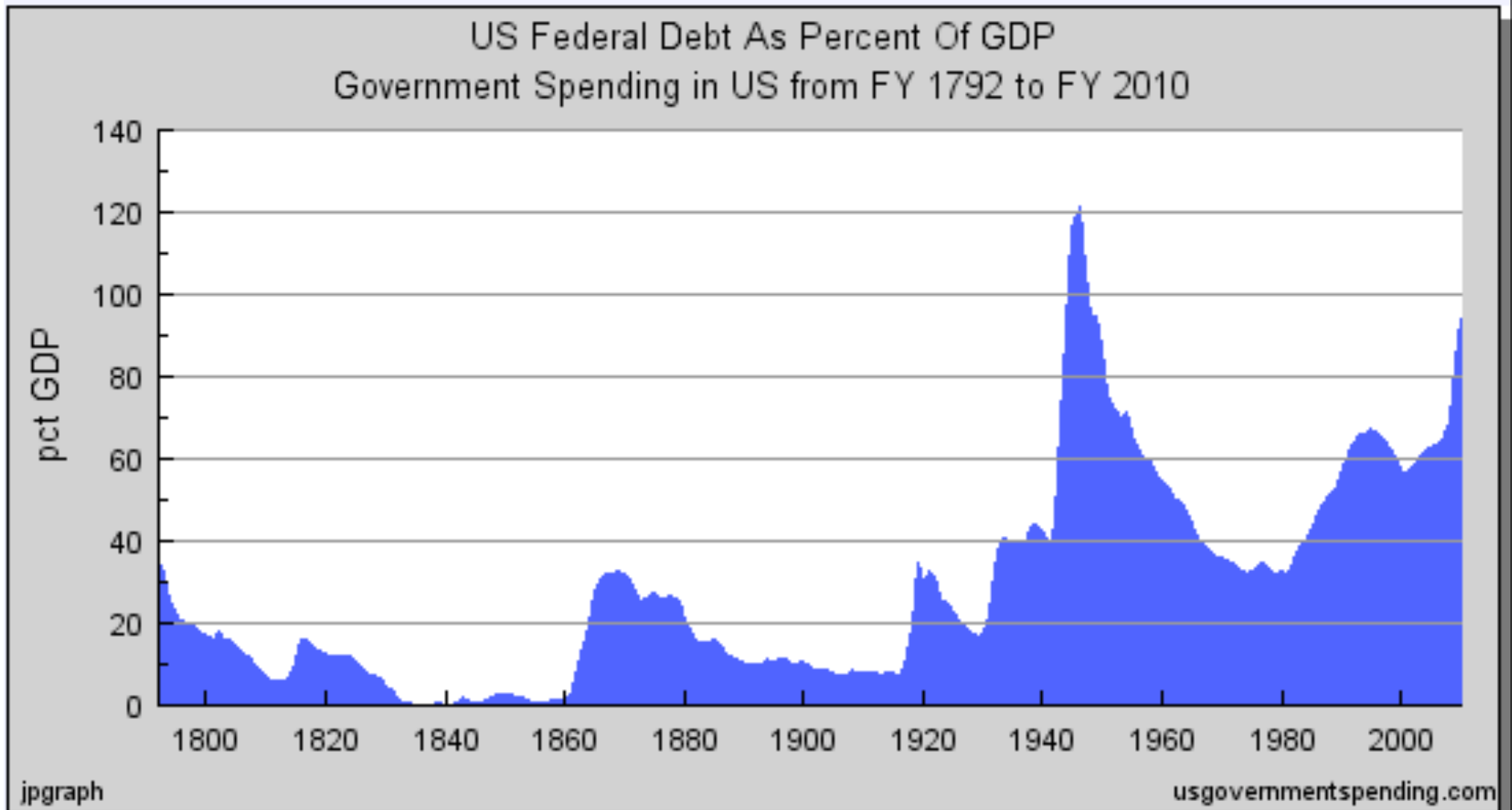
Failed Banks in the US

US-Bank Failures (2001-2010)



Source Data: FDIC

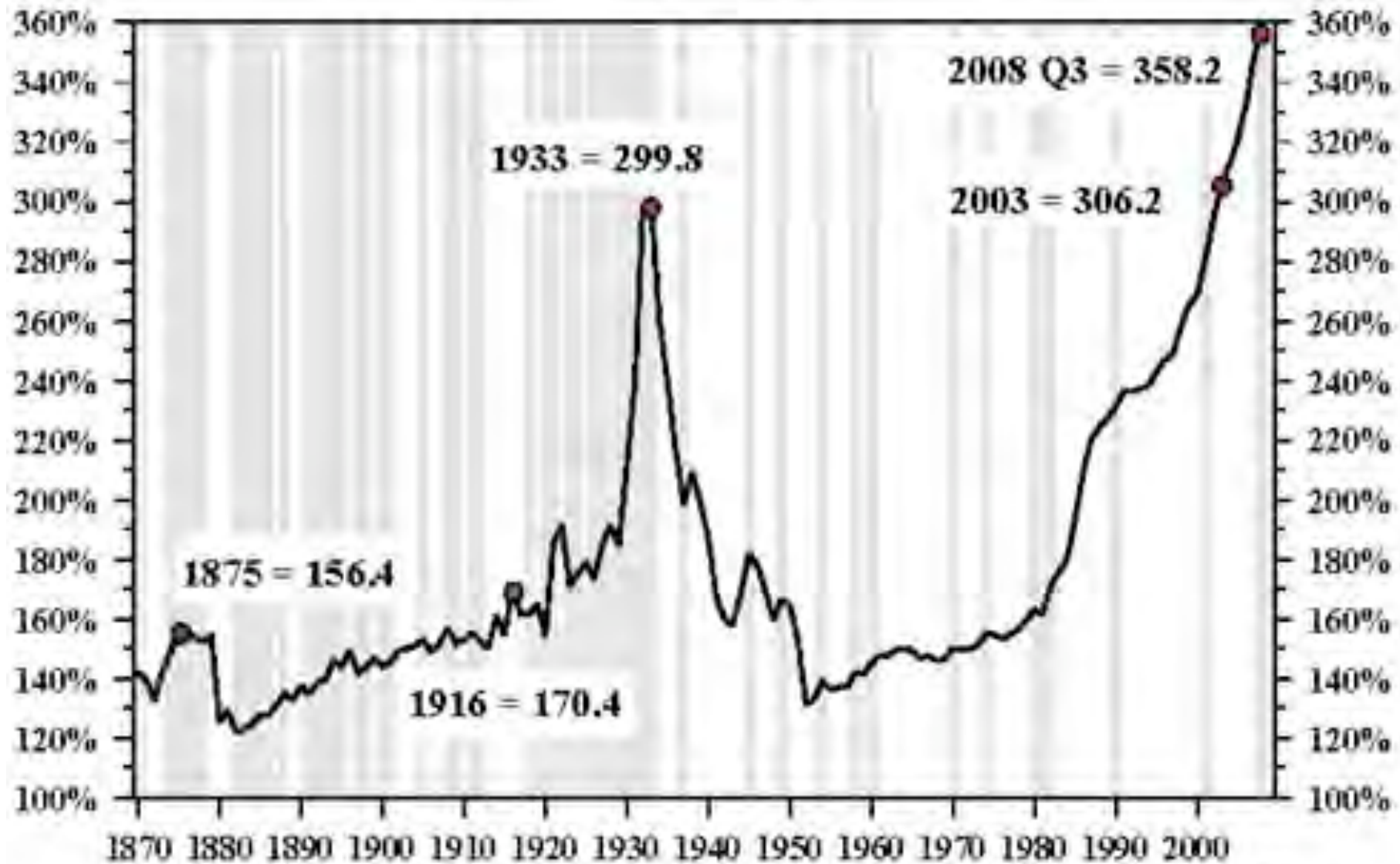
US Government Debt



Total U.S. Debt as a % of GDP

annual

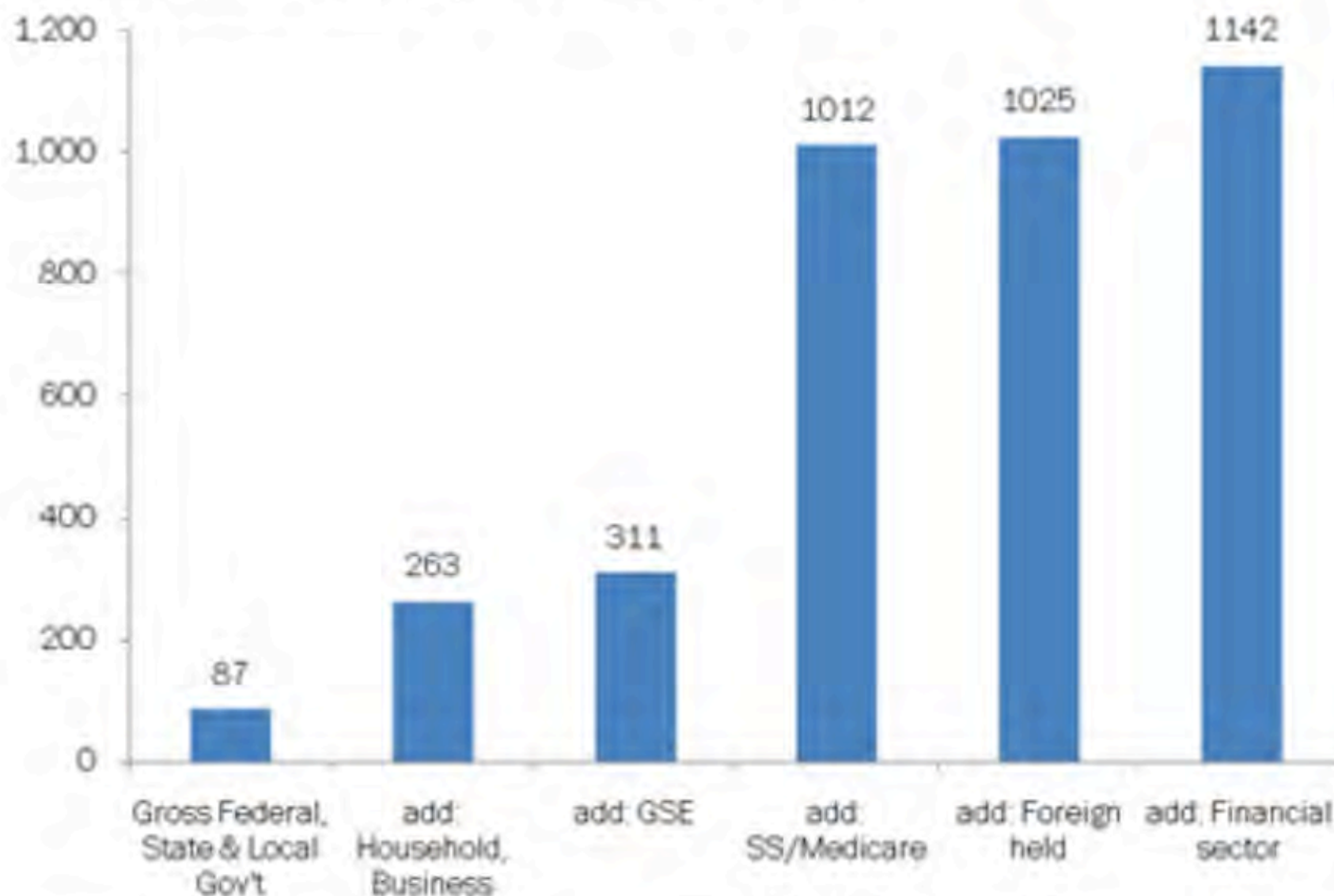
\$ 50 trillions



Sources: Bureau of Economic Analysis, Federal Reserve, Census Bureau: Historical Statistics of the United States
Colonial Times to 1970. Through Q3 2008.

Total U.S. Debt as Percent of GDP

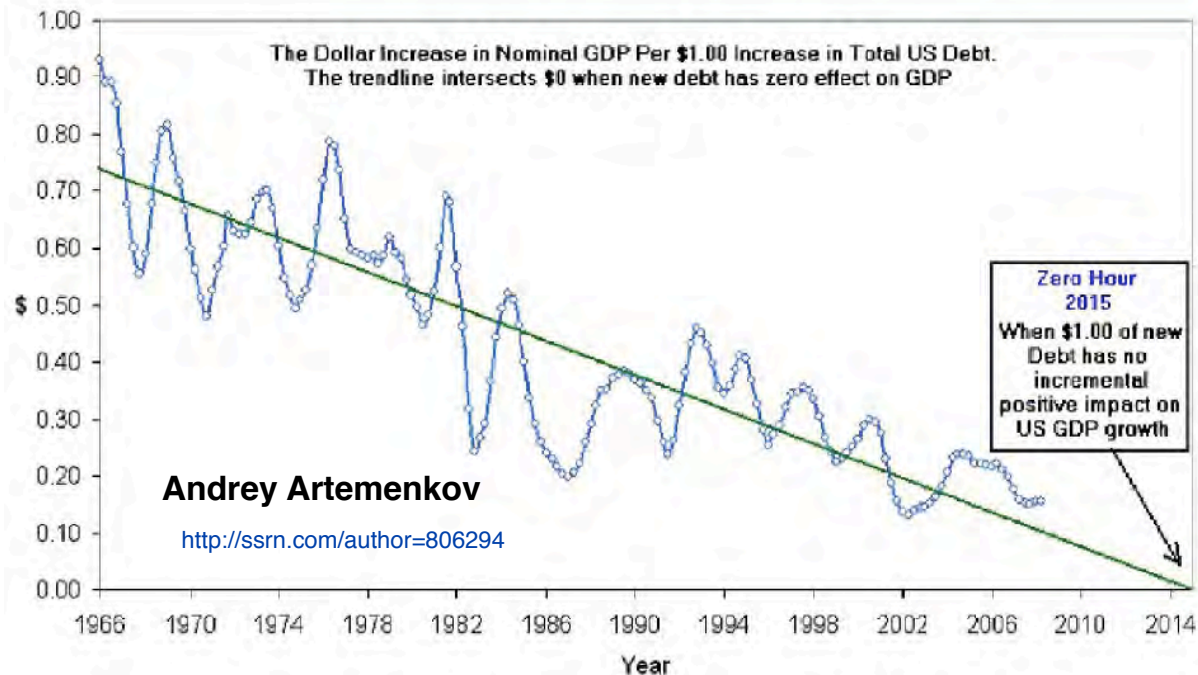
Including GSEs, Social Security/Medicare Unfunded Liabilities



Source: Federal Reserve Z.1, FHFA GSE Report 2008/RGE Monitor, Richard W Fisher ("Storms on the Horizon", Dallas Fed 5/28/2008), Rather & Kittrell

Future Scenarios

- Best case scenario: Japan “lost decade”
- European scenarios
- USA scenarios
 - *US consumers still the “big spenders” → Default risk is increasing → interest rates will have to rise at a certain point of time or US has to stop importing*
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Future Scenarios

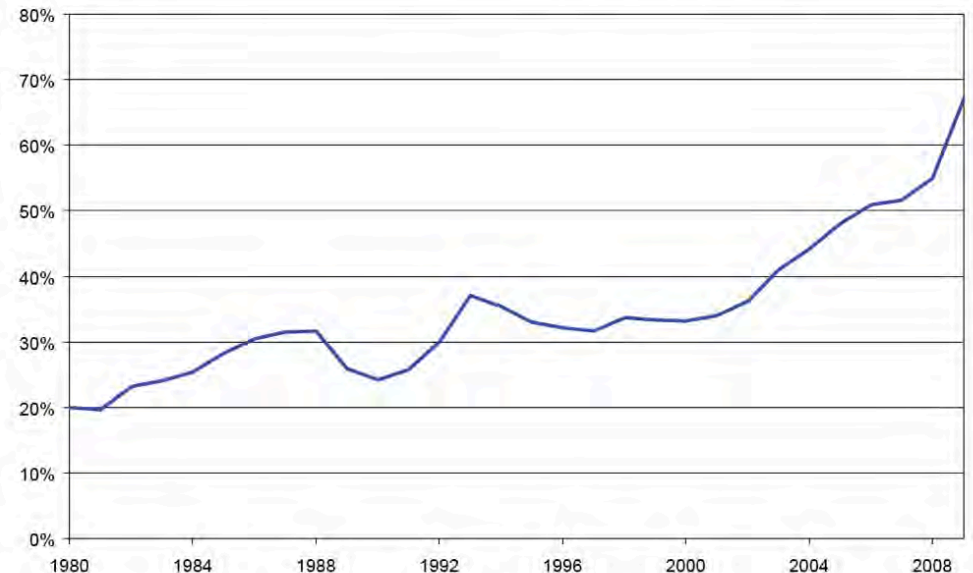
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Future Scenarios

- Best case scenario: Japan “lost decade”
- European scenarios
- USA scenarios
 - *US consumers still the “big spenders” → Default risk is increasing → interest rates will have to rise at a certain point of time or US has to stop importing*
 - *Dollar risk versus Euro, Yen and Yuan risks*
- **China scenarios...**
 - *Enormous and motivated human capital*
 - *Enormous internal market*
 - *The country of bubbles*
 - *Huge dependence on energy*
 - *Environmental problems*

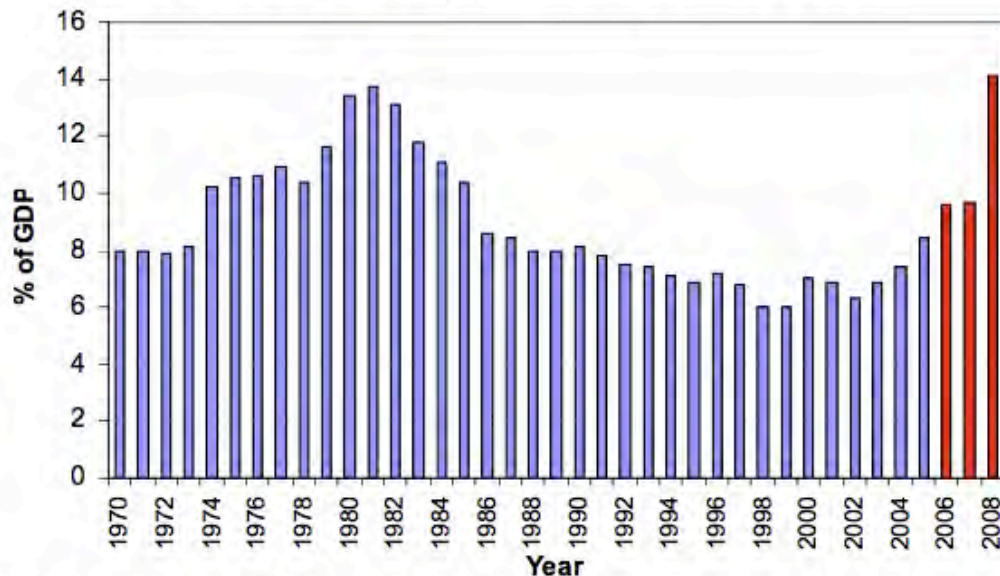
Chinese fixed asset investment share of GDP



Source: Andrew Hunt Economics As of 12/31/09

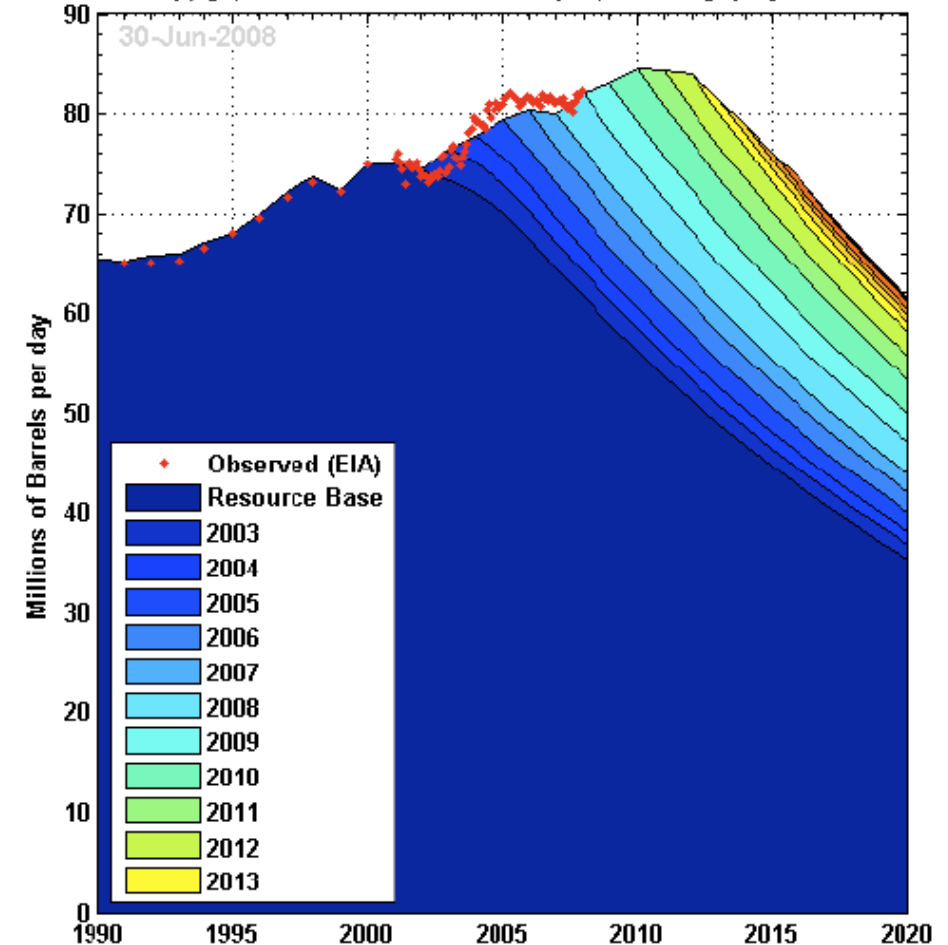
Future Scenarios: the energy problem

Figure 1: Energy Consumption in the US as Percent of GDP



Source: Energy Information Administration and calculatedrisk.blogspot.com
Note: data for 2006-2008 is estimated

World Oil Supply (Crude Oil + Natural Gas Liquid) and Megaproject Contributions



Economists rely on the always climbing remaining conventional oil reserves, when in reality every explorer knows that since 1980 more oil is produced than found and the remaining reserves should decline."

Source: J. Laherrere

New risks to consider

- Inflation and Deflation
- Bank failures
- “Government risks”
- Economic Slowdown (China)
- Financial instabilities are developing everywhere and will develop even more than in the past.
- Systemic risks are rising planet-wide, with entangling of many risk components (everything is linked).

Impact on risk allocation in portfolios and portfolio optimization

- Standard asset allocation and risk management does NOT work when we need it most
- We need several levels of risk assessment and management:
 - Fat tail, copula dependence, expected shortfall bootstraps...
 - Financial crises

Towards new strategy and asset allocation

A) Need to use financial instability diagnostics

B) Need to re-examine “low risk” investments (such as fixed-income...) => interest risks vs default risks



The screenshot shows a news article from the 'FRONT' section. The header includes 'TOP-NEWS', 'BÖRSEN-TICKER', 'GURU', 'INSIDER', 'KOLUMNE', and 'KOMMENTAR'. The article title is 'Pensionskassen liquidieren Griechen-Bonds' with a sub-headline 'Anfällige Altersvorsorge: Schweizer Pensionskassen haben nur ein dünnes Polster.' and a photo of two elderly people on a bench. The text discusses the liquidation of Greek bonds by pension funds.

TOP-NEWS | BÖRSEN-TICKER | GURU | INSIDER | KOLUMNE | KOMMENTAR

FRONT  RSS > News

Pensionskassen liquidieren Griechen-Bonds

01.07.2010 07:18

Viele Kassen sind zum Verkauf unter pari gezwungen. Die Verluste halten sich aber in Grenzen. Bei weiter stotternden Finanzmärkten schliessen Exponenten aber neue Sanierungsmassnahmen nicht aus.

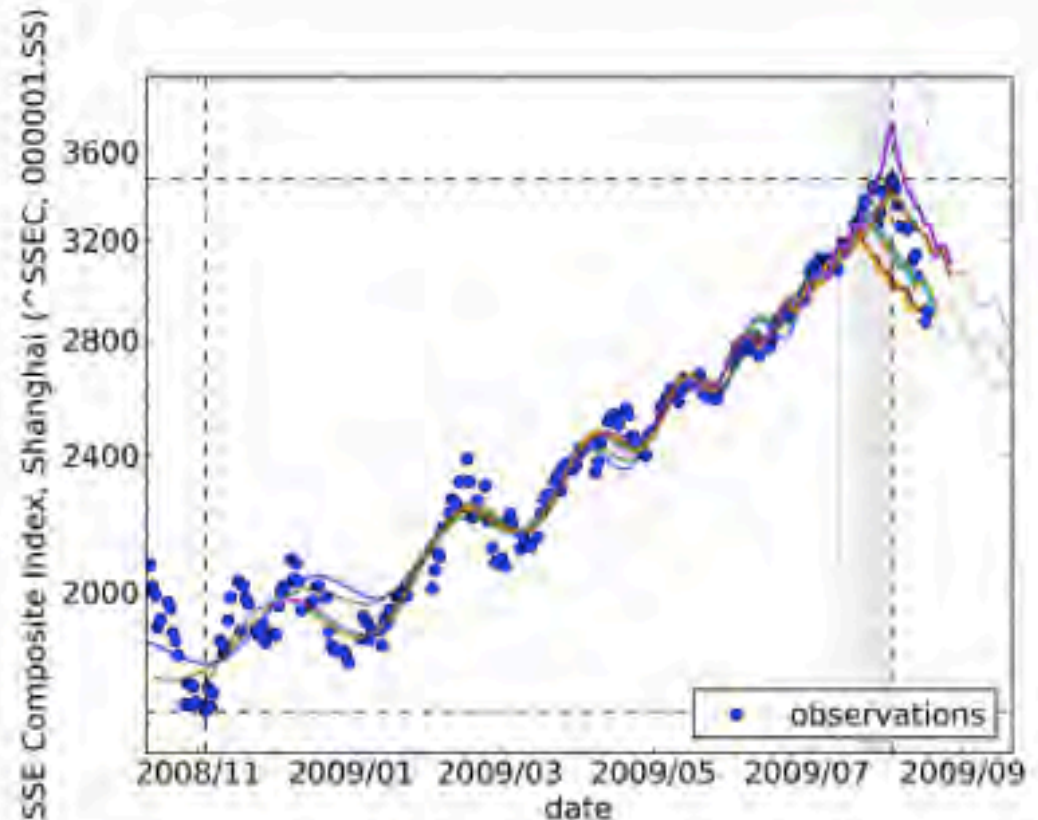
Anfällige Altersvorsorge: Schweizer Pensionskassen haben nur ein dünnes Polster.
Bild: Keystone

C) Need to combine strategic with tactical asset allocations (including need for timing because buy-and-hold will not be anymore a winning strategy)

FCO@ETH: Towards operational science of financial instabilities

- Main mission:
 - Identify bubbles
- Theory:
 - Positive feedback
- Deliverables
 - Weekly global bubble scan
 - Research, papers
 - Public forecasts
 - Digital timestamps

Didier Sornette, Maxim Fedorovsky, Stefan Riemann, Hilary Woodard, Ryan Woodard, Wanfeng Yan, Wei-Xing Zhou



Methodology for diagnosing bubbles

• Inputs:

-prices

-factors (interest rates, interest spread, historical and implied volatility, exchange rates)

• Methods:

-Self-consistent calibration of prices (not returns)

-Portfolio of methods to identify transient bubble regimes (entropy, hierarchical analysis, reverse engineering with ABM...)

Methodology for diagnosing bubbles

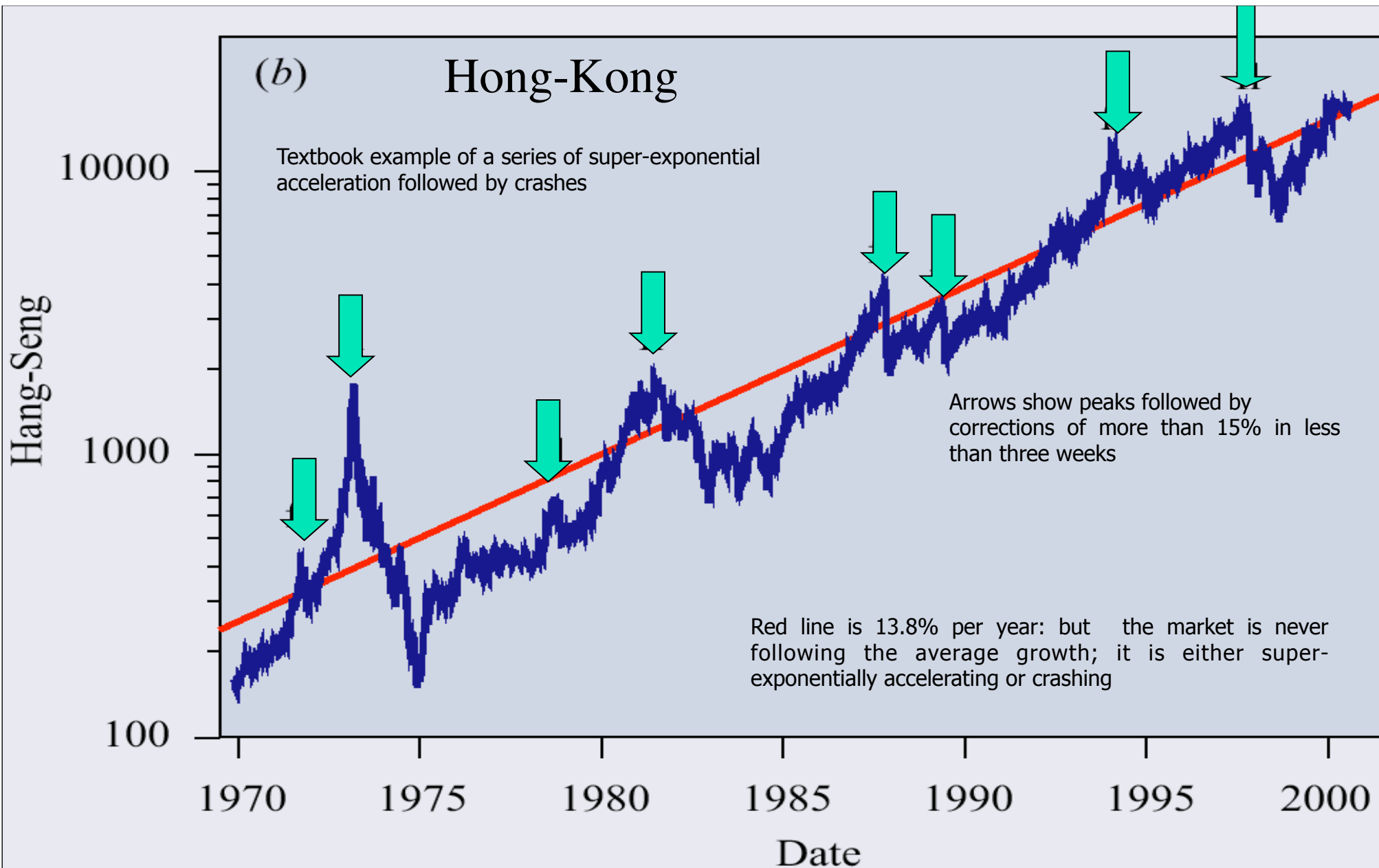
- Positive feedbacks of higher return anticipation
 - * Super exponential price
 - * Power law “Finite-time singularity”

- Negative feedback spirals of crash expectation
 - * Accelerating large-scale financial volatility
 - * Log-periodic discrete scale-invariant patterns

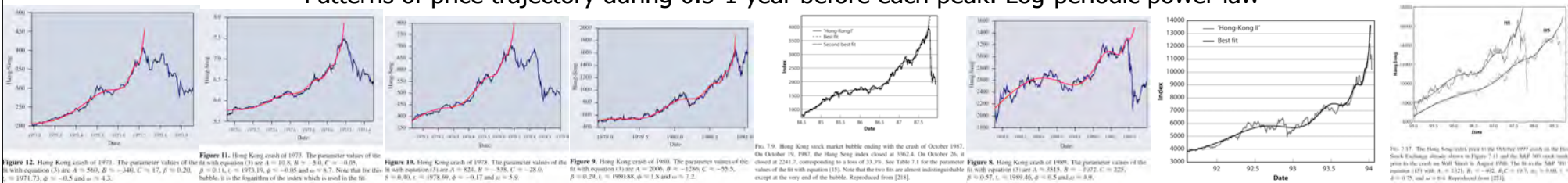
The Financial Bubble Experiment

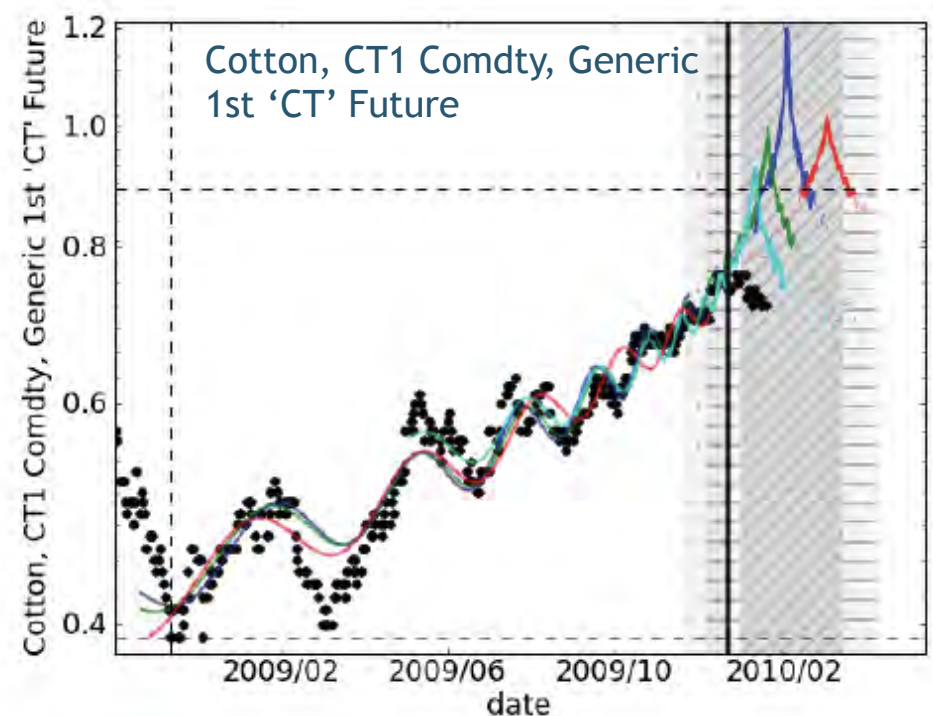
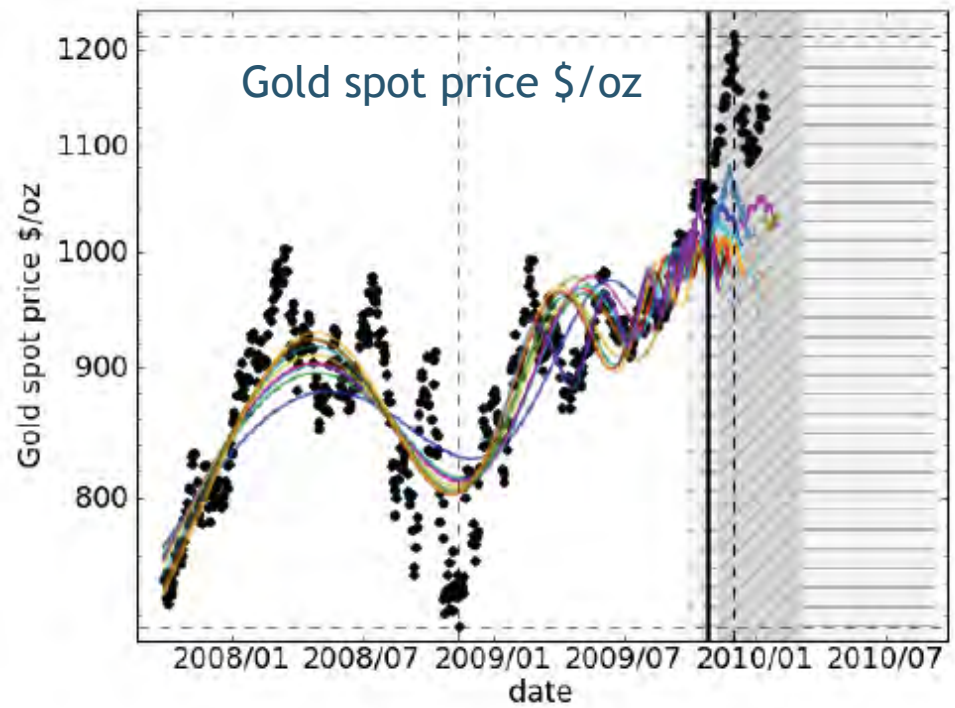
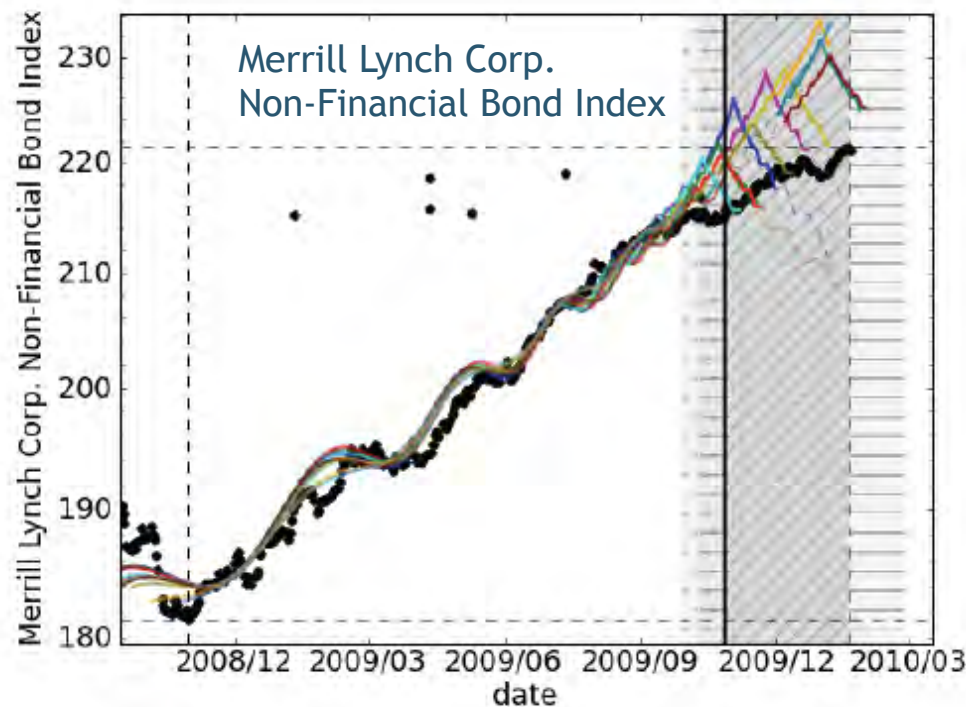
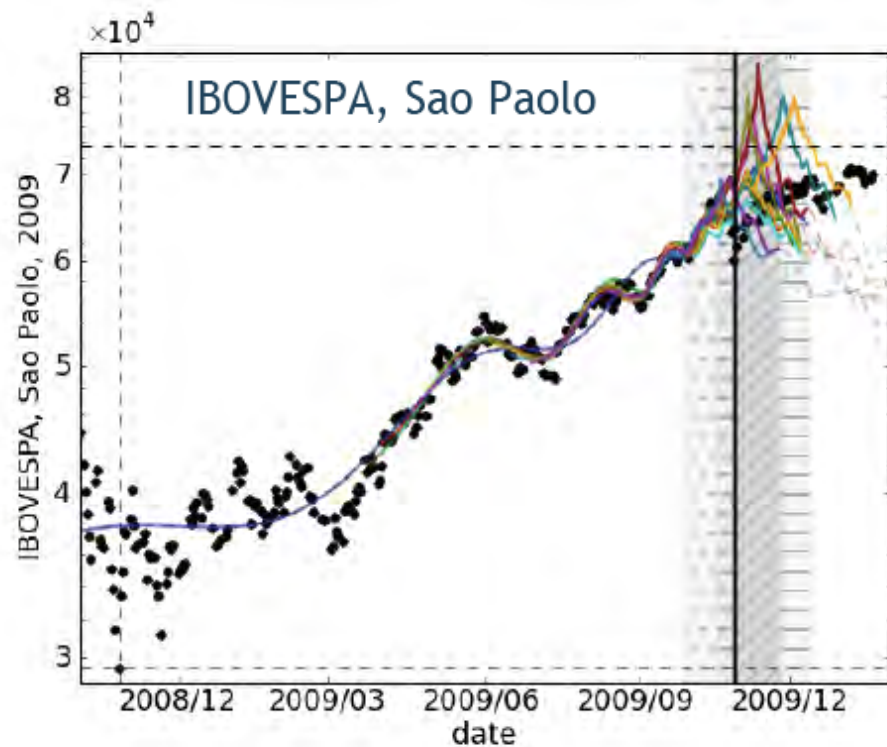
advanced diagnostics and forecasts of bubble terminations

- ***Hypothesis H1: financial (and other) bubbles can be diagnosed in real-time before they end.***
- ***Hypothesis H2: The termination of financial (and other) bubbles can be bracketed using probabilistic forecasts, with a reliability better than chance.***



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





Solutions?

The problem of institutional and academic memory loss

- Glass-Steagall act (1933)
- Credit creation by banks (R. Werner)

The key question: is there evidence that the new financial innovations and a much expanded bank system has brought any real gain for innovations, economic development, employment?

As Krugman suggested, is “boring banking” sufficient?

Final remarks

1-All proposals will fail if we do not have better science and better metrics to monitor and diagnose (ex: biology, medicine, astronomy, chemistry, physics, evolution, and so on)

2-Leverage as a system variable versus the illusion of control by monetary policy, risk management, and all that

3-Need to make endogenous policy makers and regulators (“creationist” view of government role, illusion of control and law of unintended consequences of regulations)

4-Fundamental interplay between system instability and growth; the positive side of (some) bubbles

5-Time to reassess goals (growth vs sustainability vs happiness). In the end, endogenous co-evolution of culture, society and economy

**KEY CHALLENGE: genuine trans-disciplinarity by
TRAINING in 2-3 disciplines + CHANGE OF CULTURE**

Support slides

Why bubbles are not arbitrated 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

14 factors to propel a market bubble

1. the capitalist explosion and the ownership society,
2. cultural and political changes favoring business success,
3. new information technology,
4. supportive monetary policy and the Greenspan put,
5. the baby boom and their perceived effects on the markets,
6. an expansion in media reporting of business news,
7. analysts' optimistic forecasts,
8. the expansion of defined contribution pension plans,
9. the growth of mutual funds,
10. the decline of inflation and the effects of money illusion,
11. the expansion of the volume of trade due to discount brokers,
12. day traders,
13. twenty-four-hour trading,
14. the rise of gambling opportunities.

CENTRE DE PHYSIQUE



LES HOUCHES

EDITORS:
B. DUBRULLE
F. GRANER
D. SORNETTE

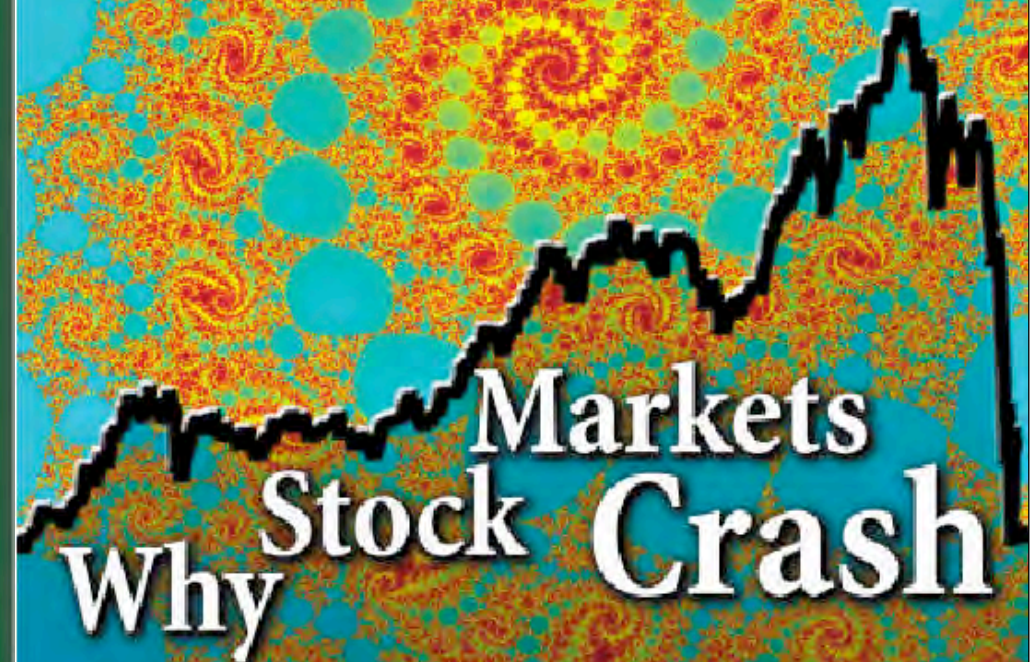
SCALE INVARIANCE
AND BEYOND

1997

EDP SCIENCES • SPRINGER

DIDIER SORNETTE

Princeton
University
Press
Jan. 2003



Critical Events in
Complex Financial Systems

49

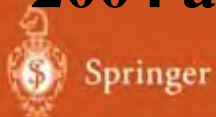
D. Sornette

Critical Phenomena in Natural Sciences

Chaos, Fractals,
Selforganization and Disorder:
Concepts and Tools

**First edition
2000**

**Second
enlarged edition
2004 and 2006**



Malevergne · Sornette



Extreme Financial Risks

Y. Malevergne
D. Sornette

Extreme Financial Risks

From Dependence
to Risk Management

Nov 2005

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632 LECTURE NOTES IN ECONOMICS
AND MATHEMATICAL SYSTEMS

Yannick Malevergne
Alex Saichev
Didier Sornette

Theory of Zipf's Law and Beyond

 Springer

2009

Further Reading

T. Kaizoji and D. Sornette, Market Bubbles and Crashes, in press in the Encyclopedia of Quantitative Finance (Wiley, 2008)
(preprint at <http://arxiv.org/abs/0812.2449>)

D. Sornette and R. Woodard Financial Bubbles, Real Estate bubbles, Derivative Bubbles, and the Financial and Economic Crisis
(preprint at <http://arxiv.org/abs/0905.0220>) will appear in the Proceedings of APFA7 (Applications of Physics in Financial Analysis, <http://www.thic-apfa7.com/en/htm/index.html>)

Didier Sornette, Why Stock Markets Crash
(Critical Events in Complex Financial Systems)
Princeton University Press, January 2003

Y. Malevergne and D. Sornette, Extreme Financial Risks (From Dependence to Risk Management) (Springer, Heidelberg, 2006).

William C. Dudley (President and Chief Executive Officer of the Federal Reserve Bank of New York), April 2010; Remarks at The Economic Club of New York, New York City. “Asset Bubbles and the Implications for Central Bank Policy”

- Turning to the first issue of whether there are asset bubbles, I am going to be a bit of a heretic and argue that **there is little doubt that asset bubbles exist** and that **they occur fairly frequently**.
- In conclusion, let me underscore the challenge that central bankers face in combating asset price bubbles. Doing so effectively **requires us to be successful in both identifying the incipient bubble** and in developing and implementing a response that will limit bubble growth and avert a destructive asset price crash. This is not easy because asset bubbles are hard to recognize in real time and each asset bubble is different. However, **these challenges cannot be an excuse for inaction**. Recent experience strongly suggests that asset bubbles exist and that their collapse can be very damaging to the financial system and the macroeconomy."

Mr Jean-Claude Trichet, President of the European Central Bank, on the occasion of the Susan Bies Lecture, Kellogg Distinguished Lecture Series, Evanston, Illinois, 27 April 2010.

“What can central banks do in a financial crisis?”

- First, I will argue that financial crises share some commonalities. In particular, crises are associated with the emergence of euphoria and complacency in financial markets, typically supported by rapid credit growth and a growing belief that new concepts like financial innovation or technological advances have rendered old limits on economic performance obsolete. The existence of such commonalities in the anatomy of financial crisis gives rise to a number of hopes. They suggest that **it is possible to develop warnings of nascent crises at an early stage**. They imply that policy-makers could design and implement policies that contain or avoid such crises."
- Such commonalities offer hope that **policy-makers can detect, at an early stage, a nascent financial crisis**. On the basis of inductive logic, we can exploit historical regularities to help predict the future. Being able to identify financial tensions **would allow appropriate policy actions to be taken in a timely manner**."