



Workshop on 'Financial, Technological, Social and Political Bubbles'

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Prime Tower Clouds, Zurich, 26 March 2015



Key Propositions

- Crises are the “norm” rather than the exception
- Most crises are endogenous and are the consequence of excess leverage, i.e., bubbles
- Bubbles are the key drivers as well as signatures
- Bubbles results from procyclical positive feedbacks
- Specific signatures (Nonlinear stochastic finite-singular processes)
- Possibility of developing probabilistic warning
 - 1) diagnostic of bubbles
 - 2) forecast of change of regime (burst)

What is a bubble?

A non-sustainable transient exuberant market regime!

Universal bubble scenario => ENDOGENEITY and POSITIVE FEEDBACK

Charles Kindleberger, Manias, Panics and Crashes (1978)
Didier Sornette, Why stock markets crash (2003)



Displacement

Credit creation

Euphoria

Critical stage / Financial distress

Revulsion

Financial bubbles, which we have been observing for over 400 years:



Tulip mania



South Sea bubble



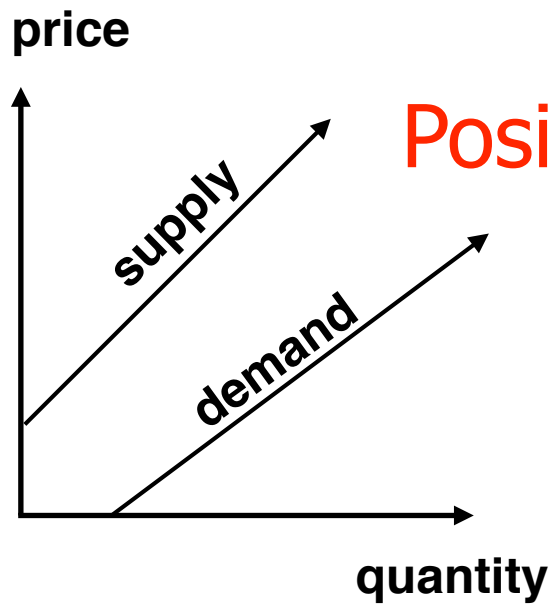
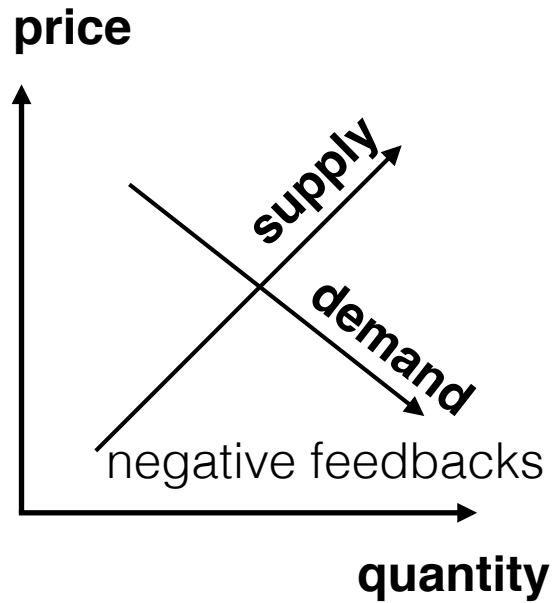
IT bubble



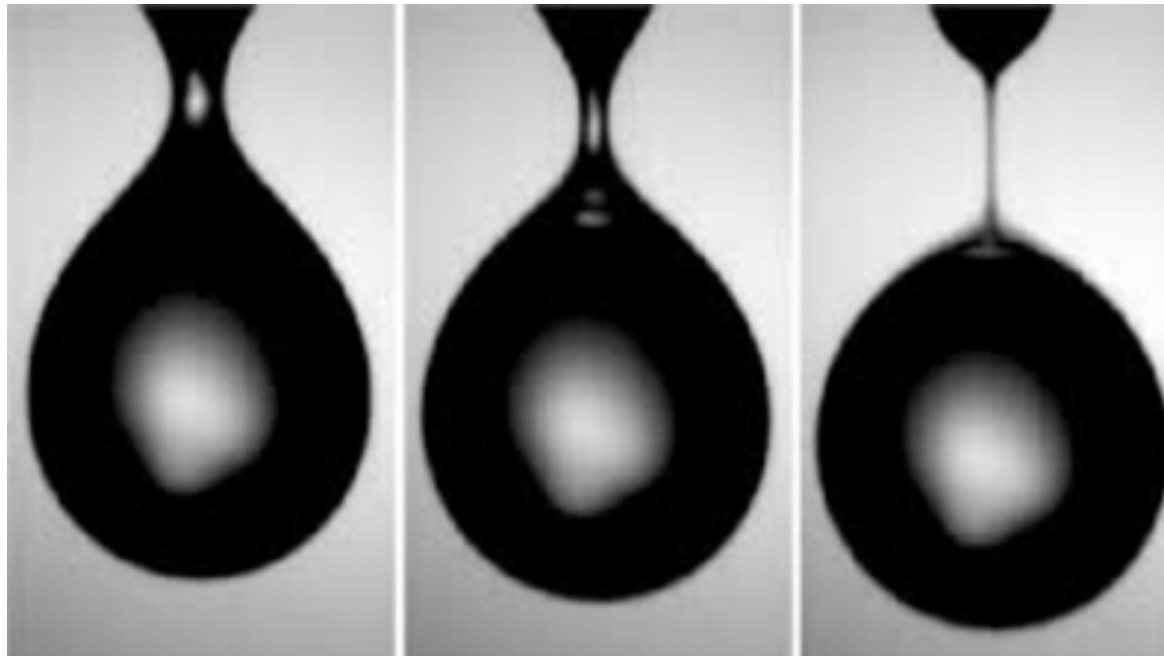
Housing bubble

What is a bubble?

standard law of supply and demand



Positive feedbacks



Mechanisms for positive feedbacks in the stock market

- **Technical and rational mechanisms**

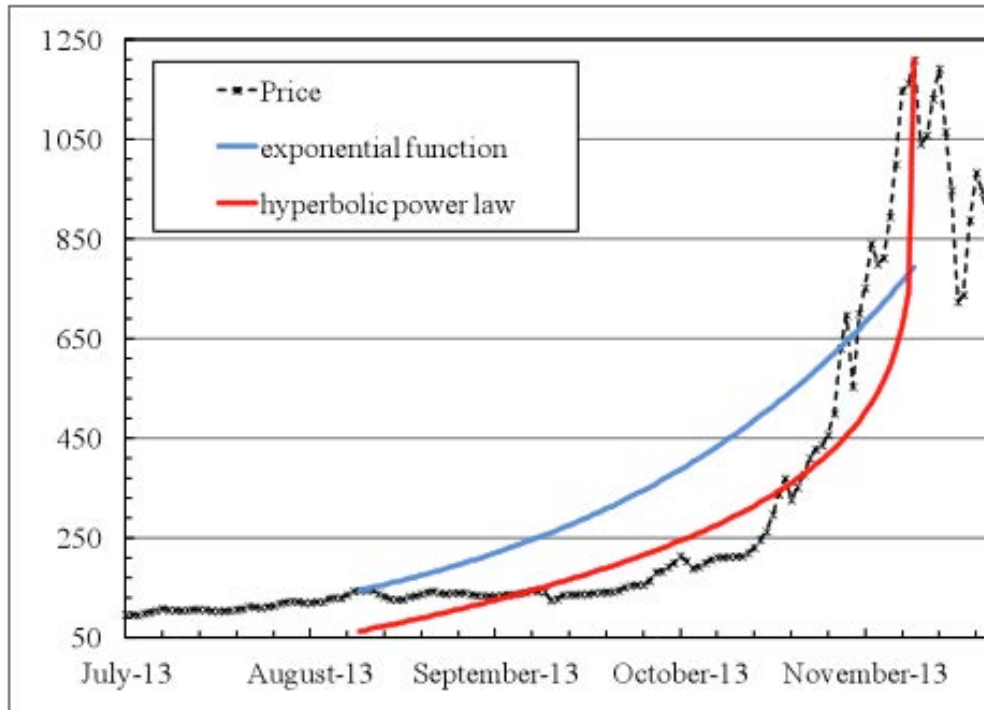
1. Option hedging
2. Insurance portfolio strategies
3. Market makers bid-ask spread in response to past volatility
4. Learning of business networks, human capital
5. Procyclical financing of firms by banks (boom vs contracting times)
6. Trend following investment strategies
7. Algorithmic trading
8. Asymmetric information on hedging strategies
9. Stop-loss orders
10. Portfolio execution optimization and order splitting
11. Deregulation (Grimm act repelling the Glass-Steagall act)
12. Central banks monetary policies

- **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)
3. “Social Proof” mechanism

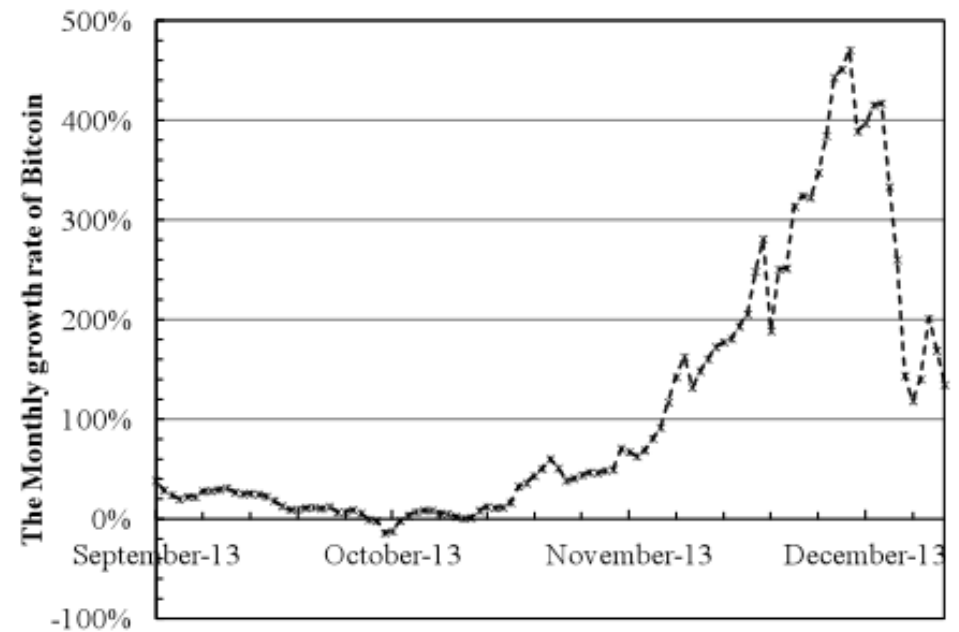
Example of the bitcoin bubble

price



The price of Bitcoin before its large correction at the end of November 2013. A hyperbolic power law is needed to capture the steep rise in the price. This is the hallmark of a positive feedback mechanism and a bubble.

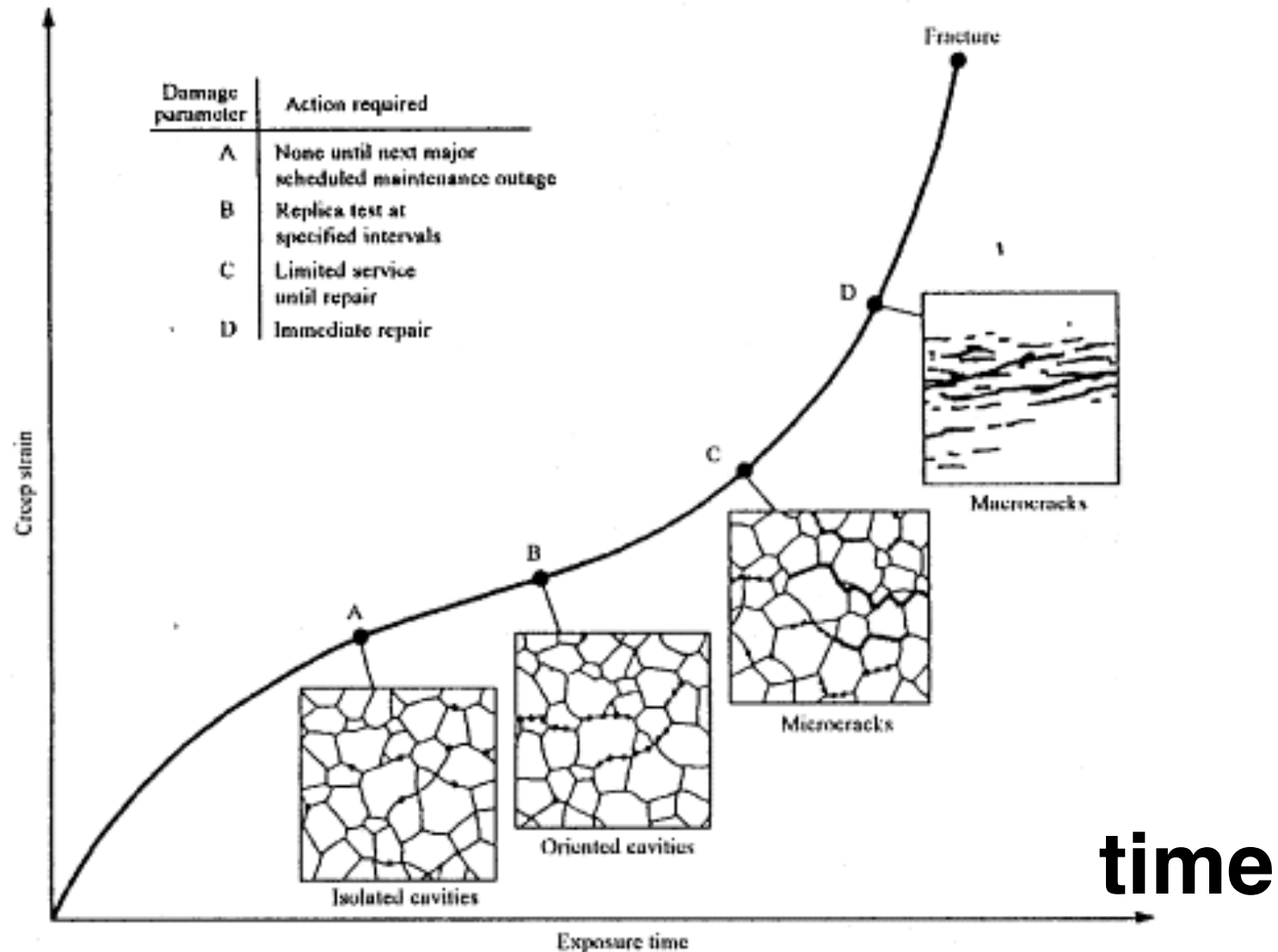
return



The Monthly growth rate of Bitcoin before its large correction end of November 2013. It can be clearly seen that the growth rate itself is growing; this is caused by a positive feedback mechanism. The asset is in a bubble phase.

Creep strain as a function of time

creep deformation

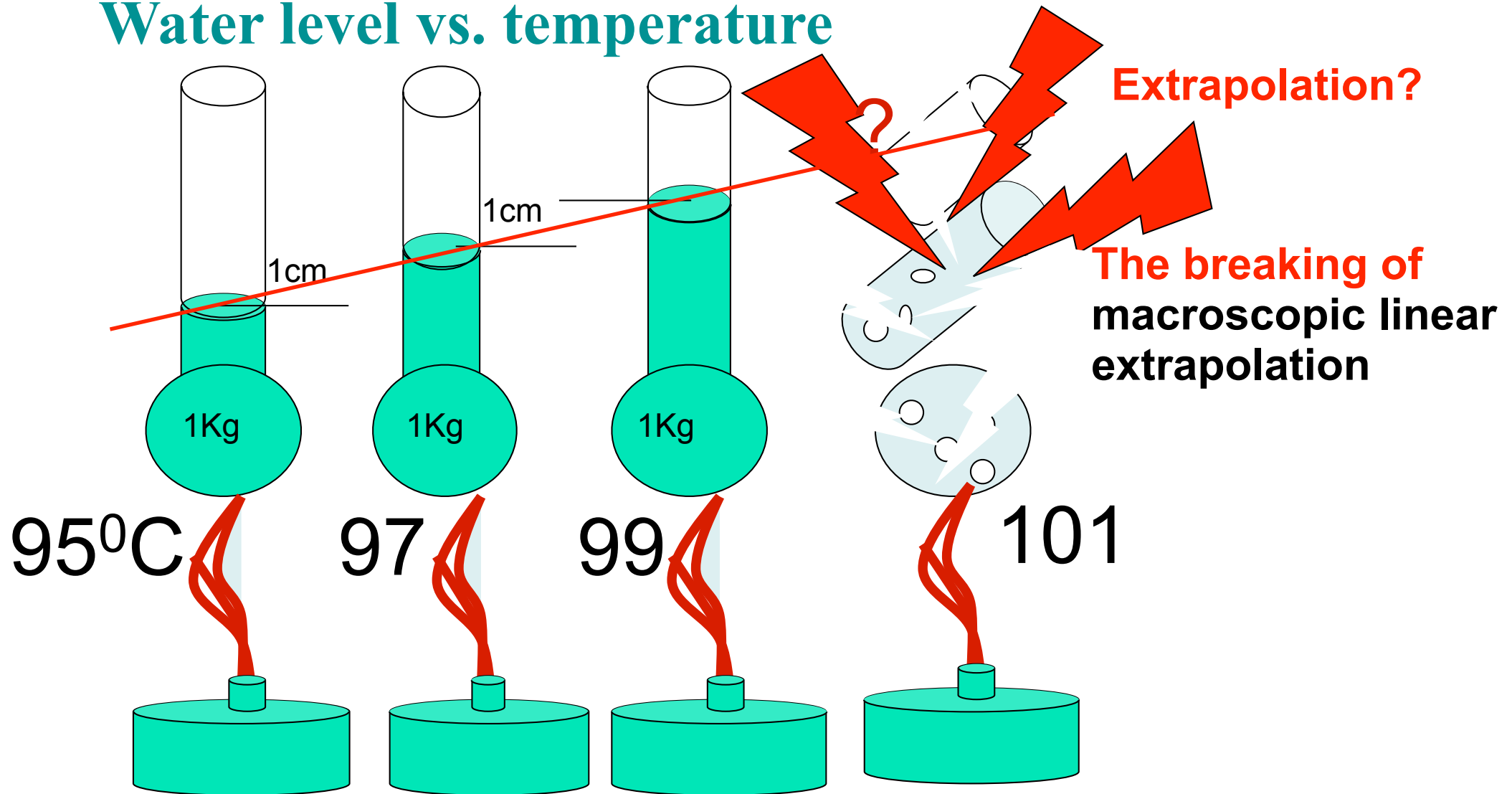


predictability via “finite-time singularity behavior”

$$\frac{de}{dt} \sim \frac{1}{(t_c - t)^{p'}}$$

Changes often result from a progressive maturation towards an instability (bifurcation)

Water level vs. temperature



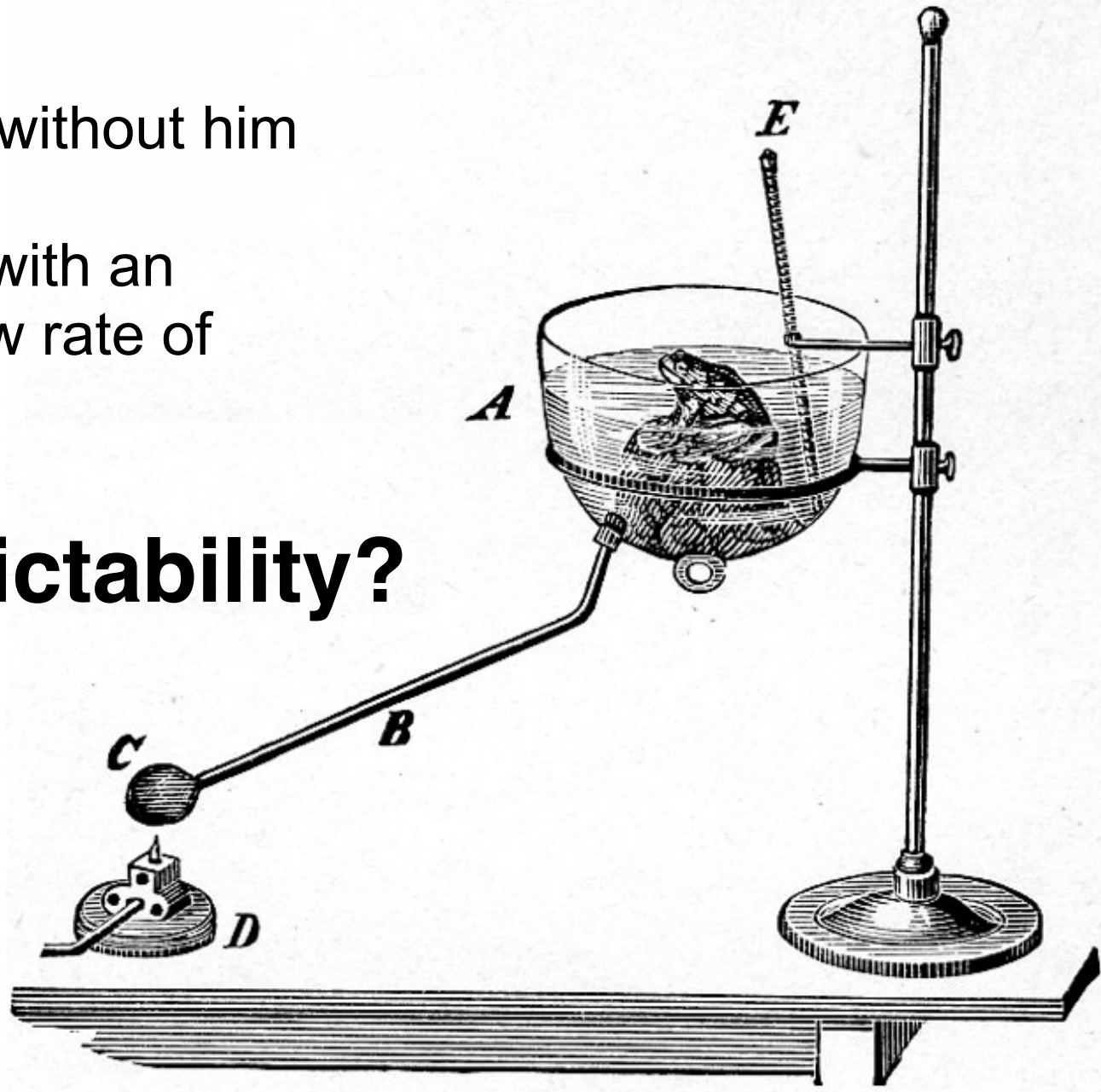
BOILING PHASE TRANSITION

More is different: a single molecule does not boil at 100C°

The boiling frog story

Boiling a frog without him knowing it:
no sensation with an
extremely slow rate of
change

No predictability?



Signs of Upcoming transitions

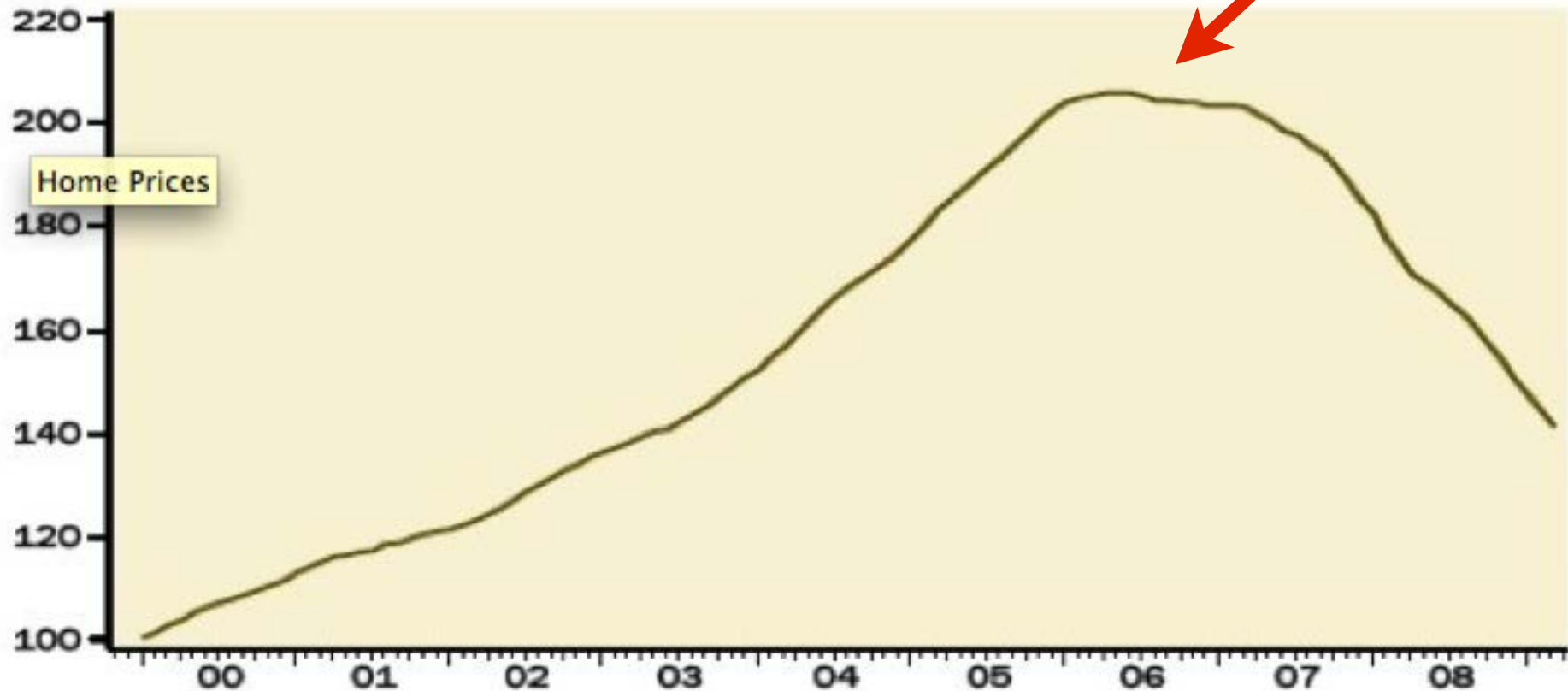
Early warning signals as predicted from theory

- Slower recovery from perturbations
- Increasing (or decreasing) autocorrelation
- Increasing (or decreasing) cross-correlation with external driving
- Increasing variance
- Flickering and stochastic resonance
- Increased spatial coherence
- **Degree of endogeneity/reflexivity**
- **Super-exponential growth with positive feedbacks**



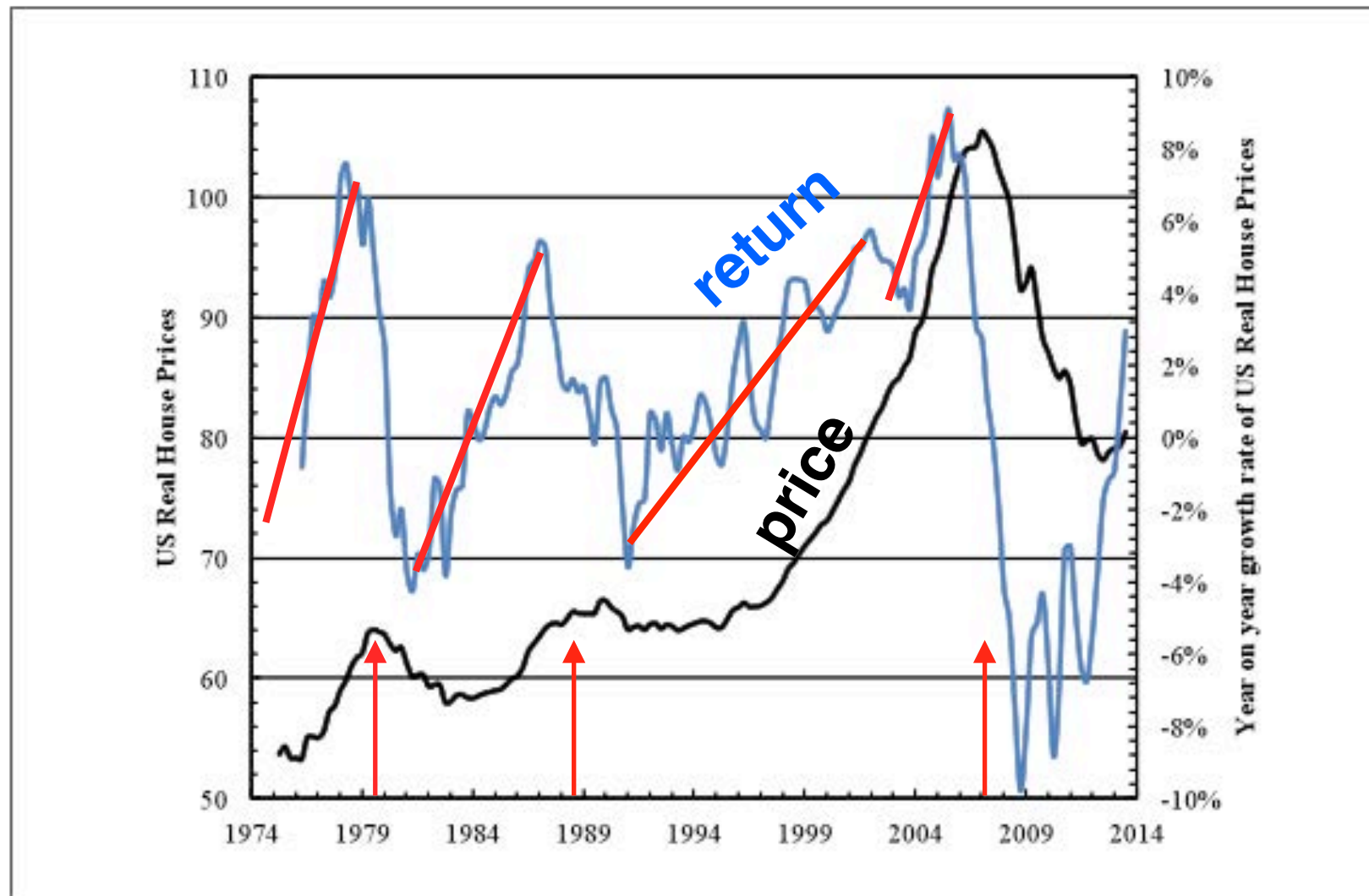
US real-estate: why did it stop increasing?

S&P/Case-Shiller Home Price Index: Composite 20
(Jan 2000 = 100, seasonally adjusted)



Source: Haver Analytics, Gluskin Sheff

U.S. real-estate bubble

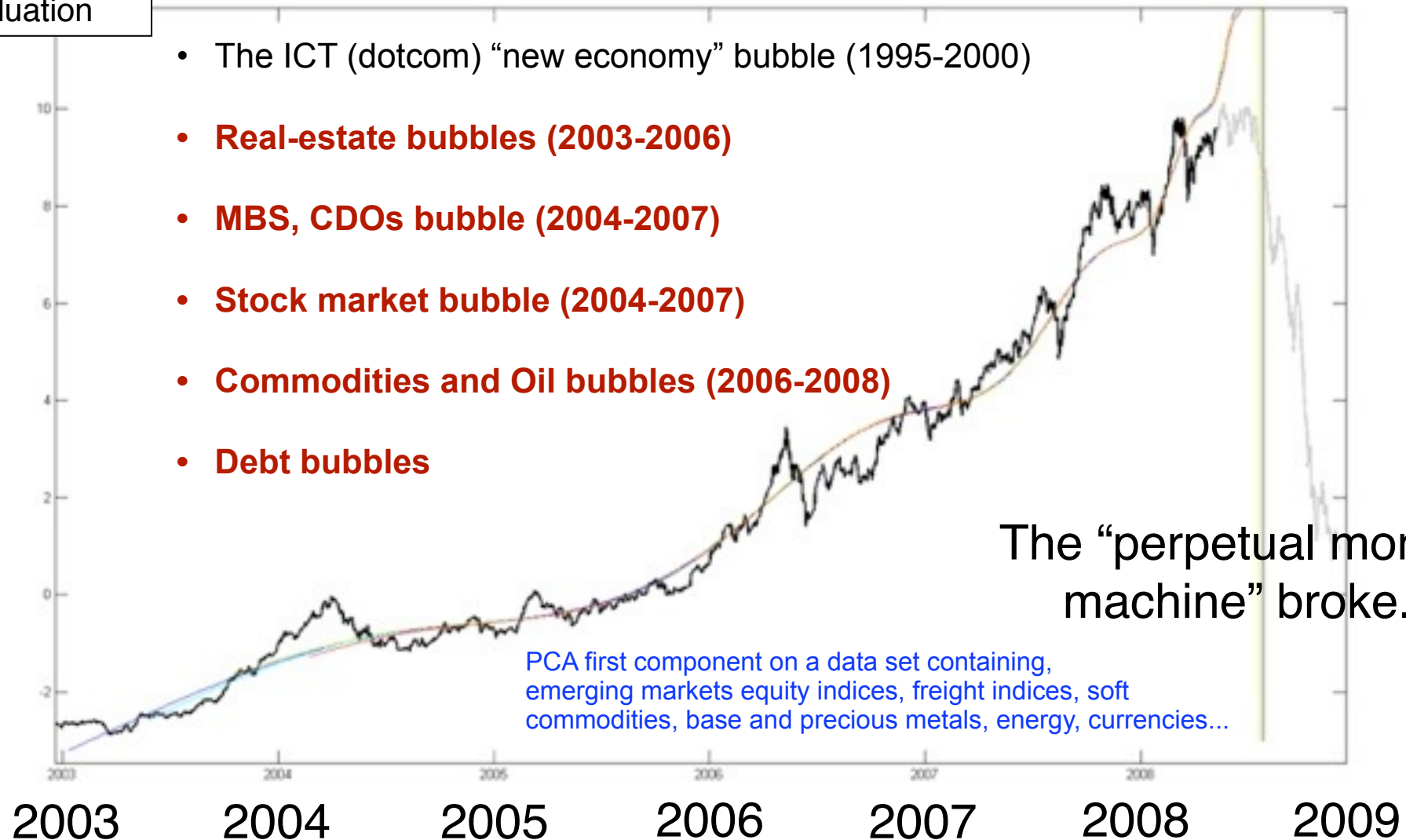


Real U.S. House Prices between 1974 and 2014. Levels are shown in black and should be read on the left axis. Yearly growth rates are shown in blue and should be read on the right axis. Three peaks in the growth rate coincide with a correction in the levels. When the growth itself grows, the process becomes unstable and a correction follows (Source: Federal Reserve Bank of Dallas international house price dataset, <http://www.dallasfed.org/institute/houseprice/>)

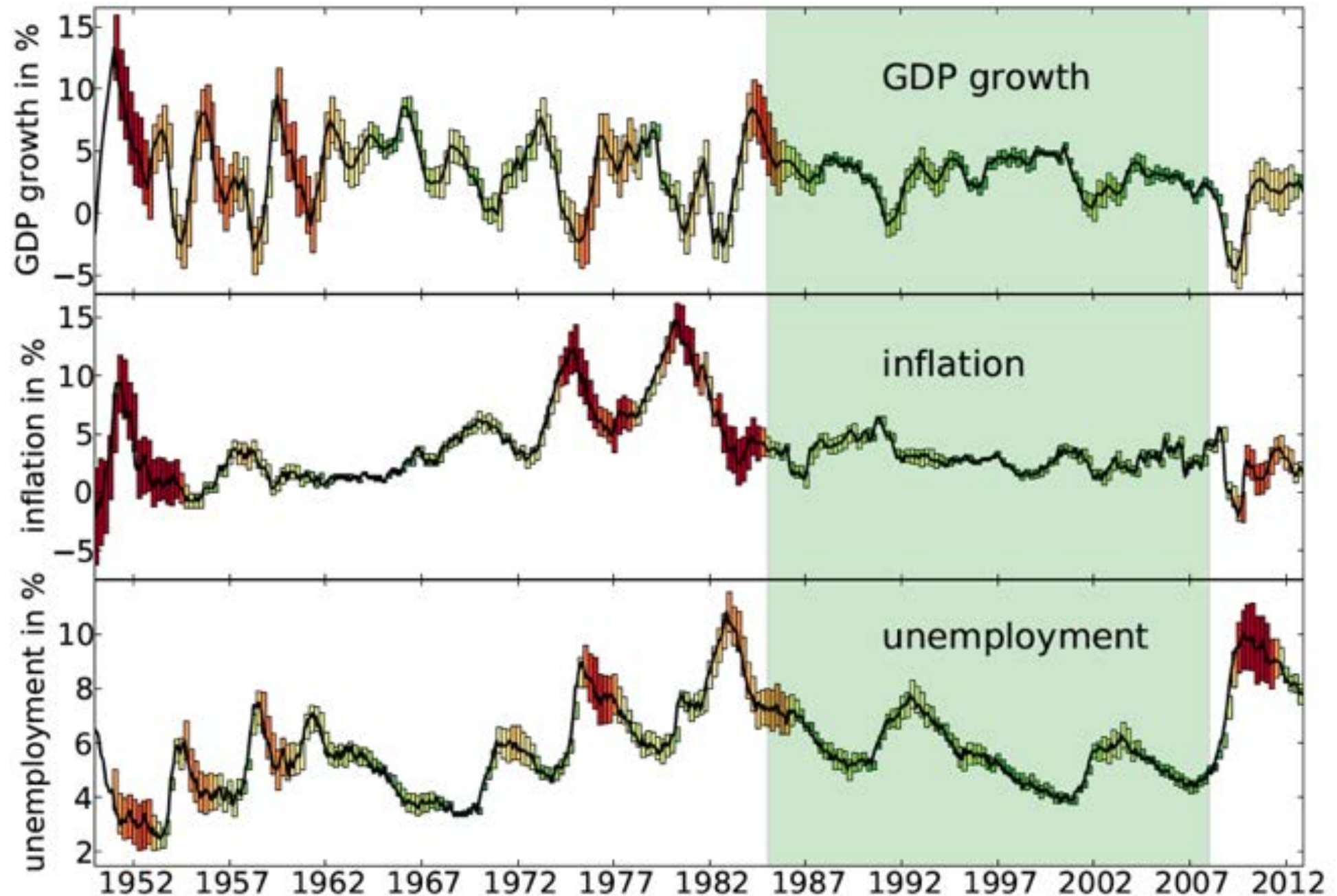
The Global Bubble (2003-2008) and the illusion of the perpetual money machine (1980-2008)

Index of over-valuation

- Worldwide bubble (1980-Oct. 1987)
- The ICT (dotcom) “new economy” bubble (1995-2000)
- **Real-estate bubbles (2003-2006)**
- **MBS, CDOs bubble (2004-2007)**
- **Stock market bubble (2004-2007)**
- **Commodities and Oil bubbles (2006-2008)**
- **Debt bubbles**



MISLEADING METRICS: THE GREAT MODERATION



Post-2008 bubbles foaming everywhere

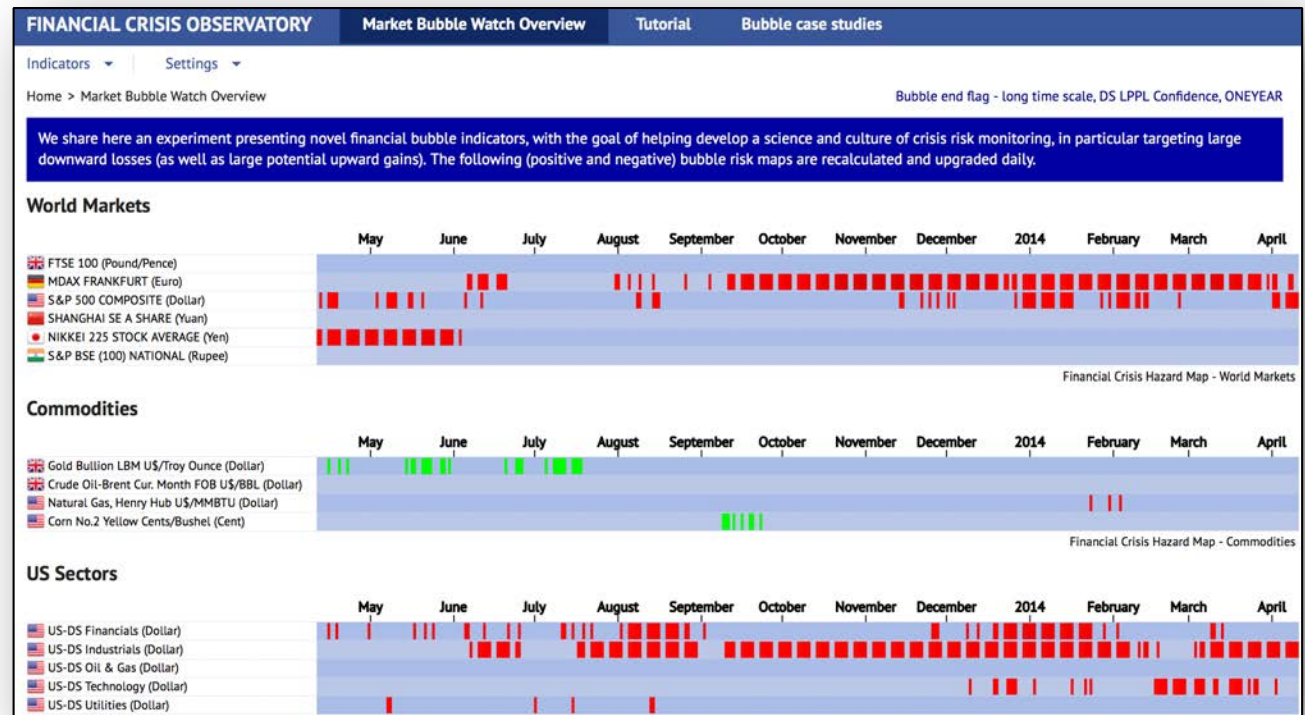


and

bursting

The Financial Crisis Observatory

The Financial Crisis Observatory (FCO) is a scientific platform aimed at testing and quantifying rigorously, in a systematic way and on a large scale the hypothesis that **financial markets exhibit a degree of inefficiency** and a potential for predictability, especially during regimes when bubbles develop.



We hunt for bubbles using **Brutus Supercomputer**, scanning more than twenty five thousand financial time series every day. We search for specific log-periodic power law (LPPL) patterns with robust statistical measures. A selection of results is publicly available: <http://risikopedia.ethz.ch:2375/>

The FCO Cockpit – Global Bubble Status Report

Peter Cauwels & Didier Sornette

March 1st, 2015

	# Assets	# Bubbles March 1st 2015	% Bubbles March 1st 2015	% Bubbles February 1st 2015	% Bubbles January 1st 2015	% Bubbles December 1st 2014	% Bubbles November 1st 2014	% Bubbles October 1st 2014
Fixed Income	116	99	85%	76%	30%	14%	32%	46%
<i>Government</i>	34	30	88%	82%	67%	36%	67%	73%
<i>Corporate</i>	82	69	84%	73%	16%	5%	18%	35%
Equities	185	47	25%	18%	22%	12%	6%	13%
<i>Country</i>	78	16	21%	21%	21%	10%	6%	21%
<i>US-Sector</i>	63	13	21%	27%	38%	22%	6%	11%
<i>EUR-Sector</i>	32	18	56%	3%	3%	3%	9%	3%
<i>Special</i>	12	0	0%	0%	0%	0%	25%	20%
Commodities	38	17	45%	39%	24%	34%	45%	24%
Currencies	96	37	39%	47%	33%	43%	43%	36%
Total	435	200	46%	42%	27%	21%	25%	28%

- 56% of all the European Stoxx Equities Sector Indices give clear warning signals. A month ago, that was 0%. We have never seen an increase in warning signals on such a grand scale and on such a short time period before;
- 85% of all Fixed Income indices, globally, show clear warning signals. There we saw the big jump already last month;
- Interestingly, even though all our risk indicators are flashing red, the implied volatility, a so-called fear gauge for global markets, has dropped very significantly over the past months;

The Social Bubble Hypothesis

Didier Sornette and Monika Gisler

DEFINITION: “Enthusiastic supporters of an idea / a project / an opportunity weave a network of reinforcing feedbacks based on exuberant anticipation that lead to widespread endorsement and extraordinary commitment beyond what would be rationalized by a standard cost-benefit analysis.”

WHY IS IT USEFUL FOR POLICY? it attracts the private sector and venture capital to invest in risky projects that are useful the domain of the public sector.

Need to engineer useful bubbles for innovation !

Three detailed case studies

- The US Apollo Program (1960-1969)
- The Human Genome Project (1990-2003)
- The FuturICT Project (2010-2013)

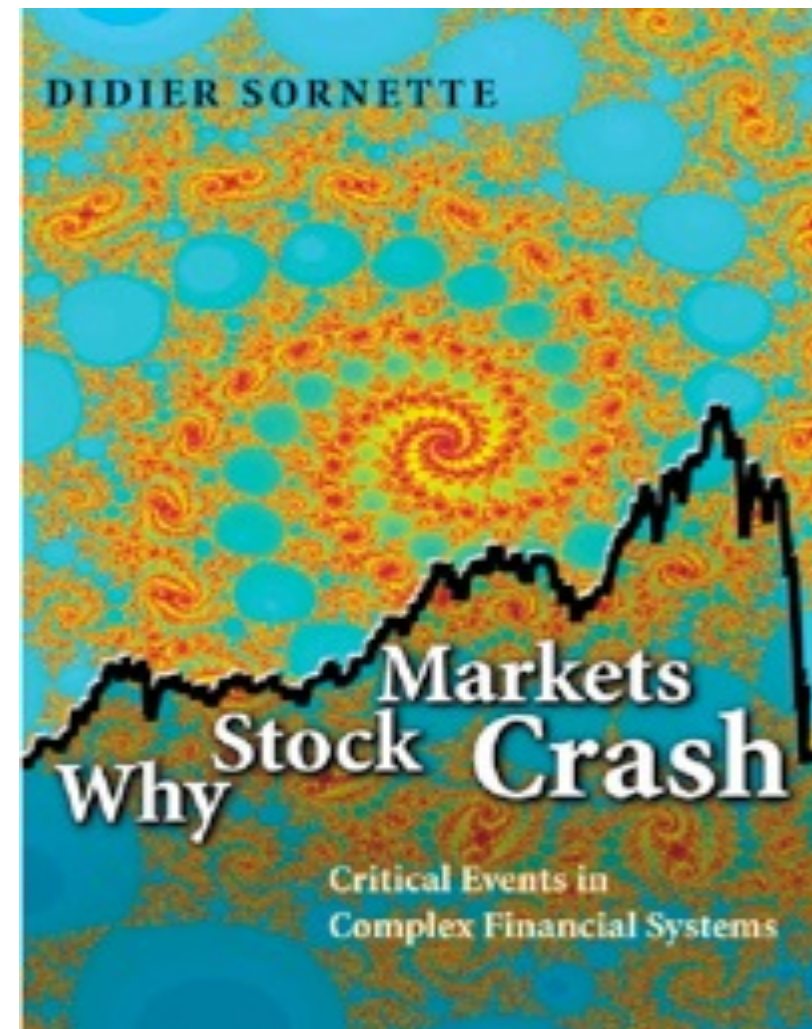
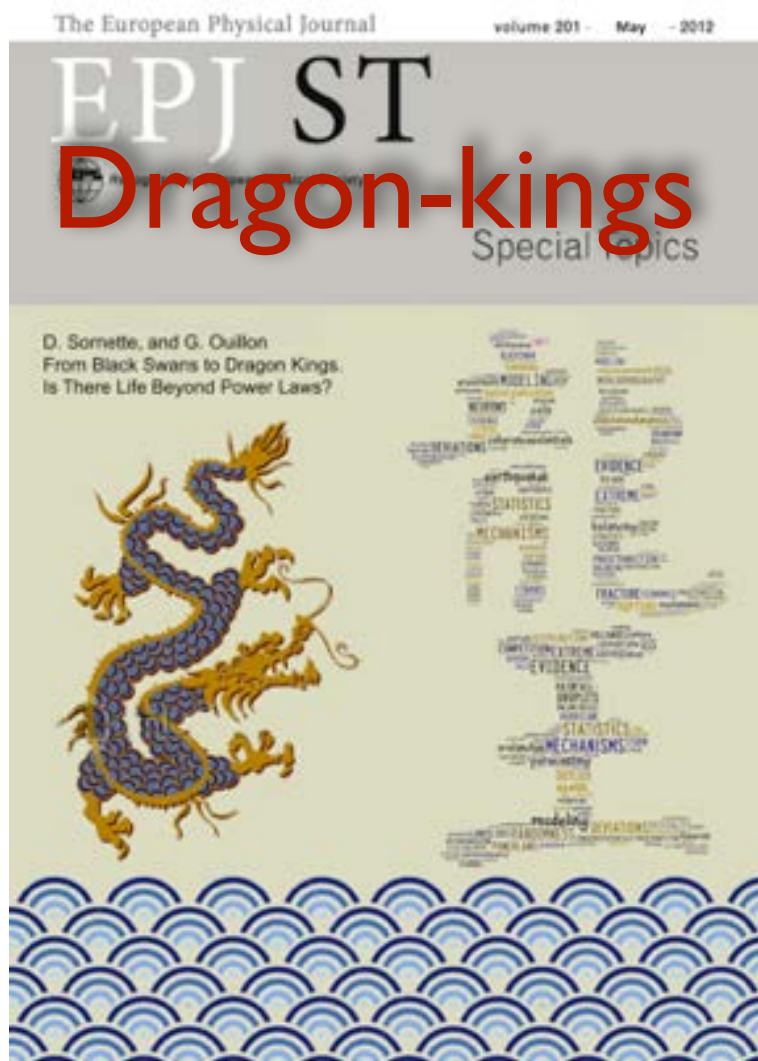


Future Social Bubbles ?

- biotech and nanotech, genonomics, proteomics, ENCODE, personalized medicine
- Apps revolution (like pre-Internet boom)
- open and big data revolution (+3-5 Trillion\$ annually, McKinsey Oct. 2013)
- Green tech revolution
- Gas and oil Fracking
- Space frontier (SpaceX, Orbital Science Corp., Virgin Galactic...)
- Ocean frontier
- Nuclear energy technology revolution

Inside a Creepy World: Diagnosing Economic & Financial Bubbles

Didier SORNETTE
www.er.ethz.ch





Break!

ETH Risk Center: Future Events in 2015

September 7-10: **ESREL 2015 - European Safety and Reliability Conference** at ETH Zurich



Eidgenössische Technische Hochschule Zürich
Swiss Federal Institute of Technology Zurich

ETH RISK CENTER

- More information on www.riskcenter.ethz.ch

How Can Investors Spot The Signs & Manage The Symptoms Before The Bubbles Pop?

- understand the conditions that can fuel bubbles (“easy money”, credit, foreigners, need for yield, monetary policy...)
- watch for the buzz and stories that signal bubbles
- use metrics that are sensitive to bubbles (change of trends...)
- Look for transient returns (6 to 18 month) and manage the risks
- Time@Risk portfolio allocation
- don't underestimate central banks' ability to boost stock markets!

