ETH
Eidgenössische Technische Hochschule Zürich
Swiss Federal Institute of Technology Zurich

D MTEC Departement Management, Technology, and Economics

Entrepreneurial Risks

The Financial Bubble Experiment
First Results (2 November 2009 - 1 May 2010)

D. Sornette, R. Woodard, M. Fedorovsky, S. Reimann, H. Woodard, W.-X. Zhou
(The Financial Crisis Observatory)
Department of Management, Technology and Economics,
ETH Zurich, Kreuzplatz 5, CH-8032 Zurich, Switzerland

Brazil IBOVESPA

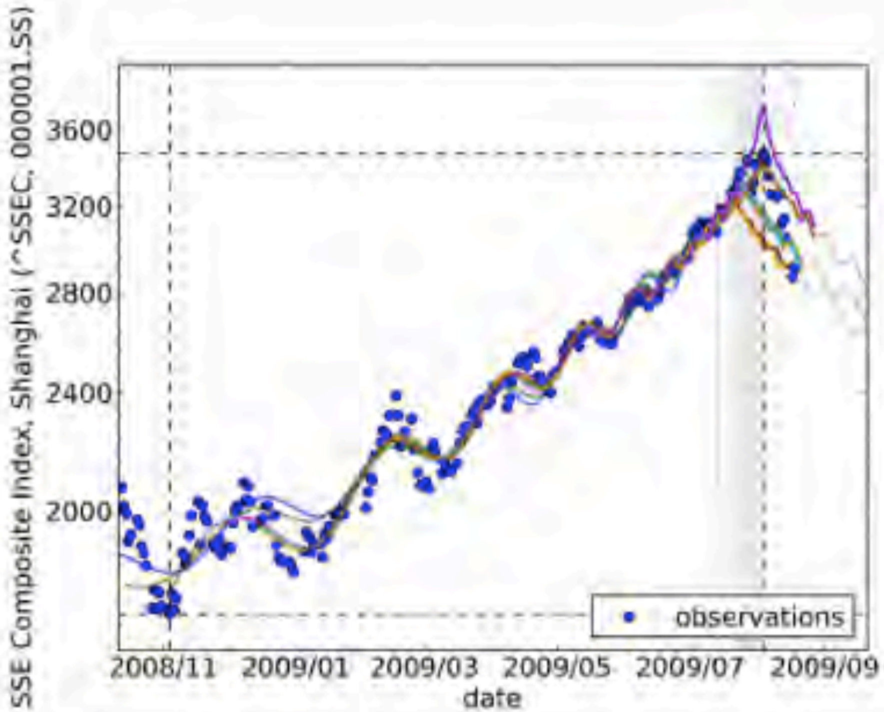
Gold spot price - USD

Merrill Lynch European Bond Index

Cotton future - USD

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



WHAT IS A BUBBLE?

Academic Literature: No consensus on what is a bubble...

Ex: Refet S. Gürkaynak, Econometric Tests of Asset Price Bubbles: Taking Stock (2008)
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.

Professional Literature: we do not know... only after the crash

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."

THE FINANCIAL BUBBLE EXPERIMENT

advanced diagnostics and forecasts of bubble ends

- ***Hypothesis H1*: financial (and other) bubbles can be diagnosed in real-time before they end.**

- ***Hypothesis H2*: The termination *(regime change)* of financial (and other) bubbles can be bracketed using probabilistic forecasts, with a reliability better than chance.**

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

The Financial Crisis Observatory*
Department of Management, Technology and Economics, ETH Zurich, Kreuzplatz 5, CH-8032 Zurich, Switzerland
(Dated: November 2, 2009)

Publication date	MD5SUM SHA256SUM SHA512SUM
2009-11-02	6d9479eb2849115a12c219cfa902990e d7ad5c9531166917ba97f871fb61bd1f6290b4b4ce54e3ba0c26b42e2661dc06 808bbfaddbca3db8d0f55d74cabedf5201ecd70340f86e27dfac589ce682144f52f6fc4b3ff1ac75231038d86dae58bd320e7fb17ef321b4bc61a19e88071039
2009-11-02	5d375b742a9955d4aeea1bd5c7220b2b 5a9c395b9ab1d2014729ac5ff3bb22a352e14096fa43c59836ea0d4ae0e3b453 e7ef9150b4738253f4021b0600eff1cd455b2671e421b788b9268b518439b56699994b3f8b395742bdc7622b5536034e74ade86e0a46bff71ed5ff9a293f809f
2009-11-02	fd85000d0ce3231892ef1257d2f7ab1e d3f3d504d85d50eb3dc0fe2c3042746db2f010509f4d1717370d14012972e86f 91a8fa82b7f08deea2df2a1f7cef266f5aa155bb0c047f65b14315f7229d92976cc7b30453453fb8ecd0350783907c83652192d32ba90fb1cce128385832e63a

TABLE I: Checksums of Financial Bubble Experiment forecast documents.

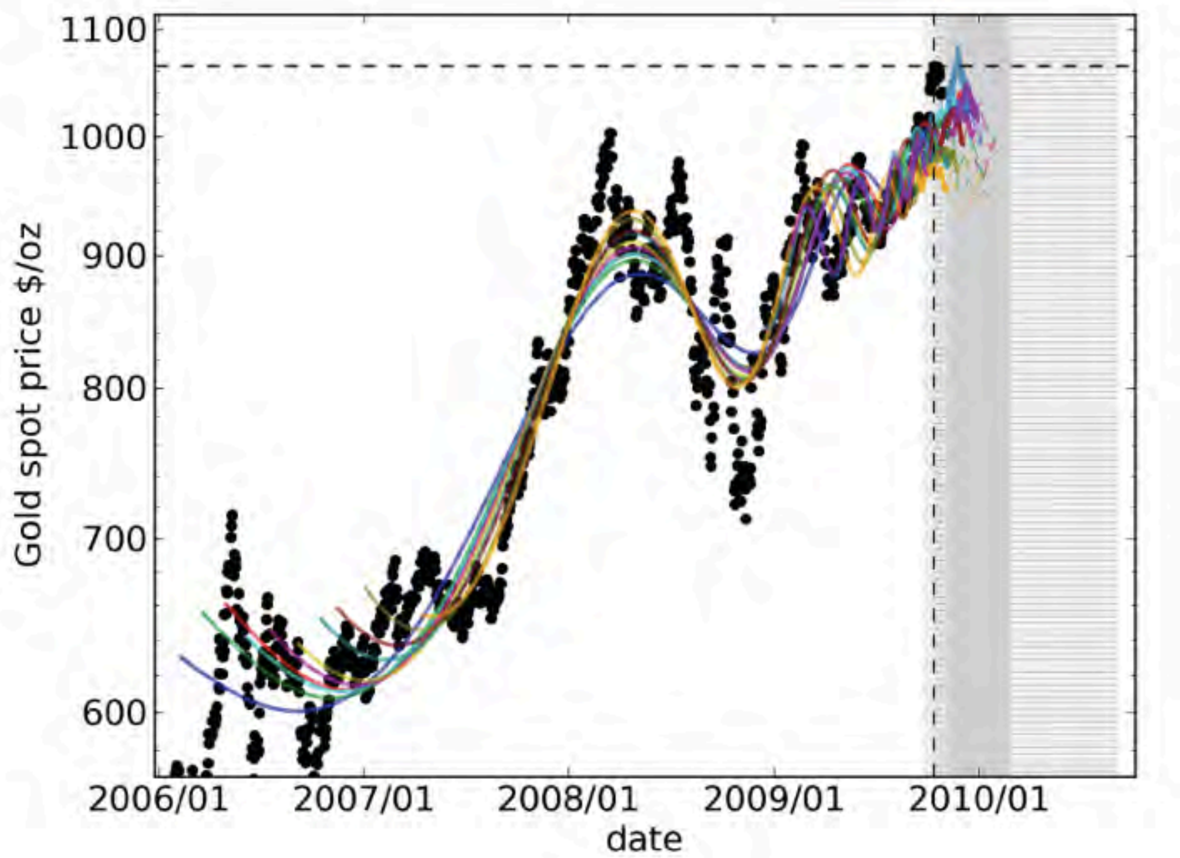
Checksums of forecast documents

Publication date Document name Asset	MD5SUM SHA256SUM SHA512SUM
2009-11-02 fbe_001.pdf IBOVESPA (Brazil)	6d9479eb2849115a12c219cfa902990e d7ad5c9531166917ba97f871fb61bd1f6290b4b4ce54e3ba0c26b42e2661dc06 808bbfaddbca3db8d0f55d74cabedf5201ecd70340f86e27dfac589ce682144f52f6fc4b3ff1ac75231038d86dae58bd320e7fb17ef321b4bc61a19e88071039
2009-11-02 fbe_002.pdf ML Corp. Non-Fin. Index	5d375b742a9955d4aeea1bd5c7220b2b 5a9c395b9ab1d2014729ac5ff3bb22a352e14096fa43c59836ea0d4ae0e3b453 e7ef9150b4738253f4021b0600eff1cd455b2671e421b788b9268b518439b56699994b3f8b395742bdc7622b5536034e74ade86e0a46bff71ed5ff9a293f809f
2009-11-02 fbe_003.pdf Gold spot price (USD)	fd85000d0ce3231892ef1257d2f7ab1e d3f3d504d85d50eb3dc0fe2c3042746db2f010509f4d1717370d14012972e86f 91a8fa82b7f08deea2df2a1f7cef266f5aa155bb0c047f65b14315f7229d92976cc7b30453453fb8ecd0350783907c83652192d32ba90fb1cce128385832e63a
2009-12-23 fbe_004.pdf Cotton futures (USD)	8e019304004ebf06df17384ff664ff57 27c650d85a802eafecd8389391c440458816ff13b5c573bab710e3b7739f2e38 388fa7941c691fe7c8887886a932dd6a6aa28a967b5b05bf3cf96cdb836b499f354a78bca67d86aa246985b80e75670c3bd6300f6f4f92ca3bd0b59ac675e1eb

Gold spot price (fbe.003.pdf)

Forecasted quantiles

	Start	End
05/95	2009-10-13	2010-09-07
20/80	2009-11-05	2010-02-25



H1: Identification of a bubble

- Proof of bubbles in two of the four assets at the time of our forecasts (IBOVESPA and gold).
- Proof of bubble in the Merrill Lynch Index, but it ended just before our forecast date. Now out of a bubble regime.
- For cotton (23 Dec. 2009 release), no confirmation yet by clear change of regime. New analysis suggests bubble is still developing.

H2: Forecast of change of regime

- IBOVESPA and gold clearly show changes of regime beginning within our forecasted quantile windows.
- Change of regime in the Merrill Lynch Index started just before our forecast date but compatible with quantile forecast.
- For cotton, a 12% drawdown occurred in the predicted quantile range. Partial success (or failure) for H2, as change of regime not clear and our present indicators diagnose that the bubble has not ended: the bubble is still growing into a larger bubble.

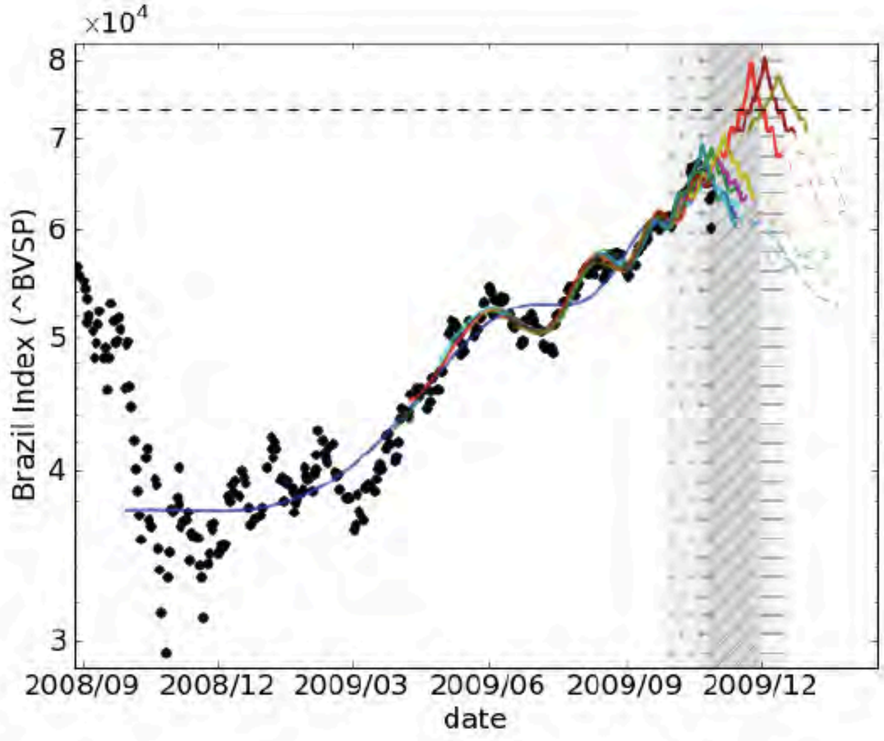
Eidgenössische Technische Hochschule Zürich
Swiss Federal Institute of Technology Zurich

D MTEC Departement Management, Technology, and Economics

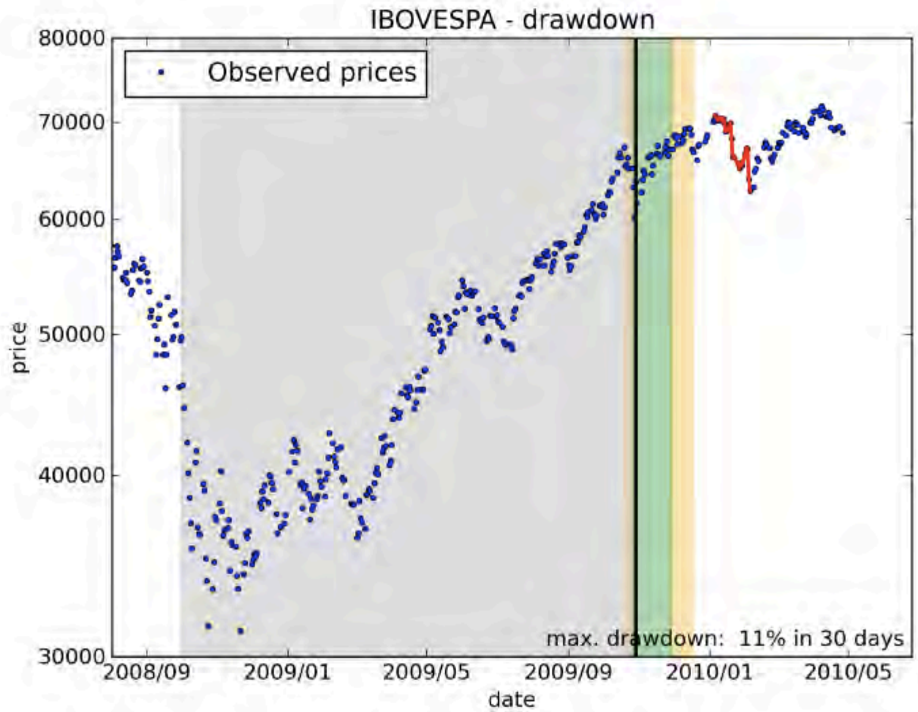
Entrepreneurial Risks

Brazil IBOVESPA

Forecast



Realized



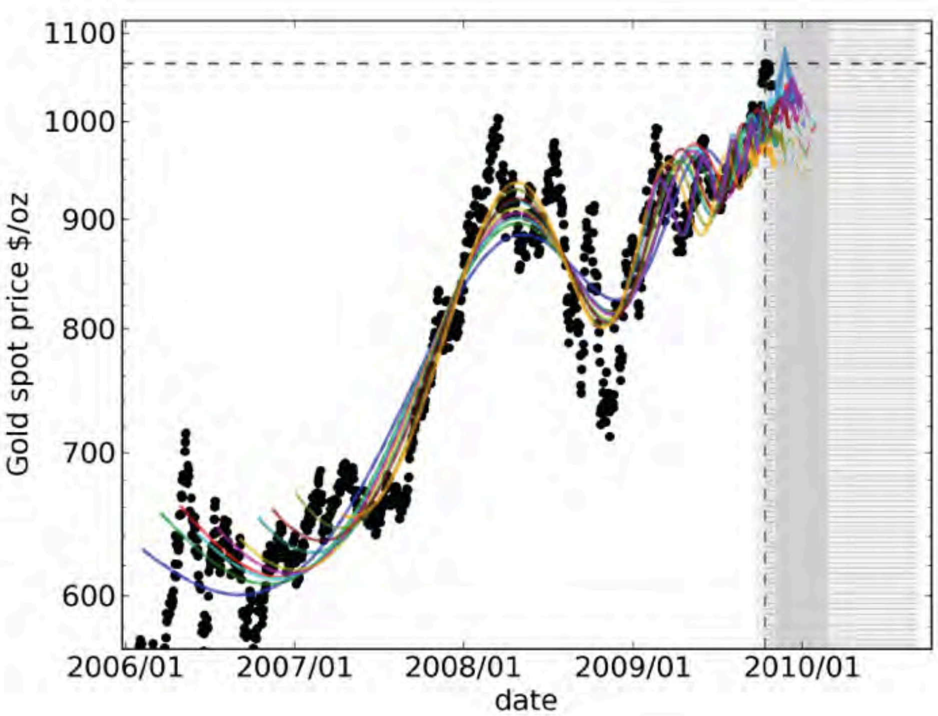
ETH
Eidgenössische Technische Hochschule Zürich
Swiss Federal Institute of Technology Zurich

D MTEC Departement Management, Technology, and Economics

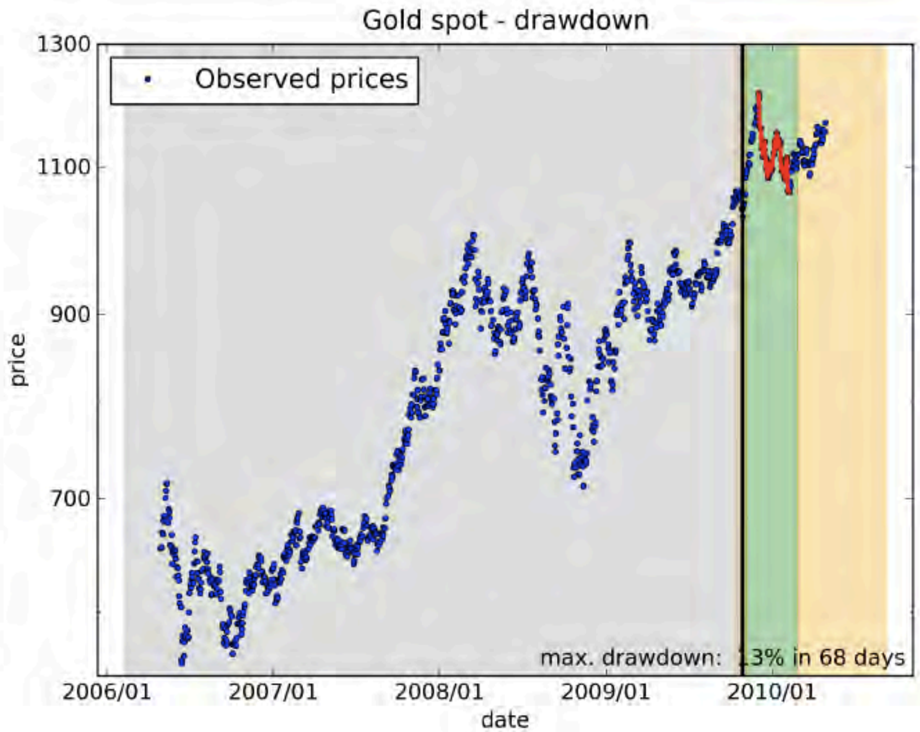
Entrepreneurial Risks

Gold spot price - USD

Forecast



Realized



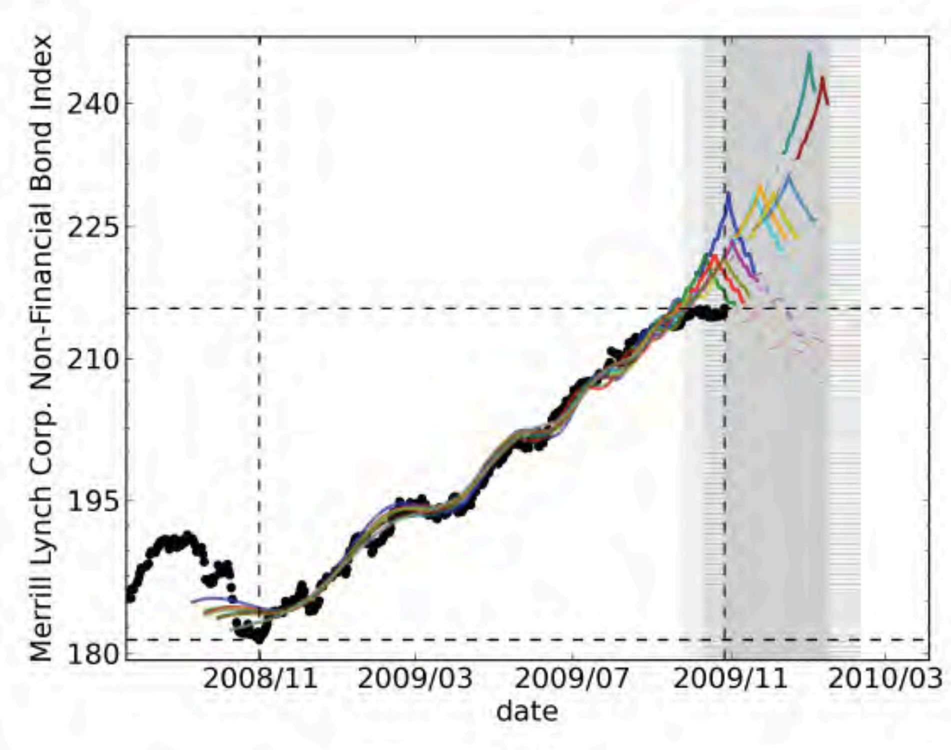
ETH Eidgenössische Technische Hochschule Zürich
Swiss Federal Institute of Technology Zurich

D MTEC Departement Management, Technology, and Economics

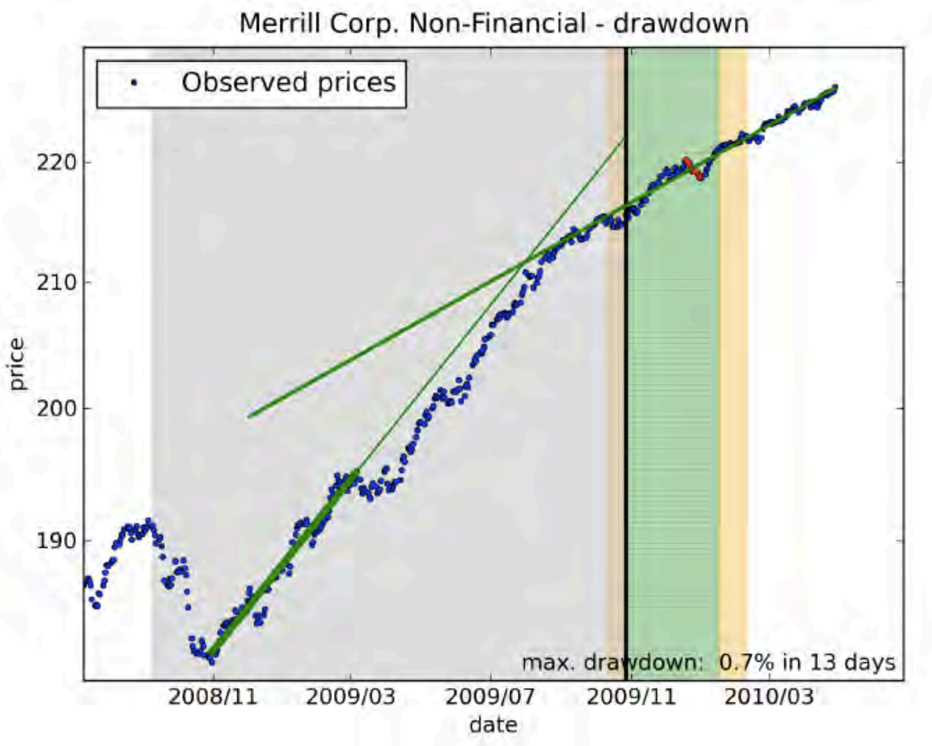
Entrepreneurial Risks

Merrill Lynch European Bond Index

Forecast



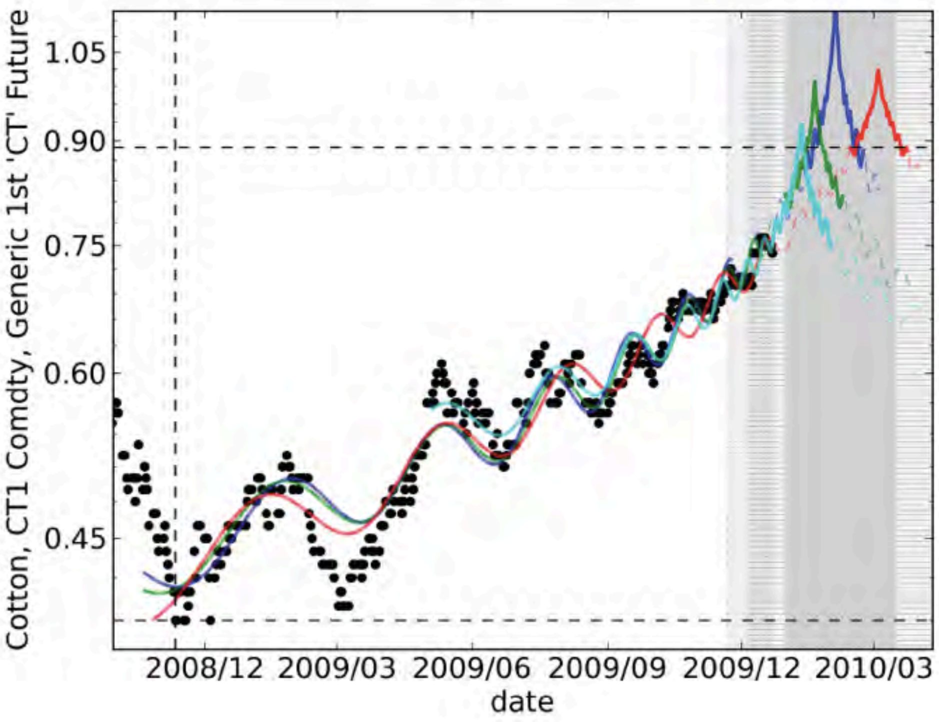
Realized



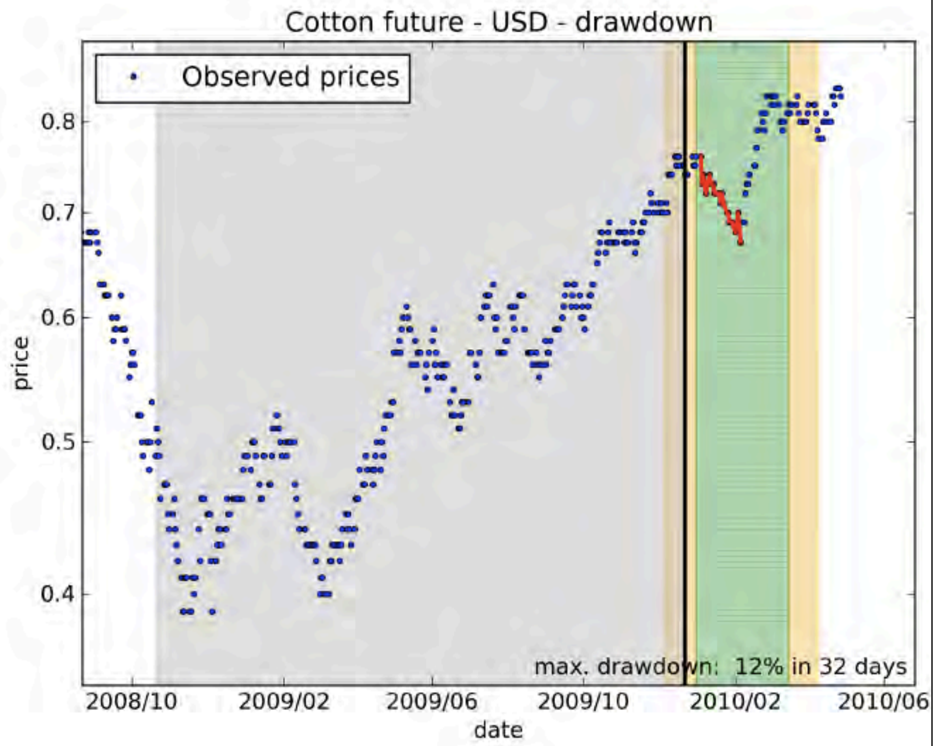
Eidgenössische Technische Hochschule Zürich
Swiss Federal Institute of Technology Zurich

Cotton future - USD

Forecast



Realized

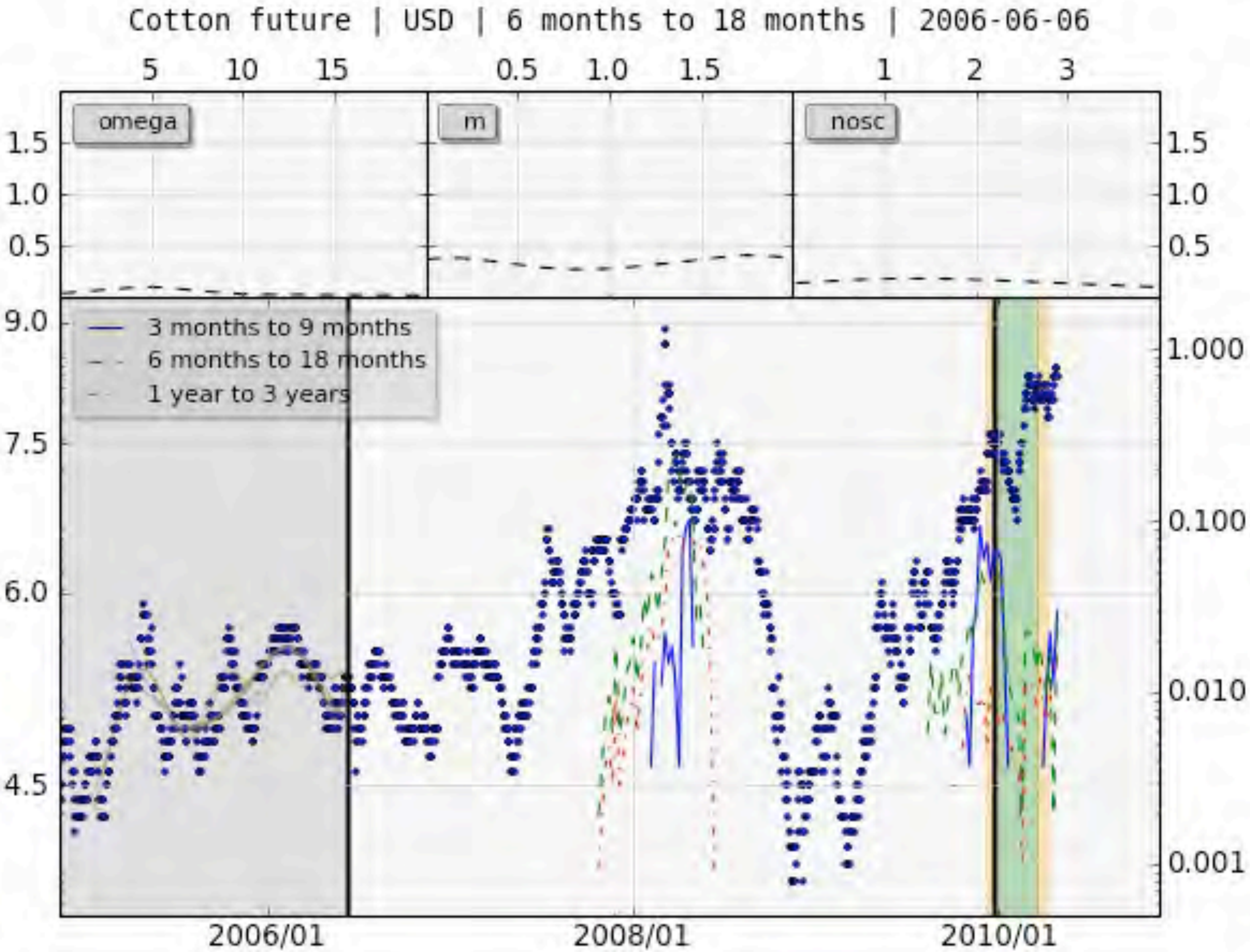


What next?

- We learned a lot: Improved methodology (multi-scales, data-assimilation...)
- With our present version, we would not have selected Merrill Lynch bond index (no learning on ML).
- 5-10 new forecasts to be published within the week


IBOVESPA | BR | 6 months to 18 months | 2010-04-27
omega
m
nosc
5
10
15
0.5
1.0
1.5
1
2
3
1.5
1.0
0.5
7.5
6.0
4.5
3.0
6
4
2
0
1
2006/01
2008/01
2010/01


IBOVESPA | BR | 6 months to 18 months | 2010-04-27
omega
m
nosc
5
10
15
0.5
1.0
1.5
1
2
3
1.5
1.0
0.5
8.0
7.2
6.4
5.6
8
7
6
5
2010/01


Cotton future | USD | 6 months to 18 months | 2006-06-06
omega
m
nosc
5
10
15
0.5
1.0
1.5
1
2
3
1.5
1.0
0.5
9.0
7.5
6.0
4.5
1.000
0.100
0.010
0.001
3 months to 9 months
6 months to 18 months
1 year to 3 years
2006/01
2008/01
2010/01

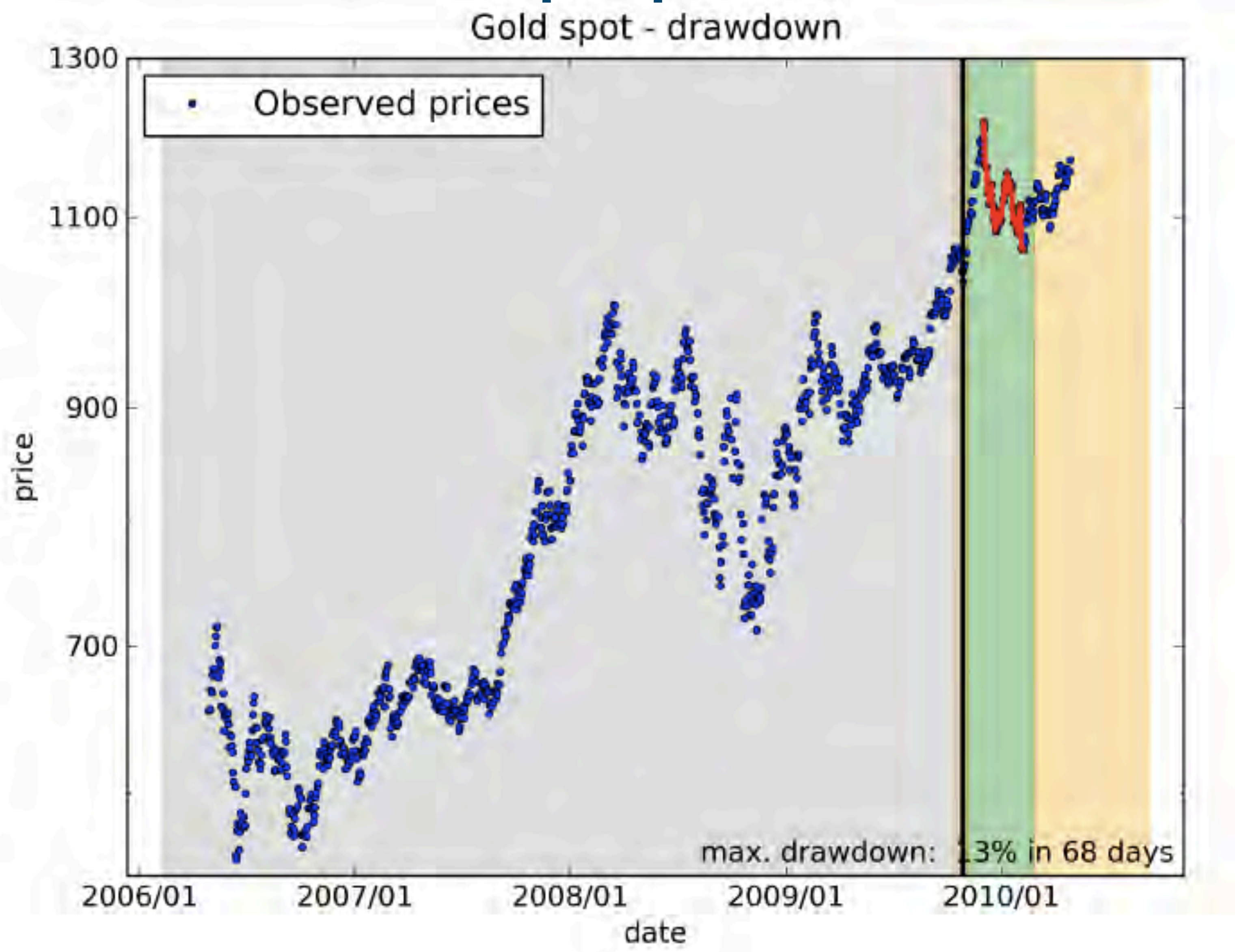
William C. Dudley (President and Chief Executive Officer of the Federal Reserve Bank of New York), April 2010; Remarks at The Economic Club of New York, New York City. "Asset Bubbles and the Implications for Central Bank Policy"

- 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."

Gold spot price - USD



- Open questions:
  - ✳Assess success rigorously
  - ✳Estimate statistical significance of the method
  - ✳Policy implications
  - ✳Impact on markets
  - ✳Impact on academic view of efficient markets