

Market Cycles, Risk Measurement and Early Warning of Asset Price Bubbles

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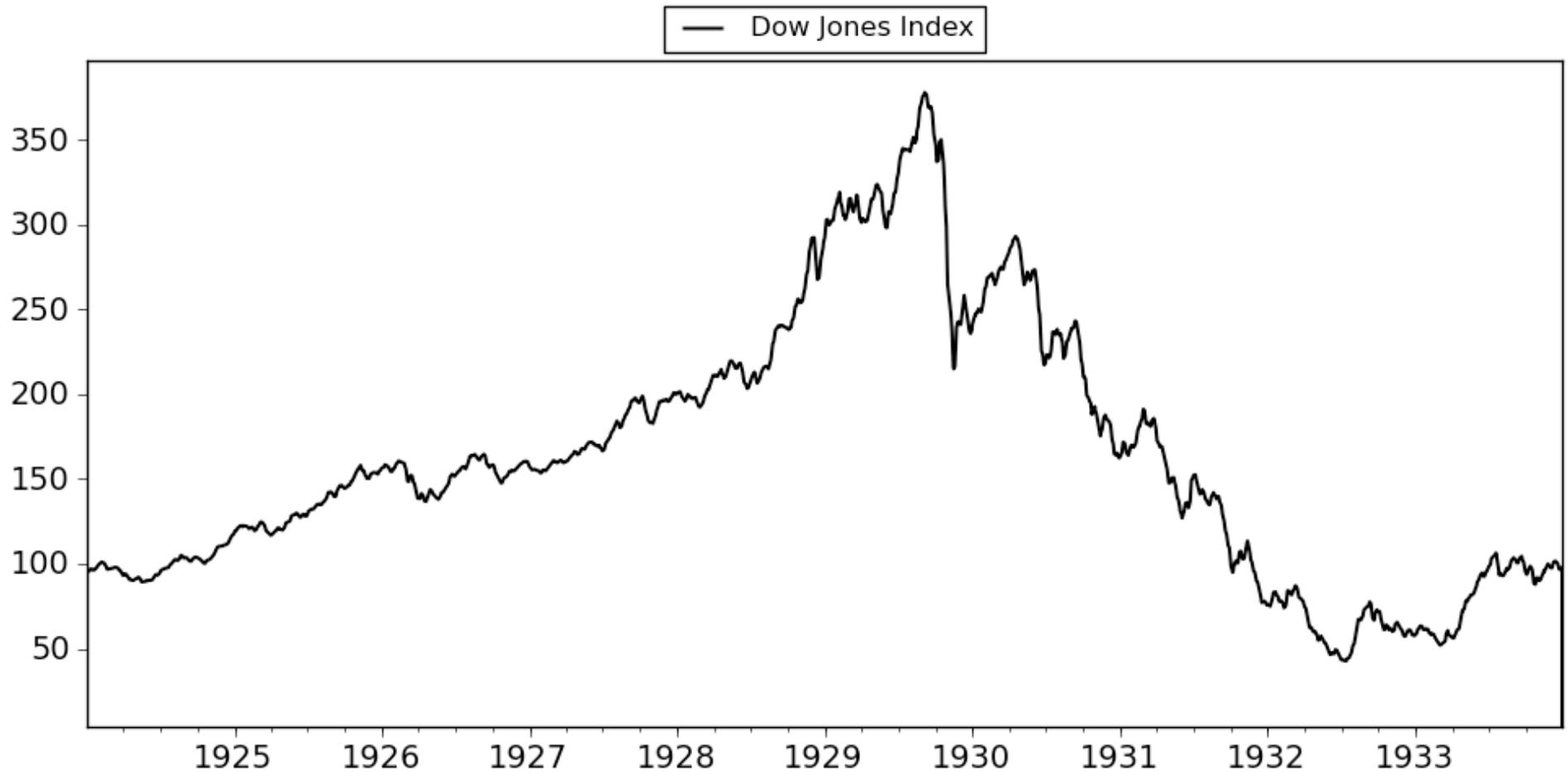
That's All Very Well In Practice...

- Things that work in practice are essential.
- Theory should explain *why* they work and what their limitations are.
- In the physical sciences, theories have evolved out of long and painstaking observation, leading to the discovery of regularities in data.
- In economics and finance experiments are difficult to do.
- Empirical observation is crucial.

Market Cycles

- Equity Market Boom and Bust Cycles are present in data for (at least) the past 150 years.
- Here are some examples from the 20th and 21st Centuries.

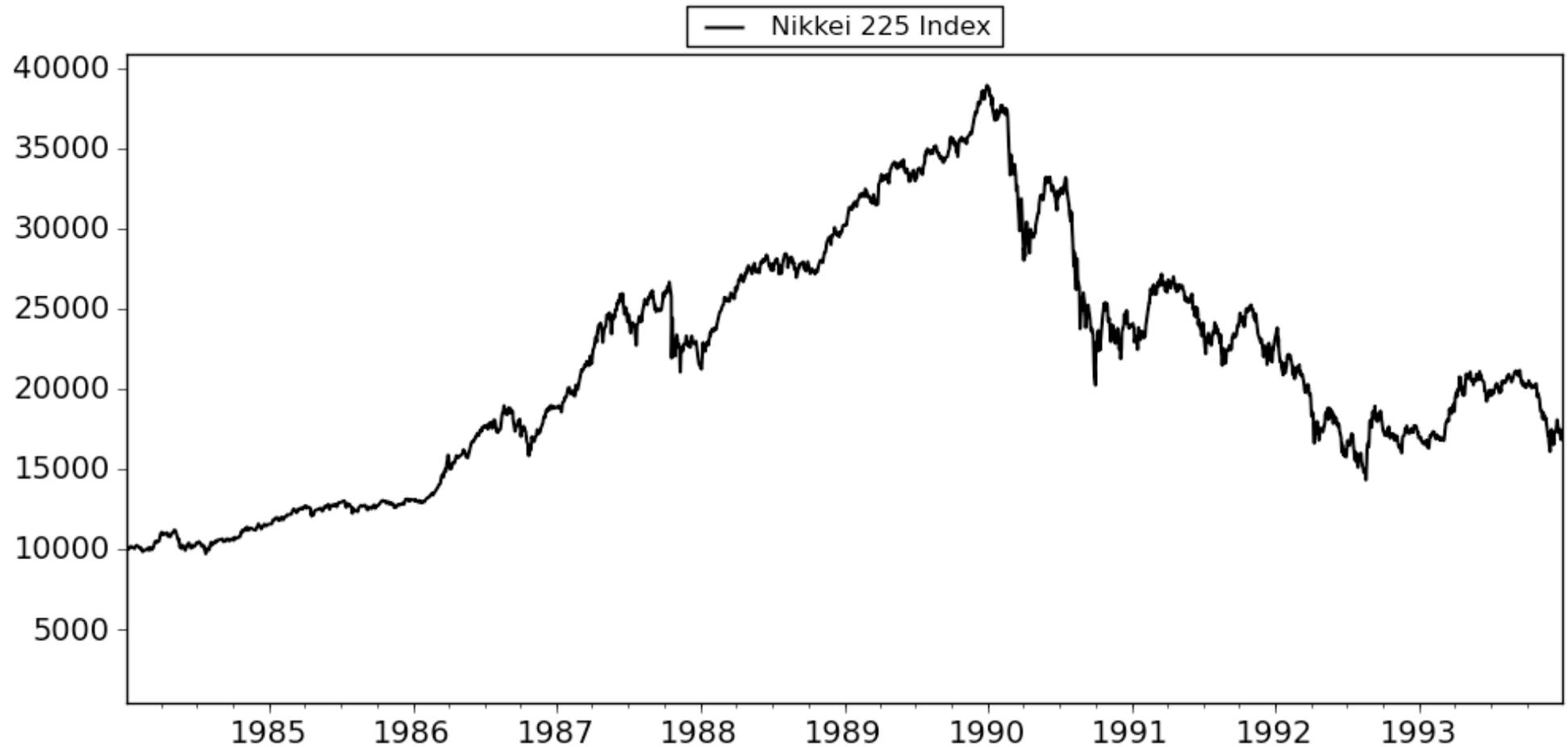
The 1929 Crash



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Dow Jones Industrial Index 1924-1934

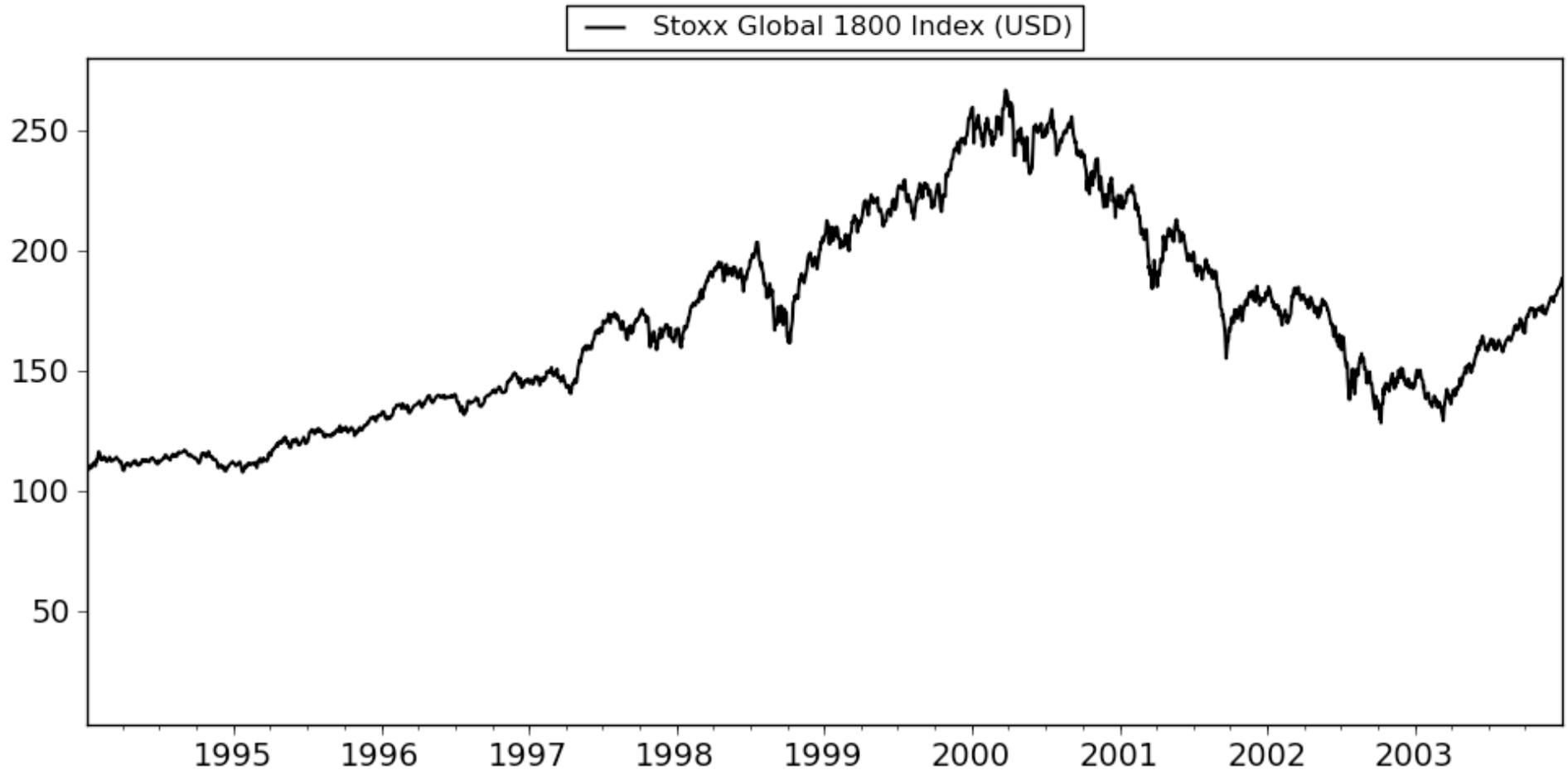
The Japanese Equity 'Bubble'



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Nikkei 225 Index 1984-1994

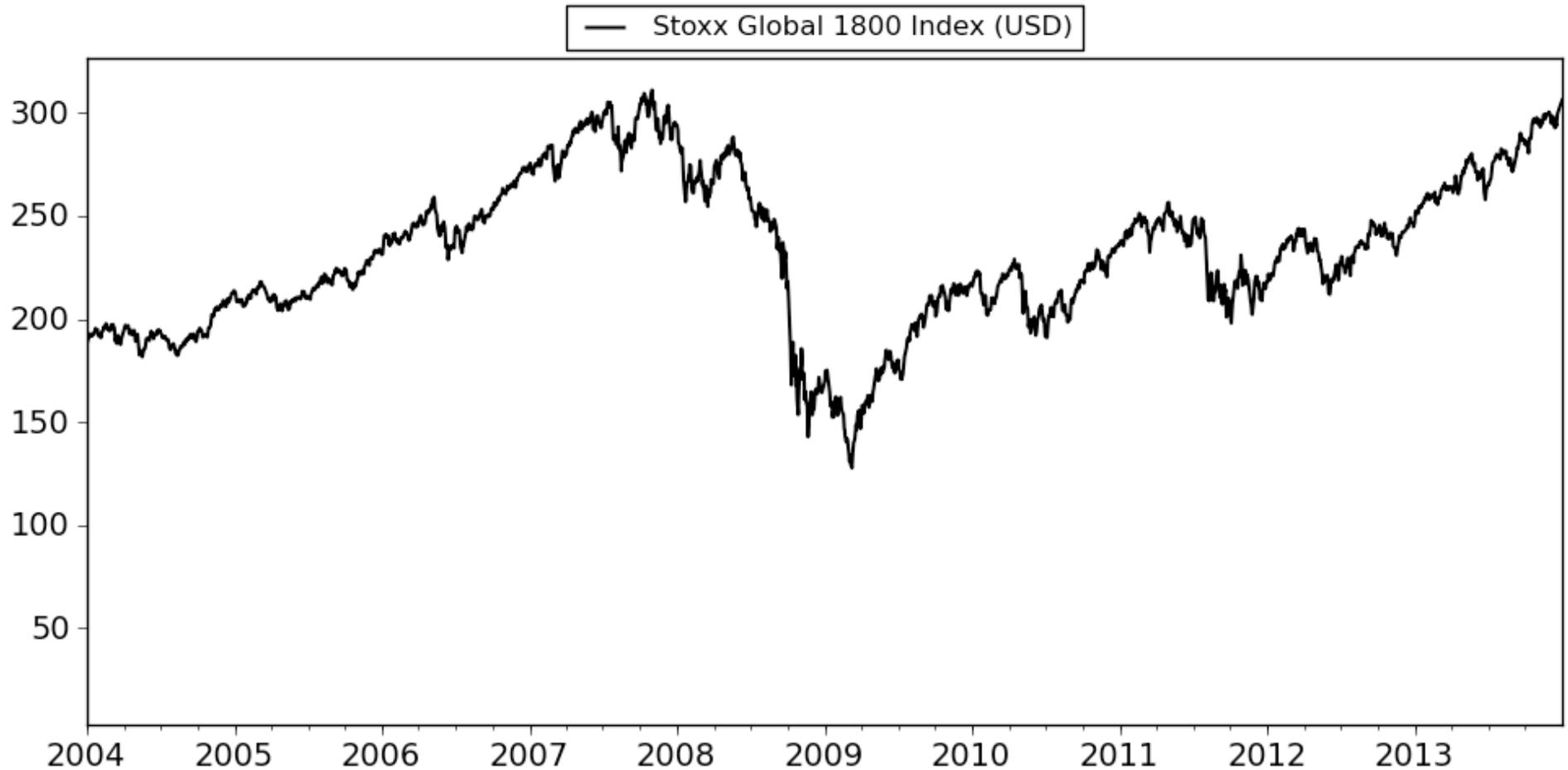
There have been 3 global equity booms, and 2 busts, since 1994



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Stoxx Global 1800 Index 1994-2004

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Stoxx Global 1800 Index 2004-2013

Market Cycles

- Whenever a boom turns to bust there are people who say it was a bubble (this is the IMF's *definition* for example)—and others who say that it wasn't or that there was no way to know if it was without hindsight.
- The 2013 Economics Nobel Prize Lectures provided a wonderful glimpse of two extremes in the debate.

Market Cycles

Fama lays down the challenge:

“Such policy statements seem to define a bubble – now I have to say it this way because when people use the word bubble they never tell you what they mean –

–such policy statements seem to define a bubble as a strong price increase that implies a predictable strong decline – *predictable strong decline*. ...But the available research provides no reliable evidence that price declines are predictable.”

Market Cycles

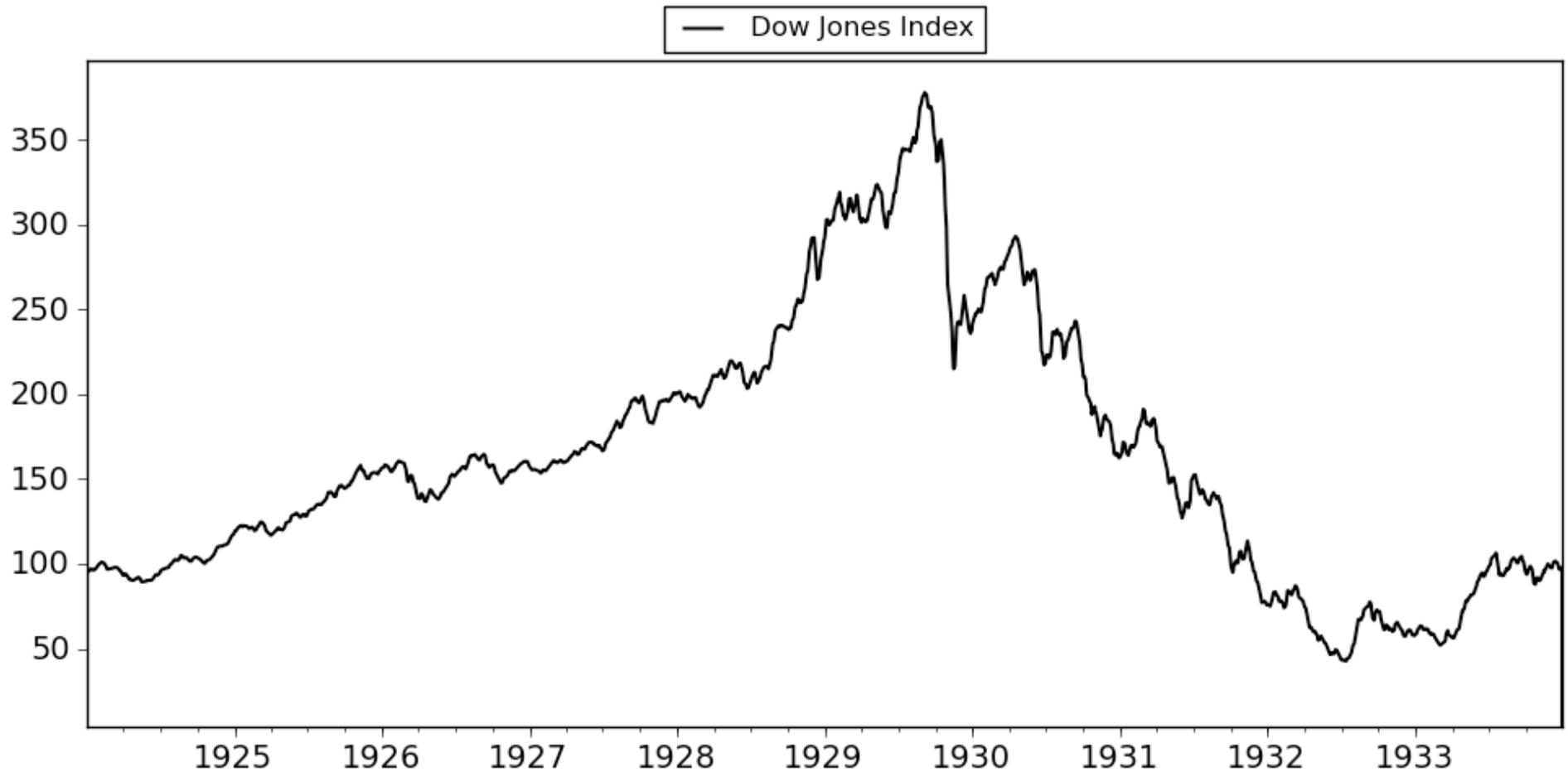
Shiller attempts a rebuttal:

“What is a bubble? You say nobody defines it so I will define it.

A speculative bubble is a fad. People get excited, sometimes too excited, about phenomena. Prices start going up. They start talking about it. The newspapers start writing about it and the price goes up more and it goes on for a while.

But it can't go on forever and eventually it breaks and the bubble bursts.”

Market Cycles



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At what point would you have known that prices were going to fall?

Market Cycles

- This is not something that only matters in theory.
 - Stock market busts are followed by significant drops in GDP. (IMF 2003)
 - The probability of a major recession or depression (while small) rises significantly following stock market crashes. (Barro and Ursúa 2009)
- Loss of income and capital in pension plans and endowments can be catastrophic when bubbles burst.

Market Cycles

- Central Bankers have expressed the opinion that they should attempt to identify prospective bubbles and deflate them.
- (Some even seem to claim they have the means to do this!)
- Central Banks have been given new 'Macroprudential' regulatory responsibility to do this or something like this.
- See John Cochrane's WSJ reflections on why this might not be such a good idea.

Market Cycles

- What is a bubble?
- In the aftermath of the ‘Tech Bubble’ crash there was a lot of discussion about the role of Central Banks in ‘leaning against bubbles’ (whatever they may be.)
- e.g. Laurence Meyer, Stephen Cecchetti who ‘know one when they see one’.

Market Cycles

- There has been a lot of academic research attempting to define/model them.
- See e.g. Markus Brunnermeier survey of results to 2008
- Some asymmetry between buyer and seller is necessary. (e.g. Brunnermeier survey and José Scheinkman 2013)
- There has also been recent research on detecting bubbles by tests on high frequency market data. (e.g. Jarrow et al 2011)

Market Cycles

- At Omega Analysis we have a great deal of empirical evidence that some strong price increases lead to *predictable* declines.
- We can make a prediction such as: “The S&P 500 Index will decline by at least 33%.”
- (That was, in fact, our prediction at 31 Dec 2013.)
- This arises from observed asymmetries in *risk* to buyers and sellers.
- To sketch the ideas behind this, I need to turn to Risk Measurement.

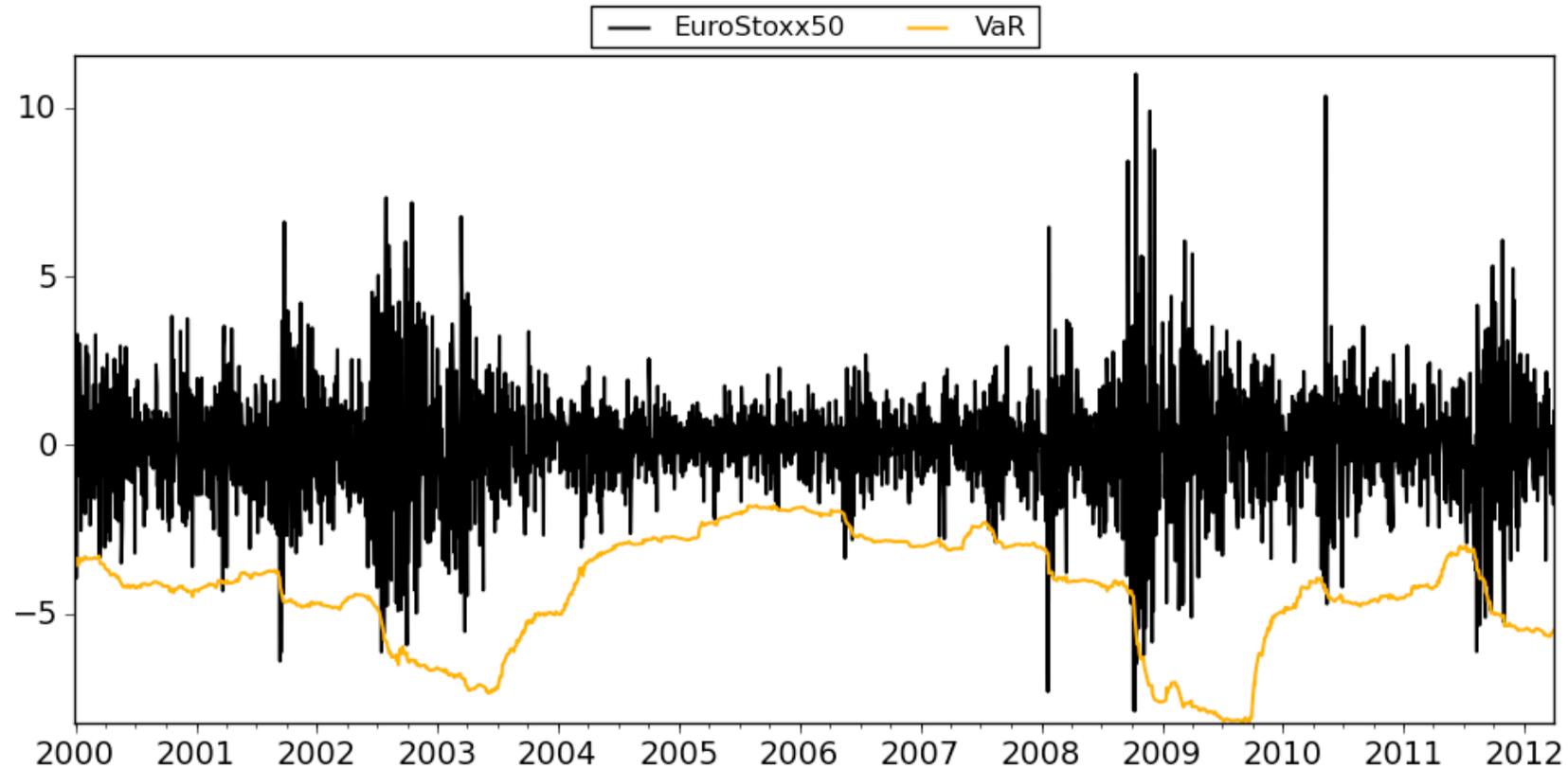
Risk Measurement

- Controlling the risk of loss is of fundamental importance in finance.
- You can't control it unless you can measure it.
- Measuring risk is the critical first step.

Value at Risk

- The 1-day 99% Value at Risk (VaR) is the worst loss 99 days in 100.
- But that means it's the *least* you will lose 1 day in 100.
- VaR is just a dividing line.
- This is what that dividing line looks like for the EuroStoxx 50 Index, calculated with our proprietary tail model.

Value at Risk



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Predicted 99% VaR levels in % per day. In 3154 days out of sample the VaR level was breached 34 times.

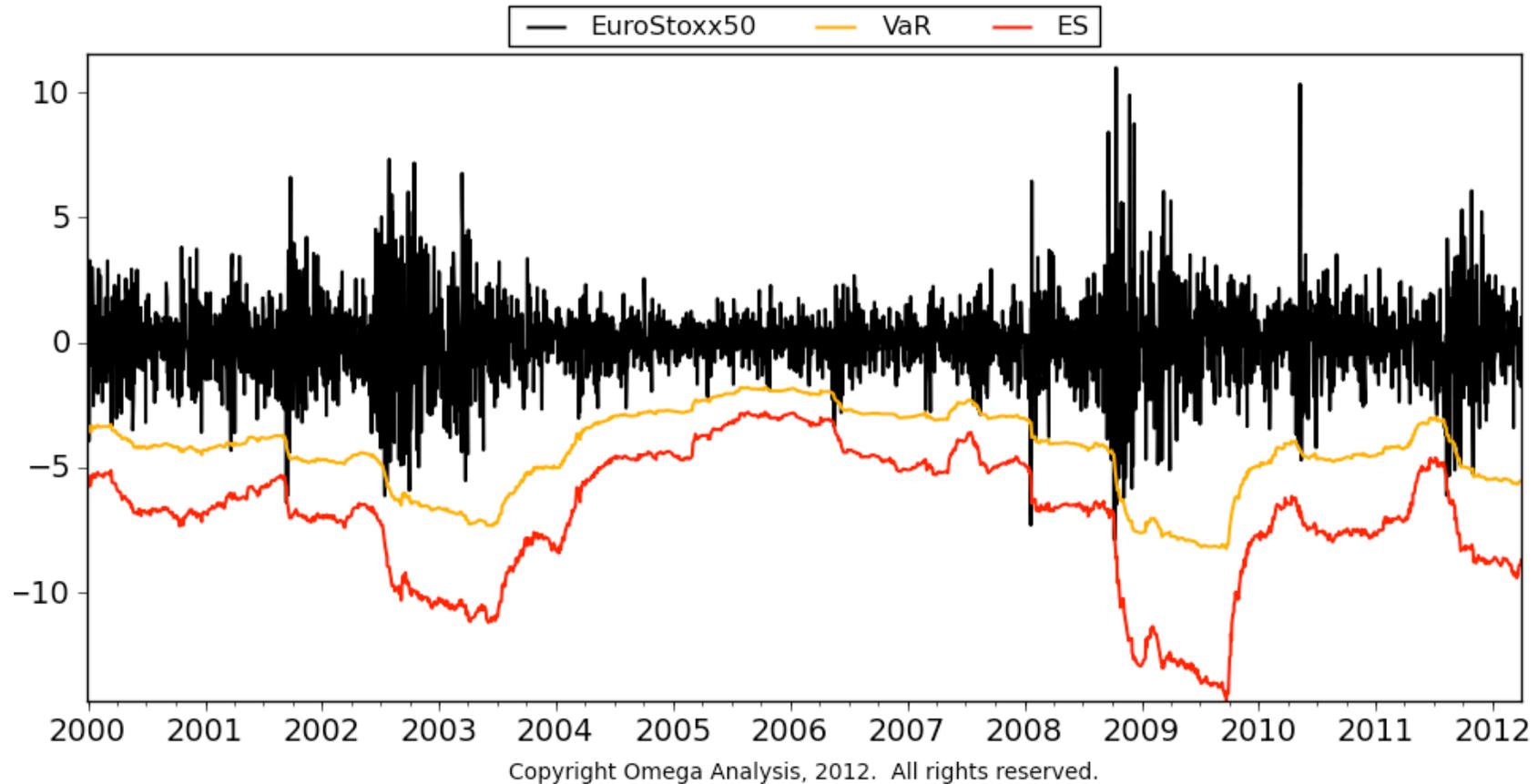
VaR is only half of the information we need

- VaR is just a dividing line.
- The 1-day 99% Value at Risk (VaR) is the *least* you will lose 1 day in 100.
- What should you expect to lose that 1 day in 100?

Expected Shortfall

- The 1-day 99% Expected Shortfall (ES) is the average loss conditional on a VaR breach.
- Expected Shortfall, at least in theory, allows you to control risk by being prepared for these losses.

Expected Shortfall



Predicted 99% ES levels in % per day. In 3154 days out of sample the ES level was breached 5 times.

Expected Shortfall

- Expected Shortfall, at least in theory, allows you to control risk.
- In practice, this only works if your estimates are good.
- VaR and ES can only be calculated by using a model of the tails of returns distributions.
- The tail model is a critical tool. Financial market data has *fat* tails.

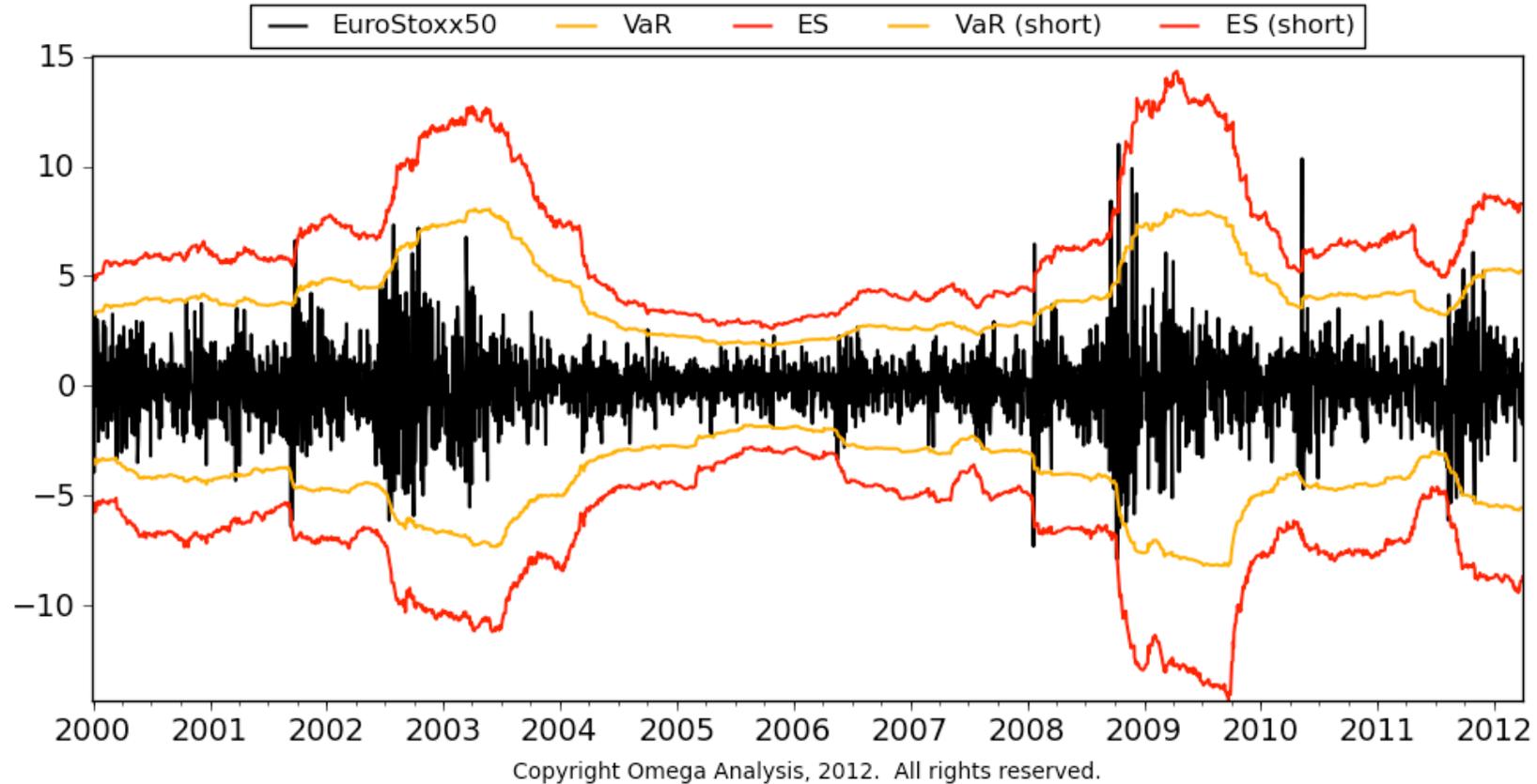
Checking the Tail Model

- VaR breaches should match the probability level.
- Over a long period the model should produce one 99% VaR breach per 100 days.
- ES breaches should be consistent with the tail model.
- For example, in typical equity markets Omega Analysis' ES breaches occur about one day in 600 which is consistent with the average tail parameter.

If you can measure Downside Risk you can measure Upside Risk

- Correctly measuring VaR and ES for a short position is no different than doing it for a long position.

VaR and ES for Long and Short



Out of sample VaR and ES work equally well for long and short positions.

Better Instrument = More Information

- Accurate risk measurement allows the observation of (previously invisible) regularities and anomalies in market data.
- These anomalies are the key to our Early Warning Indicators.

Early Warning of Asset Price Bubbles

Comparing Upside and Downside Risk

- Accurate risk measurement for Long and Short positions reveals recurrent anomalies with predictive power.
- When a market is rising but buyers are exposed to more downside risk than sellers, the market is out of balance.
- We call such periods *Unstable Expansion Modes*.

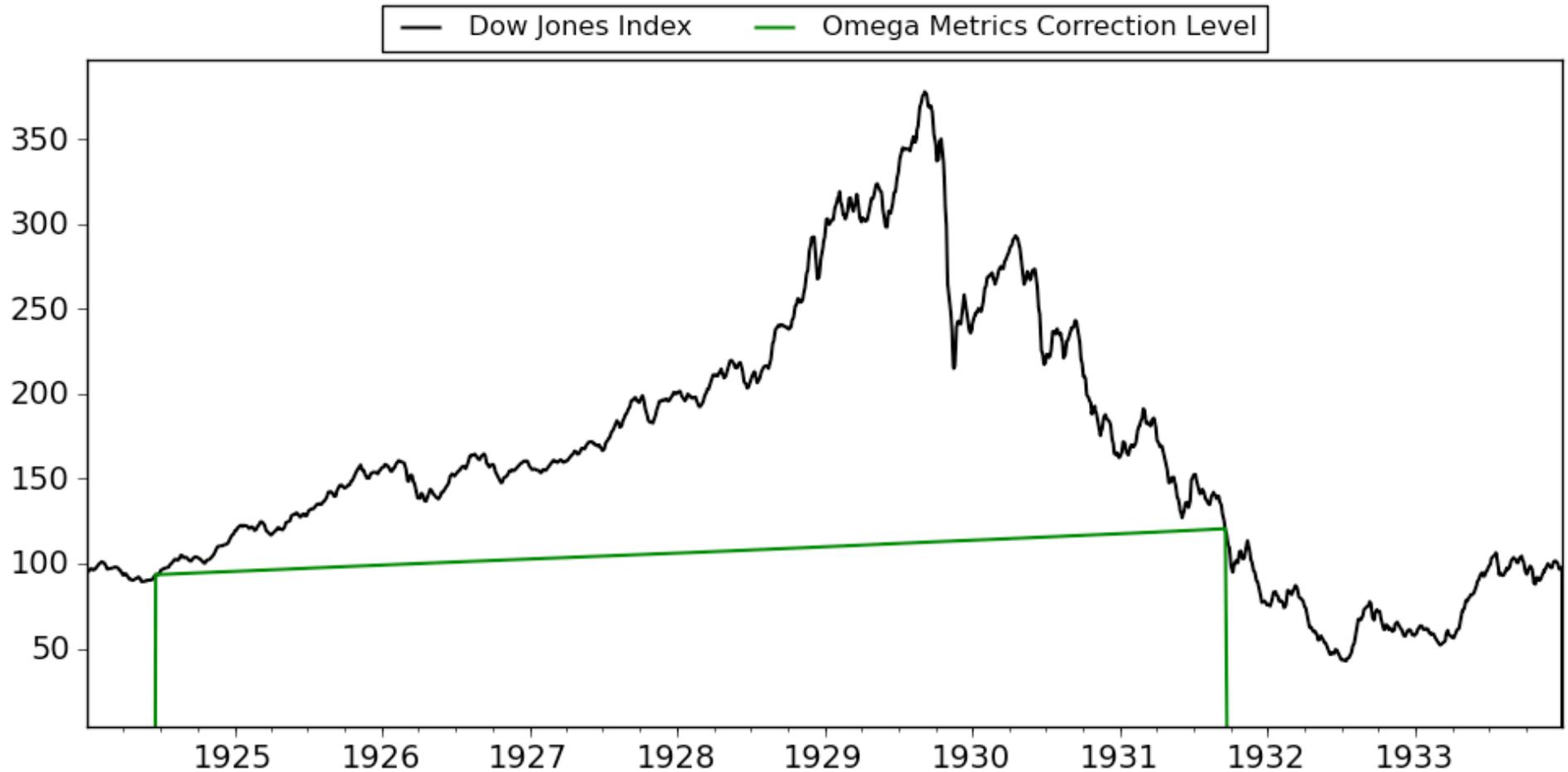
Early Warning of Asset Price Bubbles

- Unstable Expansion Modes *should* lead to market corrections.
- They (almost) always do. When they persist for long periods the correction can be violent.
- When an Unstable Expansion has been confirmed we carry the market value forward as if it had been invested at the risk free rate.
- This is our predicted *Correction Level*.

Early Warning of Asset Price Bubbles

- What follows is a series of *out of sample predictions* made using only the data available in the past.
- Nothing has been optimised.
- The same ‘arbitrary but reasonable’ parameters have been used in each case.

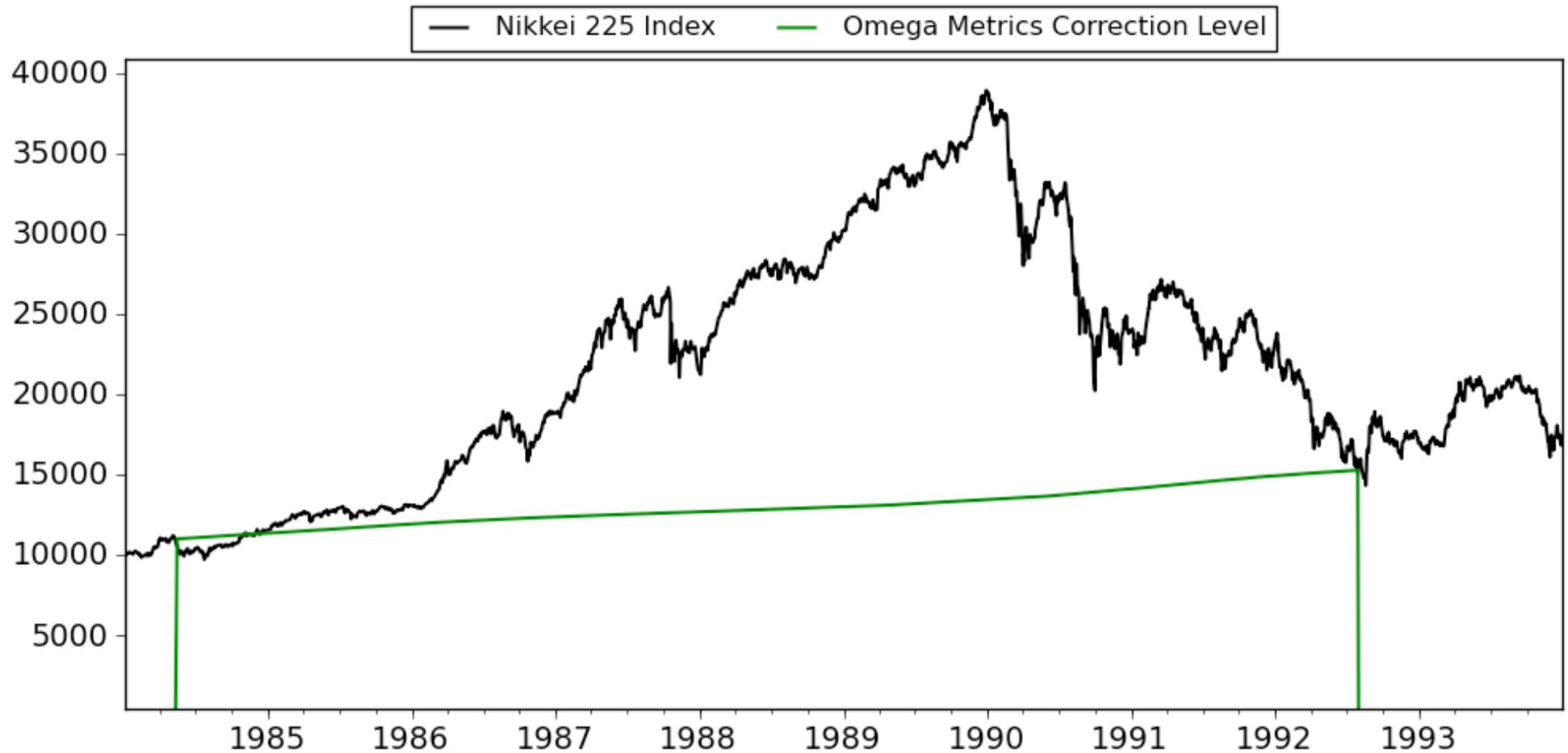
The 1929 Crash Prediction



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Dow Jones Industrial Index 1924-1934

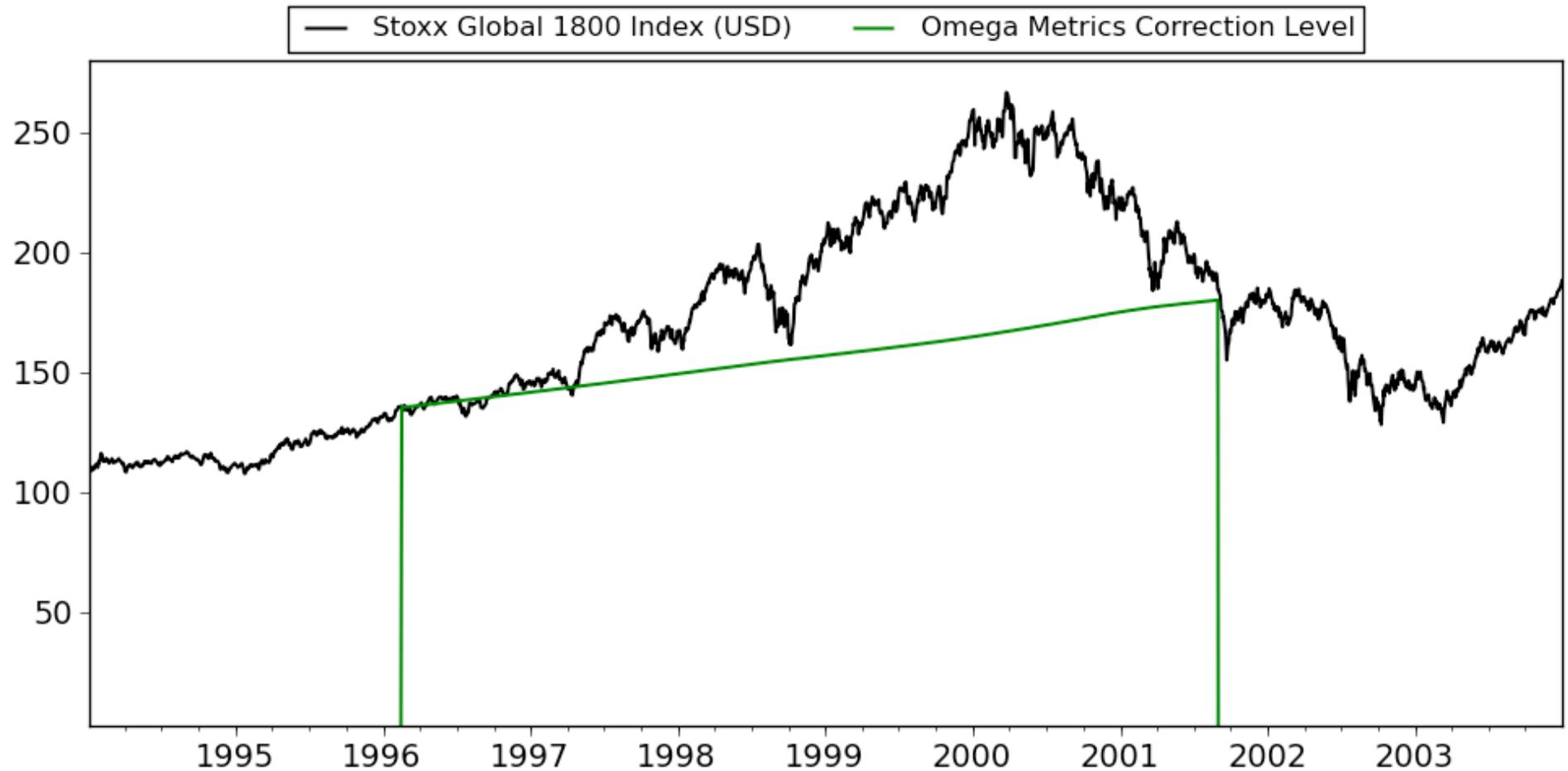
The Japanese Equity Crash Prediction



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Nikkei 225 Index 1984-94

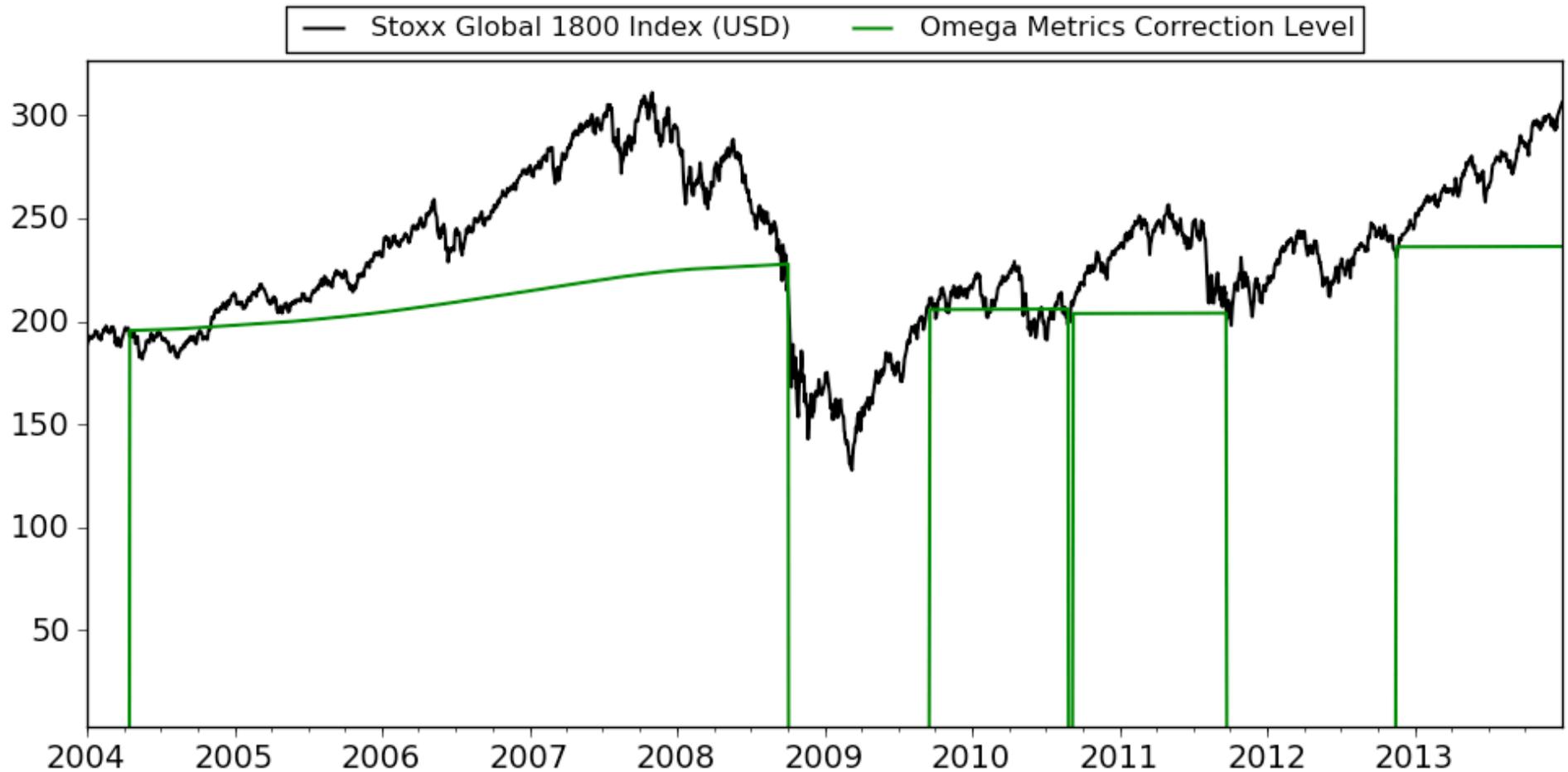
Global Equity Crash Predictions



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Stox Global 1800 Index 1994-2004

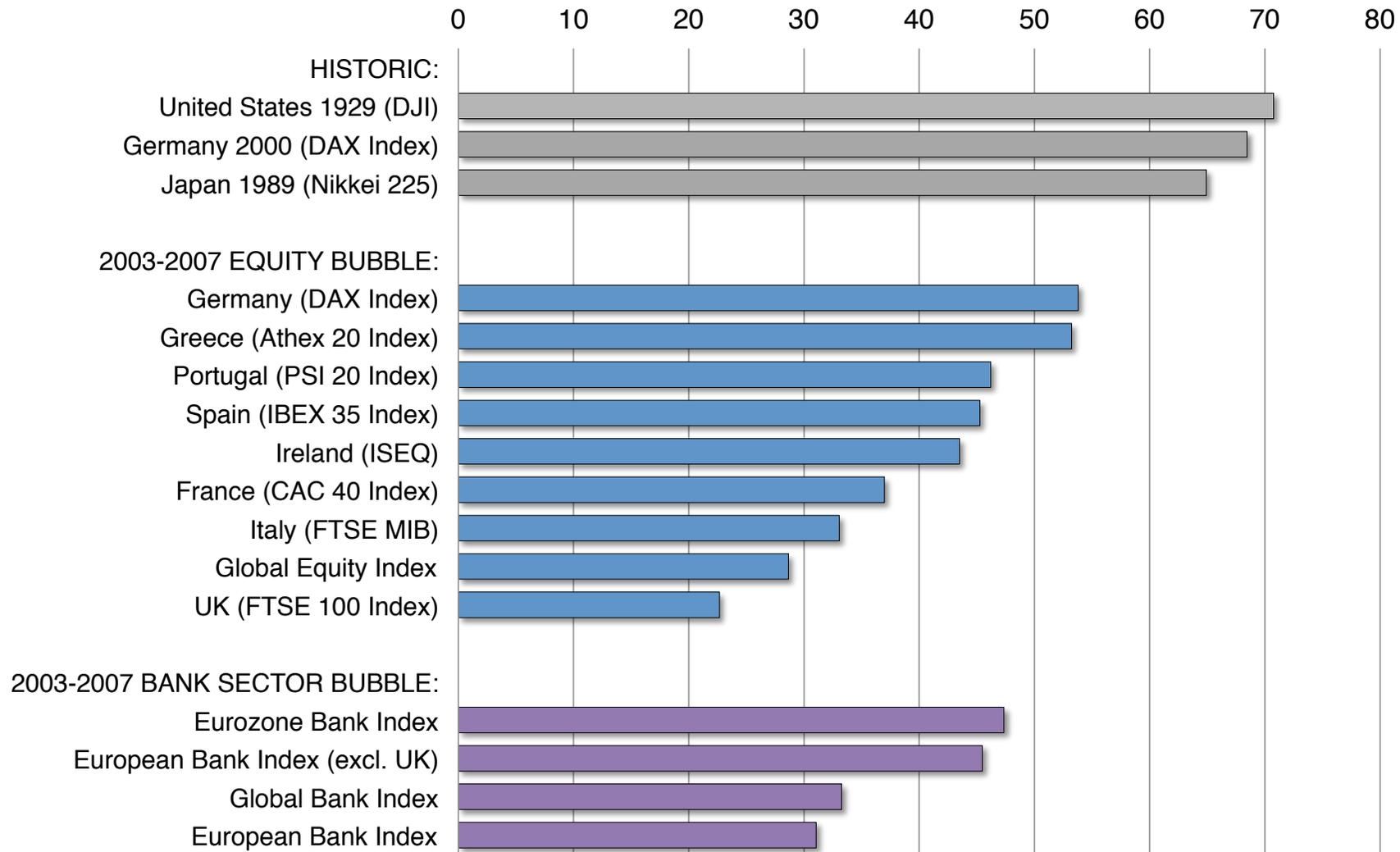
Global Equity Crash Predictions



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Stox Global 1800 Index 2004-2013

Comparison of Historic Correction Levels



All subsequently fell at least as much as the Correction Level predicted.

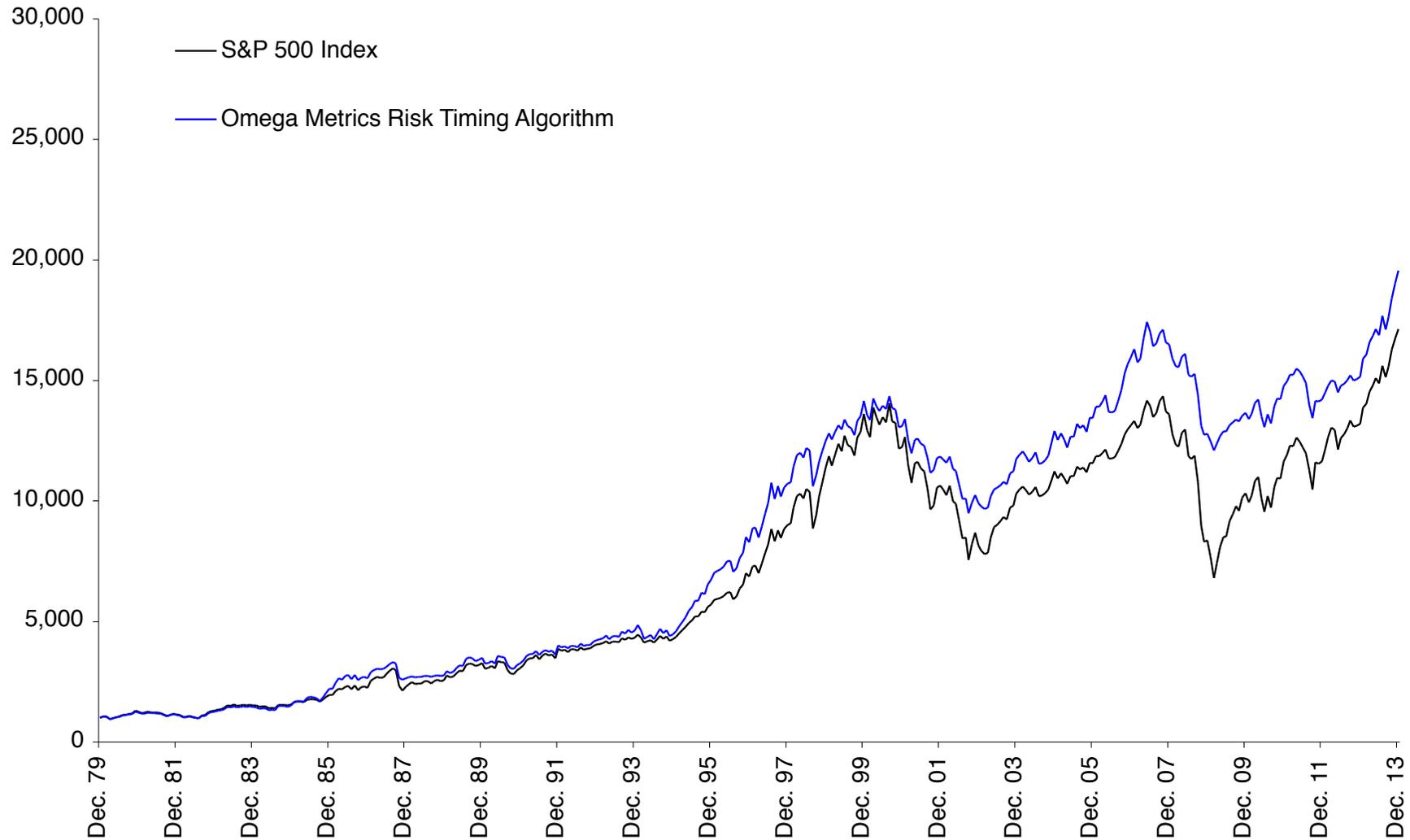
A Practical Proof of Predictive Power

- The same approach can be used to identify *Unstable Contractions* –‘anti-bubbles’ which should produce a market rebound but may instead turn into panic selling.
- Together with *Unstable Expansions* these define periods where we are *predicting* rises and *predicting* falls in prices.
- A simple trading algorithm following these indicators provides a test of the predictive power of our ‘risk anomalies’.

A Practical Proof of Predictive Power

- Risk levels are predictable.
 - Bubbles expand in periods of relatively low risk.
 - Risk increases as Boom turns to Bust.
- Adjusting exposure to maintain a risk target makes money.

A Practical Proof of Predictive Power 1980-2013

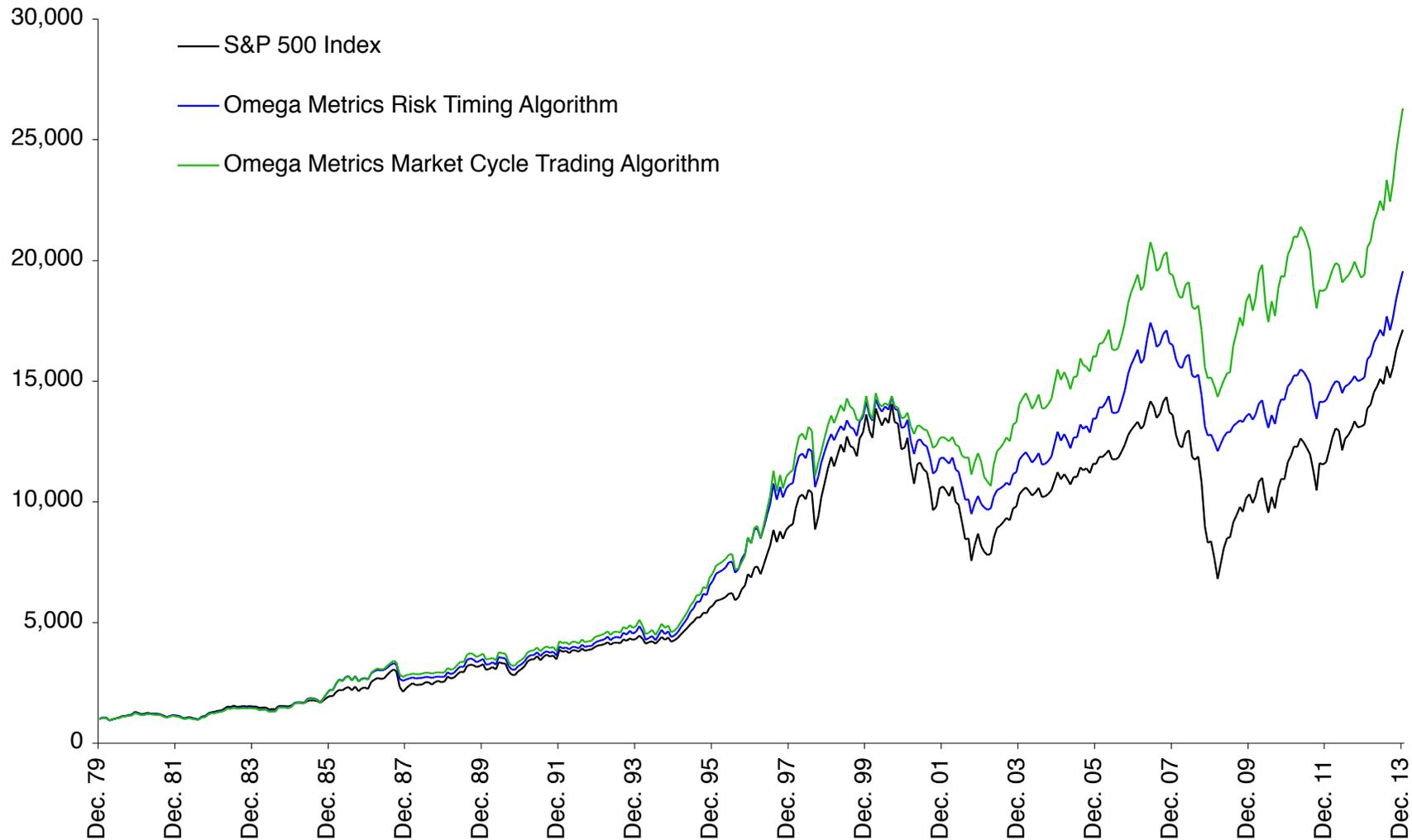


Initial value 1000. Results in other markets and other historic periods are similar.

A Practical Proof of Predictive Power

- Market *direction* is predictable.
- *Momentum* signal comes from *uncorrected* Unstable Expansions.
- *Value* signal comes from *corrected* Unstable Contractions.
- Here is the result of following the risk, momentum and value predictions.

A Practical Proof of Predictive Power 1980-2013

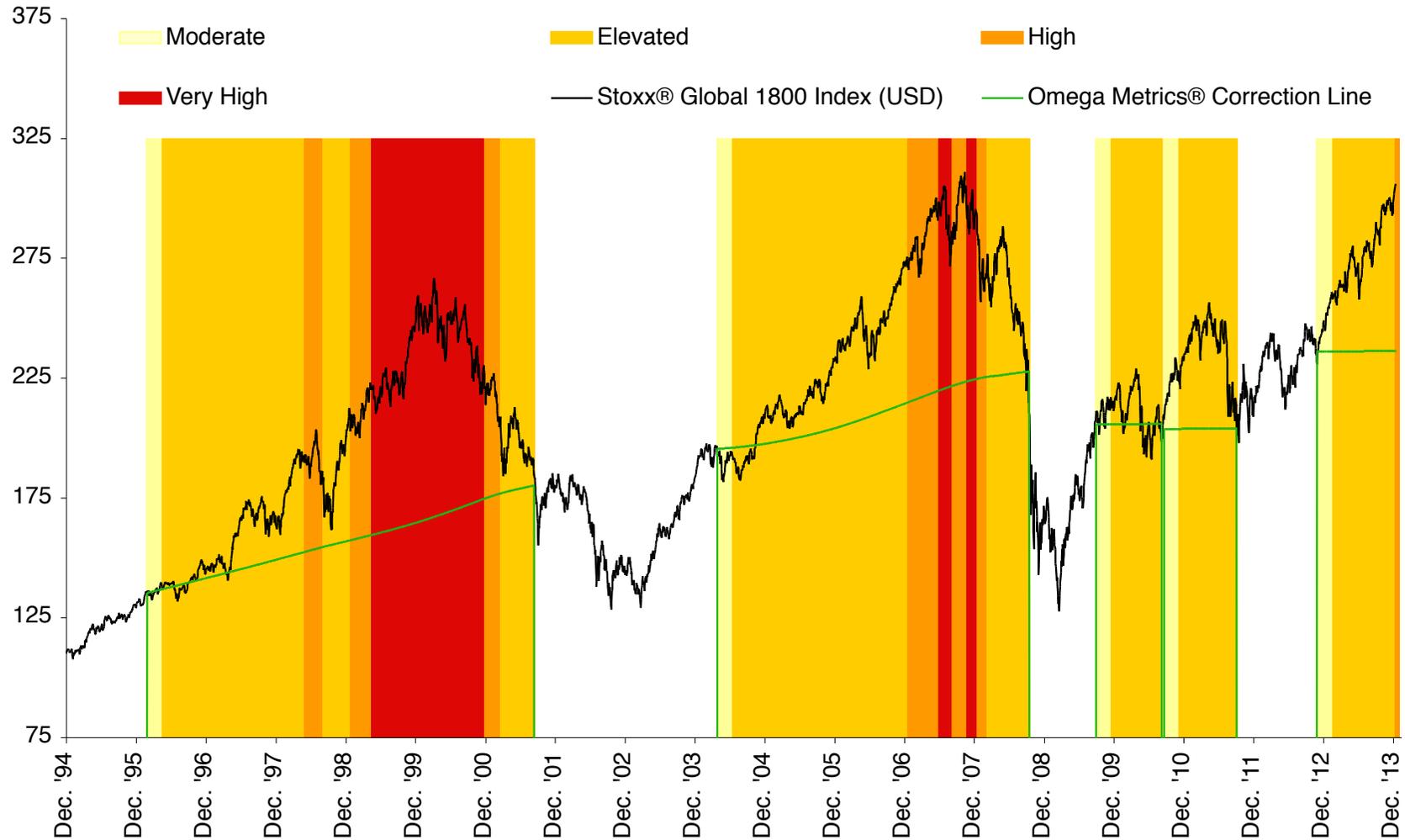


Initial value 1000. Results in other markets and other historic periods are similar.

How Can The Warnings Be Used By Central Banks?

- Market Sector Indices (e.g. Real Estate, Banks) show the same features.
- Increased capital requirements for overheating sector lending?
- Avoid monetary policy mistakes? (ECB)
- Avoid crisis response that makes things worse? (Disastrous bank mergers brokered or forced by regulators during Unstable Contractions in 2008)

Early Warning Indicators - Central Bank Version

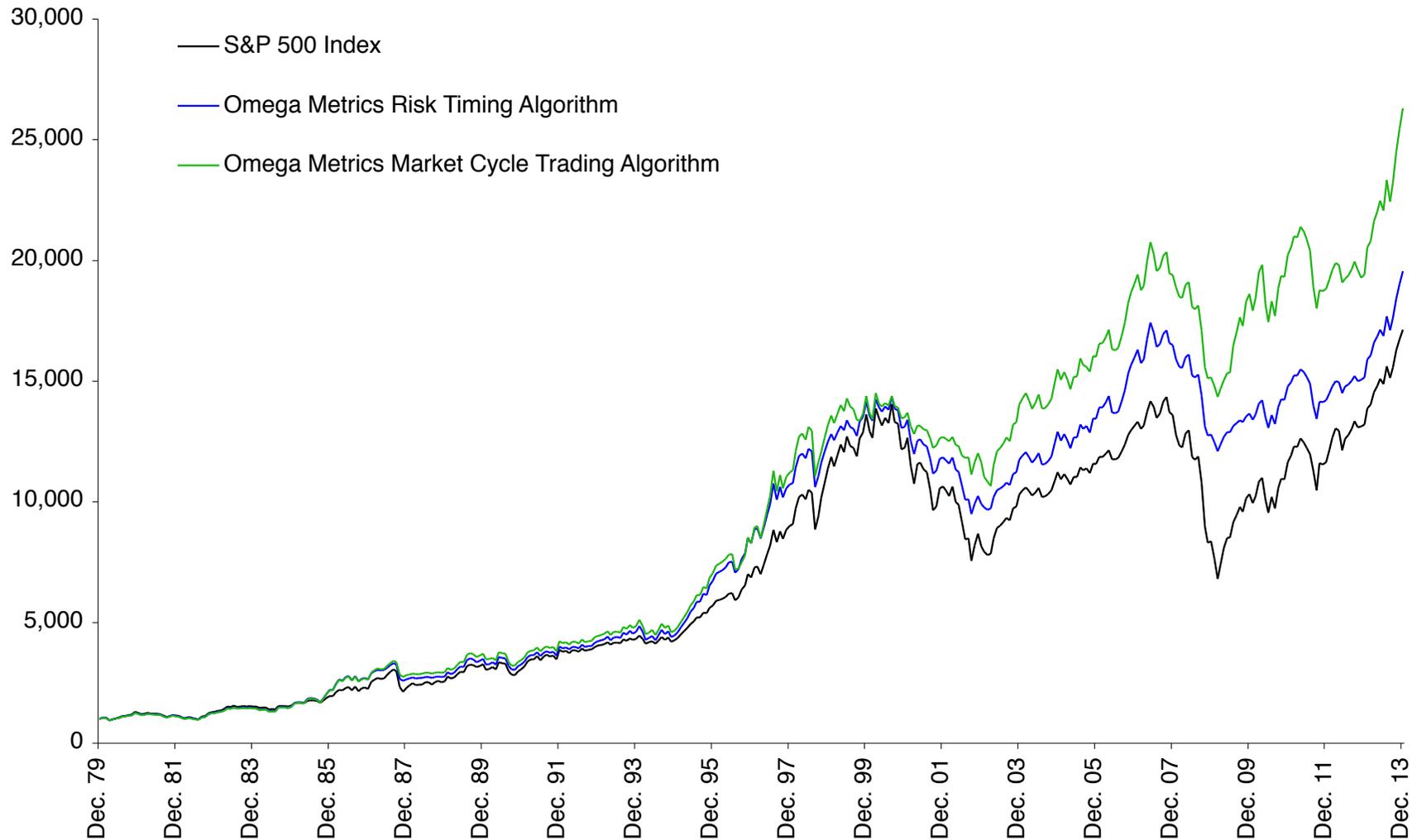


Stoxx Global 1800 Index 1994-2013

How Can The Warnings Be Used By Investment Managers?

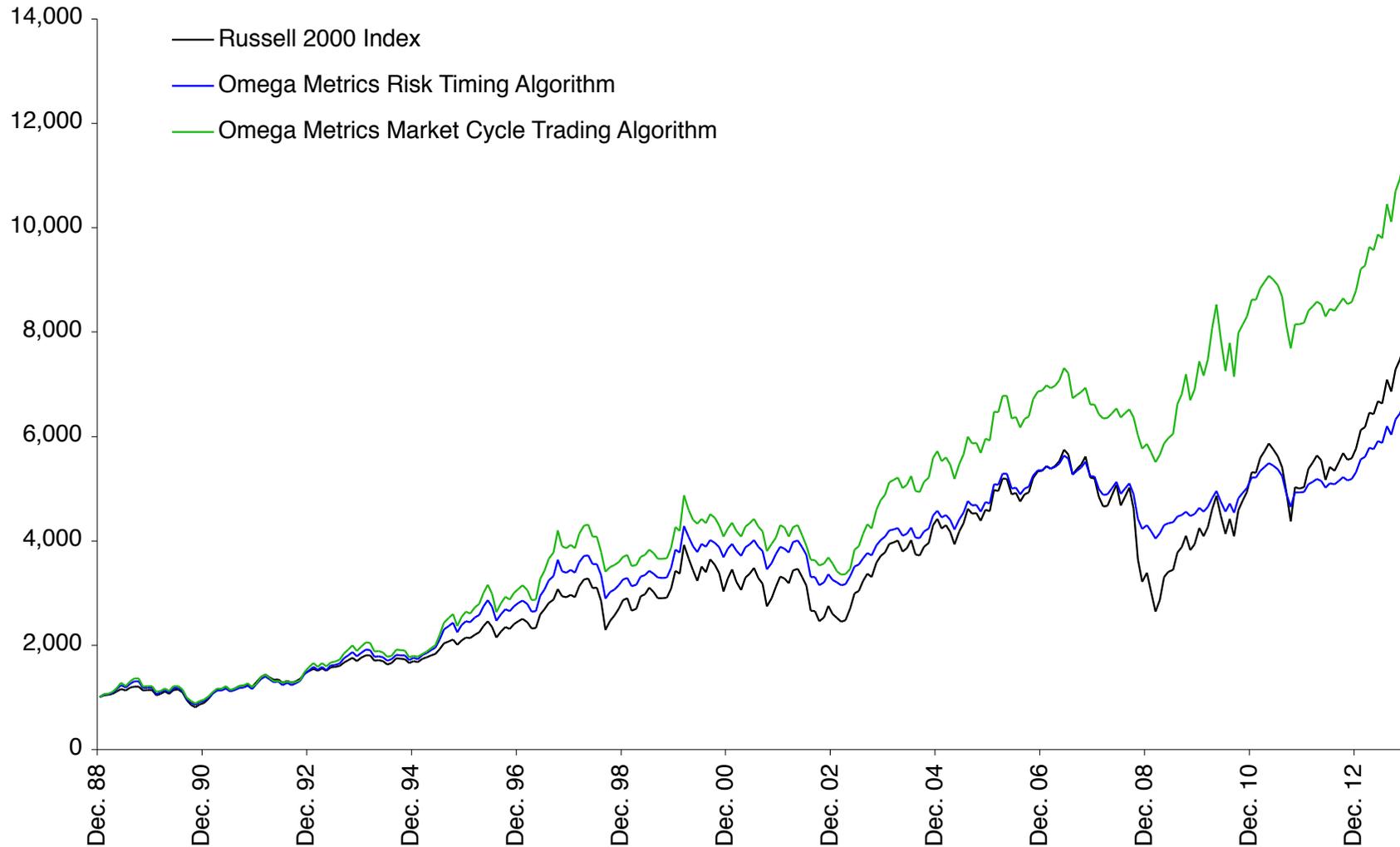
- Add alpha by following Momentum and Value.
- Reduce drawdowns and preserve both capital and income.

Trading Market Cycle Information in the S&P 500



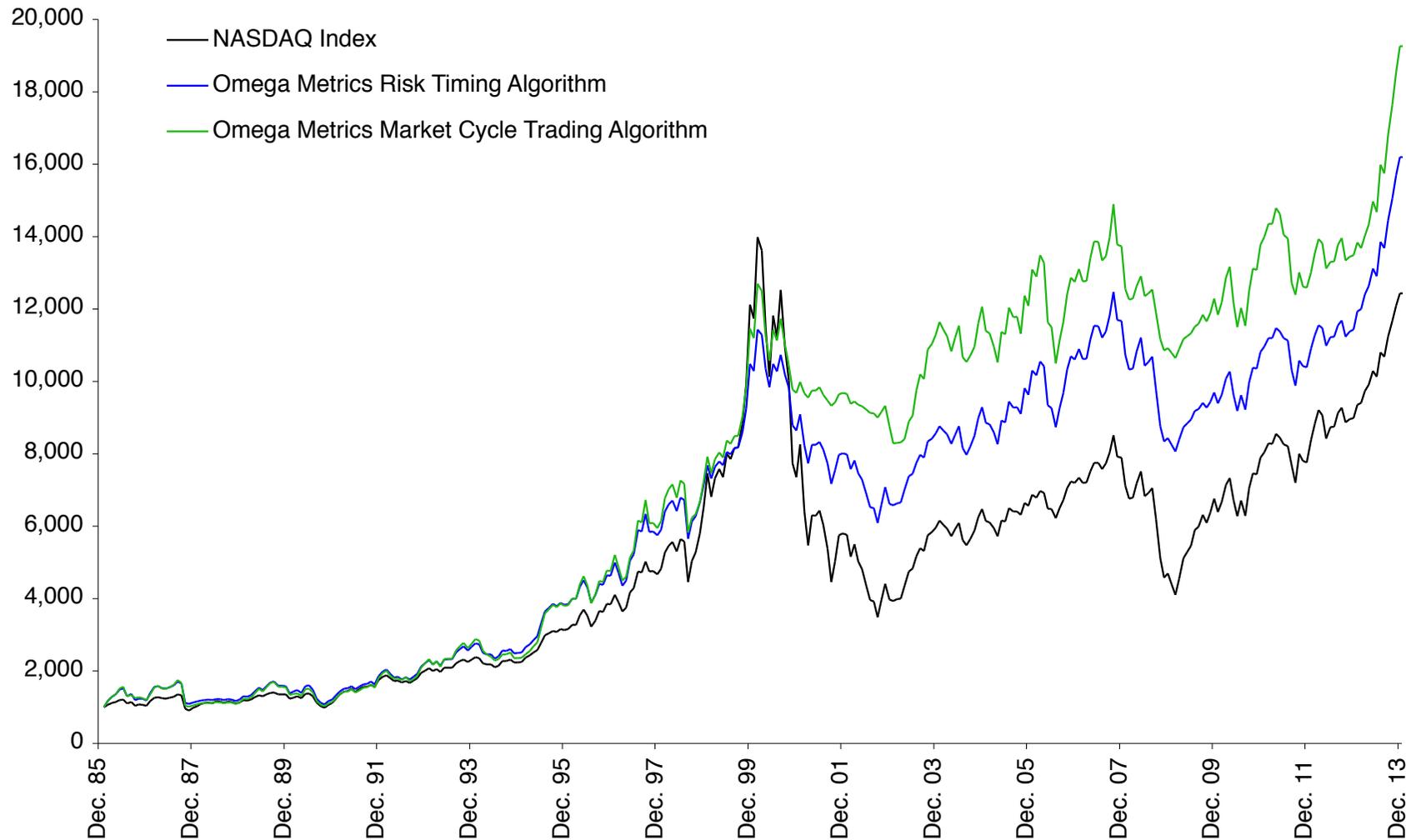
Initial value 1000. Results in other markets and other historic periods are similar.

Trading Market Cycle Information in the Russell 2000



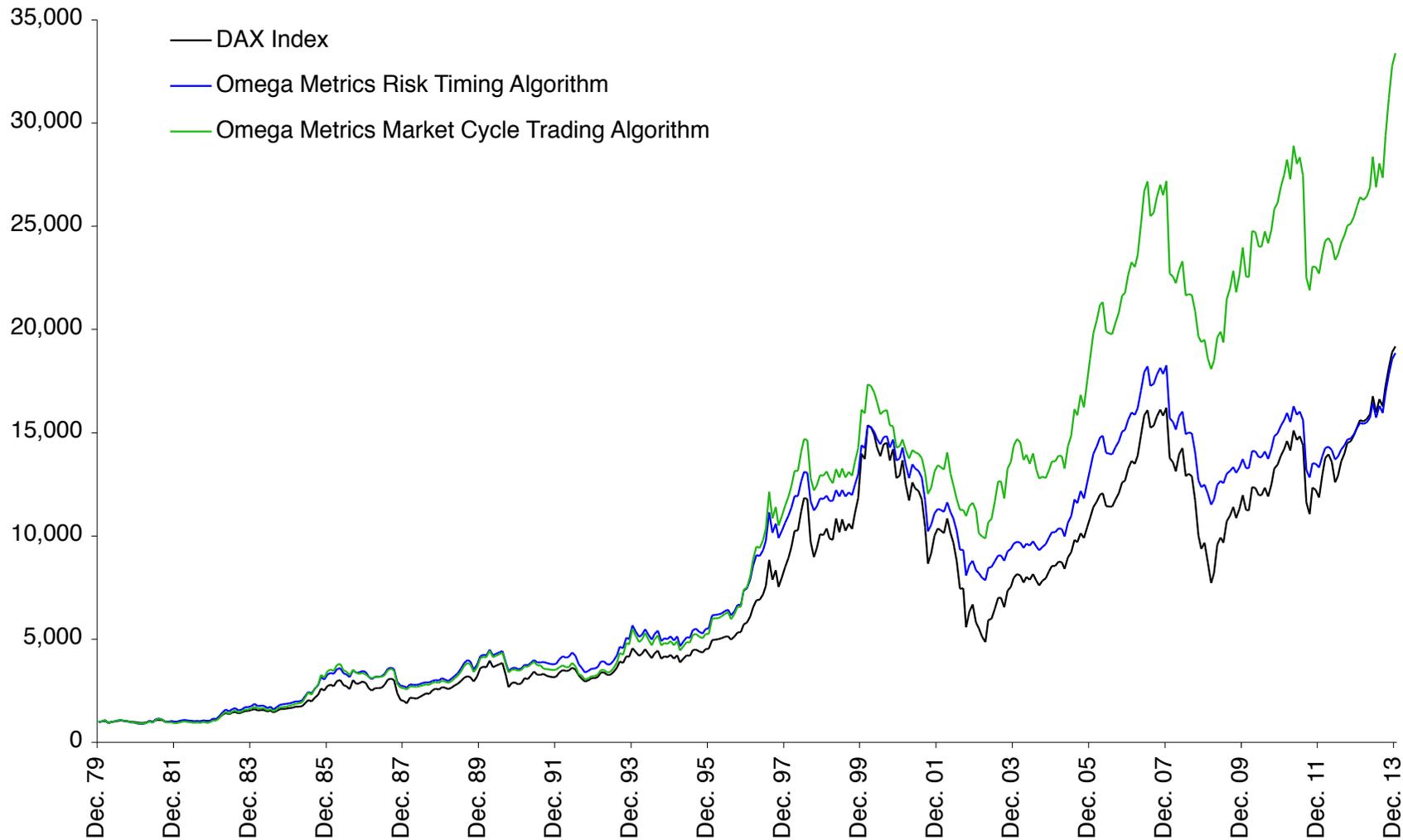
Initial value 1000. Results in other markets and other historic periods are similar.

Trading Market Cycle Information in the Nasdaq 100



Initial value 1000. Results in other markets and other historic periods are similar.

Trading Market Cycle Information in the DAX 30



Initial value 1000. Results in other markets and other historic periods are similar.

Some Uncorrected Unstable Expansions: 31 Dec. 2013

- S&P 500 Index: 33% (CL is 1,234)
- Russell 2000 Index: 32% (CL is 792)
- NASDAQ Composite Index*: 38% (CL is 2,579)
- TSX Composite Index: 10% (CL is 12,289)
- DAX 30 Index: 25% (CL is 7,154)
- CAC 40 Index: 18% (CL is 3,528)
- FTSE 100 Index: 11% (CL is 6,006)
- FTSE 250 Index: 30% (CL is 11,155)
- STOXX Global 1800 Index: 23% (CL is 270)

* In the lecture, this was incorrectly listed as the NASDAQ 100 Index rather than the NASDAQ Composite Index. As of 31 December 2013 the levels for the NASDAQ 100 Index were: 49% (CL is 1849)

That's All Very Well In Practice...

- Our Empirically derived predictors work very well in practice. But they dont tell us *why* booms and busts occur.
- Why are boom bust cycles present?
- They are consistent with a 'Minsky type' view about investment funds.

Minsky's Hedge, Speculative and Ponzi Financing

- Hedge Financing: Cash flows pay interest *and* principal.
- Speculative Financing: Cash flows pay interest. Principal repayment depends on prospect of capital gains.
- Ponzi Financing: Interest payments require capital gains (or more borrowing).

Minsky Applied To Large Investment Funds

- If Fixed Income investment meets income needs no equity investment would be made.
- Equity investment is *borrowing* from the FI pot.
 - Income requirement is the ‘interest’.
 - By definition this is Speculative Finance at best.

Minsky Applied To Large Investment Funds

- ‘*Smart Money*’ buying equities near the bottom following a boom may convert to Hedge financing after a sufficient capital gain, while still paying the ‘interest’ with dividends.
- Investors entering later in the boom will always be Speculative. If they are early enough, dividends will pay most, or even all, of the interest.
- The last in are Ponzi financed.
 - They will be forced sellers and will eventually precipitate the next bust.

Example from the Current Boom

- Global 1800 Index was 130 in March 2009 and 260 by February 2013.
- Dividends were approximately 5% per year in that period.
- Typical pension fund income requirement is 7% per year.
- Even the 'Smart Money' needs to take capital gains.
- As they exit, equity price declines make Ponzi financed investors forced sellers and we head for the next bust.

How Much Could This Matter?

- AUM at 500 largest asset managers is about \$80 Trillion.
- Free float Market Cap of Equities worldwide is only about \$40 Trillion.
- Risk Free rate is essentially zero.
- Large investment pools are forced into equities...

From Practice to Theory?

- Data base for cross checking bubble models.
- Timing of Flows from large investment funds.
- ...

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