

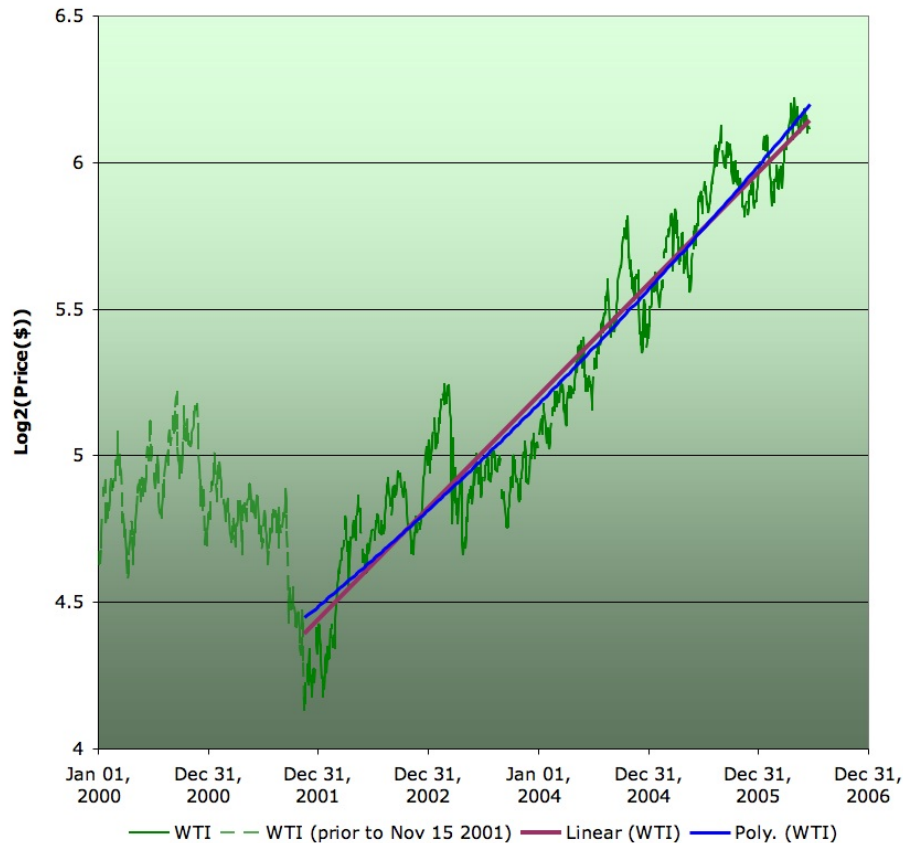


Is Oil In a Price Bubble?

Posted by [Stuart Staniford](#) on June 23, 2006 - 9:20am

Topic: [Economics/Finance](#)

Tags: [bubble](#), [peak oil](#) [[list all tags](#)]



Log (base 2) of West Texas Intermediate spot price in nominal US dollars Jan 2000-Jun 20th, 2006, together with linear and quadratic fits to the data from Nov 15th, 2001 onwards (the low before the recent price run-up). On this scale, 4 is \$16, 5 is \$32, and 6 is \$64. Graph is not zero-scaled. Source: [EIA](#).

An alternative explanation for the [plateau](#) (besides [probably the start of peak oil](#)) runs as follows:

There is a speculative bubble going on in the oil markets. Financial institutions (optionally aided by too much money supply from the Fed) are pumping money into the oil futures market and jacking up prices. This is depressing demand and meaning that suppliers have to leave oil in the ground because there's no customers for it, even though prices are very high.

I've been hearing this argument with increasing frequency - it seems to be particularly beloved by OPEC ministers and oil company executives that don't want to acknowledge peak oil, but also don't want to be blamed for high oil prices. One variant of it is articulated clearly over at [A greek speculator's journal](#). Aspects of it have also been discussed by James Hamilton here in [Contango](#),

[speculation, and the price of oil](#), in [commenting on strange remarks by Al-Naimi](#), and then in the last few days in a debate in comments [here](#).

The core issue with this storyline is well put by Professor Hamilton:

I do not share the view that speculation should be thought of as a separate force from supply and demand contributing to the price of oil. An investment fund that today buys a September 2006 futures contract for \$75 (\$3 above the current spot price of \$72) will only make a profit if the spot price of oil in September turns out to be above \$75 a barrel. If such speculators prove to be correct and the spot price does rise from its current \$72 to, say, \$80 a barrel by September, that price hike would be a further factor depressing September demand and potentially increasing September supply. Why would the September spot price be even higher than the current spot price, if users of oil in September will be buying less oil than they are now? According to the speculation theory, we'd have to see even more investment dollars flowing into the market in September than we are currently, causing an even bigger addition to stockpiles (that is, the rate at which oil is added to storage must itself go up at an ever-increasing rate) in order to compensate for the lost demand that \$80 oil would choke off as well as to justify an even higher price than at present. And that additional money, in turn, would supposedly be going into February 2007 contracts for \$83 oil, in hopes that the February 2007 spot price would be even higher, say \$85. All this only makes sense if one believes that investment funds will continue to pour ever-increasing sums into oil futures and an ever-increasing volume of oil gets added to inventory each month. Since the total investment funds and physical facilities for storage are inherently finite, someone in this chain is going to find that they have irrationally thrown their money away. I would argue that this someone is in fact the joker at square 1 who thought you could make money with a September 2006 futures contract betting against the fundamentals.

To me, a much more natural way to try to interpret this phenomenon is that the investment funds are betting not on a bigger fool to bail them out in September, but rather are trying to evaluate the September fundamentals for supply and demand. First, let's look at the upside. There is currently very little spare capacity in global oil production, meaning that a supply disruption of just a few million barrels a day could easily result in a pretty impressive spike up in the spot price of oil in September. Where might such a supply disruption come from? Oh, maybe Nigeria, or Iran, or Iraq, or Saudi Arabia, or Venezuela, or Russia, to name a few. Even if the probability of such an event is low, the large payoff if it occurs could give an attractive expected rate of return-- play such a gamble over a long enough time period, and you could make out quite well, even if everything remains calm over this particular coming six months.

I agree with almost all of this (in general my views on peak oil are quite similar to Professor Hamilton's). However, one area in which I differ is that I do believe in bubbles in general, and in particular I believe that a bubble in oil market prices is a logical possibility, and it is an empirical question to decide whether or not it is happening.

Professor Hamilton is a [neoclassical economist](#), with a strong commitment to the idea that humans always behave rationally. That leads to the efficient markets hypothesis - the idea that markets will immediately incorporate all useful information about future events, and therefore prices will appear to move randomly (because if future market movements were predictable,

people would trade on those predictions to make money and thus cause the anticipated movement to happen immediately rather than on the anticipated future schedule). I have noticed that Prof Hamilton, like other neoclassical economists, is [quite resistant](#) to calling anything a bubble.

I view the efficient market hypothesis as a frequently useful approximation because it certainly is the case that most financial market participants are very interested in enriching themselves, highly driven and motivated in this pursuit, and capable of at least some degree of rational analysis.

(As an aside, I should stress that I do not think that humanity generally is primarily driven by self-interest, but the more altruistic members of the species become social workers, nurses, and environmental activists, people driven by intellectual curiosity become professors, and so on, while the people extremely anxious to make a financial killing become investment bankers and hedge fund managers and it is the latter subspecies who's nature mainly shows up in financial markets. From this standpoint, the neoclassical economics professor, who spends his (or her) life studying and justifying the rational selfish behavior of financial market participants while himself forgoing most of the opportunity to engage in this kind of accumulation in order to educate the young and write scholarly papers, makes an interesting paradox.)

However, it is also the case that humans are a highly social species. Psychologists and neuroscientists have shown pretty persuasively that our emotions profoundly color our judgements (indeed emotions are critical to the process of forming a judgement - people with brain lesions that interfere with their emotional machinery are unable to perform the simplest everyday tasks because they cannot prioritize). (See, for example, Antonia Damasio's fascinating book [Descartes Error](#)). Furthermore, our emotions and judgements are infectious - we influence the people we talk to to share both our moods and our opinions. Thus human judgements (eg about market prices) are the result of a collective social/emotional process which can undergo large scale self-organizing phenomena.

This means that it is possible for booms and busts to occur as a kind of occasional outlying anomaly in the normally more-or-less efficient operation of the market. A wonderfully concise and jaundiced view of the phenomenon is the late J.K. Galbraith's book [A Short History of Financial Euphoria](#). Galbraith's introductory description of a bubble will serve admirably here:

The more obvious features of the speculative episode are manifestly clear to anyone open to understanding. Some artifact or some development, seemingly new and desirable -- tulips in Holland, gold in Louisiana, real estate in Florida, the superb economic designs of Ronald Reagan -- captures the financial mind or perhaps, more accurately, what so passes. The price of the object of speculation goes up. Securities, land, objets d'art, and other property, when bought today, are worth more tomorrow. This increase and the prospect attract new buyers; the new buyers assure a further increase. Yet more are attracted; yet more buy; the increase continues. The speculation building on itself provides its own momentum.

This process once it is recognized, is clearly evident, and especially so after the fact. So also, if more subjectively, are the basic attitudes of the participants. These take two forms. There are those who are persuaded that some new price-enhancing circumstance is in control, and they expect the market to stay up and go up, perhaps indefinitely. It is adjusting to a new situation, a new world of greatly, even infinitely increasing returns and resulting values. Then there are those, superficially more astute and generally

fewer in number, who perceive or believe themselves to perceive the speculative mood of the moment. They are in to ride the upward wave; their particular genius, they are convinced, will allow them to get out before the speculation runs its course. They will get the maximum reward from the increase as it continues; they will be out before the eventual fall.

For built into this situation is the eventual and inevitable fall. Built in also is the circumstance that it cannot come gently or gradually. When it comes, it bears the grim face of disaster. That is because both of the groups of participants in the speculative situation are programmed for sudden efforts at escape. Something, it matter little what -- although it will always be much debated -- triggers the ultimate reversal. Those who had been riding the upward wave decide now is the time to get out. Those who thought the increase would be forever find their illusion destroyed abruptly, and they, also, respond to the newly revealed reality by selling or trying to sell. Thus the collapse. And thus the rule, supported by the experience of centuries: the speculative episode always ends not with a whimper but with a bang. Here will be occasion to see this rule frequently repeated.

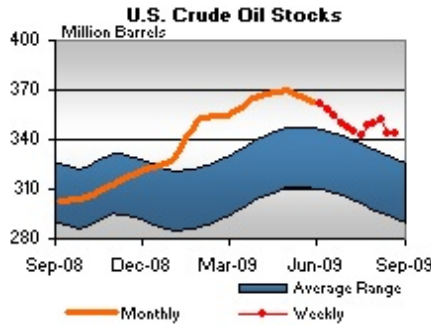
So much, as I've said, is clear. Less understood is the mass psychology of the speculative mood. When it is fully comprehended, it allows those so favored to save themselves from disaster. Given the pressure of this crowd psychology, however, the saved will be the exception to a very broad and binding rule. They will be required to resist two compelling forces: one, the powerful personal interest the develops in the euphoric belief, and the other, the pressure of public and seemingly superior financial opinion that is brought to bear on behalf of such belief. Both stand as proof of Schiller's dictum that the crowd converts the individual from reasonably good sense to the stupidity against which, as he also said, "the very Gods Themselves contend in vain."

Although only a few observers have noted the vested interest in error that accompanies speculative euphoria, it is, nonetheless, an extremely plausible phenomenon. Those involved with the speculation are experiencing an increase in wealth--getting rich or being further enriched. No one wishes to believe that this is fortuitous or undeserved; all wish to think that it is the result of their own superior insight or intuition. The very increase in values thus captures the thoughts and minds of those being rewarded. Speculation buys up, in a very practical way, the intelligence of those involved.

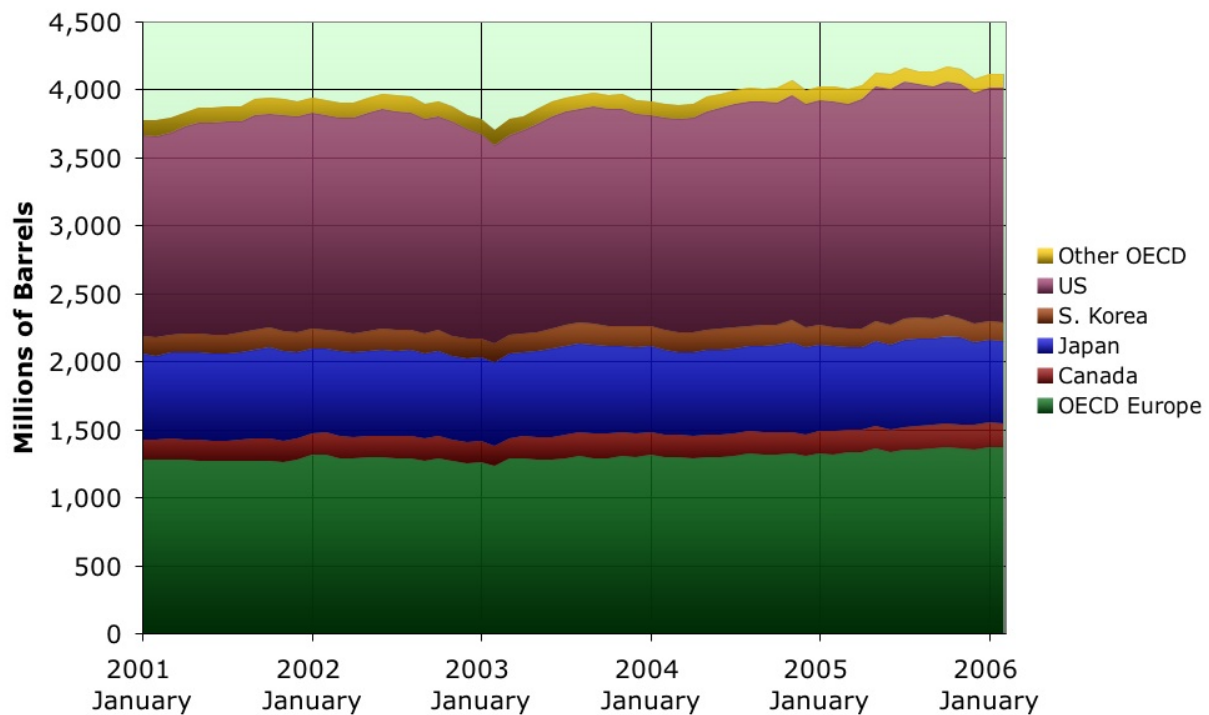
Ok. So in my mind it's very clear that this kind of dynamic *could* get established in the oil markets as a result of peak oil. The question is, has it yet? Are we, at the moment, in Professor Hamilton's efficient oil market world where speculators are rationally profiting from correctly anticipating constrictions in oil supply and the robustness of demand? Or have we made the irrevocable crossing into the delirious territory of [irrational exuberance](#), where money can only be made as long as there are enough greater fools still wishing to rush across the river after us?

As best I can judge, we have not yet crossed into irrational territory. (Though I think this is something we should stay constantly on our guard about - it could easily happen in the future). I will make two arguments. The first is based on Professor Hamilton's observation that excessive irrational speculation in oil futures would have to end up showing up in oil inventories. Are oil inventories excessive?

The EIA keeps publishing graphs like this one:



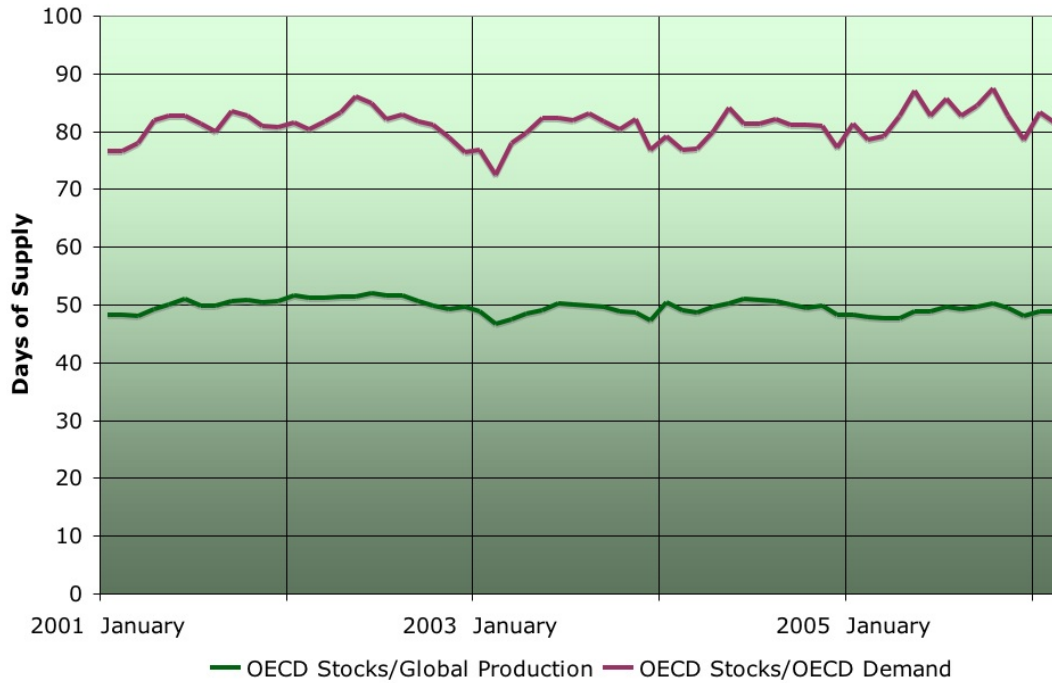
suggesting that stocks are anomalously high, which would seem, on the face of it, as though there is something strange and bubbly going on. However, if we step back and take a broader (and zero-scaled) view, I think the effect largely goes away. Here's the recent history of OECD oil stocks (which are the only ones for which data are compiled as far as I know).



Breakdown of OECD stocks from Jan 2001-Jan 2006. Source: [Table 1.5 of EIA IPM \(May 2006\)](#).

We can see that there has been some increase in inventories during the recent price run-up (which started at the bottom on Nov 15th 2001), but it doesn't seem too enormous given the excess geopolitical risks that the market is now facing).

In fact, looked at another way, there is really no increase at all. We would expect the amount of stocks oil consumers hold to grow over time because the amount of oil being used is growing over time. Thus to maintain the same number of days supply (to provide a fixed level of security against logistical or geopolitical disruptions), the physical amount of oil in stocks must grow over the years. And if we look at the number of days supply, there has been no significant trend of increasing stocks at all:



Number of days supply represented by OECD stocks (both commercial and governmental/strategic). Source: [Table 1.5 of EIA IPM \(May 2006\)](#) for stocks, [Table 1.4](#) for global production, and [Table 1.7](#) for OECD demand.

I did it two ways. One (the upper, plum, curve) was to divide OECD stocks by OECD oil consumption (on the view that the stocks are essentially inventory for those country's consumption). The other is to divide OECD stocks by global production (on the theory that the OECD -- especially via IEA mechanisms -- is holding stocks with a view to stabilizing the entire global oil market). That gives the lower, green, curve. Either way, the curves have no real trend and current values are not abnormal relative to the entire history of the price run-up. If there was an irrational bubble, we might expect these curves to be trending upwards, probably at an increasing rate.

Another possibility is that speculators are not holding claims against oil in the storage system that the EIA tracks, but instead are holding the oil in their own facilities which are not counted as stocks, thus meaning the stocks are under-reported. There are [news reports](#) of investment banks buying warehouses to put oil in. However, while this is clearly happening on some scale, this cannot be any part of the explanation for the production plateau - such oil if it is not counted as stocks must be being counted as sales to final customers, and therefore is adding to demand for physical oil (not depressing it). The hedge fund warehouse is directly in competition with the consumer gas-tank for the (non-increasing) amount of oil the producers are able to ship.

My second argument against the idea that there is an oil market bubble at present derives from the work of [Didier Sornette](#) and his collaborators. Sornette comes from a background in physics studying sudden ruptures in materials, but has increasingly applied physical techniques of statistical mechanics to financial markets, in particular to bubbles and crashes (a crash in a market being somewhat analogous to a sudden rupture in a strained physical material).

Long ago, I knew quite a lot of statistical mechanics so I have been able to understand some of Sornette's [papers](#), and book [Why Stock Markets Crash: Critical Events in Complex Financial Systems](#), which I highly recommend. However, in the interests of keeping an already long post from getting too much longer, I am going to leave a fuller treatment to some future occasion.

At the moment I will just observe that one of the signatures Sornette has identified of a bubble in the making is that the rate of growth in the price of the asset is growing faster than exponential. This happens roughly because the positive feedback process inherent in the bubble draws in more and more buyers and causes prices to go up faster and faster. If we plot the log of price against time, a non-bubbly exponential price rise will be a straight line. However, a bubbly situation will lead to a log-price line that is curving up.

Let me illustrate with some examples from a paper [Is There a Real-Estate Bubble in the US?](#) which Zhou and Sornette wrote last year which predicted that the US housing bubble would end around now (largely successfully, I would say - they also earlier successfully identified the end of the UK housing bubble). The paper identifies some states with markets that were not bubbly:

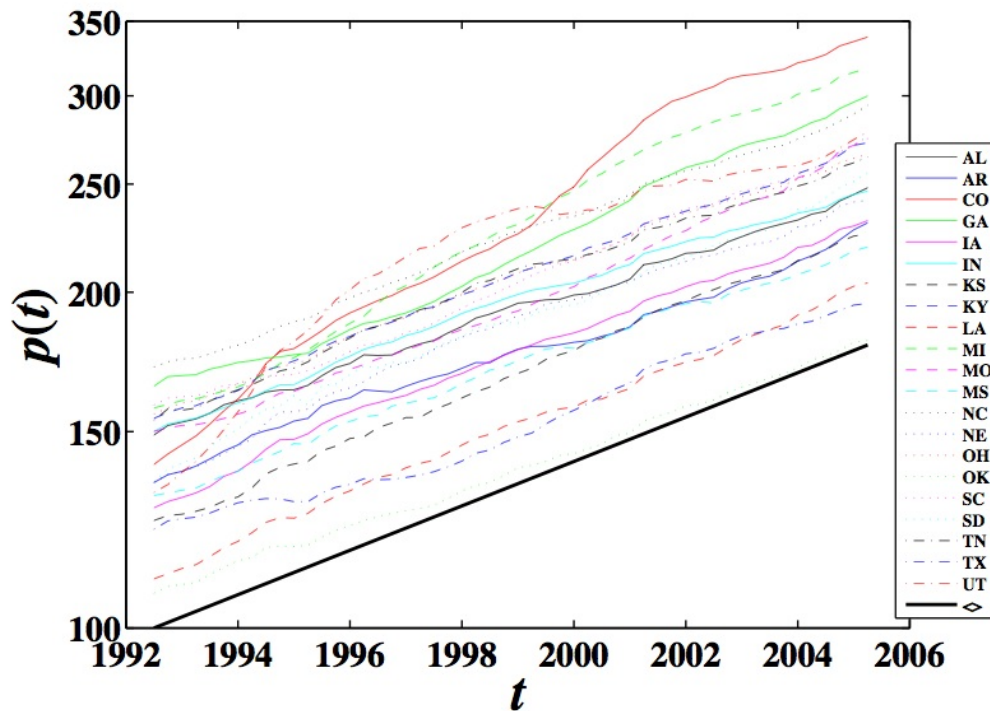


Fig. 3. (Color online) Quarterly HPI in the 21 states which have an approximately constant exponential growth, qualified by a linear trend in a linear-logarithmic scale. The thick straight line at the bottom of the figure is the average over all 21 states corresponding to an annual growth rate of 4.6% over the last 13 years. The corresponding states are given in the legend. Note that Colorado seems to be on a faster trend.

House price indexes for non-bubbly US states. This is Figure 3 of Zhou and Sornette, [Is There a Real-Estate Bubble in the US?](#)

As you can see, these states have straight line growth in their log-prices. These states are largely those that Paul Krugman [memorably described](#) as Flatland:

In Flatland, which occupies the middle of the country, it's easy to build houses. When the demand for houses rises, Flatland metropolitan areas, which don't really have traditional downtowns, just sprawl some more. As a result, housing prices are basically determined by the cost of construction. In Flatland, a housing bubble can't even get started.

Other states, however, Zhou and Sornette identified as bubbly because the log-price graph curves upwards:

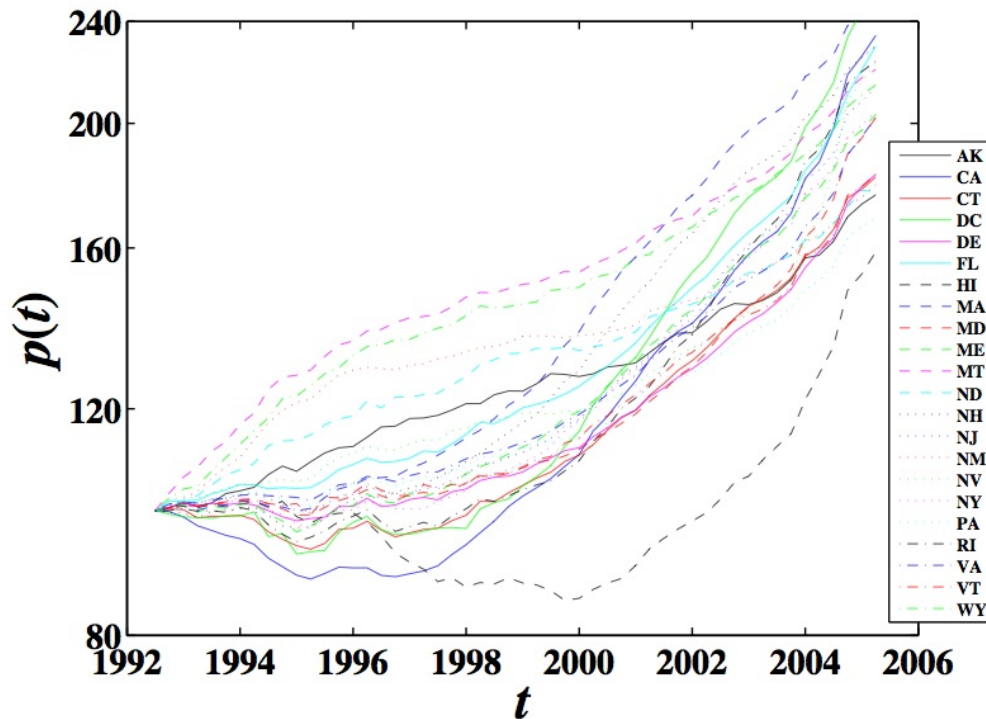


Fig. 5. (Color online) Quarterly average HPI in the 21 states and in the District of Columbia (DC) exhibiting a clear upward faster-than-exponential growth. For better representation, we have normalized the house price indices for the second quarter of 1992 to 100 in all 22 cases. The corresponding states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

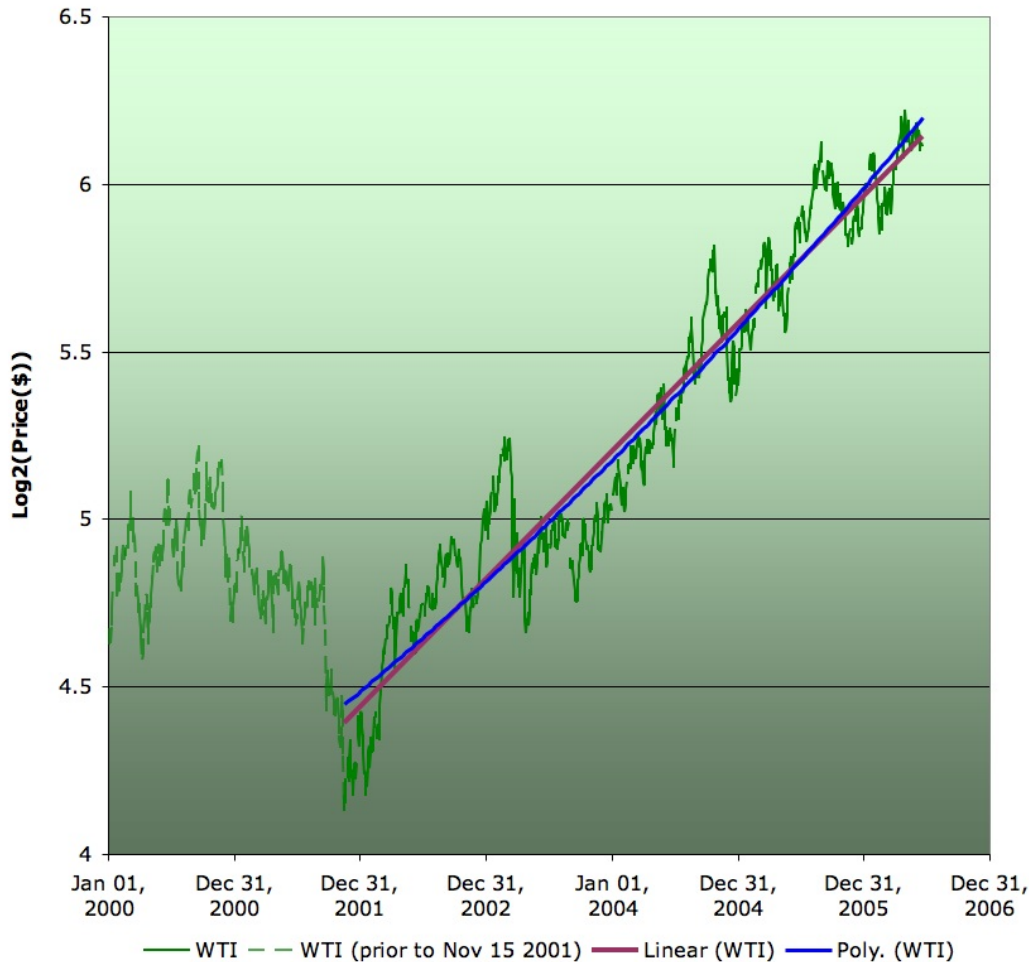
House price indexes for bubbly US states. This is Figure 5 of Zhou and Sornette, [Is There a Real-Estate Bubble in the US?](#)

These states correspond roughly to what Krugman called "The Zoned Zone":

But in the Zoned Zone, which lies along the coasts, a combination of high population density and land-use restrictions -- hence "zoned" -- makes it hard to build new houses. So when people become willing to spend more on houses, say because of a fall in mortgage rates, some houses get built, but the prices of existing houses also go up. And if people think that prices will continue to rise, they become willing to spend even more, driving prices still higher, and so on. In other words, the Zoned Zone is prone to housing bubbles.

So it would seem, according to Sornette's methodology.

Anyway, looked at with that lens, how does oil look? Here's a quick and dirty way to assess it:



Log (base 2) of West Texas Intermediate spot price in nominal US dollars Jan 2000-Jun 20th, 2006, together with linear and quadratic fits to the data from Nov 15th, 2001 onwards (the low before the recent price run-up). On this scale, 4 is \$16, 5 is \$32, and 6 is \$64. Graph is not zero-scaled. Source: [EIA](#).

The graph above shows the log spot price of WTI from Jan 2000 to June 20th of this year. (I used log base 2 because I find it a little easier to figure out what the numbers mean than natural logs, and logs base 10 don't have any useful dividers between \$10 and \$100) I have taken the start of the price rise as November 15th 2001 which is when prices bottomed out after the tech crash and the events of 9/11. To that price rise I fit both a linear trend, and a quadratic. To the extent the price was curving up in a bubblicious manner, we would expect the quadratic to depart markedly from the straight line. It elects not to do so - the two are very close. Thus we see that although there is considerable volatility in the price (and the pattern of that is worth further analysis in the future) the price rise is very much exponential in nature. So I take this as further evidence that we do not have a self-reinforcing bubble.

At least not yet.



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