Back-to-the-Future Look at Oil Prices--Will Higher Prices Bring More Supplies?

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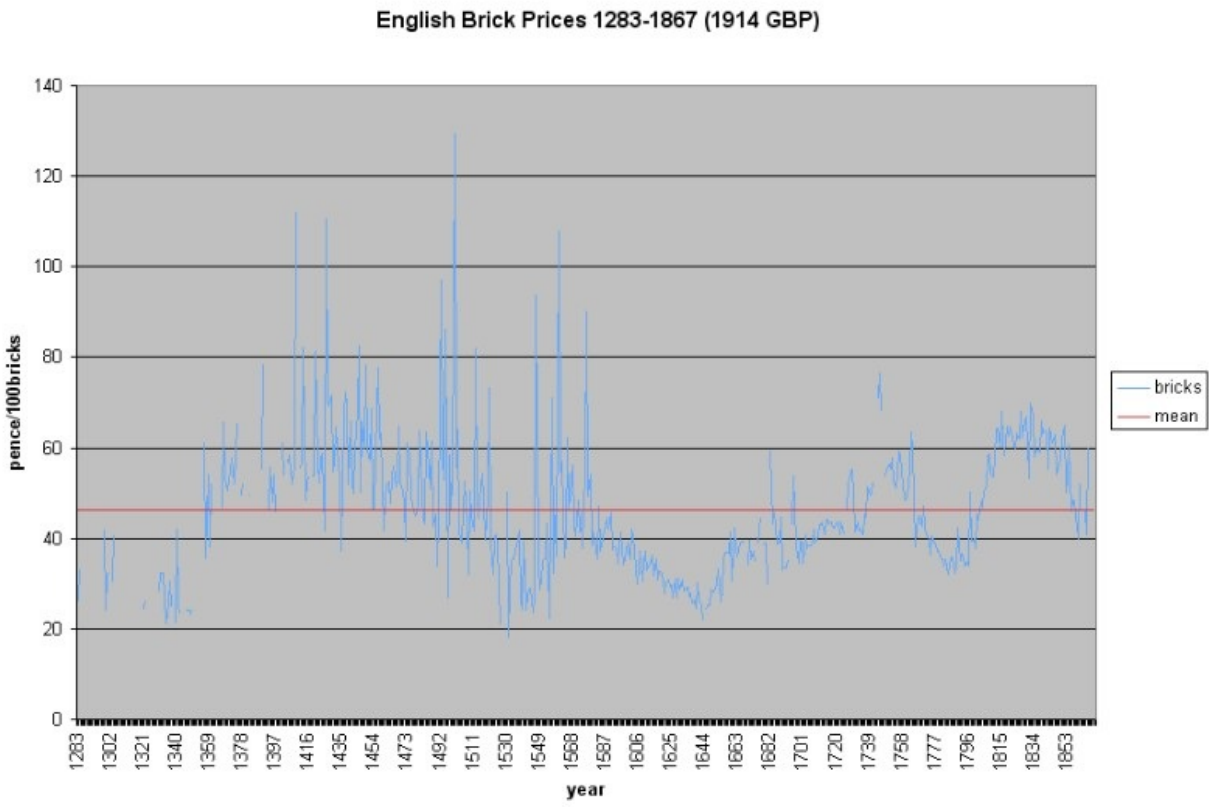
This is a guest post by Glenn Morton, a geophysicist in the oil industry. For Kerr-McGee Oil and Gas Corp., Glenn served as Geophysical Mgr Gulf of Mexico, Geophysical Mgr for the North Sea, Dir. Of Technology and as Exploration Director of China. Currently he is an independent consulting geophysicist.

In 1982, I had a fascinating lunch with my boss's boss's boss, Arco's VP of the Southern Region, Tom Neal. This was at the height of the last oil boom. The price of oil was $32/bbl headed to $100 (everybody knew). I was a 30 something oilman wannabe, Neal had achieved significant success. He taught me about economics that day. He and the VP of the Northern Region, Tom Wilkinson (one had to be a Tom to be a VP in those days), had had a meeting with Peter Drucker. At the time of the meeting, oil had just begun to show some signs of weakness and people were expecting a slight near-term decline in the price of oil. Drucker had asked these two very savvy VP's how low the price of oil would go. Both had mentioned numbers in the low $30s. Neal then told me that Drucker asked them to tell him their worst case scenario. What is the absolute worst that could happen to the price of oil? Neal said he responded with a value of $28 as the absolute worst. Drucker told them that he thought the price would drop to $14, which is about what the price was when the oil boom started in the mid-1970s. Both VPs were aghast, but disbelieving. But by the time of my lunch with Neal, he was beginning to think Drucker was correct.

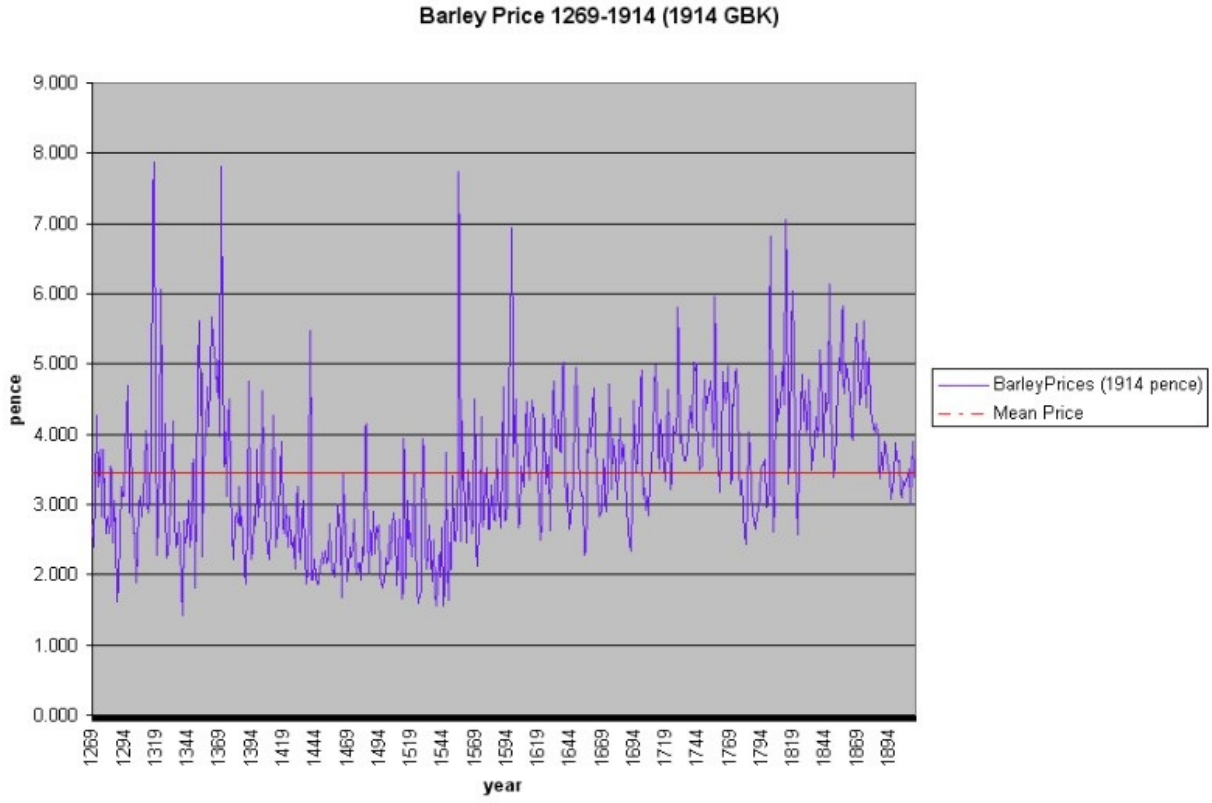
Drucker's reasoning was based upon the idea that a cartel can't control the price forever and when the price of a commodity goes above the long term average (inflation adjusted) price, it will inevitably fall back. Drucker told Neal and Wilkinson, and Neal told me about the Tulip Bulb cartel. In 1593 an enterprising Dutchman named Charles de L'Ecluse developed a tulip bulb capable of being raised in Europe. A cartel was formed to control the supply. Europe went wild for them. By 1623 a tulip bulb could fetch 1000 florins (the average monthly wage was 150 florins). By 1635, 40 bulbs went for 100,000 florins and in 1636 Tulip bulbs were a commodity on the stock market. But then, the price was too high and people decided that they didn't care that it was a tulip, they weren't going to pay that much for a tulip. Prices weakened, and eventually they plummeted back to where they had been at the start of the frenzied boom. Drucker was saying that the oil boom of the 1970s was a repeat of the tulip bulb cartel. In 1982 the price(inflation adjusted) and production profile for the entire history of the US oil industry looked like:

Drucker's suggestion at the time made perfect sense with the historical data. Anytime over the past 100 years that oil went above its average price, it would inevitably fall back to that level again. The average price was $15 dollars in 2004 dollars.This is especially true post-1879. In general, after commercialization, oil prices remained relatively flat during the early stages of production history. Eventually Drucker was correct, the price for oil in April of 1986 was below $10 per barrel. This phenomenon is quite widespread and is implicitly believed in by the economists. As price rises, entrepreneurs go out and produce more supply driving the cost for the commodity back to its historical inflation adjusted average.The purpose of this article is to refute the concept that non-renewable commodities follow the same curve.

Let's look at bricks.[1] Bricks are the perfect renewable commodity. There is a world of clay to be baked, and demand does not yet threaten to wipe out the supplies. If brick prices go to high, the average farmer can quickly build a kiln and make them for himself, assuming even moderately acceptable supplies of clay. So, what does the price history of bricks look like? In inflation adjusted pence,[2] adjusted to 1914 pence, the price of bricks from 1283 to 1914 looks quite flat. Technology seems not to have cheapened the real price of bricks.

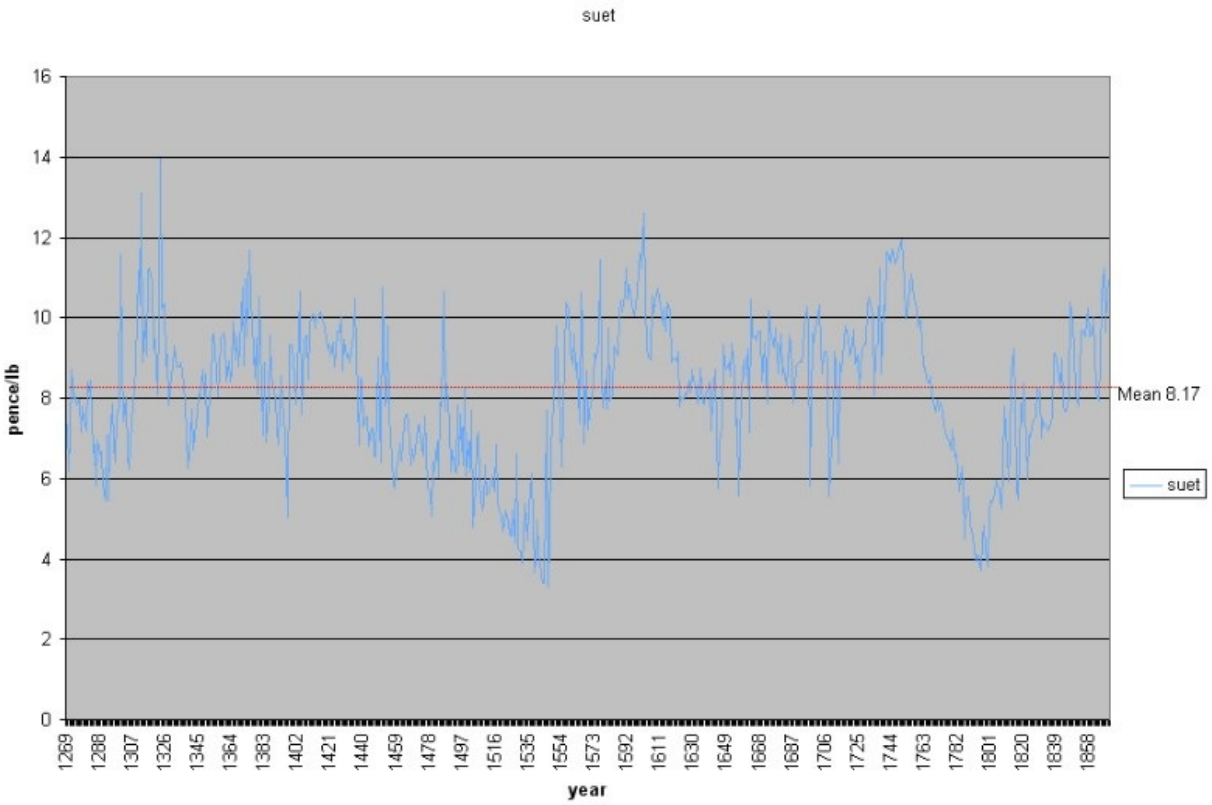


Likewise, Barley prices have remained flat throughout that same time interval. They, too, are renewable.

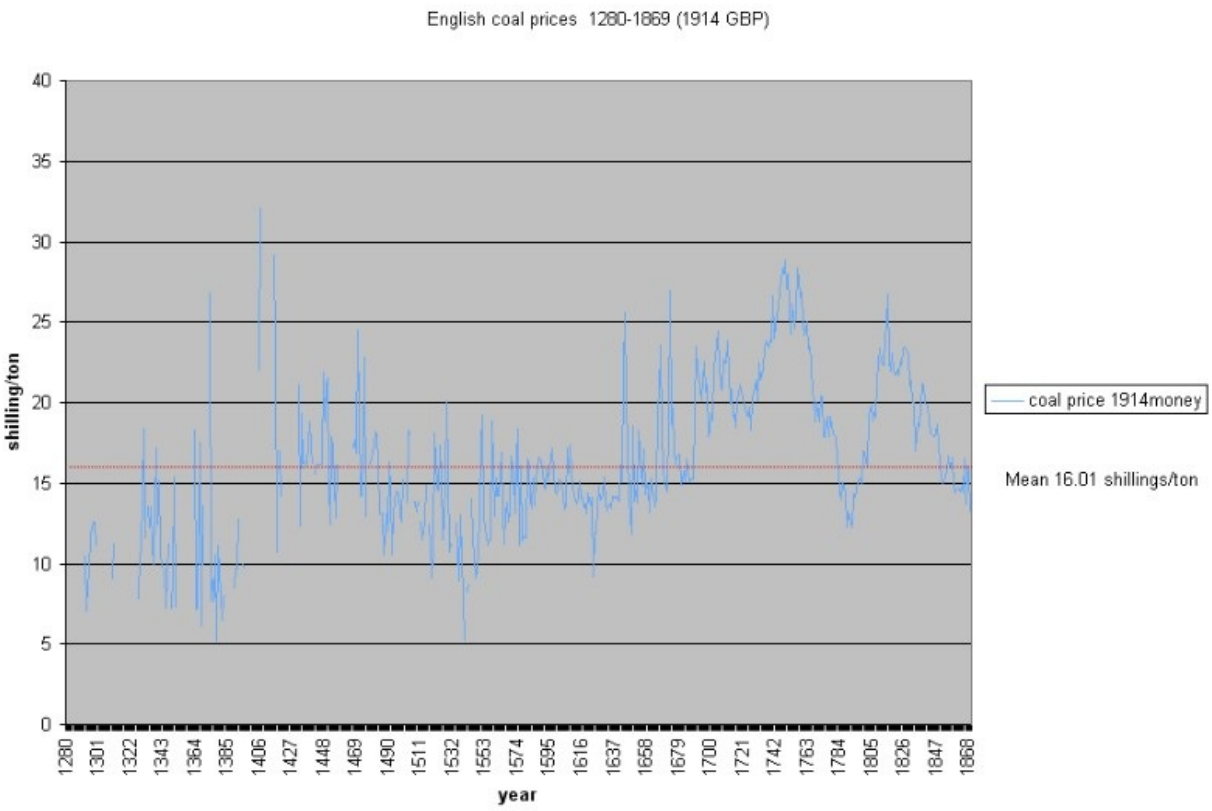


Suet, beef or lamb fat which melts about 21° C, is equally renewable and the inflation adjusted price has remained relatively flat for the 600 years of this data. When the price gets too high,

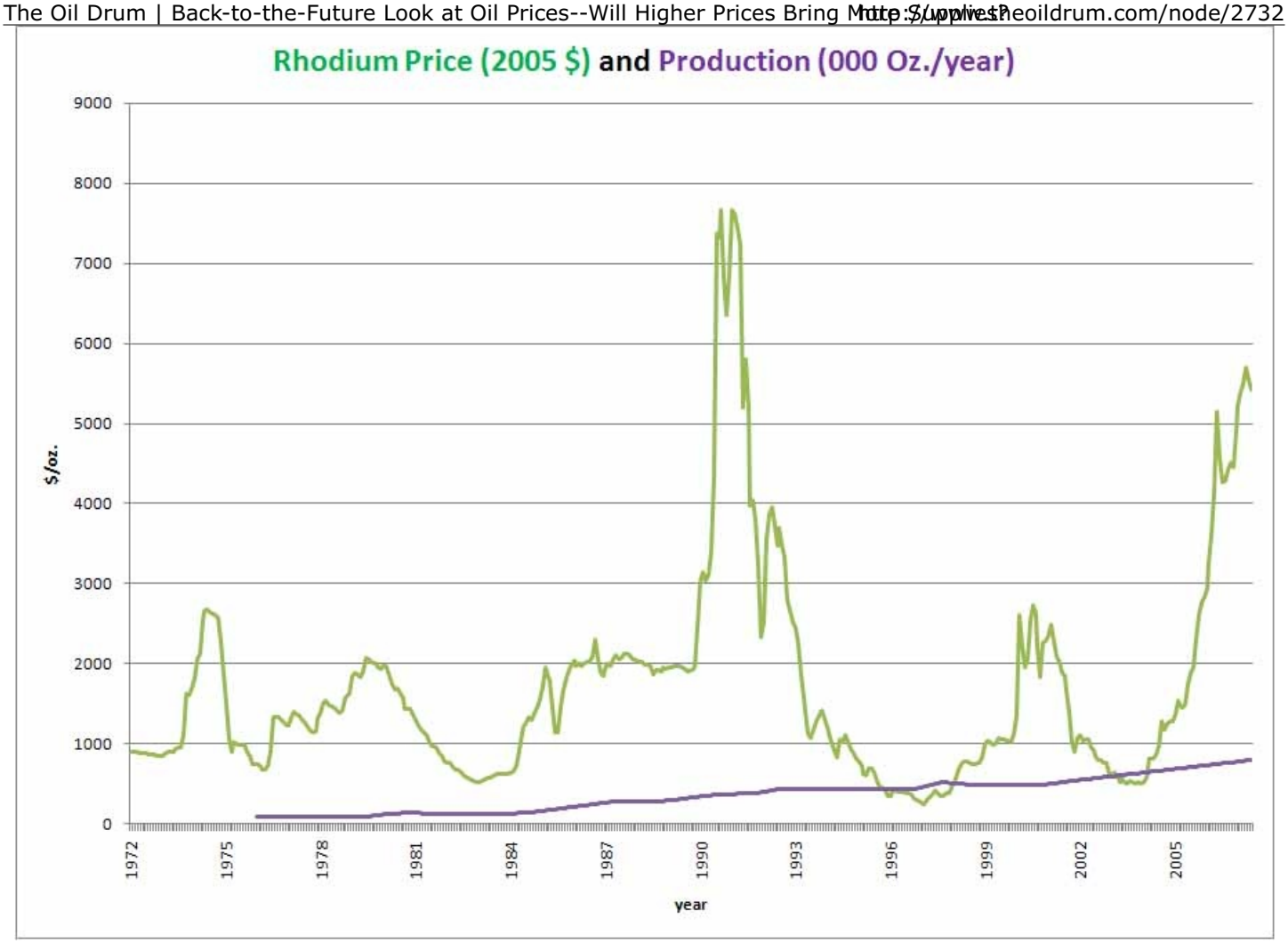
farmers can 'renew' the flocks and herds and produce more suet.



From 1280 until 1869, coal prices remained flat. It is very difficult to find newer historical coal prices without having to pay Platt's large quantities of money.But, early in a non-renewable commodity history, the price can remain flat (and the time frame shown below is certainly early in the production curve).



Looking at this data, one would be tempted to think that the economists are correct. That if the price of oil rises, new supplies will come in to dampen down the price. But what happens when one runs out of a substance? Rhodium is the rarest metal of which commercial quantities are produced. Rhodium is often associated with platinum so if you want to find rhodium, find platinum. South Africa's Merensky Reef formation's sulfide deposits have the richest source of rhodium on earth, 17 parts per billion, compared with 258 parts per billion for platinum.Rhodium is the only known catalyst capable of breaking nitrous oxides into harmless and non-polluting nitrogen. Since there are no primary rhodium deposits on earth, and rhodium is produced solely as a by-product of the mining of platinum and palladium, rhodium can't, in general be profitably mined alone; to be profitable, it also requires the selling of platinum and palladium. Because the laws have mandated the use of catalytic converters there is a demand for rhodium. Automakers, to ensure a continued supply of rhodium, use a platinum, palladium, rhodium system in the converters. This ensures that rhodium will be produced because there will always be a demand for platinum and palladium. Because rhodium must be used in diesel catalytic converters, demand often outstrips the supply. Automakers use about 60% of the production with the chemical, electrical and glass-making industries using about 15%. One interesting difference between oil and rhodium is that in 2001, 40,000 ounces of rhodium were obtained from recycled catalytic converters.



In looking at the chart above, one can see an interesting phenomenon, which will become important for understanding the future price of oil. The high spike in rhodium prices in the early 1990s was not solved by a massive increase in supply. Supplies have been constantly increasing at a very slow rate each year. Price spikes are solved by demand destruction. A presentation May 15th, 2006 spoke about this:

Bill Sandford:

If you look at the numbers in the book, this year we're suggesting another year of deficit for rhodium. So that's on top of last year, which was also a deficit. And the market was already very tight coming into this year. It's a very small market, as you know, a tenth of the size of platinum and palladium, easily distorted. A few years of deficit, some fund buying as well, and it's all become rather spiky. As for the future, well you can bet that all the car companies are looking at the situation and they are pretty much the market for rhodium. Since 1990 when rhodium was $7,000 they've been very careful about the amounts they use. It's a market which they probably find a little bit frightening really. So taking Rhodium out is actually not that easy. NOx legislation is getting tighter and tighter and therefore there will be a need for rhodium. But I think I'd agree with Mike. We've never given a price forecast for rhodium, I don't think this is a good time to start."

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But its fair to say that you haven't seen anything changing on the demand side that would make you think that there would be much less rhodium used in the next 12 months compared to the last 12 months?

Bill Sandford: No.

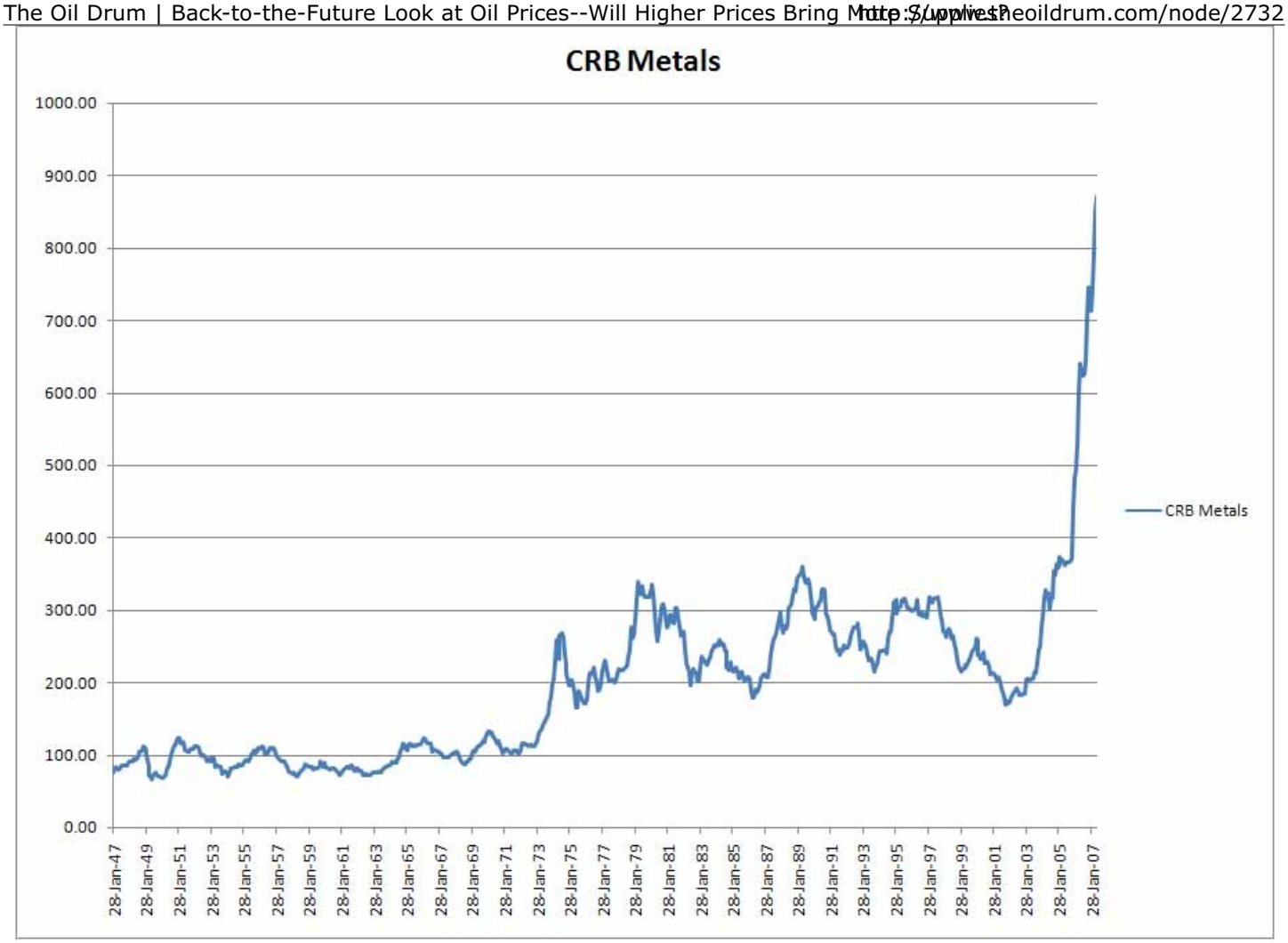
Mike Steel:

Well, I think as Bill says, especially in the auto sector, the use of rhodium in autocatalysts is still critical to their effectiveness and in the total scheme of things it's not such an enormous cost to the auto company. Of course they don't like anything that's a high price, but I think they realize they have to have rhodium to make their catalysts work. Sure in some other sectors, wherever it's possible, people will be looking very hard at the use of rhodium and trying to get it out wherever they can. And one has to say on the other side, in the longer-term, there will be more rhodium coming out of South Africa - if and when Eastern Bushveld operations are successful and when there's more UG2. So it's a question of timing and the problem with the rhodium market, as Bill said, is that it is very thin and therefore relatively small differences between supply and demand can have a disproportionate effect on the price."[3]

What we have with rhodium is a necessary commodity (legally necessary) which is hard to come by. Interestingly, the production has gone up more rapidly than oil. Rhodium production has gone up 66% from 15 million tons per year in the 1976 to 25 million tons in 2007, but the price has gone up almost 600% (in inflation adjusted numbers). World oil production has only increased 40% during the same interval with the price only going up 50% (inflation adjusted), and we whine about the price of oil! The pattern we see is that the price is going up in the face of increasing production. One could argue that increase is not rapid enough to sate the demand and that would be correct, but this is because the supply is very, very inelastic. We also see short-lived superspikes in the price. As with the tulip bulb mania, the spikes are ended because the customers simply won't pay that much for a rhodium. The economic response, as Mike Steel above said, is to try to get out of it wherever they can. During high price spikes, research is aimed at figuring out how to get by on less of the expensive material.

The interesting thing about the rhodium price curve is it's spikiness. This is reminiscent of the early days of oil, when, because of the rarity and low productivity of the early wells (<50 bbl/d) any new demand or new supply could wildly gyrate the price. The price for rhodium appears flat, but how early is it in its production history? And what is the impact of its dependence upon platinum for 'survival', given that it is merely a by-product? However, the rhodium curve does not have the same appearance as seen in suet, bricks, and barley. While one might argue that the inflation adjusted value is flat, it isn't flat in the same way as barley and other renewables.

So, what about a basket of non-renewable commodities--the precious metal index? There is a perfect index which shows that a basket of metals, which are non-renewable, are not behaving the same as the renewables shown above. The CRB index Metals sub index is shown below. One can see three periods; a step-function from pre-1973 to post 1973 and another step function beginning in 2003. Clearly something is very different is happening.



A recent New Scientist article, and a book written in the early 1970s may explain what is happening. Some readers will be old enough to remember the Club of Rome's Limits to Growth book in the early1970s. The book was about civilization running out of various resources. When the oil prices took off in the early 1970s, the Press, with its usual inability to get things right, concluded that the Club was correct and we were running out of resources.

But, as Matt Simmons pointed out, the Club wasn't talking about the 1970s, they were talking about the early part of this century. A few weeks ago I got my New Scientist magazine, and it contained an article on rare earth metals and the reserves vs current usage. Apparently the metals sector is having as much trouble finding new reserves as is the oil industry. Here is what the article says in one of the charts:

"If Demand Grows...
"Some key resources will be exhausted more quickly if predicted new technologies appear and the population grows

Antimony 15-20 years Silver 15-20 years
Hafnium ~10 years Tantalum 20-30 years
Indium 5-10 years Uranium 30-40 years
Platinum 15 years Zinc 20-30 years."[4]

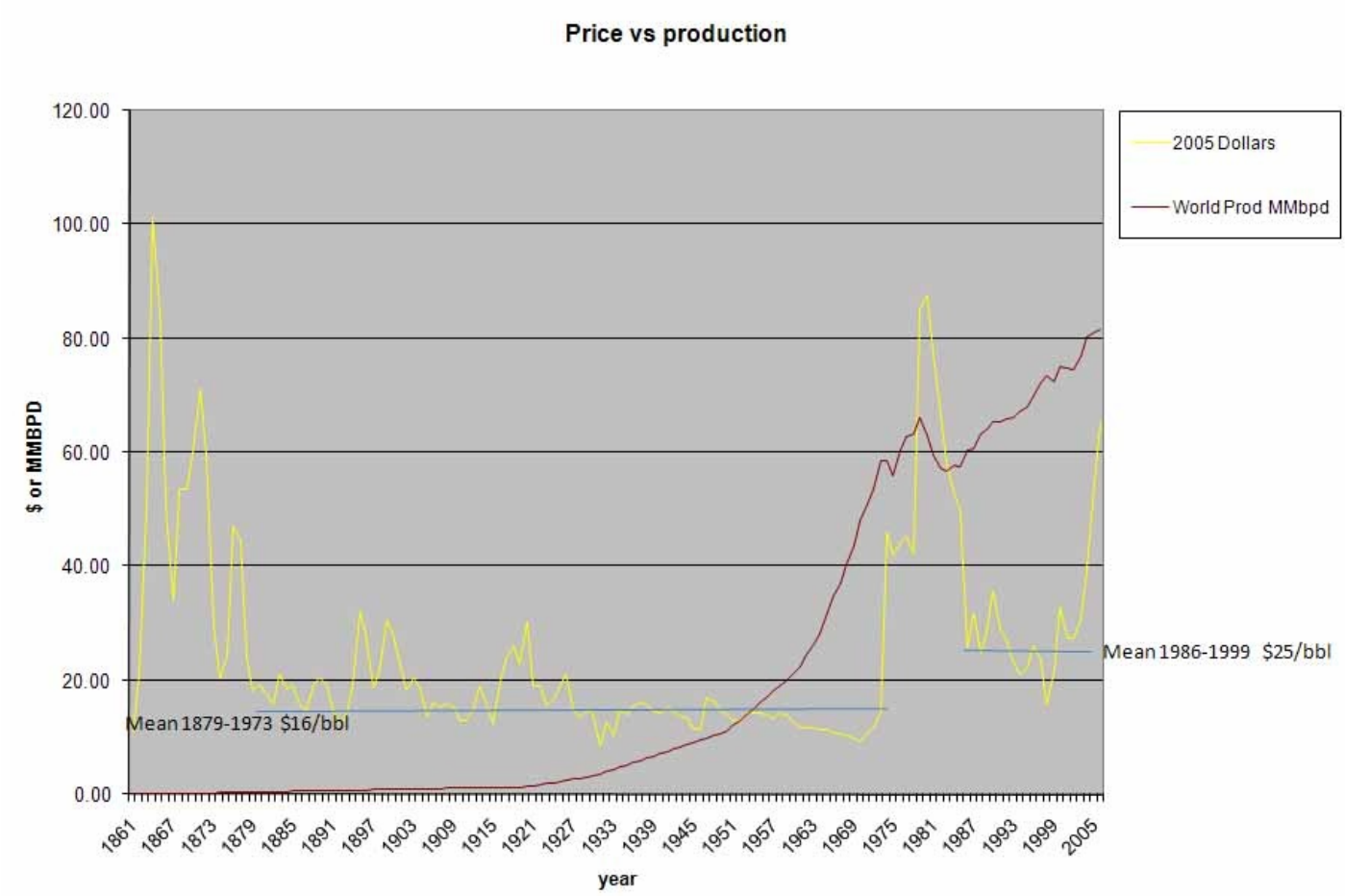
Cohen further notes:

"Take the metal gallium, which along with indium is used to make indium gallium arsenide. This is the semiconducting material at the heart of a new generation of solar cells that promise to be up to twice as efficient as conventinal designs. Reserves of both metals are disputed, but in a recent report Rene Kleljn, a chemist at Leiden University in the Netherlands, concludes that current reserves 'would not allow a substantial contribution of these cells' to the future supply of solar electricity. He estimates gallium and indium will probably contribute to less than 1

percent of all future solar cells--a limitation imposed purely by a lack of raw material."[5]

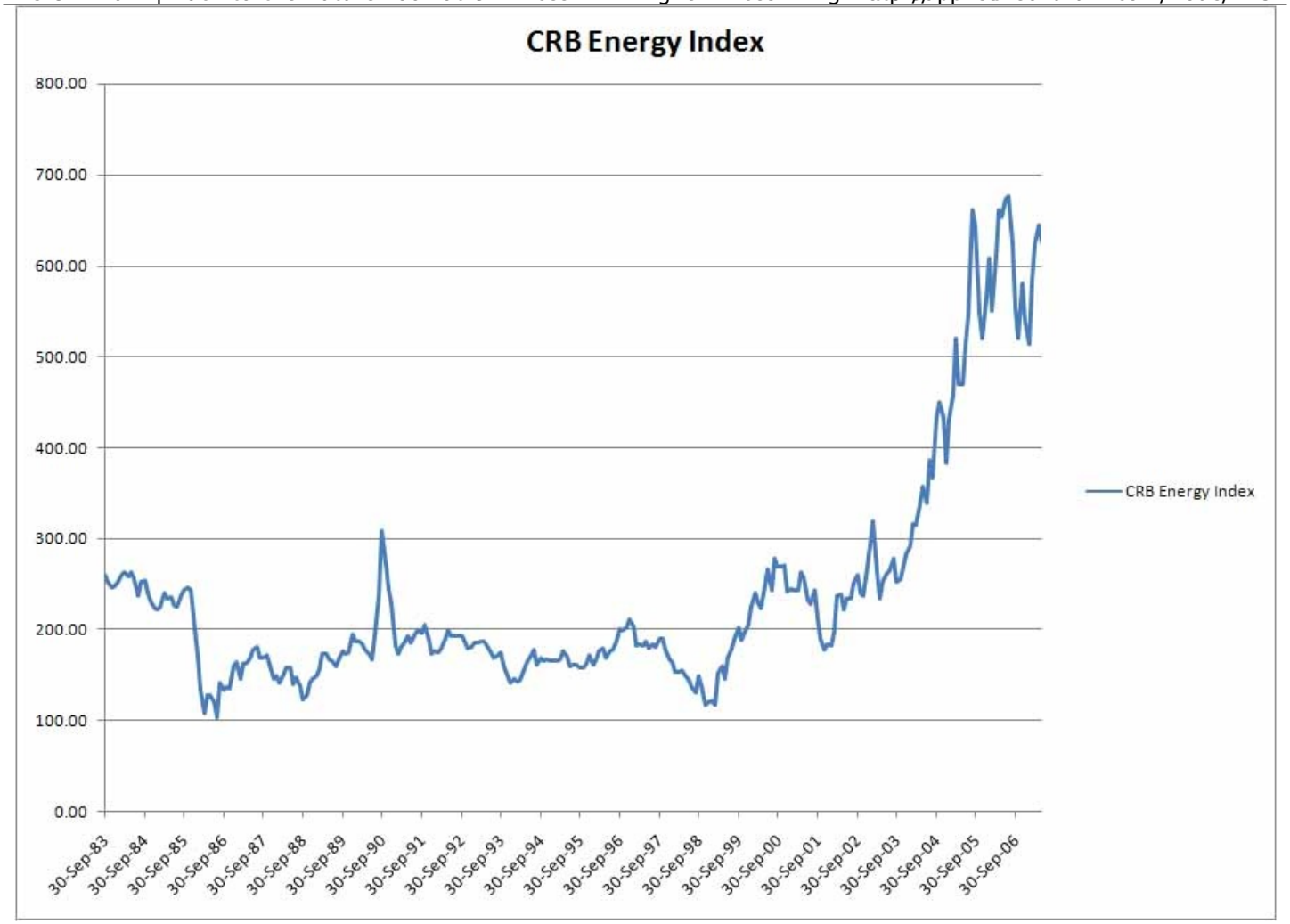
It is clear that the historical view of economists, that high prices will bring new supplies and thus drive down costs, may not be efficacious in the case of non-renewable commodities.

Now, let's go back and look at oil. Above, I showed the chart, used by the economist Drucker to convince my vice presidents that oil prices would always be flat. But let's look at what happened, in inflation-adjusted dollars since that time. The collapse in the price of oil was caused by the development of the big North Sea fields, which, by 1982, had brought to the market 2.6 million barrels per day which hadn't been there in 1975. The collapse of the prices in the 1980's was caused by new supply. But today is very different. We are increasing supply, and the price is rising, indicating that world demand is driving this round of price increases. Oil, like rhodium, is now a demand driven market. Unlike rhodium,oil can't be recycled from old gas tanks. The oil price curve seems to be a mixture of the rhodium spiky curve AND the CRB step-function curve.



The interesting thing to notice was that even with the collapse of prices in the mid 1980's, the mean price for oil, in inflation adjusted dollars, didn't return to its historic value of $16/bbl. It formed a new, higher price floor of $25/bbl, which, I believe, reflects the demand.This new floor is reminiscent of the new floor seen in the CRB index. One would be hard pressed to claim that OPEC had the ability to control the prices in the late 1980s. This chart, along with that of the CRB index, raises a serious question about the faith of the economist who believes that inflation-adjusted prices should be flat over time. Does this actually apply to a non-renewable resource like rhodium or oil, or coal? Does it only apply early in the history of the logistics curve? In the case of oil and rhodium, we have rising production AND rising prices, both on a short term and long term basis.

Another case is the CRB Energy Index. It shows a step-function, but it isn't behaving as a renewable commodity.



These last few charts are showing behavior which is unexpected based upon the inflation adjusted, commodity flat price theory. So, what will the future prices look like? Let's go backwards to the future.

In physics, one learns that the laws of physics are time-reversible. For example, if you want to know where that cannonball came from, if you know it's velocity and direction, you can reverse the direction of time and find out where it came from. Similarly, you can fire a cannonball in the opposite direction at the same speed and you should whack the other guy's artillery.Some physicists believe that the expansion of the universe will one day reverse and the universe will shrink down to cause a Big Crunch. To study this they simply time reverse the equations governing the expansion. This may work with the price of oil as well.

Under this assumption, let's reverse time in the above chart and take a back-to-the-future look at the price history. The only time we know of in which oil was quite rare is the period between 1861 and 1879. Maybe we can learn our future by looking backwards and reversing time.

As one goes from 1969 back towards 1861, one sees a generally rising price. One also sees price spikes increasing in amplitude as one goes further back. Here is a list of the price spikes going backwards toward ever decreasing production

year	peak	previous low	percentage drop
1926	$20.90	$12.40	41%
1920	$30.15	$12.83	57%
1899	$30.36	$18.60	39%
1895	$32.02	$12.21	62%
1876	$47.13	$20.29	57%
1871	$71.05	$33.79	52%

1864	$101.12	$10.70	89%

As one goes into a period of very short supply, one should expect that as with rhodium, people will try to avoid using oil. To paraphrase what was said of rhodium, people would be "*trying to get it(oil) out wherever they can.*" Getting out of it wherever we can will take many forms and will cause the price drops seen in the 'back-to-the-future' interpretation of the oil price history.

This coming aversion to oil will take many forms. Probably the quickest reaction will once again be the purchasing of fuel-efficient vehicles. But that can only reduce demand so much. At some point, where possible, people will telecommute. This is not a popular option with most bosses. Eventually it will take off, but today, I simply don't believe the numbers I see. This from a UK news article:

"By the same token, the US Department of Energy projects the number of telecommuters will reach 29.1 million by 2010, thus accounting for 27.4 per cent of the US workforce. This translates into a projected savings of 300 million litres of fuel worth more than $100 million." http://web20.telecomtv.com/pages/?newsid=41257&id=e9381817-0593-417a-8639-c4c53e2a2a10&view=news

This is nearly unbelievable, because this should be reflected in a drop in gasoline usage--something recent history (not to mention prices) has shown to be false. Of all my friends, I only know of one true telecommuter--my youngest son. He is a software programmer--a darn good one, but he works from his apartment. He tells me that some of the apartment residents are suspicious of this guy who stays home all day and doesn't go to 'work'. He loves the 'commute', down the hall to his table in a little cubby set up for work. If even 10% of the workforce were telecommuting, he would not be getting the reactions he gets.

This article defines a telecommuter as someone who works at home at least some time during the week. It says there are 32 million telecommuters in the nation. By that definition, when I was Exploration Director for China, I was a 'telecommuter', but I saved no fuel.Everyday I drove to work, buring up energy as I went. I arose at 5am, and was checking my email from home at 5:30am. I then drove to the office at 6:30 am, returning by 6pm. After a brief dinner, I would be once again doing email from home until 10:30 at night. I was a 'telecommuter'. Such silly definitions of telecommuting illustrate how hard it is to get real data on the number of people who really do work at home. However, this major re-structuring of the US workplace will happen when oil prices get too high (no predictions on what price that is), but it will cause one of the deep drops in oil price when it happens. Unfortunately, it may occur so late in the game that the drop in price will not last any longer than those gyrations seen between 1861 and 1879, when the oil price stabilized (relatively speaking).

This article should guide us a bit in what we should expect in the future. We have already seen a relatively short-lived gyration in the price of oil. In July 2006, the price of oil was reached a record of $79/bbl. Then by the end of September, 2006, the price had plummeted to $58/bbl and it continued to decline until the late January 2007 price of $51.11/bbl was reached on Jan.22, 2007. From there it has risen again to above $68/bbl by the time of this writing in late June 2007. This was an extremely short-lived drop in price, by 1990's standards. It says something about the strength of the demand which is driving the price rise in the last few years, but it also says something about the inability of the oil industry to bring large new production quantities online. Rhodium is an element we could live without, if we had to without seriously altering our current lifestyles. Lack of petroleum would seriously crimp our standard of living. The question is, are we about to go back-to-the-future?

References.

1. The data for this and the following analyses comes from http://gpih.ucdavis.edu/files/Englang_1209-1914_(Clark).xls

2. adjusted for inflation by http://measuringworth.com/calculators/ppoweruk/

3. http://www.platinum.matthey.com/uploaded_files/Pt%202006/Pt%202006%20Q&A%20transcript.pdf

4. David Cohen, Earth Audit," New Scientist May 26, 2007, p. 38

5. David Cohen, Earth Audit," New Scientist May 26, 2007, p.35

charges are made.

From http://home.entouch.net/dmd/oilecon.htm