A Nice Counterexample
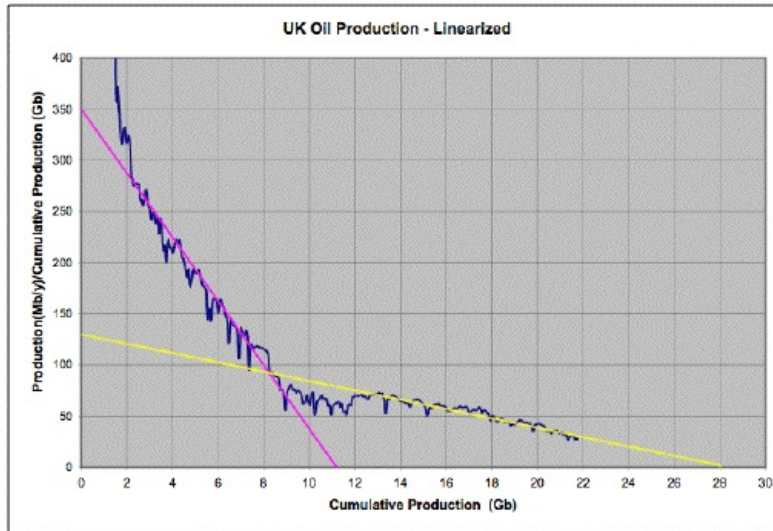
Posted by Stuart Staniford on October 1, 2005 - 1:21am
Topic: Supply/Production
Tags: hubbert peak, oil prices, peak oil, uk oil [list all tags]

Nick Rouse kindly provided me with an Excel spreadsheet with a Hubbert linearization of UK oil production (the only thing I added was the yellow line). As you can see, there was a long period when the curve looked linear and yet it would have totally misled you had you simply extrapolated it to the axis. You would have thought there was going to be about 11gb, but now it's headed for 28gb. So, things are more complex, and we must see if we can come up with some principle for dividing the Romanias (where this method seems to have worked with amazing success), from the UKs (where it would have been very misleading) before we can feel any confidence in our extrapolation of the Saudi graph or the world graph. More below the fold.


This is intriguing - generally the UK is the poster child for the scariness of peak oil because it has had such high depletion rates recently. But just when we were getting used to it as a reliable method of scaring disobedient children into compliance, here it is messing up our nice simple-minded Hubbert theory. The basic problem becomes quickly clear when we look at the production versus time curve here:
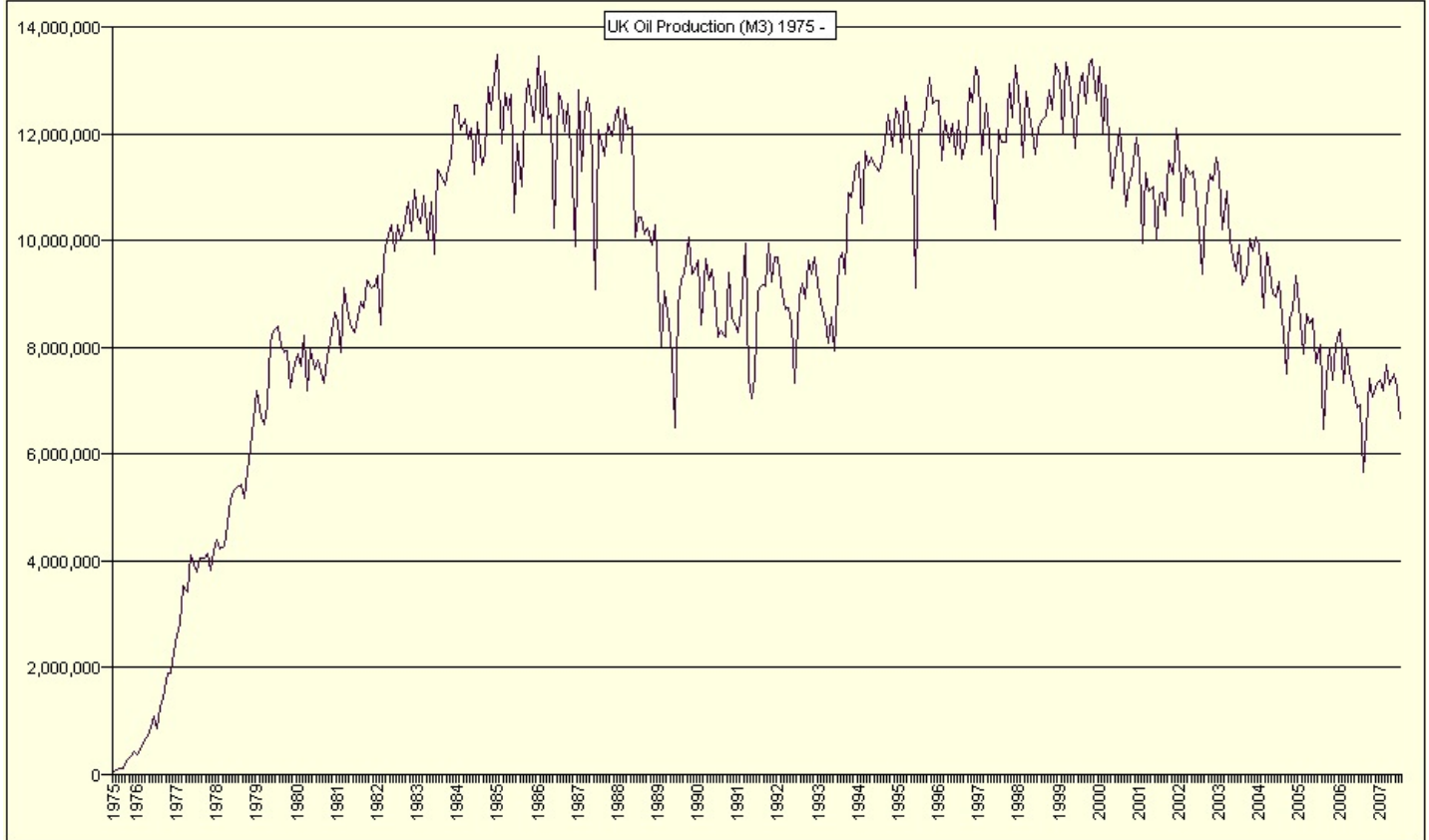
This is underlined referenced from here. Clearly, production initially looks like a nice Hubbertian single peak, but then, whoops, a bunch more oil from somewhere is produced. And the initial (pink) straight line above only knows about the first peak, so when we get this second, superimposed peak it is not accounted for. However, we do go linear again, just with a different (yellow) line going to a much higher URR (28gb versus 11gb).

Clearly, we are likely to run into the same general kind of problem with Russian production, where James Williams shows:

Crude Oil and Condensate Production
Russia & USSR

January 1990 - May 2007

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— USSR — Russia
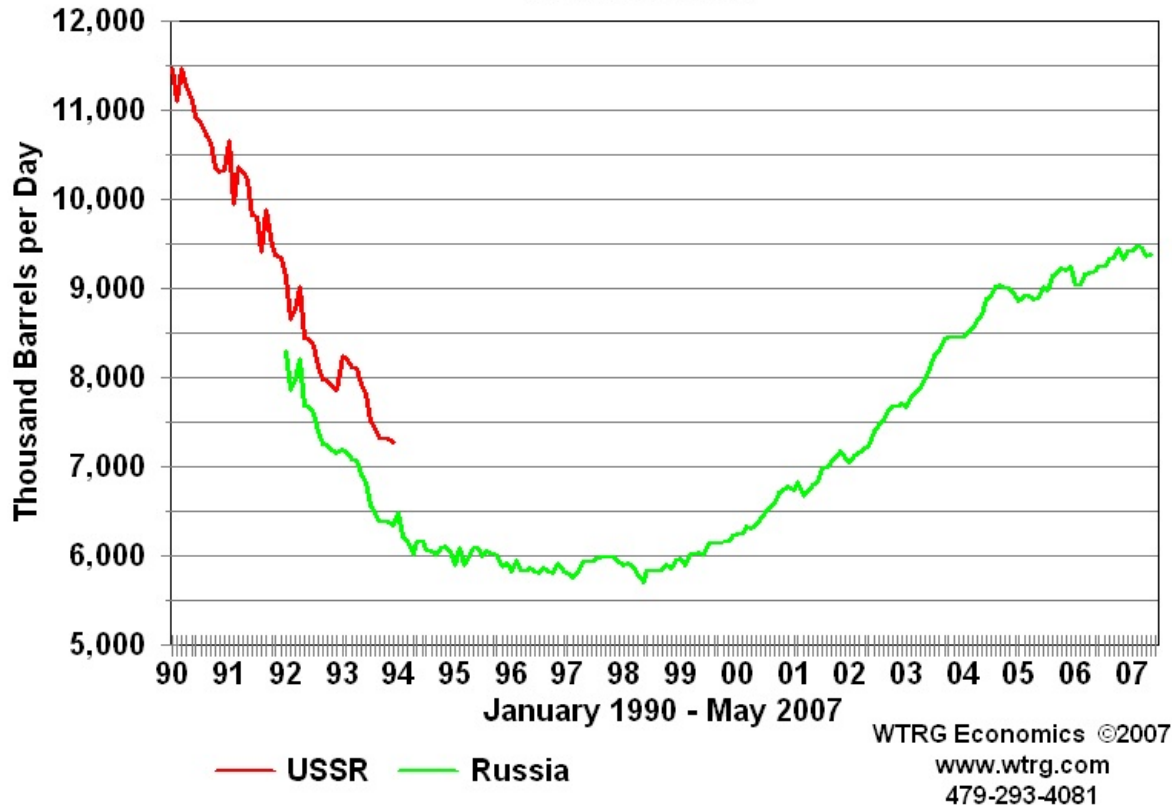
So now we need to know why did production not follow the same kind of general pattern that has worked so well for Texas, the US, or Romania? In the Russian case, it's reasonably clear what happened: society collapsed. Douglas Reynolds has argued, fairly plausibly, that the collapse was caused by the beginning of depletion in Russian oil production, but even if so, the decline would certainly have been greatly exacerbated by the resulting societal collapse. A lot of industry ground to a total halt, GDP was halved, life expectancy was sharply reduced, and the population declined. The subsequent partial recovery in production just goes to show that a societal collapse can actually cause oil production to drop even faster than geology alone dictates. At least, this is clearly so for communist economies: whether the lesson extends to capitalist economies could probably be (fiercely) argued both ways.

In the UK case, economists will quickly be tempted by the idea that oil prices had something to do with it, since the second peak starts to go up again in 1993, a couple of years after the price spikes of the first gulf war. However, it's pretty clear that price does not cause too much deviation from the basic Hubbert model in the US or Romanian case, so we would be left trying to explain why price matters greatly in some places but not in others (especially challenging in the US, center of the free market religion). So this explanation doesn't seem too tempting to me (price seems to explain some of the noise about the basic Hubbert curve, but not the gross features of the shape of the curve).

Nick notes that Jean Laharrere has considered the possibility of discovery as an explanation. Here's Laharrere's figure plotting UK backdated discovery and production:
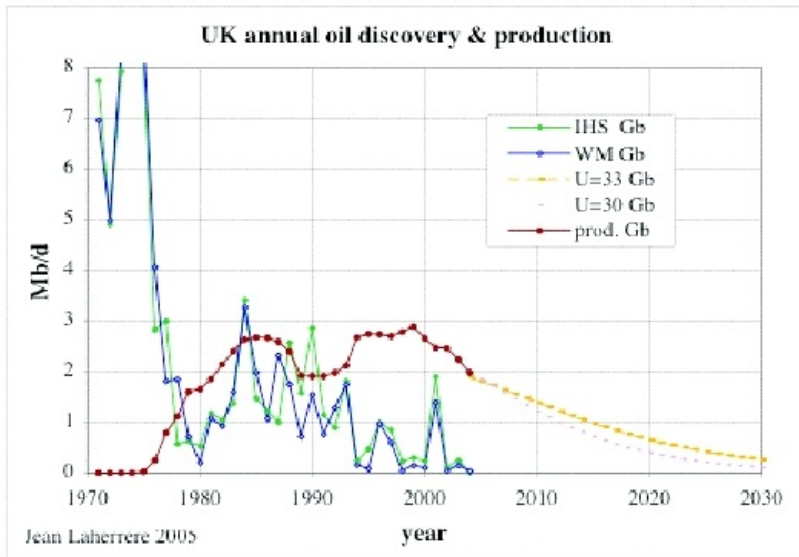
Clearly, we can see that this bimodal discovery curve looks like a good explanation of the bimodal peak in production. A lot of discovery initially occurs in the late sixties and seventies, and this powers production in the late seventies and eighties. But there's a second wave of discovery beginning after 1980, and this powers the second peak. There's not much of a third wave of discovery, so there seems limited prospect for much relief in UK depletion rates soon.

It's interesting to contrast the situation with that in the US. Laharrere again:
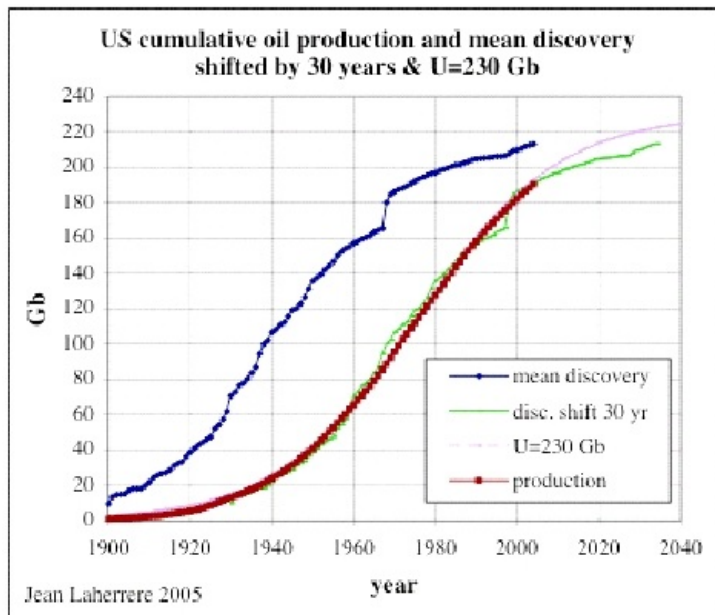
This time we have cumulative production plotted versus time. Pretty clearly, the nice sigmoidal logistic discovery gives a sigmoidal production curve 30 year later. What's different in the North Sea is that production comes on stream much faster - production is following discovery by only a decade or so, rather than three decades. Clearly the world was in rather a hurry to get that oil by this point in history (after the oil shocks of the seventies).

So, here's a new tentative working hypothesis:

> Hubbert linearization is a decent approximate model for oil production unless production
> is interrupted by a societal collapse, or production is very closely following on the tails of
> a very noisy discovery curve.

Clearly, further investigation is needed to support or refute this working hypothesis. In particular, if anyone knows or discovers other countries where linearization works well, or where it fails for different reasons, I'd love to hear about it. Hopefully our resident sceptics will go do

some work and come up with some more evidence. But my final thought for tonight is just to look again at the Saudi situation.

Now the discovery picture there is somewhat unclear since we have wildly conflicting information about what their reserves really are. But Laharrere plots a variety of opinions:
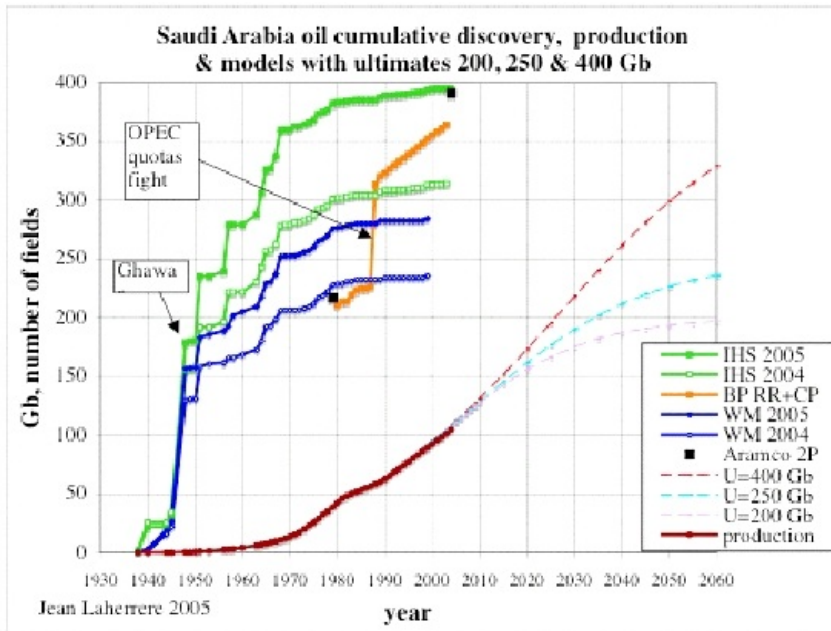
Everyone agrees that all the discovery happened a long time ago - 90% of it was before 1970, and two thirds of it was before 1960. So it seems to me that our tentative hypothesis would suggest that linearization should work decently for Saudi Arabia (unless they were to collapse - never to be ruled out in the Middle East). The implications of linearization being pretty much true for Saudi Arabia again:
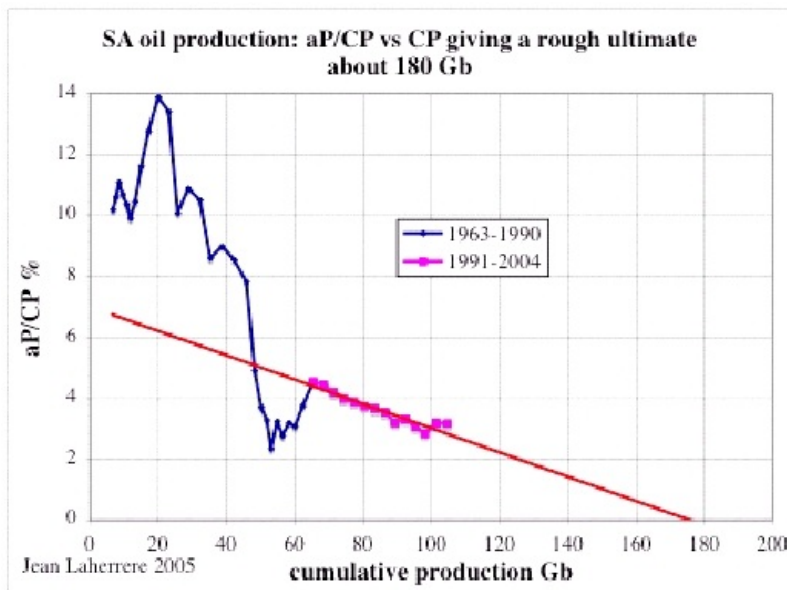
180gb of URR with 110gb produced already!