



## The Iranian Oil Weapon

Posted by [Stuart Staniford](#) on January 16, 2006 - 1:05pm

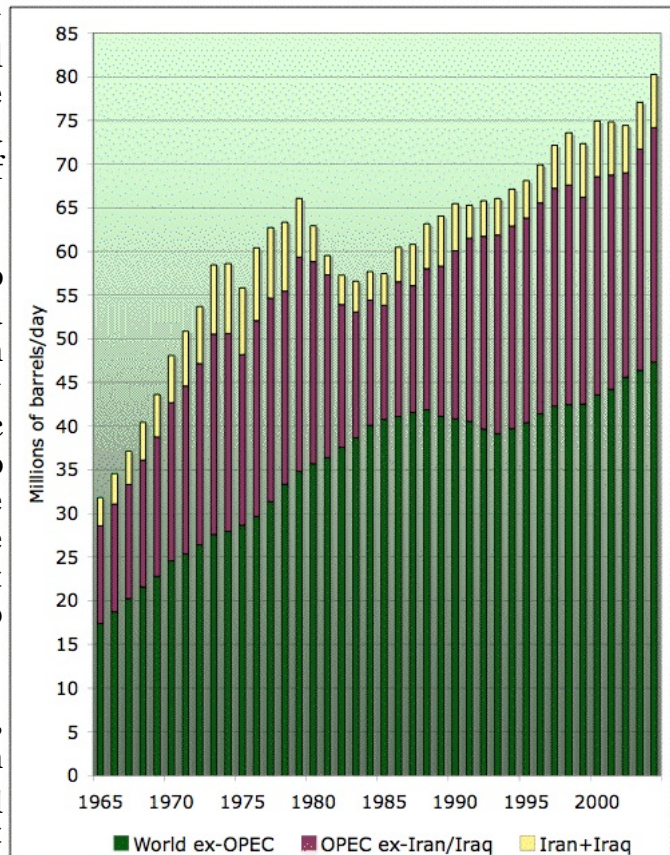
Topic: [Economics/Finance](#)

Tags: [hubbert peak](#), [iran](#), [iraq](#), [oil prices](#), [oil shock](#), [peak oil](#) [[list all tags](#)]

I'd like to take a more careful look at exactly what kind of oil weapon President Ahmadinejad is packing. In particular, let's go over the seventies oil shocks and use them to fashion a rough guesstimate of the likely impact of a cutoff in Iranian oil supplies now.

To give you the punchline up front, I'm going to argue that, with large (50%) uncertainties, a complete loss of Iranian production for an extended period might be expected to roughly double oil prices and cause massive economic impacts, while a halving of oil production due to sanctions, or retaliation to sanctions, might be expected to produce a 30-40% increase in price and significant economic impacts. If Iran is left alone, prices are quite likely to drift up somewhat anyway, but not by this much.

To help you get an overall feel for the history, the graph at right shows world oil production broken out into non-OPEC, OPEC excluding Iraq and Iran, and Iraq and Iran together (the last two having been big factors in many of the oil supply problems in recent decades). The graph runs from 1965 through 2004. The source of the data is the [BP Statistical Review of World Energy](#). You can click the picture to get a more readable version in a separate window.



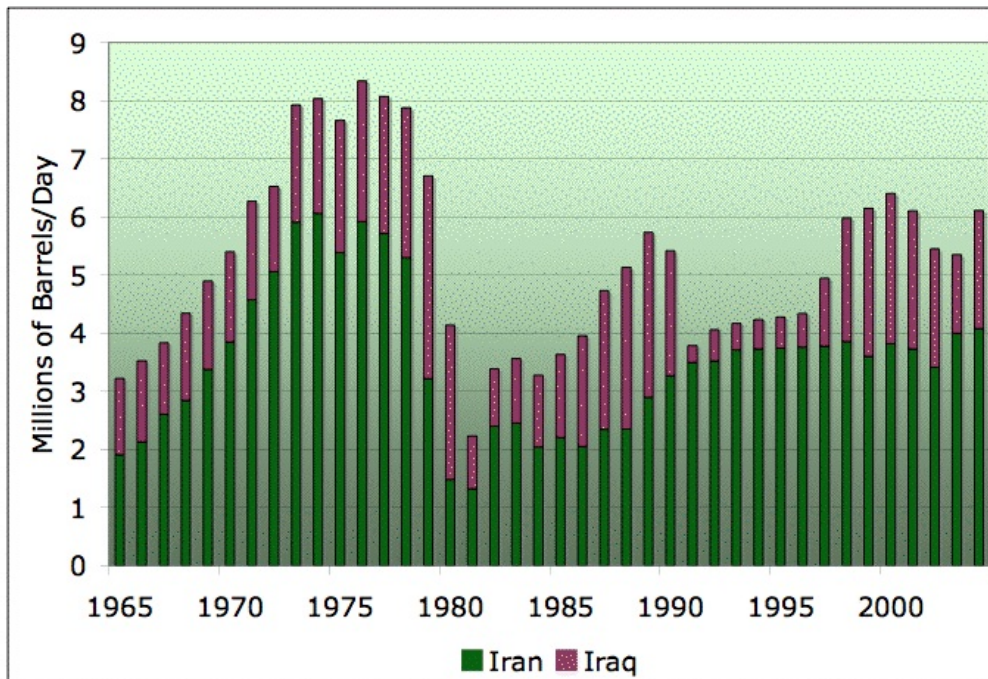
You can see in the data three oil shocks (or four, depending how you count):

- The [Arab Oil Embargo](#), which started on October 17th 1973, and ran through March 17th 1974.
- The effects of the [Iranian revolution](#) of 1979, and the [Iraq-Iran war](#) which began in September 1980. Sometimes these are viewed as separate oil shocks, but the effects are hard to disentangle.
- The [Gulf War](#) which began with the Iraqi invasion of Kuwait in August 1990.

Of these, if we measure by impacts on production and consumption, the events of 79-80 had by far the greatest effect, while the 1990-1991 Gulf War had the least. You can see the oil embargo

causing a sudden cessation in growth in oil production (which had been very rapid), and then even a little notch down in 1975. The 79-80 events cause a major multi-year drop in oil consumption and production (although as we'll see, this was due to a smaller relative price change than the Arab embargo caused). The 1990-91 events show up as just the tiniest production reduction. (Later notches in the production curve are caused by demand side events - the 1998 Asian flu, and the 2000-2001 tech stock crash.)

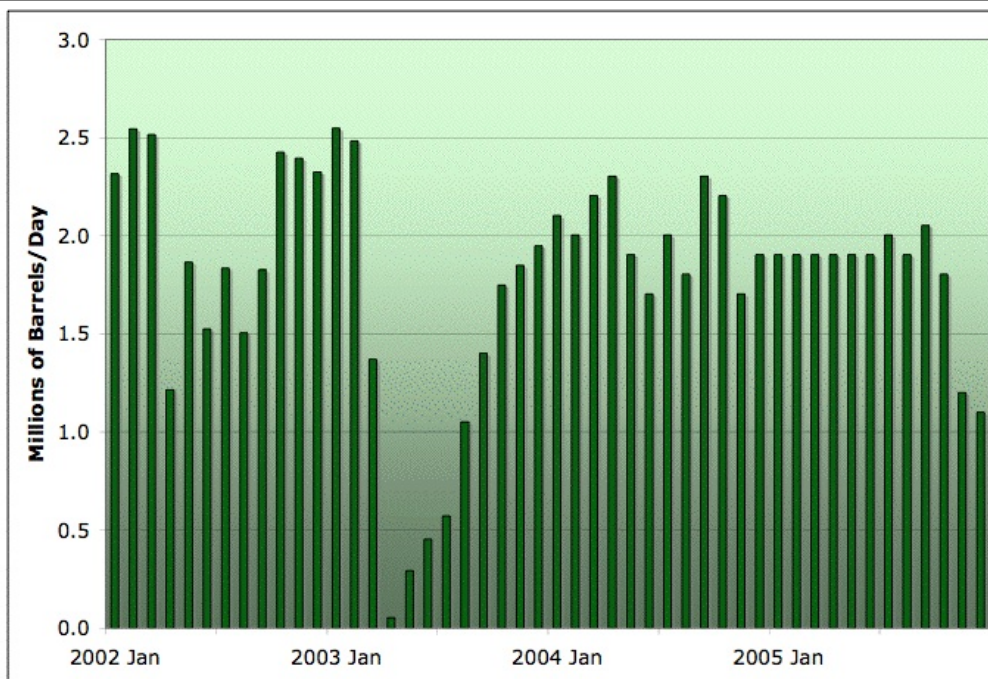
Let's now focus in for a moment on the oil production of Iraq and Iran specifically:



*Annual oil production from Iraq and Iran 1965-2004. Source: [BP Statistical Review of World Energy](#). [Click to enlarge](#).*

You can see that during 1974, while Iraq reduced production in line with their Arab brethren, Iran, under the Shah, kept right on growing production. In 1979, with the revolution, Iranian production starts to drop, but is partially offset by increased Iraqi production. However, in 1980 both have dropped to about half the 1978 level, and by 1981 we are down to a little over two million barrels/day between the two parties to the conflict - versus around 8 million barrels/day in the years 1973-1978. Production has never reached that peak level again. Iranian production slowly recovered through the eighties and early nineties to reach a level of about four million barrels/day in recent years. Iraqi production also increased during the eighties, but then fell to very little following the Gulf War. With the advent of the [Oil for Food program](#) in 1996, Iraqi production began to increase, until the most recent war began in 2003.

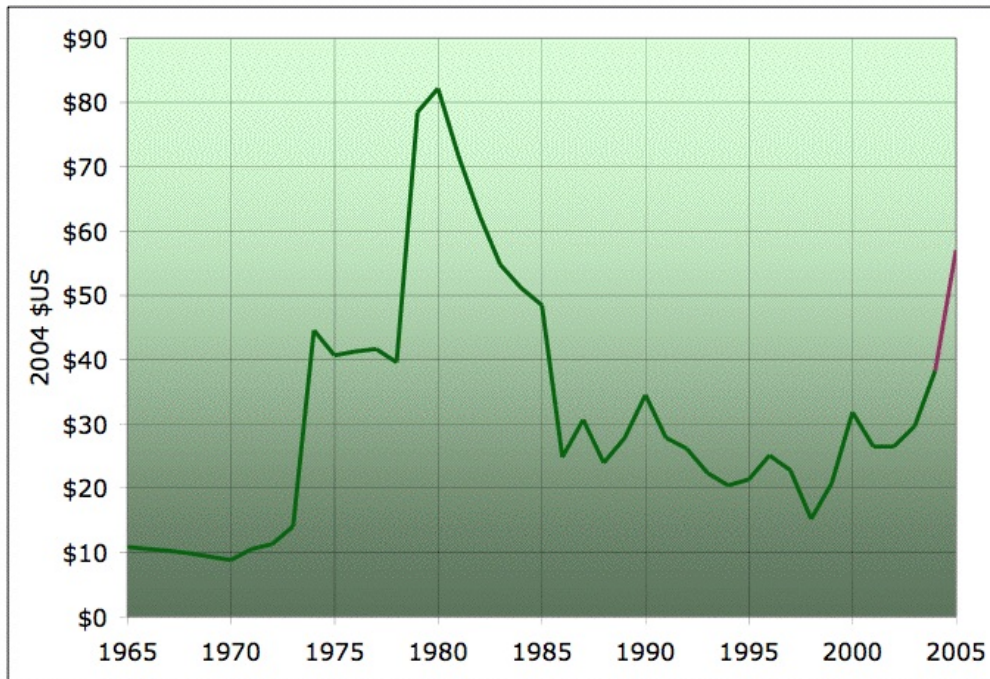
It's worth taking a closer look at that as a case study on the effects of an invasion/insurgency on oil production:



Monthly oil production by Iraq since January 2002. The [US/British invasion](#) began on March 20th, 2003. Source: [Energy Information Agency](#). November and December 2005 are estimates from news reports. [Click to enlarge](#).

As you can see, production takes a dive with the [March invasion](#) and reached a nadir of almost nothing in April. From there, it slowly comes back over the course of the next six-ninth months, and then is choppy since. It has never reached the January 2003 level again, and was particularly bad at the end of 2005. This is despite the fact that Iraq has [enormous undeveloped reserves](#), which the country has never brought into production due to ongoing political instability. Clearly the recent invasion has not improved that situation, but rather made it worse, at least on the evidence to date.

We now turn to looking at the effects of the oil shocks on price. The next figure shows average annual price of light sweet crude over time in 2004 \$US (note that prices on any given day can differ quite a bit up or down from the average price over the year).

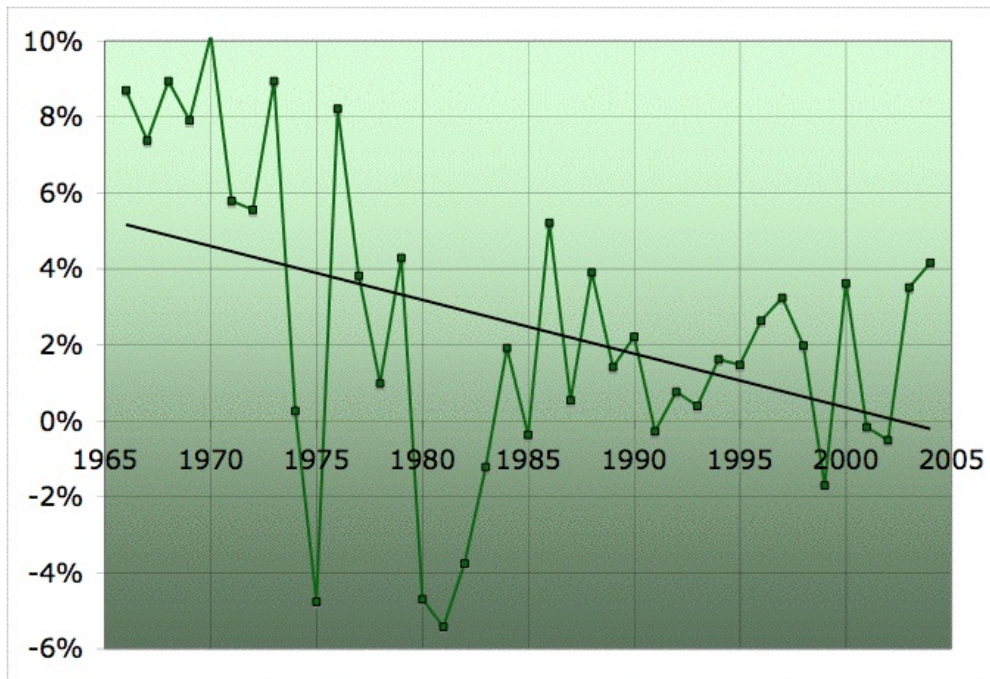


*Average price for light sweet crude during each year 1965-2004. Expressed in 2004 US dollars.  
Source: [BP Statistical Review of World Energy](#). Click to enlarge.*

As you can see, the shocks had a dramatic effect. The 73-74 shock caused prices to roughly quadruple from \$10 to \$40, where it then stayed. In 1979, prices doubled again. What we now need to do is get a more quantitative sense of how much production changed in order to produce those price changes. That should help us to estimate how bad an Iranian oil shock would be now.

Economists like to look at the relationship of price to the quantity demanded through the lens of a concept called the elasticity. The idea is that if the price changes by X%, and then we find people using Y% less, then the elasticity is  $-Y/X$ . The minus sign captures the inverse relationship - when price goes up - a positive change in price - we use less, a negative change in quantity. For very essential commodities such as oil, the elasticity is very small (it takes a lot of X to get a small amount of Y, so the ratio Y/X is small). Inessential or easily substitutable goods can have a much larger elasticity.

In general, the idea that there is a fixed number, the elasticity, that controls the response of price and quantity should only be viewed as a very rough approximation. One thing that makes it better however, is to take account of the fact that oil usage tends to respond to changes in the size of the economy much more strongly than changes in the price (in econo-speak, the income elasticity is much larger than the price elasticity). So it makes more sense to look at how much the quantity used changed in response to price, *relative to how much it would have changed otherwise*. To do this, the next graph is helpful. It shows the percentage change from one year to the next in how much oil is used worldwide (ie the percentage changes in the production graph up top).



*Year-on-year percentage change in global oil production. Source: [BP Statistical Review of World Energy](#). Click to enlarge.*

As you can see, in the late sixties and early seventies, oil production grew at roughly 8% a year (give or take a percentage point). So when the shock hit (it shows up in the 1974 point, which has a 0% growth over 1973) it causes about an 8% reduction relative to that expected. So, a 300% change in price is associated with an 8% change in production.  $-8/300 = -0.027$  - let's call it  $-0.03$ . That's pretty inelastic, all right. However, these shocks seem to cause long-lasting changes in the growth of supply and demand. In the late seventies, production growth was only running at 4% give or take. So when in 1980, it takes a dive to -4%, that is also an 8% change. However, this was associated with only a 100% change in price:  $-8/100 = -0.08$ . You can see this elasticity concept is a bit fuzzy as different shocks give different answers.

After that, there again seems to be a fairly permanent change in the nature of oil demand. It runs negative for several years (as [major efforts were made](#) to make the economy more oil efficient). And when it does start growing again in the late 1980s, it now only runs around 2% a year growth. So when the 1990 invasion of Kuwait comes, it only causes a 2% change in production (from 2% growth to zero). So that's elasticity of  $-2/15$  or  $-0.13$ .

So which is it  $-0.03$ ,  $-0.08$ , or  $-0.13$ ? Part of the pattern seems to be that the more severe the shock, the more inelastic demand appears to be in response. People are somewhat able to make modest changes in their oil usage, but find it very difficult to make sudden radical changes. It may also be that the absolute price matters as well as the relative change - when prices are lower, it takes a larger relative change to get a response. (As an aside, the straight line in the growth rate graph is a fit to the data, and the fact that it has just crossed the x-axis - zero percent growth - is one of the pieces of evidence for a near-term peaking in oil production).

Now in recent years, oil production growth has been volatile with economic swings, but the trend over the last decade is running at around 3% annually. However, in 2005, we seem to have started to run into significant difficulty expanding production much further (which has pushed prices up). Forecasts vary from people who think 2006 is unlikely to grow any over 2005 (near-term peak) to more optimistic forecasts of 2% growth or so. Let's take an intermediate case, and

assume that the rest of production grows by 1% (about 0.8mbpd), and then consider Iranian possibilities in the background of that.

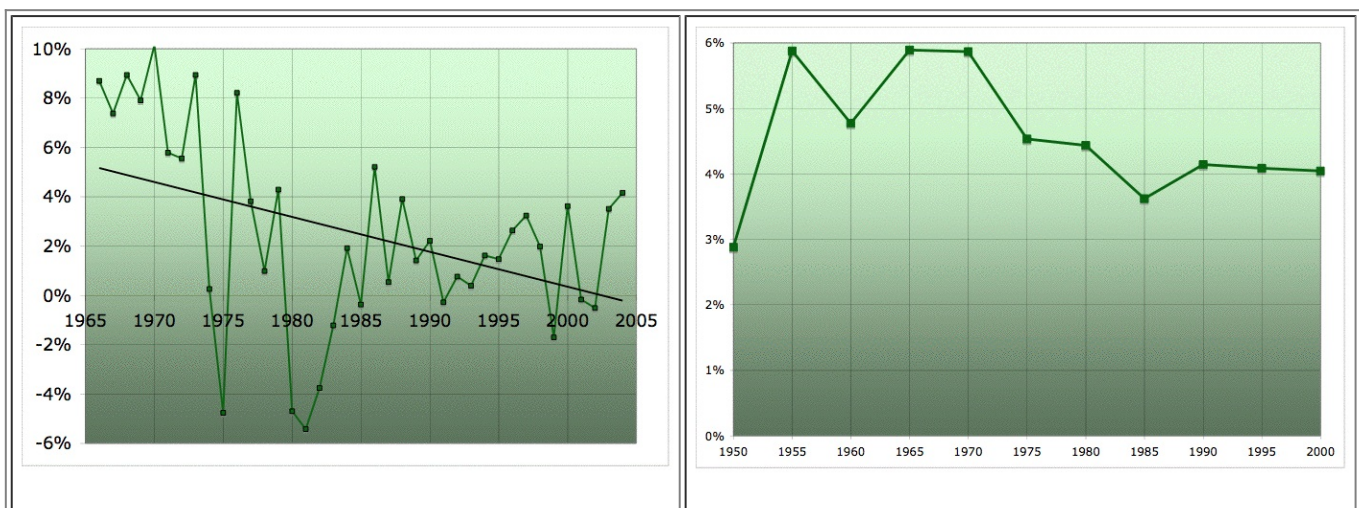
A harsh scenario is that Iranian production ceases altogether for an extended period of time, as war rages, let's say. That's a loss of about 5% of world oil production (at the 2004 rate of 4mbpd or so). Thus world production would be dropping by 4% (allowing for 1% growth in the other 95% of production), when the recent trend has been for around 3% relative growth. Thus the combination of complete loss of Iranian oil production on top of an already stressed supply situation would represent about a 7% supply change compared to the recent trend. That's comparable to the 8% shocks in 1973-74 and 1979-80. That might be expected to roughly double oil prices from their current level. There's a large uncertainty associated with the uncertain elasticity, but my guess is that the 1979-1980 oil shock represents the best model for the situation in that it came on already heightened prices.

A milder scenario might involve a deliberate reduction in oil exports by Iran as retaliation for sanctions. A halving of their production would represent about a 5% oil shock relative to trend. That might give somewhere in the region of a 30-40% increase in oil prices. No doubt enough to make significant economic trouble for the world.

All of these estimates should be viewed as 50% uncertain, given the variation in response to past oil shocks, and our lack of knowledge of how today's economy might respond differently than the rather different world economy of the seventies and early eighties.

Finally, if the US were to attack Iran, there is some possibility of a supershock. Since Iran has considerable influence over Shiite factions in Iraq, and also can attack tankers from Saudi Arabia and Kuwait in the Gulf, there is an outside possibility of a very large - more like 10-15% -- oil shock as exports from all around the Gulf were affected. That would be an economic disaster.

Indeed an argument can be made that the long-term effects that the oil shocks appear to have in reducing growth in oil production and consumption also translate into an effect in reducing economic growth generally. This next diptych shows the same oil production growth 1965-2004 graph we showed before (at left). But it also shows world GDP growth for the second half of the last century on the right. It's surprisingly hard to obtain a long annual sequence for world GDP, but [Brad deLong](#) cites the numbers every five years from 1950-2000. From that I constructed average growth rates over each five year span, which is plotted at the end of the span.



Left panel. Year-on-year percentage change in global oil production 1965-2004. Source: [BP](#)

[Statistical Review of World Energy](#). *Click to enlarge. Right panel - world annual GDP growth 1950-2000 averaged over five year intervals. Source: [Brad deLong](#). Click to enlarge.*

As you can see, in the happy years of the 1950s-1960s, economic growth was very high - running around 5-6%. For the period containing the first oil shock, it drops to only around 4.5%, and then drops again to a little over 3.5% following the second oil shock. Since then, it has recovered but only to about 4% annually, where it has been since.

Now whether the correlation in the way these growth rates evolve is indicative of causation is not certain. However, the possibility should certainly be considered when we start to consider doing things that might affect Iranian oil supply.



This work is licensed under a [Creative Commons Attribution-Share Alike 3.0 United States License](#).