

## **ECONOMIC LIMITS TO OIL SUPPLY: *A NON-HUBBERT CURVE VIEW***

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### **Summary:**

Increases of oil price in the last decade have fueled a financial boom and contributed to the subsequent bust in ways that have largely been unrecognized. Due to the international nature of the oil trade, these economic impacts lead directly to more competitive (and contentious) foreign relations.

The negative impact on the USA of buying foreign oil is significantly different from the earlier price increases of the 1970's and early '80's because of the context in which it occurs. Today the US has both substantially more sovereign debt (about twice as much as a percent of GDP) and a large negative balance of trade of which the prime contributors are oil and trade with China. These factors inhibit the ability of the US economy to grow out of the downturn.

A second impact, which is unique to oil, is the rapid creation of a massive amount of liquid capital. The large amount of capital flowing to the Gulf States (around \$500 billion/ year) is largely profit. This capital, when leveraged, produced the cheap and abundant credit which has encouraged excessive sovereign debt and private borrowing. We surmise the low cost of borrowing led to over valuations (particularly in real estate) and when those investments faltered, the financial community became aware of their risk exposure which ultimately led to the financial crisis.

This article summarizes global oil supply, the role of giant fields, cost of replacement, physical limits to supply and presents some implications to foreign policy. The authors conclude that the combined price and volume of imported oil pose an increasingly significant drag to the U.S. and global economies.

Protecting foreign sources of U.S. supply will also be an increasing drag on American national security and the choice for America is clear. In short, should the U.S. have an oil policy of 'being the last man standing' or should the U.S. transition to other sources such as natural gas for transportation? The answer to that question means our traditional discussions about volume of resource in the ground must be expanded to include physical limitations of supply and cost of supply.

Whether global production rate is at its peak or not, does not matter and we emphasize that the world is not running out of oil. The world is, nonetheless, becoming limited in its physical ability and economic capacity to add production, particularly from the high cost tier of oil resource. This situation will become acute as the 60 percent of the world's production which is from the supergiant fields starts to decline.

It is not a matter of when the oil runs out, rather, it's a matter of when the supply of money to buy imported oil is exhausted.

## **Background**

Physical characteristics of oil supply in terms of geopolitics and cost of development provide incentives in both economic and foreign policy for America to reduce its reliance on foreign oil. The U.S. is caught in a foreign policy vise. Due to the need to keep oil supply up and prices down, it is entangled with politically hostile and/ or unstable foreign governments leaving little maneuverability to pursue its self interest. Even less appreciated is the negative impact oil imports have on the American economy.

Current account surpluses and deficits go beyond trade balances to show the overall flow of capital in and out of countries and are a leading indicator of economic health. Oil imports are the most pernicious contributor to U.S. trade deficits and trade deficits, plus our sovereign debt, make up most of the U.S. current account deficits. No amount of government budget reduction, tax increase or dollar devaluation offsets the persistent erosion of the national economy and standard of living caused by the annual transfer of nearly 3 percent of U.S. GDP spent to import oil. This article considers the probability that the cost of oil imports will grow dramatically in this decade and the resulting risk to the United States economy.

The fix is not easy. Oil dominates the energy sector because of its comparatively low cost coupled with the difficulty in replacing it for transportation. Even at prices in excess of \$100 per barrel, green energy technologies are far from competitive. Investments in high cost alternatives to conventional oil are risky so long as 60 percent or more of the world's oil is produced for much less than \$5 per barrel. Price forecasting is complicated by a 'dual-tier' cost structure dominated by low cost oil coming from the Middle East and the additional need for much higher cost oil to meet demand. The EIA estimates that the Gulf States earn over \$500 billion per year from their oil exports which will grow to nearly \$2 trillion in less than 2 decades. Almost unique to the Gulf States, most of their earnings are profit. Oil profits are the single source of current account surpluses for the Gulf States.

On the other side of the ledger, there must be a deficit to correspond to the surplus. Unfortunately, it is the U.S. which is taking on about one half of the global current account deficit! Furthermore, analogous to the Great Depression of the 20<sup>th</sup> century, recovery will be hampered by these unusually large current account surpluses and deficits. Oil is the single largest cause of these excessive current account surpluses and deficits and it poses a peculiar challenge.

## **Foreign Policy Incentives**

For the past fifty years a major goal of U.S. foreign policy has been securing access to cheap and limitless supplies of foreign oil. This policy no longer serves the economic nor strategic interests of the United States. Dependence upon foreign oil not only commits American involvement in intractable Middle Eastern politics, it also limits America's options in pursuing her national security interests. Furthermore, as oil inevitably becomes scarce, there is a significant chance of armed confrontation over a dwindling supply. In addition to the economic exigency to rid America of its trade deficits, it has reason to improve its foreign policy positions by becoming independent of oil imports.

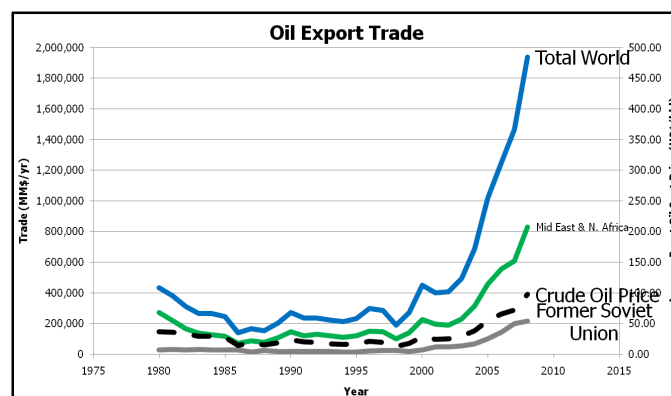
As emerging economies become more dependent upon imported oil, the more compelled they will be to secure access to it by their own means. It is delusional to believe that emerging

economies will indefinitely rely upon American power to make oil accessible just as it is absurd to believe the American taxpayer will gladly assume the burden.

Unless the U.S. curbs its oil imports, our economic well being will continue to depend upon a high profile military presence in the Middle East while still exposed to behavior risk of other oil exporters hostile to U.S. interests such as Iran, Venezuela and Russia. American military commitments and foreign policy in the Middle East place it on a potential collision course with Chinese interests. Not only does America's position in the Middle East condemn it to an endless leading role in the fight against terror, the Chinese view America as a threat to their access to oil supply. Specifically, the Chinese feel increasingly threatened as the U.S. increases its military commitments in the Middle East. The connection between China's rapid development of naval power and its determination to be unfettered in accessing foreign oil, especially in the Persian Gulf region is obvious. Furthermore, as long as states that sponsor terror benefit from their oil exports, and American forces remain central in the propping of unpopular Middle Eastern governments, it is not likely that America and her allies can win the war on terror. Eliminating oil imports allows America to reduce exposure to foreign policy risk.

### Economic Incentives

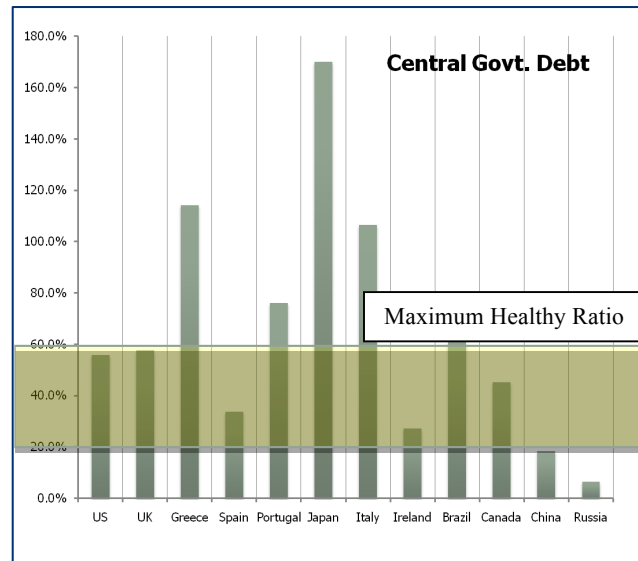
The economic impact of massive wealth transfer for oil (Figure 1) is potentially just as ruinous, but much more certain than the foreign policy risk. America risks its prosperity as long as oil imports of 3% or more of its GDP are not offset by a more rapidly growing economy. Unfortunately, America is unlikely to generate trade surpluses sufficient to offset the 3% of GDP it spends on oil because our debt and trade deficits are both so high. Consequentially, oil is the most malignant component of the current account deficit because it is the cause of both massive wealth transfer and the source of over abundant liquidity for oil exporters. Oil generated abundant, cheap capital which enabled the over-leverage and the ensuing overvaluation of investments and untenable government borrowing by the U.S. and others during the past decade. The legacy of the explosive growth in the value of oil imports since 2000 are crushing private and public sector debt levels.



**Figure 1 Value of the oil export trade. Note the magnitude of increase since 2000.**

Generally, economists have hypothesized that national economic expansion can grow at 3.0 percent, or possibly more, so long as sovereign debt does not exceed 40 - 60 percent of GDP (Figure 2). Some economists suggest the U.S. can manage sovereign debt as great as 80 percent without significant depression of growth rates because of its stable government and unique status as the world's largest economy. This status affords it benefits from being the world's reserve currency of lower borrowing cost. Whatever the limit, there is a point beyond which the amount of sovereign debt limits economic growth. America sovereign debt, which is presently near 60 percent of GDP and growing, is pushing that limit. If all American public debt (local, state and

federal) are considered as sovereign debt, the ability of the American economy to experience healthy expansion may already have been exceeded and real GDP growth may stagnate around 1.0 – 2.0 percent until sovereign debt and current account deficit is reduced. The problem is that reducing sovereign debt increases in difficulty as current account deficits grow. The U.S. trade deficits track neatly with the cost of oil imports. Oil price is the primary variable in the value of oil imports and the total trade deficit. Therefore, increases in the price of oil exacerbate the trade and current account deficits.



**Figure 2 A sampling of sovereign debts around the world. The U.S. is expected to exceed 60 percent shortly.**

Since the early 1960's, economists have treated oil imports as benign, believing the U.S. economy is a net beneficiary from petrodollar capital inflows. This twist of the Pitchford Thesis is incorrect. In times of much cheaper oil that was imported in small quantities, the U.S. economy showed no ill effects. However, during the 1970,s and at present, the combined negative economic effects of oil imports approaching or exceeding 3.0 percent of GDP make it clear that oil importation is a major contributor to current account deficits and the consequent reduced economic growth.

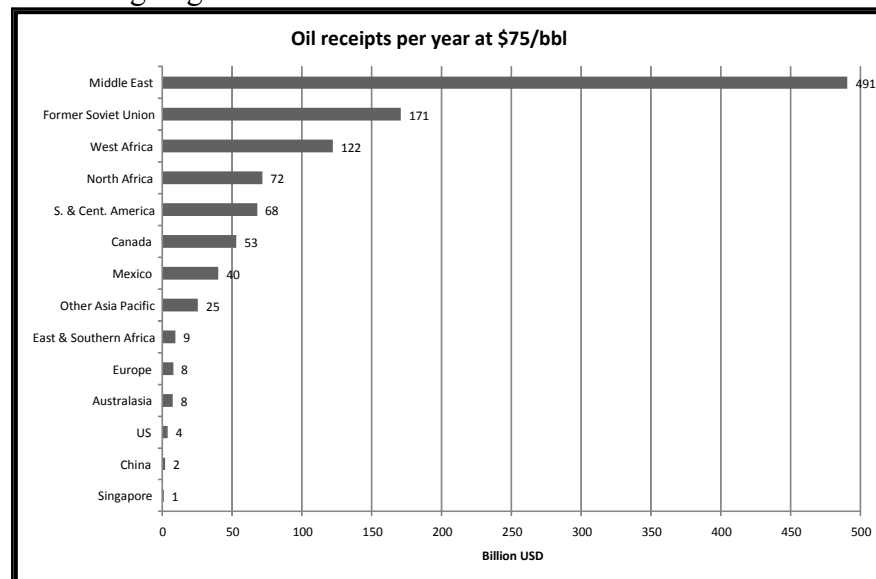
A dollar the U.S. spends on oil imports today has a more negative impact than a dollar spent in the 1970's in two ways. First, American exporters to the Gulf States have been replaced by cheaper competitors so dollars do not return to the U.S. Secondly because profits earned made from exported low cost oil, particularly those earned in the Middle East, are almost entirely profit which leads to these unprecedented concentrations of liquidity.

Furthermore, the large current account surpluses generated by oil profits are balanced by corresponding deficits. America's oil consumption is about one quarter of the world total, but the U.S. has one half of the global current account deficit! The economic tools at the disposal of the Federal Reserve and Treasury are simply inadequate to correct the situation so long as U.S. oil imports persist or grow from current levels. In other words, the American economy is in facing a situation it has never faced before and oil imports are a key part of any solution.

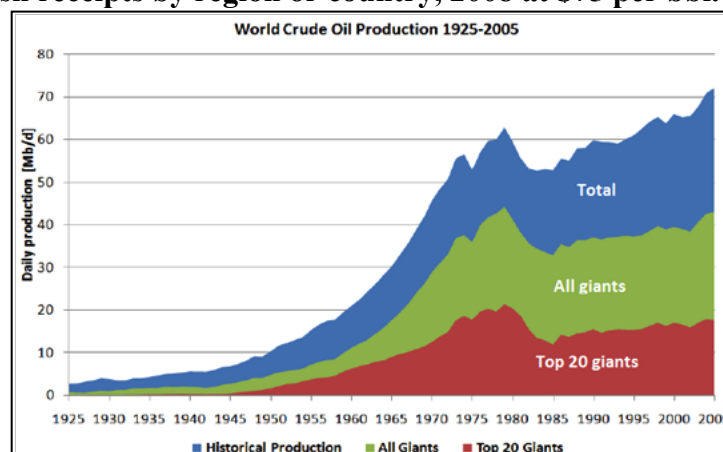
### Physical Character

America's energy future is on the horns of a dilemma. If those that contend there is adequate supply to meet growing demand over the next twenty five years are correct, oil, even at a significant premium to today's price, will remain the cheapest source of energy for transportation and alternatives to oil will remain economically disadvantaged. On the other hand, if the rate of supply hits a plateau or begins to decline, the price of oil is poised to increase dramatically. Obviously this would further exacerbate global current account imbalances. No matter what the future supply will be, the Middle East will increase its proportion of oil exports which will further exacerbate imbalances in global current accounts.

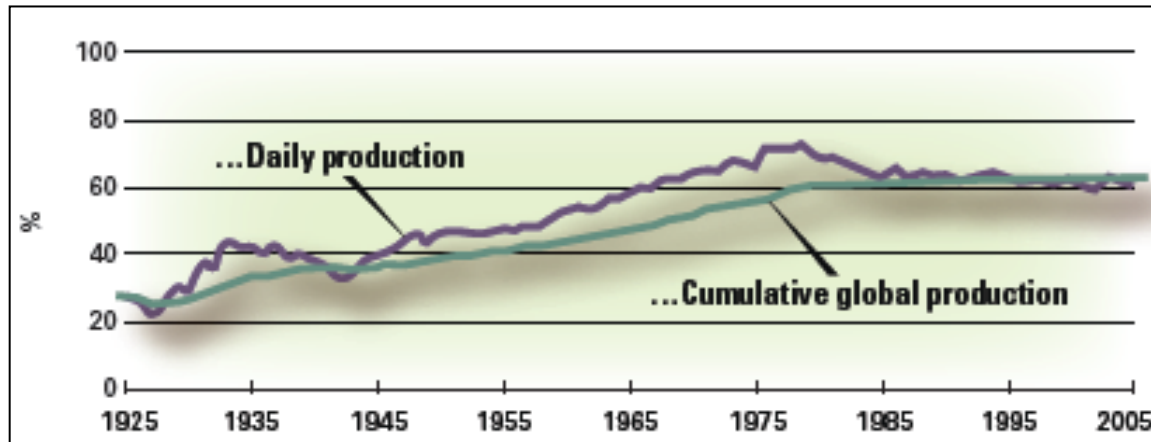
The Middle East, with its concentration of giant fields, is not only the high volume producer but also the low cost producer and will continue to be so. Figure 3 illustrates the gross cash receipts by country or area. It is well known that concentrations of oil in large reservoirs, giant fields, inherently can be recovered much quicker than the like volumes widely distributed over a much larger number of smaller accumulations. The most recent data (Robelius) show 60 percent of daily production is from only 320 of the world's 17,000+ large oil fields. The contribution of giant fields has been around 60 percent of global production since the mid-1960s (Figs. 5). The combination of low costs and high volumes generate excess capital for the Middle East significantly contributing to global current account imbalances.



**Figure 3** Gross cash receipts by region or country, 2008 at \$75 per bbl. (after BP, 2009)



**Figure 4** Contribution of 320 super giant oil fields to world production (Robelius, 2007)



**Figure 5 Percent of global production contributed from giant fields (Kelley et al 2009 after Robelius, 2007)**

Heavy oil, because of its much higher production cost is not as effective as giant conventional oil fields in generating current account surpluses. Though in theory heavy oil is more benign to the global economy than low cost conventional oil and has an inherent foreign policy advantage for America because of the large Canadian deposits, it does not appear to have a near-term potential to displace conventional Middle Eastern oil supply. Although heavy oil will become increasingly important in the future supply, development plans for heavy oil reserves do not create sufficient capacity to offset the decline of conventional giants when it starts. Massive government support is needed for heavy oil to be developed apace with conventional decline. The Canadian Association of Petroleum Producers (Anonymous), estimate that adding one million barrels a day by 2015 will cost about \$44 billion USD. Recent announcements (Eni, 2010) regarding Venezuela say about \$35 billion is needed to add 1 million bopd. Thus, adding 10 million bopd of heavy oil over 10 years presumably would cost \$350 to 450 billion. Capital commitments to develop heavy oil are not even remotely close to \$350 billion. Table 1 compares costs to develop a million barrels a day from different environments.

COST TO ADD 1 MILLION BOPD		
AREA	\$BILLION USD TO ADD 1 MILLION BOPD	COMMENT
Middle East	8	cost to drill wells and build pipeline
Deep Water	30-35	cost of topsides, not drilling
Onshore US	30- 35	cost of drill wells, not transportation
Heavy oil (Canada and Venezuela)	35 - 45	Cost to extract and transport.

**Table 1 Comparison of the approximate costs to add a million barrels a day capacity from different environments.**

New discoveries are not likely to change the status quo. Removal of U.S. regulatory obstacles to domestic drilling will not cause a miraculous increase in the rate of U.S. oil production because undiscovered or un-exploited oil resources in the U.S. are insufficient. In 2000 the USGS published an assessment of undiscovered oil and gas expected from the world's most promising basins. Though 1,428 BB of undiscovered black oil is estimated, the finding effort associated

with these volumes should also be considered. The concern for finding arises from the assessment of fields as small as 1 million barrels. The median field size of 22 mbo in 10,840 fields means that 5420 fields are between 1 and 22 mbo. Although fields in this size range have local economic value, they do not have a significant impact on global production rate. At current finding rates of 4-8 BB per year, it will take 178 years or more to find 1,428 Bbls. These 1428 Bbls are not evenly distributed. More than 60 percent of undiscovered oil is concentrated in only 10 basins. Importantly, all of these are outside of the U.S. and the new discoveries will not relieve the U.S. economy of its current account imbalances.

### **Conclusion:**

Thus the oil trade has put America in an economic conundrum controlled by the low cost producers in the Middle East. At today's prices, the U.S. could begin conversion from conventional oil, however, the low cost producers obviously seek to discourage such competition and can clearly drive down the price of oil. The foreign policy and economic interests of the United States, however, are clearly served by reducing dependence upon foreign oil. The physical evidence indicates that the Middle East will increase its share of the oil supply and its oil derived current account surpluses. A combination of tariffs on imported oil, domestic production incentives, use of natural gas for transportation whether converted to electricity or as motor fuel and conservation measures may become mandatory for America to extract itself from this current predicament.

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