



Peak Demand or Peak Consumption? A Look at OECD Oil Demand

Posted by [Sam Foucher](#) on November 11, 2009 - 8:19am

Topic: [Supply/Production](#)

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Standard economic principles have demonstrated that price is a function of supply and demand. The same is true for the recent oil prices fluctuations we have witnessed over the last few years, namely the equilibrium between supply and demand. However, the following conundrum has not been resolved: **are oil prices high due to greater demand or too little supply?** This ambiguity allows for vastly divergent interpretations of the same data and depending on the agenda you are trying to push, will easily support either.

Lately, the concept of "**Peak demand**" has been suggested in a multitude of recent articles that unfortunately do not qualify their analysis of the status quo. Some suggest that we are willing to and capable of moving away from oil. Are we?

A few years ago, some analysts lectured us about the effect of oil prices on the creation of new oil supply. Now that this argument has clearly failed, they have decided over night that we don't need oil anymore. In this debate, it is important to distinguish between demand (what you want or need) and consumption (what you get based on your ability to buy). Following this logic, consumption is "satisfied demand". Conversely, we can define the "unsatisfied demand" or "excess demand" that has been suppressed. Below the fold, I'll show that the key driver behind the price increase since 2002 has been excess demand combined with unresponsive supply.

OECD Demand

In this analysis, I follow an approach similar to the one proposed by Ye *et al.* ([pdf](#)) using a model defining a desired inventory level. The consumption trend observed between 1990 and 2001, when the market was well supplied, can be easily and accurately modeled by a linear trend taking into account monthly fluctuations:

$$D_t = a_0 + b_1 t + \sum_{k=2}^{12} b_k A_k$$

The fit result is shown as the magenta line illustrated on Figure 1 below. The above model will define normal demand levels assuming low oil prices. The OECD consumption has strongly reacted to higher oil prices and is now almost 10 mbpd the level expected by my nominal demand model.

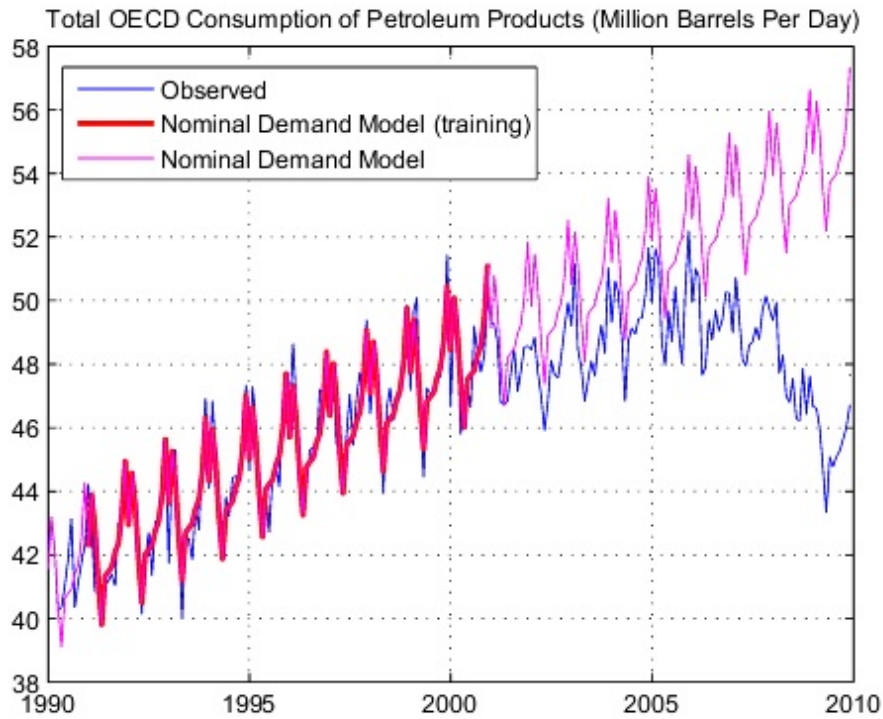


Figure 2. Observed OECD consumption and nominal demand model (monthly, total petroleum products), volumes in million barrels per day (mbpd). data from the EIA.

Looking at the residuals $C_t - D_t$, the fall in consumption from the desired level is even more telling:

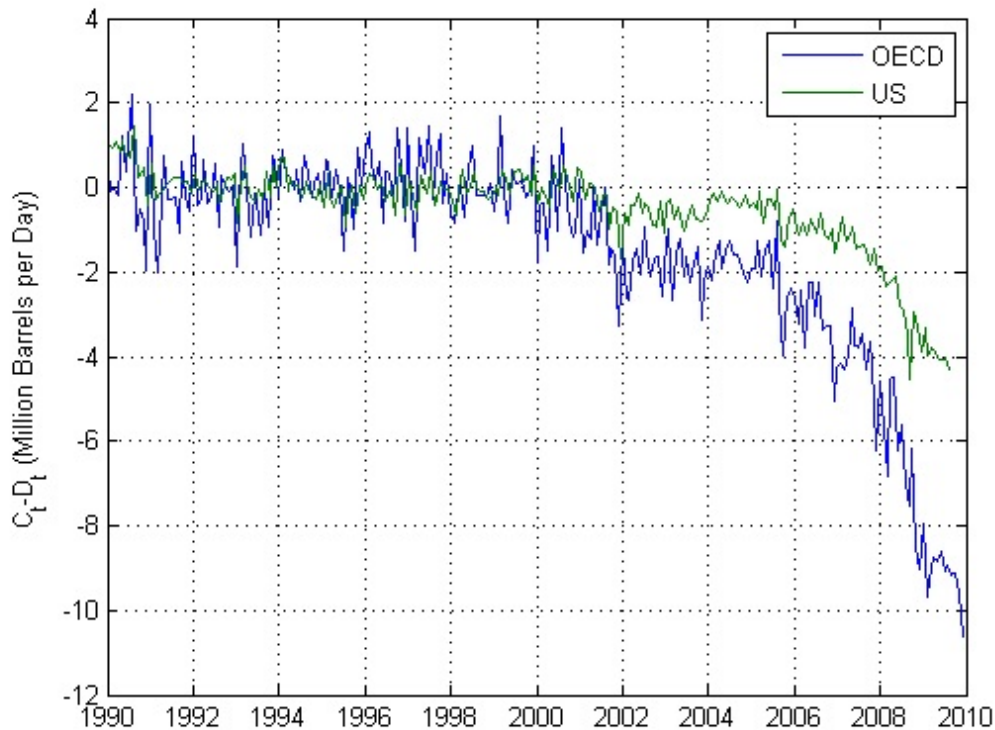


Figure 3. Difference between the nominal demand models and the observed consumption (monthly, total petroleum products), volumes in million barrels per day (mbpd). Data from the EIA.

I make the following assumptions:

1. because oil prices were so low during the 1992-2001 period (i.e. virtually no excess demand), I will call "*nominal demand model*" the linear model defined above.
2. The difference between nominal demand and observed consumption is an estimate of the excess demand: $ED_t = D_t - C_t$

Plotting the excess demand against oil prices clearly shows why prices rose until the financial collapse last year. Before 2002, prices and excess demand were contained within a tight cluster around 20\$/barrel - evidence that the market was well supplied and at equilibrium. The red line shows that prices increased by \$20 per 1 million barrels per day of excess demand between 2004 and 2008.

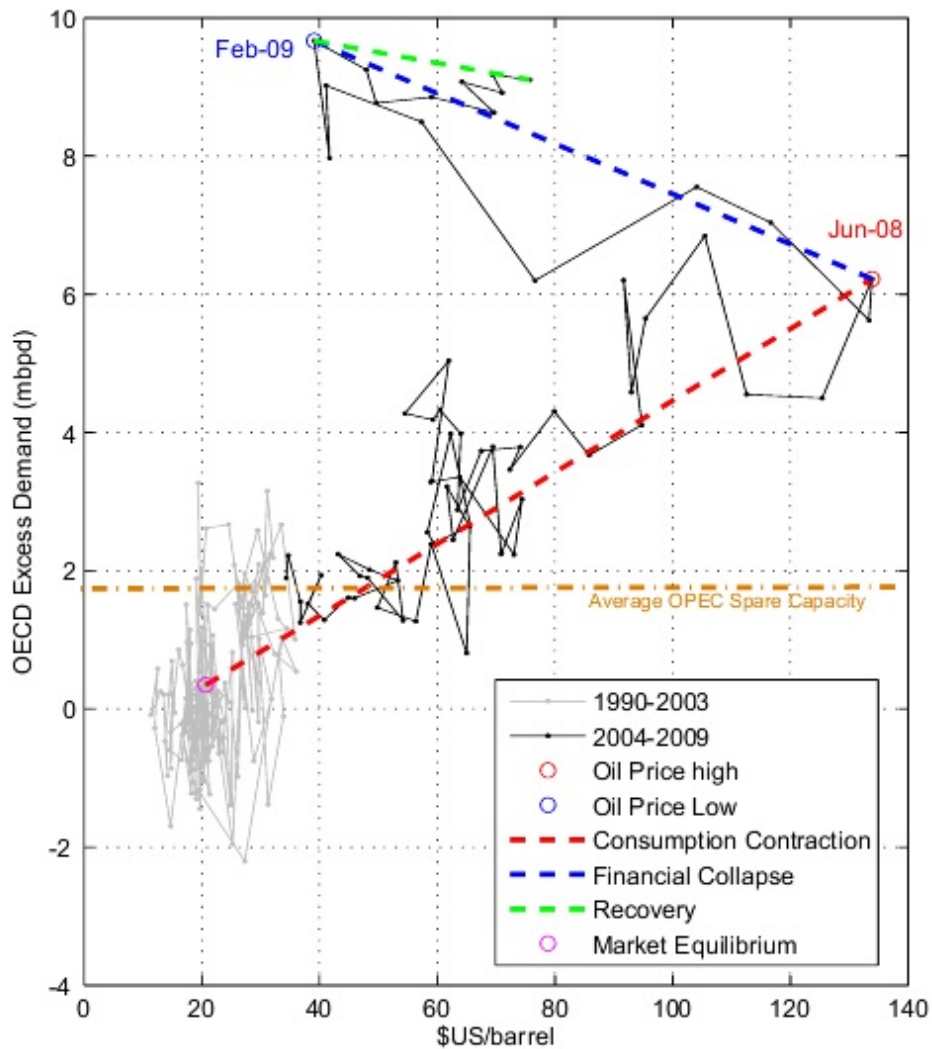


Figure 4. OECD Excess demand versus oil prices (WTI).

One could argue that the nominal demand model defined above is not stationary and has been affected by structural changes in demand. Unfortunately, the only way structural changes in demand could be estimated is if the oil prices of tomorrow would go back to \$20 a barrel for a few years within a pro-growth and healthy business environment. Only then could a new nominal demand model be estimated; those conditions won't be satisfied anytime soon.

Peak demand would suggest that the demand model would change over time, but then the level of unsatisfied demand would go down, bringing down prices with it. Actually, the severe recession we are currently in since the fall of 2008 has destroyed demand as a result of high unemployment rates and reduced credit availability. Looking at the price model on Figure 3, a return to the \$70-80 range is equivalent of a demand destruction of around 3 mbpd for all of the OECD.

What about Spare Capacity?

Spare capacity, mainly provided by OPEC, is the amount of oil that can be made available within 30 days and sustained for at least 90 days (EIA definition). Looking at the available spare capacity and the excess demand estimate, it is obvious that OPEC spare capacity has become deficient since 2002, and that the surge in excess demand coincides with the increase in oil prices as shown on Figure 5.

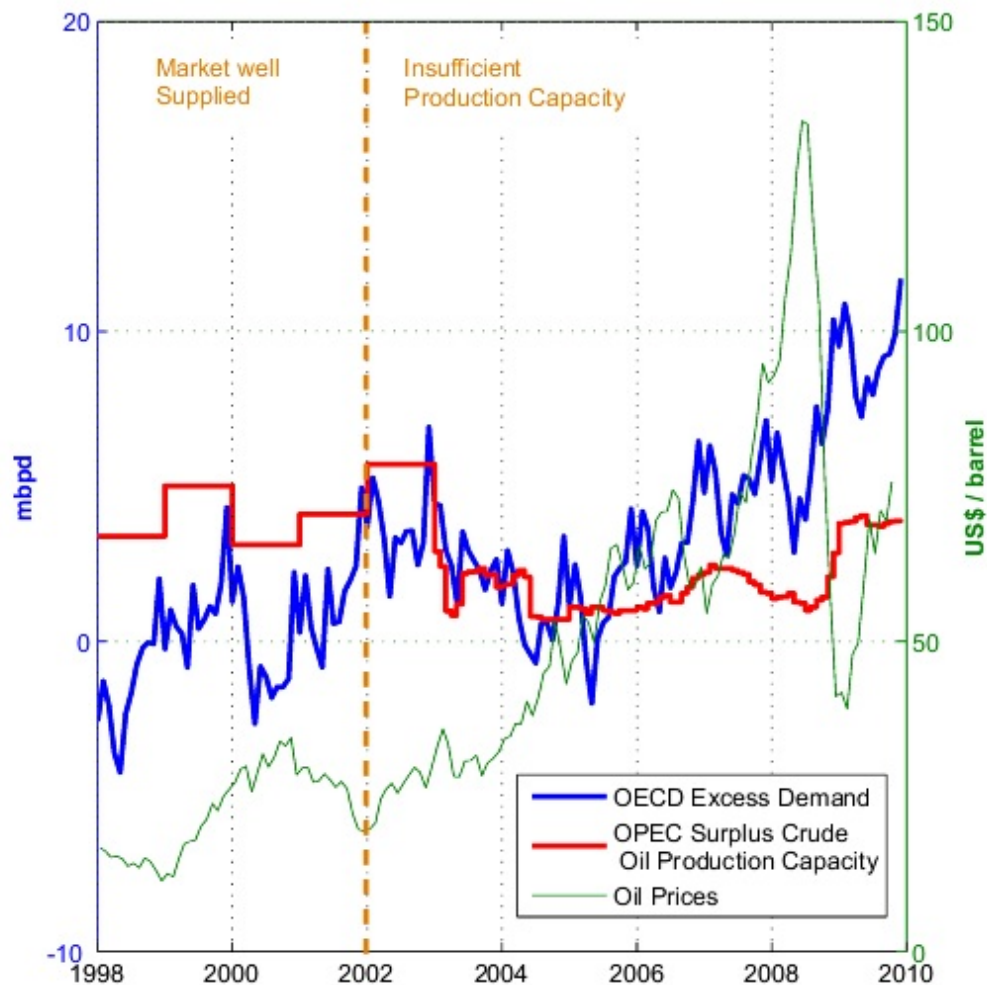


Figure 5. Oil prices (right axis) and estimated excess demand along with EIA estimate for OPEC spare capacity (left axis).

So What is Causing High Oil Prices?

As an interesting exercise, I looked at the causation between oil prices and demand/supply indicators. Causal search algorithms systematically investigate patterns of conditional dependence and apply the Causal Markov Condition to reconstruct the graph of the data generating process (A good overview is available [here](#)). I define the following quantities:

- **P**: Monthly oil prices
- **S**: Monthly oil supply
- **C**: OPEC spare capacity (EIA)
- **D**: Excess demand

I used the remarkable [TETRAD IV software](#) (family of software for causal modeling originating with Peter Spirtes, Clark Glymour, and Richard Scheines at CarnegieMellon University) available online. I split the dataset in two periods: 1998-2002 period when prices were relatively low and 2003-2008.

1998-2002 period:

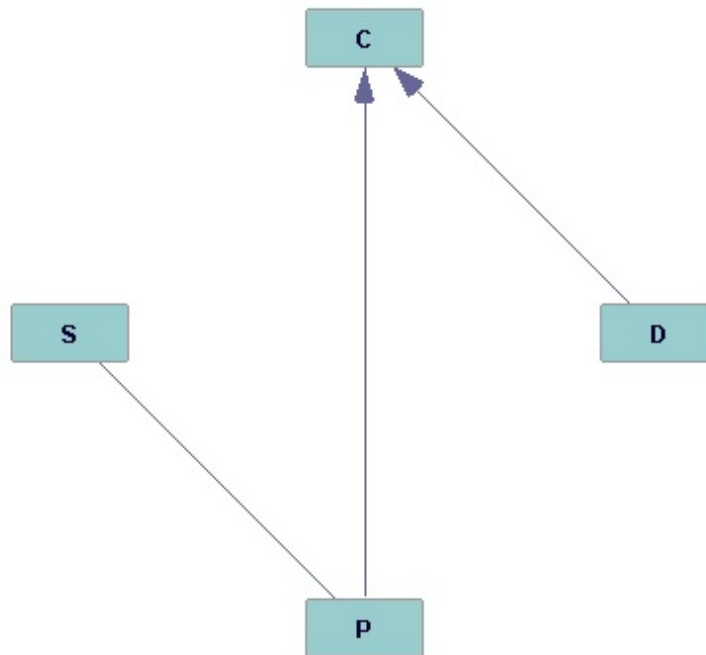


Figure 6. Graphical causal model for the period 1998-2002

Spare capacity is dependent on prices and excess demand. Prices and excess demand are independent unconditionally; but are dependent conditional on spare capacity. In short, OPEC spare capacity was playing a buffer role in order to absorb excess demand.

2003-2008 period:

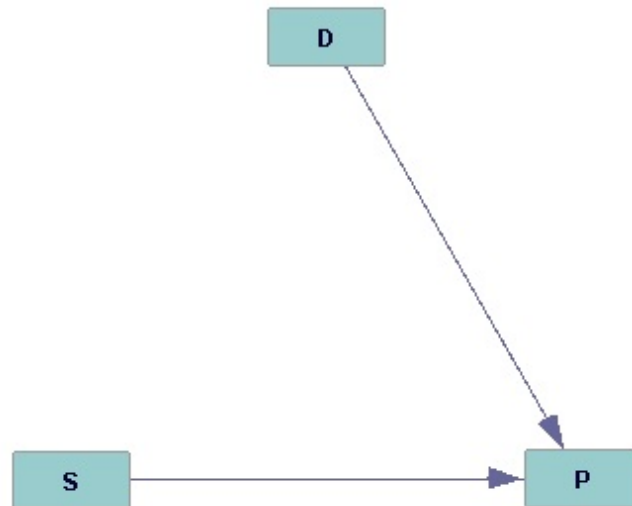


Figure 7. Graphical causal model for the period 2003-2008

Prices is dependent on supply and excess demand. Supply and excess demand are independent unconditionally; but are dependent conditional on prices. Spare capacity is independent of all the other variables at 5% significance.

Conclusions

Lower consumption does not mean lower demand, nor does it mean the increase in alternate sources of energy. If it did, it would be akin to saying that an alcoholic is sober implies he has effectively dealt with his addiction. It may be that he is sober because he has simply exhausted all of his options for obtaining additional alcohol. Also, I think it is important to differentiate between the following two causes of demand destruction:

1. Recession induced demand destruction (e.g. business going bankrupt, rising unemployment, etc.), or
2. Long-term structural changes in demand (e.g. increase in the average car mileage, increase efficiency, etc.)

In my opinion, the latter cause of demand destruction is the approach to take and can be implemented through adequate government policies (e.g. higher CAFE standards). When people are unemployed, energy efficiency is the last of their concerns. **If we do not proactively implement demand side policies and instead wait for high prices to take their toll, social unrest and higher government deficits are likely to make things more challenging, or even completely unmanageable.** Anemic supply growth, only a preamble to peak supply, was enough to create our present troubles. Wait until supply growth is negative!

We have enough data from the OECD to draw the following conclusions:

1. Sluggish supply growth is the main driver behind the 2002-2008 oil price increase. OPEC

spare capacity has become irrelevant or at least unresponsive.

2. Nominal demand is between 3 and 5 million barrels per day above production capacity.
3. Prices are increasing by \$20 for every million barrels per day of excess demand.
4. OECD consumption is very elastic to oil prices.
5. Non recession induced peak demand is not supported by the data.
6. The financial collapse and the current economic recession has at least reduced demand by 3 million barrels per day for the OECD.

In my next post, I will look at the non OECD demand.



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