

Global Oil Demand Dynamics: Rebalancing the Debate

Bassam Fattouh

The future fundamentals of the oil market cannot be more uncertain. On the one hand, many analysts claim that the world faces an energy crisis and that oil prices 'did not remain high enough for long enough to generate a solution to the energy problem, which has not gone away'. On the other hand, others argue that rather than just focusing on supply shortages and peak oil, the debate after the crisis should take into the account the possibility that oil demand may be peaking before oil supply. This (not widely held) view points to the convergence of three main drivers that would put downward pressure on oil demand in the long term: the new environment of high and volatile oil prices, higher efficiency gains in the transport sector, and government policies driven by concerns of energy security and climate change.

A major challenge in forecasting 'medium-term' or 'long-term' fundamentals is that there are too many unknown variables such as developments in technology in the transport sector and in oil extraction, change in consumer behaviour, and the impact of energy and climate change policies, among others that can play an important role in shaping these future fundamentals. The wide uncertainty surrounding the oil market, especially in the aftermath of the financial crisis, however did not prevent many analysts from making predictions that market fundamentals are likely to tighten in the future. These predictions are based on three main pillars: (1) a very limited growth in non-OPEC supply due to peak oil and/or over-ground constraints such as geopolitical factors and hardening fiscal terms; (2) a slowdown in investment in OPEC countries due to a variety of factors such as geopolitical and the incapability and/or unwillingness of these countries to invest in the oil sector in the presence of large spare capacity and large demand uncertainty; and (3) a rapid growth in global oil demand fuelled mainly by non-OECD countries.

The effects of these predictions are far from neutral. They can shape market outcomes, influence investment decisions, and filter directly and indirectly into market participants' expectations. Changes in expectations can in turn impact short-term and long-term prices and more importantly the interaction between the front part and the back end of the futures price curve.

In this article, I will focus on one element of those predictions: global oil demand, analysing some key relationships that are important to the understanding of oil demand dynamics.

Oil Demand and Income Effects

The demand for oil equation is often modelled as a function of a wide range of variables such as world economic activity and the structure and distribution of that activity, global demographical factors, demand-side technology, oil prices, the relative prices of competing energies and taxation policies. Despite this wide range of factors, the literature has persistently found that one of the main determinants of oil demand is economic activity. Yet while oil demand is strongly linked to economic activity, this relationship is far from being linear.

OECD Demand

It has been widely shown that oil demand increases faster than GDP below some income threshold but slows down beyond this threshold. In other words, the income elasticity is not constant and varies with the level of income. This observation is important for understanding oil dynamics in the USA (and the rest of the OECD). The US income elasticity has been in decline over the years and since the 1979 oil price shock income elasticity has fallen to below unity. With declining income elasticity, total expenditure on oil as a percentage of household income tends to decline, other things being equal. This implies higher resistance

of households to changes in the oil price over time, as the expenditure on oil will constitute a small share of household income. However, other things are not equal and one needs to take into account the price effect. Given the short-run price elasticity of demand, a large percentage increase in the oil price will induce a smaller percentage change in the quantity of oil demanded and as a result the expenditure share on oil out of total budget will increase as prices increase.

These dynamics can explain oil demand behaviour in the USA and OECD in the latest price cycle. At the beginning of the boom, the share of oil expenditure of households' budgets was relatively small due to a general decline in income elasticity and a relatively low oil price environment for most of the 1990s. Thus, in the early phase of the boom, households could afford to ignore the rise in oil prices as this did not hit hard their budgets. However, as prices continued on their upward path, the oil expenditure share out of households' budgets became substantial. This eventually induced consumers to react and adjust their consumption patterns. Concerning OECD demand, one can therefore draw the following two important lessons:

- Despite the decline in income elasticity or in the oil intensity of GDP, there is a threshold price above which a change in oil price can induce a substantial reduction in oil demand in OECD;
- Unlike the latest price boom, the price that could alter consumer behaviour in the case of a sharp recovery will be reached much faster this time round. The share of oil expenditure in a household's budget is higher today than at the beginning of the previous price boom and household incomes are likely to grow at a slower rate. Thus, in the future, we might witness a faster reaction of OECD demand to oil price rises.

Oil Demand in Non-OECD

The above analysis is also useful for studying the dynamics of oil demand in emerging economies. This is vital as most of the future growth in oil demand is likely to originate from economies outside the OECD, mainly in Asia and the Middle East. Evidence suggests that the oil income elasticity in non-OECD is higher than that in OECD. Based on the experience of developed economies, the income elasticity is bound to rise before it falls, due to a variety of factors. One explanation focuses on the changing nature of economic structure during economic development.

Various theoretical and empirical studies have suggested the existence of a fuel continuum that varies with the level of income or economic development. **As incomes rise, households tend not only to consume more of the same fuel but also to move up the energy ladder towards higher quality fuels.** For instance, some analysts suggest the existence of an energy ladder in cooking and lighting, which are the dominant energy-using activities for households in developing economies. The energy ladder ranges from traditional biomass or solid fuels (dung cake, crop waste, charcoal, coal) to liquid fuels (kerosene) to gaseous fuels (LPG, gas) then to electricity. There is some evidence that a similar ladder also exists for transport. The ladder ranges from no mode of

transport to bicycles to public transport to small and then to large vehicles.

One of the key factors determining the transition is the level of income per capita. However, the relationship is not linear. At a low level of income, car ownership rates (number of cars per 1000 people) are very low. As income per capita reaches a certain higher threshold the ownership rate increases very rapidly. This is because owning a car is costly and constitutes a lumpy investment, which households can only afford after their income has increased significantly. In fact, this stylised fact applies within countries over time and across countries of different levels of economic development. Household survey data from Asia also tend to support the existence of threshold effects. Such data show that ownership rates rise rapidly with increasing income per capita. Naturally this increase in vehicle ownership is associated with an increase in the share of expenditure on transport and transport fuels out of household budgets.

The above features suggest the following lessons concerning non-OECD demand:

- As income reaches a certain threshold, a group of new consumers will enter the market, inducing additional demand for liquid fuels;
- The share of expenditure on energy out of the total budget tends to rise at early levels of economic development before declining at later stages. This implies that in non-OECD the percentage growth in income is likely to be associated with larger percentage growth in oil demand;
- This last observation implies that an increase in petroleum product prices will have a significant impact on demand as there are two effects working in the same direction. On the one hand, the share of energy expenditure out of household budget is increasing as product prices increase. On the other hand, rising oil prices imply that financing this share becomes more costly. Due to these two effects, non-OECD demand response to changes in oil prices is expected to be much faster and stronger if there is another oil price boom. In the latest price cycle, fuel subsidies in many non-OECD economies weakened this price effect. However, looking into the future, non-OECD countries are likely to abolish, or reduce, fuel subsidies and some may even impose various forms of fuel taxes.

Oil Demand and Price Effects

There is more than one concept of price to consider when analysing the price determinants of demand. These include the price level, relative prices of various fuels in the energy mix, volatility and swings. Prices affect demand either directly through the usual demand-price channel or indirectly through changing the importance of oil in the energy mix and/or through their impact on growth.

Oil Prices and Economic Growth

The traditional view that dominated the thinking about oil market dynamics was based on the premise that oil price shocks (or more accurately rapid rises in prices) adversely affect economic growth and hence oil demand. While this

view recognises that the origins of the current financial crisis could be attributed to problems in the credit market, the impact of the crisis could not have been so profound if it were not for the high oil prices. Although the channel from oil prices to inflation and then to counter-inflationary measures is important, oil price shocks can induce recessions through different channels. Price shocks act as a tax that hits household incomes, affects key industries such as the motor industry, as well as consumer sentiment and spending, and can make some capital stock redundant.

This traditional view however was challenged in the upward phase of the cycle. According to the alternative view, oil price shocks are not special: they are just like many other shocks that hit the economy. In effect, the impact of an oil price shock is similar to that of an indirect tax. It involves a transfer of income from importers to exporters and by doing so lowers real disposable income and real consumption generating a deflationary effect in oil-importing countries. The ultimate impact on the global economy however would depend on how oil exporters use the oil revenues and whether these revenues are being saved or spent. Furthermore, since oil price shocks have a deflationary effect, fiscal and monetary authorities can engage in offsetting policy responses. For instance, if there is no change in inflationary expectations, monetary policy can lower interest rates to counteract the impact of an oil price shock.

In fact, one of the most interesting features of the recent oil boom is the limited impact it had on inflationary expectations. Compared to previous oil shocks, the impact of the oil price rise on the consumer price index in OECD has been muted. While the increase in the oil price generated first round effects and led to an immediate rise in consumer price inflation, the second round effects on wage inflation have been muted. This has been attributed to the decline in the power of trade unions in the OECD countries; the fact that the pool of labour supply became much bigger through the greater integration of India and China into the global economy; and the wide adoption of inflation targeting by central banks which helped stabilise inflation expectations. Regardless of the causes, the absence of expectations of wage-inflation meant that monetary authorities did not have to pursue a contraction monetary policy to combat inflation caused by higher food and energy prices.

The main implication of the above view was that the global economy could continue to grow even with persistent sharp rises in oil prices. Alternatively, oil prices have to rise to very high levels before they induce recessionary pressures that will impact global oil demand. During the boom, this belief was reinforced by many international organisations and financial institutions that were predicting high growth rates despite the sharp rise in commodity prices. This perception of the limited impact of oil prices on growth affected the behaviour of key market players.

While the view that oil price shocks are not special has gained some credence in recent years, it is premature to argue that the links from oil prices to economic growth have weakened to such an extent that the market could ignore this feedback mechanism in the medium to long term. High oil prices would eventually have an impact on growth and global

oil demand. There is however uncertainty about the time lags and about the price at which one would see a meaningful response from global economic growth. In other words, there is a large uncertainty as to how far oil prices would have to rise before they endanger the growth prospects of the world economy.

Oil Demand and the Relative Price of Oil in the Energy Mix
Relative fuel prices affect the energy mix by substitution at the margin. When the relative price of a certain fuel goes down, its relative share in the fuel mix tends to rise. But relative prices of particular fuels can stay low only if increased demand can be satisfied by an elastic supply response. This has a number of implications. First, carbon taxes or subsidies, by changing relative prices, can affect the relative shares of oil in the energy mix. In the case of ethanol (especially the first generation), the supply response is likely to be muted in the long term as there are concerns that first generation bio-fuels are affecting the food supply. So, while the decrease in the relative price of ethanol would initially increase demand, the limited supply response will eventually cause its price to rise. To maintain its competitiveness, consuming governments will have to resort to subsidies.

Although coal and gas are not direct competitors for oil, they can no longer be ignored in the transport sector with the entry of the electric vehicle and compressed natural gas (CNG) cars. Unlike ethanol, the supplies of coal and natural gas fuels are much more elastic and an increase in demand for these two energy sources will not necessarily change much their relative prices in the energy mix and hence are likely to remain competitive without government support. If a carbon tax is imposed, the relative attractiveness of natural gas in the transport sector will increase while that of coal will decrease (in the absence of Carbon Capture and Sequestration, CCS).

Factors outside the Oil Market: Recessions, Step-Down in GDP and Oil Demand

The events of 2008–2009 have revealed quite clearly that shocks external to the oil market can have an enduring impact on the oil market in general and oil demand in particular. Regardless of its shape, recession often involves a ‘step down’ in GDP or output loss. The size of the step-down or the level effect of the recession can prove to be substantial. The loss in output occurs through various channels. For instance, financial crises may reduce participation in the *labour force* by discouraging jobseekers and prompting employed workers to retire. Crises can also lead to an increase in the underlying (‘structural’) unemployment rate. Finally, a financial crisis may depress investment and slow down capital accumulation especially if credit market conditions tighten and access to credit becomes more restricted and costly.

Based on the history of previous crises, the IMF in 2009 found that the path of output tends to be substantially and persistently lower following banking crises. On average, the IMF finds that there is no rebound to the pre-crisis trend over the medium term. On the positive side though, it finds that in most economies, growth returns to its pre-crisis rate.

Since oil demand is linked to GDP, financial crisis also

results in oil demand loss. In fact a series of shocks originating from outside the oil market can result in substantial oil demand losses, which may take a few years to recover from. In the current crisis, the magnitude of the step down is still unclear but it appears to be quite substantial. In its 2009 World Oil Outlook, OPEC estimates that just before the crisis in 2008, the average consumption of OPEC oil reached a peak of 31mb/d and that it could be as late as 2013 before this level is reached again. Reaching the pre-crisis peak level will be helped by the speed of the global economy recovery and affected by the efficiency measures pursued, and the growth of non-OPEC supply and alternative energy sources.

Policy Factors

There are two key non-price factors that are believed to have a large impact on oil demand. These are government policy and technological innovations. While in theory it is possible to distinguish between policy and technological innovations, in practice they are highly interrelated. There is great uncertainty regarding the impact of these policies on oil demand. However, it is possible to make the following observations:

- The drive for improved fuel efficiency in the transport sector is likely to continue unabated thanks to technological innovations which would improve the vehicle characteristics and due to government policy which favours more efficient, greener and smaller cars;
- The trend for improved efficiency is already set in motion and is unlikely to be reversed by oil price declines. On the other hand, an increase in oil price or its volatility and concerns about the future availability of oil can accelerate the growth in efficiency. In other words, the pace in growth of efficiency is asymmetric to price changes;
- Technological innovation and government policy are not exogenous and are affected by developments inside and outside the oil market;
- Countries' pursuit of improved efficiency will occur both in developed and developing economies perhaps with greater vigour in the latter;
- Potential cooperation at the international level on key

areas such as advancement of electric car technology will consolidate over time;

- Although oil will continue to be the dominant fuel in the transportation sector for years to come, other sources of energy such as coal, gas, and ethanol have started to compete at the margin. This competition will only intensify over time;
- Despite the fact that these technological innovations and government policies will only impact the oil market at the margin, the effects on oil demand are both cumulative and potentially irreversible and hence cannot be ignored in the long term.

Conclusions

The above analysis suggests that the evolution of global demand dynamics is affected by a large number of interrelated factors. Expectations that global oil demand will continue on a robust and high-growth trajectory may materialise, but this is not a foregone conclusion. Oil exporters, companies, and market analysts should somehow factor into their expectations the possibility of policy reversals, development setbacks, shocks originating from outside the oil market, and should explore the role of price and income effects on long-term oil demand which can perhaps produce more balanced views. Unfortunately, this has not been done so far and an expectation of robust growth in oil demand, which is essential for the story that market fundamentals will tighten, is accepted uncritically. Stories that China's and India's thirst for oil is impossible to quench are now widely believed. This should come as no surprise because for stories to have an effect on market psychology they must sensationalise events surrounding oil market dynamics (peak oil supply, peak oil demand, future energy crisis, return to oil shortages, the end of cheap oil, just to mention a few examples). While in the past such sensational stories had limited impact on the functioning of the oil market, this is no longer true. In their recent book titled *Animal Spirits*, George Akerlof and Robert Shiller ask 'But what if stories themselves move markets? ... What if they themselves are a real part of how the economy functions? ... The stories no longer merely explain the facts; they are the facts.'