Oil Prices and Transport Sector Resilience

Introduction

1. Oil is important for consumers generally, and the transport sector in particular. Oil accounts for 51 percent of New Zealand's total consumer energy, and transport accounts for at least 80 percent of New Zealand's oil consumption. Most of this oil is imported.

2. Changes in oil prices can have a substantial impact on firms and households. For firms who are major users of fuel, either in their day-to-day operation or in the transportation of goods and services to market, the price of such fuel can have a major impact on profitability. Low to medium income households are also particularly exposed to increasing and volatile oil prices. Transportation costs account for more than 14 percent of household expenditure in New Zealand and are the third largest single expenditure item (Statistics NZ 2008).

3. The paper provides a basis for discussion on (i) global oil prices and price forecasts, and (ii) the risk exposure of the transport sector to oil price changes and its implications for the wider economy.

Oil prices

4. At a fundamental level, oil prices are driven by supply and demand (or market perceptions of supply and demand), although this can be obscured at times by the financial markets in which oil is traded. Markets for oil trading include spot markets; futures markets; and over the counter risk management products such as options.

5. Historically, oil prices have been volatile and unpredictable, and it is a reasonable assumption that oil prices will continue to be volatile in future. In that sense, the record price spikes in 2008 were not unusual when seen in a historical context, or when considered in real rather than nominal terms.

Source: Energy Information Administration, Ministry of Economic Development

Figure 1: Historic oil and petrol prices

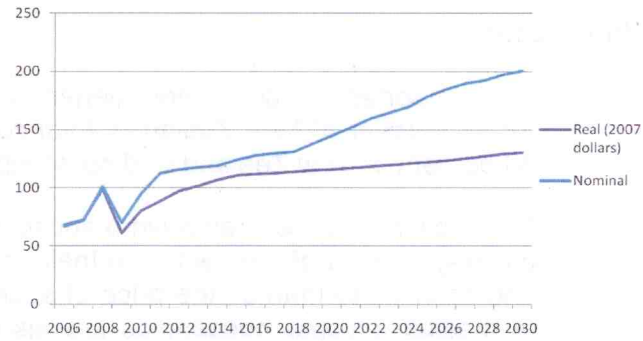
6. Quotations from oil futures markets provide us with a ready potential source of forecasts of future crude oil and oil product prices. However, there is still debate as to how useful these price forecasts are for policy analysis purposes. Analysis by the Ministry of Economic Development[1] concludes that they are useful for the prediction of long-term average prices, but of little use for predicting short-to-medium term market volatility, including price spikes.

7. Beyond the futures market, the International Energy Agency (IEA) provides authoritative and regular forecasts, via its annual Medium Term Oil Outlook and the World Energy Outlook.

[1] Samuelson, Dr Ralph D.; "Oil: An Introduction for New Zealanders"; MED, 2008.

8. The IEA estimates a real and nominal oil price of over US$100 in the medium-to-long term. The 2008 World Energy Outlook forecast US$100 per barrel as the most likely average real oil price per barrel through to 2010, increasing to US$122 by 2030.

9. The IEA has traditionally taken a relatively optimistic and demand-driven view on the future supply of oil, suggesting that supply with sufficient investment would keep up with forecast demand.



Source: IEA, 2009; World Energy Outlook 2008

Figure 2: Estimated crude oil prices to 2030

10. More recently the IEA commented that current investment in oil production infrastructure is insufficient, making the future supply of oil more problematic and costly in light of the long lead times in bringing new sources of crude oil and refined product to market. It also noted the faster-than-expected decline rates of particularly large oil fields, and a concentration of oil production in a number of politically volatile countries.[2] This in turn increases the risk of sudden oil price shocks, caused either by political tensions in major supplier countries or by a physical shortfall in supply.

11. It is important to note that the world will not suddenly run out of oil. Nevertheless, there are real long-term price risks associated with present investment levels in energy infrastructure and higher field decline rates. (For more background on global oil supplies please refer to Appendix I.)

12. While substantial increases in domestic oil production would improve New Zealand's trade balance, it would not necessarily insulate the New Zealand economy from oil price volatility or long term prices rises (see also Appendix II). This is because, like all internationally traded commodities, domestic oil and fuel prices are largely driven by the international price.

New Zealand's exposure to oil price rises

Effects of oil prices changes on the transport sector

13. Reflecting the importance of energy to economic activity, high or volatile oil prices can have a pervasive effect on economic performance. For example, increased prices for energy-intensive building materials such asphalt and bitumen can lead to significant increases in the cost of infrastructure projects. Furthermore, sectors of the New Zealand economy whose fuel costs make up the dominant proportion of their operating costs (eg fishing, aviation, etc), are particularly exposed to high and volatile oil prices.

14. It is not just these sectors of the economy that feel the effect of oil price changes. New Zealand's overall level of exposure to oil price changes is more acute than many of our trading partners due to our distance from international markets. High and/or volatile oil prices are immediately felt by primary production exporting sectors with long transportation networks to international markets. Tourist visitor numbers to New Zealand are also at risk from significant increases in aviation fuel costs. International and domestic transportation costs, largely determined by oil prices, therefore play a significant role in the competitiveness of businesses right across the economy. The transport sector's exposure to increasing and volatile oil prices is therefore an issue of strategic importance.

[2] see IEA, 2008, World Energy Outlook 2008

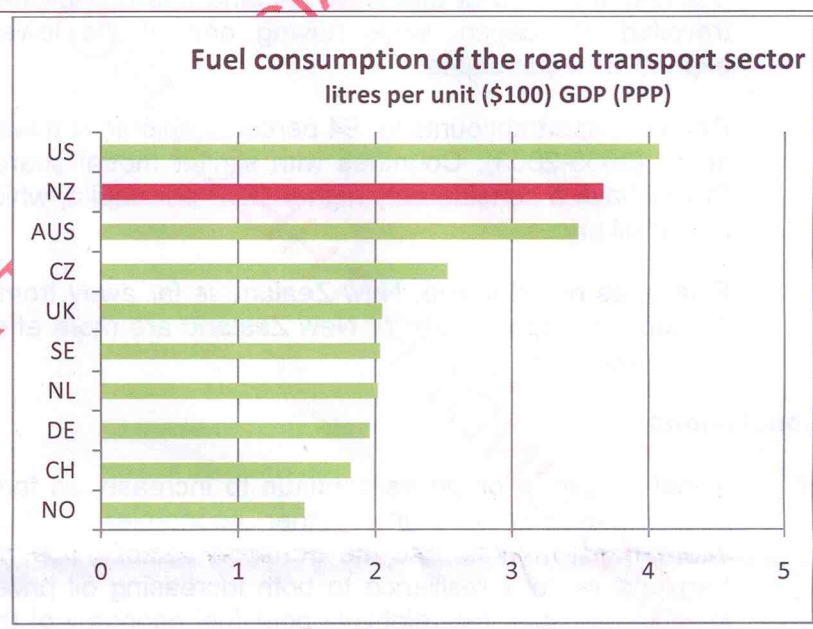
15. Oil price changes can also have negative effects on the transport sector itself. Obviously road users, most notably logistic firms and their customers, but also private motorists and public transport providers immediately feel the price impact. As a result transport revenue can be affected by a reduced demand for both fuel and travel. This in turn may affect the amount of funding available for infrastructure investments. New Zealand research indicates that a 10 percent (real) rise in the price of petrol will decrease petrol consumption by 1.5 percent within a year and 2 percent after two years[3].

16. There are of course also benefits from high oil prices. They can reduce the demand for transport services; encourage people to use less energy intensive transport modes, including public transport; and incentivise energy diversification and efficiency. For instance, persistent high oil prices often lead to the adoption of more efficient vehicles, the development of previously marginal or uneconomic non-conventional oil, and low-carbon technologies and fuels. (Fuels produced from non-conventional oil sources are also significantly more carbon-intensive, on average.[4])

New Zealand's vulnerability relative to other countries

17. New Zealand is a comparatively large user of oil for transport fuels.[5] A number of factors contribute to this reliance on oil. Population density is low and major production, consumption and export centres are dispersed, leading to high levels of freight movement between centres. For instance, a high proportion of New Zealand's freight task consists of the movement of relatively high volume commodities such as milk and forestry products. For these goods, transport costs can represent a high proportion of overall costs.

18. Road transport energy productivity expressed as the amount of fuel required to generate one unit of GDP is a useful indicator of the economy's exposure to changing oil prices and to the affordability of transport (see Figure 3).



Sources: European Commission, MoT, International Transport Forum

Figure 3: Road transport energy productivity in 10 OECD countries (2007)

19. New Zealand has comparatively low energy productivity, at 3.6 litres per US$100 GDP. Sweden is of a comparable size and population density to New Zealand and only requires about 2 litres per US$100 GDP. The Czech Republic, which has a similar GDP per capita to New Zealand, only requires 2.5 litres of fuel to generate US$100, 30 percent less than New Zealand.

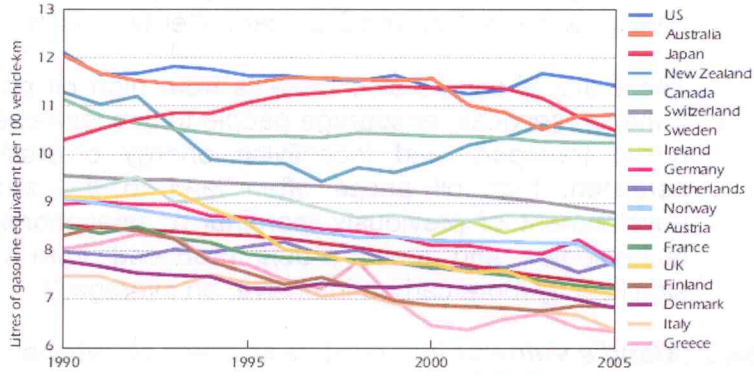
[3] Kennedy, D., Wallis, I. 2007, Impacts of fuel price changes on New Zealand Transport, Land Transport New Zealand, Research Report 331, 138pp.

[4] OECD, 2008, Oil dependence: Is transport running out of affordable fuel?, p12

[5] Delbruck, F., 2005, Oil Prices and the New Zealand Economy, Reserve Bank of New Zealand: Bulletin, Vol. 68, No.4

20. Modal choice in New Zealand is limited, even in major cities. In combination with the availability of relatively affordable vehicles, this has led to a high reliance on the private motor vehicle. New Zealand has one of the highest per-capita car ownership rates in the world.

21. The fuel economy of private motor vehicles is relatively low compared to most other OECD countries (see Figure 4).



Sources: IEA, 2007, Energy Use in the New Millennium,

Figure 4: Fuel economy of the light vehicle stock in OECD countries (2005)[6]

22. MED recently modelled 2008 vehicle purchase choices through the period of 2010 to 2030 and found that we could expect to see around a 20 percent improvement in the efficiency of the light vehicle fleet. However, this would still place New Zealand at a significant comparative disadvantage compared to other OECD nations.[7]

23. In terms of affordability of transport for business and individuals, a comparison between 17 IEA countries shows that New Zealand has one of the highest levels of vehicle kilometres travelled per capita, while having one of the lowest levels of personal consumption expenditures per capita.

24. Road transport accounts for 94 percent of distance travelled and 84 percent of travel in urban areas (2005-2008). Countries with similar modal shares such as Australia and the United States have a considerably higher GDP per capita, which increases their ability to cope with higher oil prices.

25. Finally, as noted above, New Zealand is far away from key markets for goods and tourists. As such, transport costs for New Zealand are more affected by oil prices than in most other OECD countries.

Conclusions

26. If real long term oil prices continue to increase, as forecast, New Zealand's economy may suffer relatively more than other economies. This risk centres on our distance to international markets and the transport sector's dependence on imported oil. Overall, the transport sector's resilience to both increasing oil prices and oil price volatility is relatively low. In particular the relatively poor fuel economy of the New Zealand fleet is an important energy challenge facing the economy.

27. Although growth in oil demand is expected to slow, it will remain New Zealand's dominant consumer energy source, reflecting its high value as a versatile transport fuel. It can be expected that New Zealand's vulnerability will be reduced marginally by the combined effects

[6] This figure shows trends in fuel economy and gives a proxy of fuel economy of the light vehicle fleet in 17 IEA countries. Measuring the actual on-road fuel economy of the light vehicle fleet is difficult and definitions of light vehicles differ in various countries.

[7] Emissions intensity can be used as a proxy for energy efficiency. Average greenhouse gas emissions from the light vehicle fleet is expected to reduce to 190g/km in 2030 (down from about 240g/km). By comparison, Europe's light fleet is likely to be at an average of 130g/km in 2030.

of the Emissions Trading Scheme, and the potential increased availability and affordability of new technologies such as electric vehicles and second generation biofuels.

28. Although there are no significant regulatory barriers to the uptake of prospective fuels and technologies right now, the cost, supply, convenience and reliability of new technologies compared to existing technologies appear to be key barriers. Should new technologies, new fuels and efficiency gains not be forthcoming (eg due to insufficient incentives), the sector's resilience would decrease further.

Appendix I: Global oil supply

World oil resources, reserves and production

The earth contains a finite amount of fossil-hydrocarbon resources. The process of the generation of oil in source rocks and its move to oil fields is well understood, and the areas with potential hydrocarbon accumulations are well known.

One can generally distinguish between conventional oil and non-conventional oil. Conventional oil typically includes oil produced or extracted using the traditional oil well method whereas non-conventional oil typically includes oil produced from tar sands and synthetic crude oil made from coal or gas. However, categorisation varies depending on the economic or geological criteria used.

Because of reservoir characteristics and limitations in petroleum production technology, not all of the total available oil resources can be recovered. Those hydrocarbons that can be recovered are considered to be reserves.

Several independent estimates suggest an ultimately recoverable world total of two to three trillion barrels[8]. World-wide cumulative production reached about 1.1 trillion barrels in 2006[9].

Oil reserves for which there is reasonable certainty that they can be extracted profitably – on the basis of assumptions about cost, geology, technology, marketability and future prices – are usually called 'proved' reserves. Reserve estimates are often categorised as 'proved', 'probable' and 'possible' with associated probabilities of production at 90%, 50% and 5%, respectively.

Our knowledge of remaining reserves is uncertain and subject to the factors noted above. Published reserve data varies considerably, largely due to differences in reporting methods of different institutions and a lack of information for reserves in OPEC countries. In June 2008 remaining proven reserves were estimated at 1.4 trillion barrels.[11] In due time, with improvements in technology and with higher prices, an unknown number of "probable" and "possible" reserves may be added to the volume of "proved" reserves (this is often referred to as 'reserve growth').

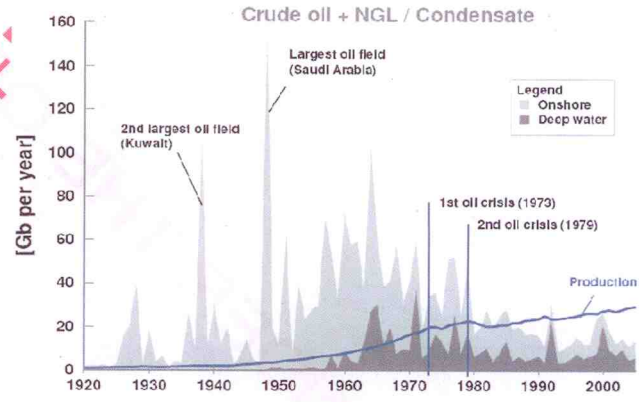


Figure 5: Oil discoveries vs. production[10]

Oil discoveries peaked in the 1960s. Since the 1980s oil consumption has been greater than annual discoveries of new reserves, and new discoveries have steadily declined (see Figure 5).

The first fields exploited are the largest, cheapest and easiest. Small, inaccessible and costly fields are left until later. While there are large non-conventional resources (e.g. oil shales), their use can be costly, more carbon-intensive[12] and they may yield less energy for energy invested. This is

[8] Zittel, W., Schindler, J., 2007, Crude Oil - The Supply Outlook, Report to the Energy Watch Group, October 2007, EWG-Series No 3/2007, p37

[9] IEA, 2006, World Energy Outlook 2006

[10] Zittel, W., Schindler, J., 2007, Crude Oil - The Supply Outlook, Report to the Energy Watch Group, October 2007, EWG-Series No 3/2007, p33

[11] BP, 2008, BP Statistical Review of World Energy June 2008 (includes tar sands), broadly consistent with data from IEA, 2006, World Energy Outlook 2006

[12] OECD, 2008, Oil dependence: Is transport running out of affordable fuel?, p12

because the ratio of energy delivered to energy costs declines as more and more energy is required to find, extract, process and deliver oil.

World oil production will peak when the rate of decline of old and existing fields exceeds the rate of growth of new and expanded fields. The suggestion that world oil production must eventually peak is uncontroversial as oil is a finite resource, although it is difficult to determine the timing of this event.

Better technology and higher prices can delay a decline in total production (e.g. 'probable' reserves may become 'proved'); however, at some stage an inevitable decline must follow. It is important to understand that while this will make it more likely that prices will increase it does not mean that the world will suddenly run out of oil.

Optimistic vs. pessimistic views on the future of oil

Views on the future of oil can be divided broadly into "optimistic" and "pessimistic" views. While the view that world oil production will peak at some stage is uncontroversial, there are questions and significant uncertainties regarding

- when fundamental supply constraints will occur,
- to what degree people think technology and economics can overcome current and future supply constraints,
- how fast production will decline, and
- to what degree alternative energy sources – including non-conventional oil – can make up for the decline.

The optimistic view suggests that fundamental supply constraints and geological limits will not be reached until some time beyond the immediate future. Investment into oil production infrastructure will be sufficient to keep up with demand. New technology and rising prices will lead to new discoveries and the extraction of previously inaccessible reserves. Improvements will occur at a rate and cost that is sufficient to maintain an adequate supply of oil. Even if oil becomes increasingly inaccessible and unaffordable, other resources such as tar sands and coal-to-liquids technology will be able to substitute oil.

The pessimistic view suggests that fundamental supply constraints and geological limits will soon be or have already been reached (i.e. the supply of oil cannot keep up with demand). New discoveries, new technologies and improvements will not be sufficient to maintain an adequate supply of oil. Other resources will not be able to fully substitute oil. This increases the likelihood of sudden price shocks and economic disruption.

Many international and governmental institutions, including the International Energy Agency, have tended, at least until recently, to be relatively optimistic in their outlooks. Others, including the Association for the Study of Peak Oil and Gas (an international network of non-profit organisations and researchers), have been much more pessimistic.

Appendix II: New Zealand's (short term) oil security measures

Most of New Zealand's oil security policies and practices are aimed at the mitigation of short-medium term oil supply interruptions. They are not designed to cope with oil price spikes or to raise the resilience to long term price increases.

The key provision underpinning New Zealand's security of oil supply is our participation in the International Energy Programme (IEP) administered by the International Energy Agency (IEA). The main obligation under the IEP is for member countries to hold oil reserves equivalent to 90-days of net imports. During a declared emergency, the IEA can order the release of a proportion of these stocks by member countries, thereby maintaining reliability of (global) supply. This mechanism has only formally been triggered once, in 2005 during Hurricane Katrina, and in this case it was credited with calming the oil market and preventing hoarding behaviour and a price spike. Importantly however, the 90-day obligation cannot be used unilaterally to control domestic prices or supply within New Zealand.

Domestically, measures to ensure New Zealand's short-medium term oil supply are covered by the Oil Emergency Response Strategy which is in the process of being implemented by MED. This strategy is intended to provide a range of possible measures in the event of short to medium term supply interruptions – most likely arising from a domestic incident (e.g. as the result of damage to infrastructure during an earthquake).