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Parliamentary Commissioner for the Environment

Te Kaitiaki Taiao a Te Whare Pāremata

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Impact of natural resource limits on inflation and growth

Briefing to the Finance and Expenditure Committee

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Introduction

Thank you for the invitation to assist with this inquiry.

You have asked me a number of interlinked questions about the impact of environmental limits on inflation and economic growth. These are not easy questions to answer. Theodore Roosevelt once exclaimed "O for a one-handed economist!" He was tired of economists who gave advice along the lines of "On the one hand, this… On the other hand, that…" This duality is unavoidable because at the heart of economics lies the duality of supply and demand. And the interaction between supply and demand can be very hard to predict when thinking about resource limits.

My presentation has three parts. First, I briefly show how environmental issues appear when looked at from an economic perspective. Second, I discuss each of the six natural resource limits mentioned in the letter from the Chair and consider these in relation to inflation, growth, and substitutability. Third, I re-examine oil in more depth because it is arguably the most pressing issue economically in the short term due to our dependence on it. Oil has additional significance because it is connected to the problem we are running up against most dramatically – climate change.

The environment through an economic lens

Our environment is fundamental to our economy. It provides us with sources of goods, such as oil and water, that we need to survive and be productive. Our environment also acts as a sink for bads, such as carbon dioxide and nitrates, which are the by-products of our productivity that threaten our wellbeing.

Your letter gave us six examples of natural resource limits. Four of those examples -- oil, water in Canterbury, fishstocks, and soil productivity -- are examples of sources. We use them as inputs into production and/or consume them. The other two are examples of sinks. The atmosphere acts as a sink for greenhouse gases and the Rotorua and Taupo lakes act as sinks for nitrates and phosphate. The ability of both of these systems to act as sinks is limited. Below, I consider the four sources first, and then the two sinks.

Scarcity of sources

Economists generally think in terms of resources becoming scarce, rather than reaching limits. The usual mechanism for allocating scarce resources is price. On the supply side, price rises are driven by resources becoming harder to find and more costly to extract. On the demand side, price rises are driven by people wanting more. Increasing scarcity is inflationary – it puts upward pressure on production costs and prices, all else being equal.

In response to upward pressure on prices, a complex set of responses on both the supply side and the demand side occurs. Suppliers may use lower quality resources, substitute other resources and implement technological innovations. Consumers may lower their

consumption or switch to less expensive substitutes if they are available. If we can substitute, there will be costs in the short term as the economy adjusts, but then the inflationary pressure will ease.

The effect that increasing scarcity will have on non-inflationary growth is complicated. It will depend on the interaction between the demand and supply side responses. The effects of increasing resource scarcity on growth can only be predicted using macroeconomic models, and these are necessarily based on a variety of assumptions.

Oil

How much oil is left and how much will be worthwhile extracting is uncertain. What is apparent is that “conventional” oil is becoming more costly to extract. Most of the world’s oil supplies used so far have come from the most easily found and exploitable reserves. Future supply will come from reserves that are harder to find, and more costly to extract and refine.

Current oil prices are both a short-term spike and a long-term structural issue.

Fish

Around the world, fishstocks are becoming increasingly scarce due to overfishing.

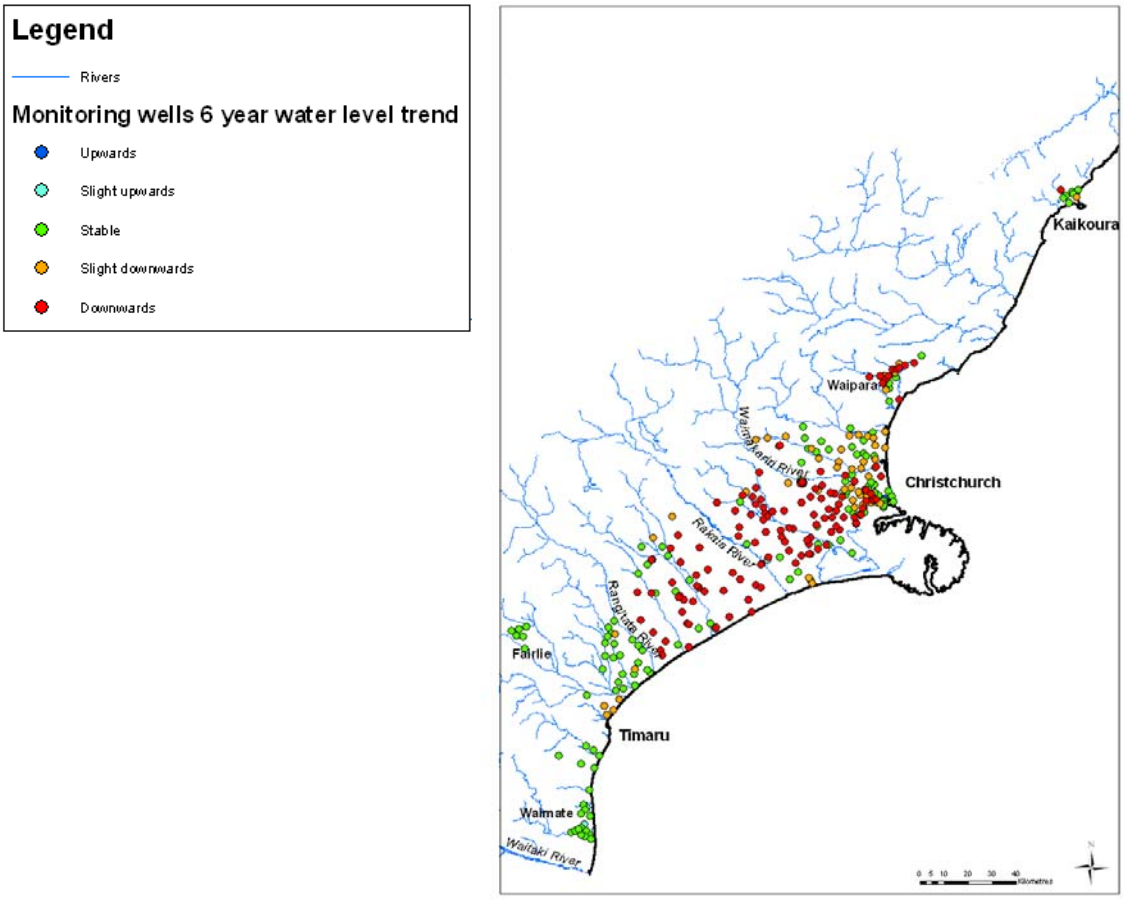
As stocks decline, fish become harder to find and more costly to catch. This puts upward pressure on production costs and price. As costs and prices rise, suppliers and consumers respond. Suppliers switch to other more abundant fish stocks and adopt new technologies. Consumers buy cheaper fish or other proteins such as other meats or soya beans.

Compared to most other countries, we manage our fisheries in New Zealand relatively sustainably through the quota system. The long-term success of our fishing industry critically depends on setting the total allowable catch at a sustainable level and on adequate enforcement of the quota system.

However, despite the relatively good management of our fish stocks, New Zealanders will face increasing prices for fish. This is because New Zealand is part of the global fish market. Increasing global scarcity will push up prices in New Zealand as well, resulting in inflationary pressure. New Zealanders will no longer be able to afford to enjoy eating a wide range of fish at a reasonable price. And although the focus of this presentation is on narrow economic issues, this is not just about a loss of food – the loss of marine biodiversity makes us poorer.

Fresh water as a source

Generally, water is not scarce in New Zealand. But we do have a scarcity problem - rain often does not fall where and when we want it. On average the South Island West Coast receives around ten times as much rain a year as Canterbury. Climate change predictions suggest this difference will probably get more extreme.



There are a variety of responses possible to address a decline in water supply. However, these options require investment and increased production costs, which will put upward pressure on prices.

Currently, there is no price for water. Our system of water allocation under the Resource Management Act is first come, first served. This is not efficient. Economic theory suggests we should introduce a water price to encourage more efficient use. This could increase production costs in the short-term. However, in the long term, costs will be lower than without a water price because we would be both using the resource more efficiently and investing in supply more efficiently.

Declining soil productivity

Provided the soil substrate is looked after well, soils productivity can be maintained by adding fertiliser. From a short-term economic standpoint, the limited resource in this case is fertiliser. Increasing farming intensity around the world has led to a greater reliance on fertiliser. On the supply side, nitrogen is unlimited, but the manufacture of nitrogen fertiliser – urea – requires natural gas. We may yet see a shift from nitrogen fertiliser back to clover. Phosphorus, also essential for plant growth, is becoming increasingly scarce; the shift from guano to the poorer source of phosphate bearing rock has already occurred.

Rising world fertiliser prices will affect production costs and thus food prices causing inflationary pressure.

Scarcity of sinks

The problem associated with increasing scarcity of sinks differs from that associated with sources in a very important way – increasing scarcity is not usually signalled by increasing price because sinks are seldom priced.

Sinks are typically public goods with undefined property rights. Historically, we have not accounted for the full long-term costs of using these resources. Economic theory suggests

that generally the most efficient management option is a market-based instrument – that is, putting a price on discharges.

The atmosphere as a sink for greenhouse gases

The atmosphere has a limited ability to absorb greenhouse gases without negative consequences. We have only one atmosphere, so we need to reduce emissions.

Our supply side options are limited. Possibly we will be able to capture and store carbon emissions in some cases but this technology is still developing and will likely be energy intensive. The major response needs to come from the demand side. The options are to move toward non-fossil energy and lower energy consumption.

This committee is also dealing with the Emissions Trading Scheme Bill. This bill effectively puts a price on using the atmosphere as a sink. In the short-term, there will be an increase in costs that will cause inflationary pressure as the economy structurally adjusts. The medium-term economic impact will depend on world carbon prices.

In thinking about the economic impact of the Emissions Trading Scheme, it is essential to think about what would happen to our economy without it. Already the Europeans are considering tariffs on imports from countries that do not put a price on carbon.

But this problem transcends short-term economic thinking. The choice on whether or not to act has been described as the choice between a damaged world and a more damaged world.

Water bodies as sinks

Water bodies are used as sinks for excess nutrients and pathogens.

New Zealanders are increasingly aware of the risk of algal blooms from increased concentrations of nutrients. The photograph shows an algal bloom in a lake in the

Waikato. The day after the photograph was taken, nine beef cattle drank the water and died.[1] There are real economic consequences here.

As with the atmosphere, water bodies are sinks that are not priced, and nutrient discharge pricing systems may help since price can signal scarcity. Nutrient discharge pricing systems are being trialled around the Lake Taupo and Lake Rotorua catchments.

In the short-term, if better control of nutrients has significant costs pricing this sink may well be inflationary. And it may well curb short-term growth or require some destocking. However, in the long-term if we do nothing and let our water bodies become increasingly polluted we may face increasing costs through impacts on animal and human health and sharp falls in production. Fresh water fishing and tourism will suffer. Further, we will not be able to enjoy beautiful, clean lakes and waterways.

An unusual map of the Waikato River is shown below. The width of the river is proportional to the nitrate concentration. After the river passes Huntly the concentrations

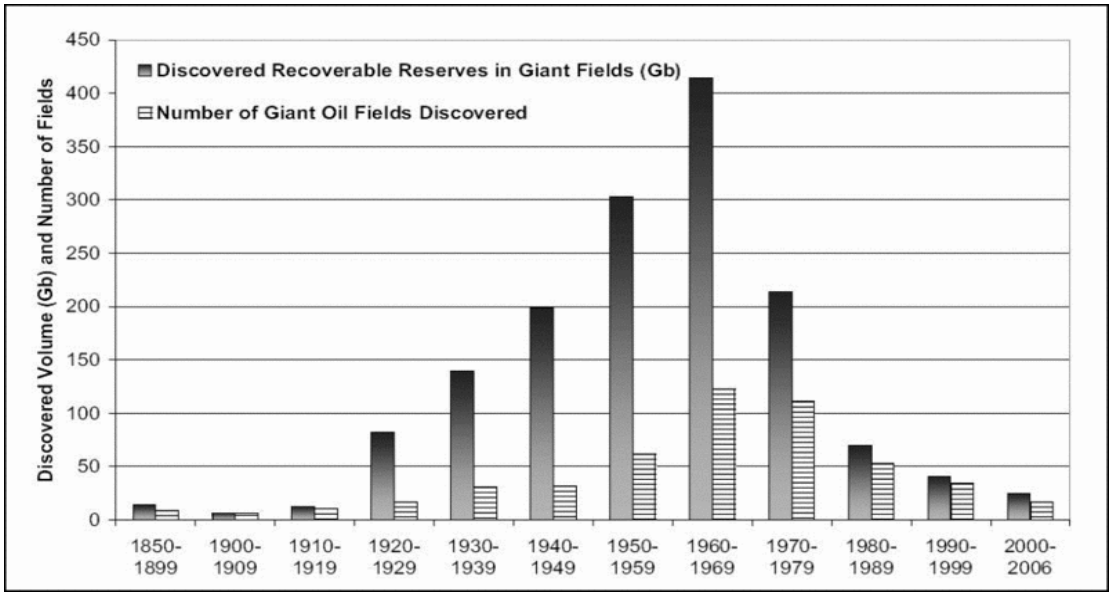
[1] Sourced from Environment Waikato.

are above 0.5 g/m^3, which Environment Waikato suggests is too high to prevent the excessive growth of nuisance plants.

Oil

I now consider oil in more depth. In the 1960s and 1970s, the Club of Rome and others predicted that oil would "run out" – often characterised now as "the boy who cried wolf". But it would be unwise to take all such warnings as "wolf crying".

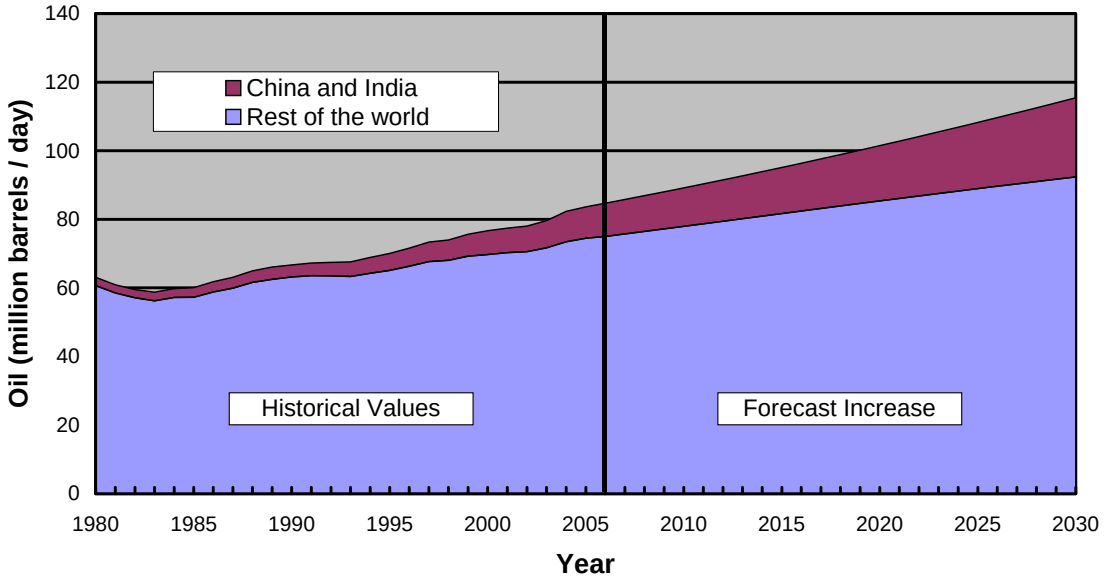
In the long term, the amount of recoverable reserves is highly debated. But we do know that oil is becoming more costly to extract. Most of the easily exploited reserves have been tapped.



The bar graph shows two different kinds of information about giant oil fields – fields with 500 million barrels of ultimately recoverable oil.[2] The dark gray bars show the discovered recoverable reserves (in billions of barrels) in giant fields from 1850 to 2006. The striped bars show the number of giant oil fields discovered in the same time period. The number and size of new giant fields discovered peaked in the 1960s.

[2] Robelius. 2007. *Giant Oil Fields - The Highway to Oil: Giant Oil Fields and their Importance for Future Oil Production.* Uppsala University, Interfaculty Units, Acta Universitatis Upsaliensis. Available online at http://publications.uu.se/abstract.xsql?dbid=7625

Increasing demand for oil is driving up its price. Much of this demand will be driven by increasing growth in Asia. Between 1980 and 2006, demand in China and India increased by over 300%, while the rest of the world grew by about 34%.[3] The International Energy Agency (2007) predicts in their reference scenario that consumption will increase by about 140% by 2030, compared with 36% for the rest of the world.[4]



The world has been consuming the best oil – light "sweet" low sulphur oil that is cheap to extract. No substitutes have yet appeared that have the same desirable characteristics. Biofuels may make a contribution but not on the same scale. The oil being extracted from tar sands in Canada is heavy and bituminous and its extraction uses large amounts of natural gas. In New Zealand lignite is being suggested as a substitute, but Southland lignite is very different from Saudi Arabian light crude.

A much stronger response is required on the demand side – lower consumption and more efficient consumption.

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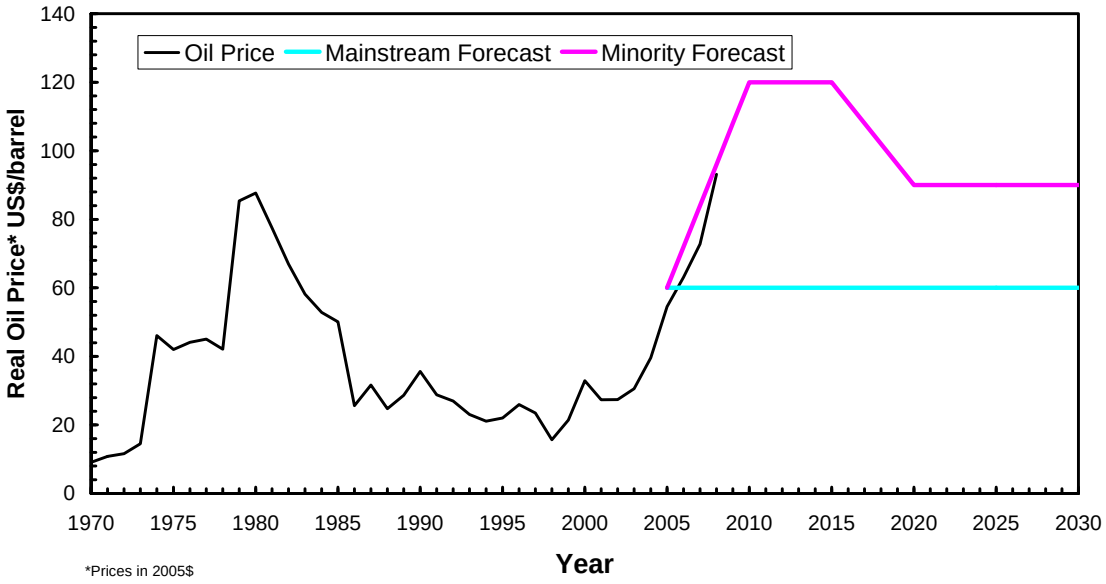
[3] Energy Information Association (2008). *International Energy Outlook 2007.*
[4] International Energy Agency. (2007). *World Energy Outlook.* OECD/IEA, France.

In his letter, the Chair asked if I think current oil prices are the result of a short-term spike or long-term structural change. My answer is both.

The graph shows annual oil prices since 1970 in 2005 US$ per barrel.[5] The current price in real terms has now returned to its peak in the early eighties. The Chair also asked for comment on the mainstream and minority forecasts from the MED report *New Zealand's Energy Outlook to 2030*.



The rationale behind the MED oil price forecasts is described in the paper by Samuelson and Taylor (2005).[6] The mainstream forecast assumes a Base Case oil price of US$60 per barrel flat trend to 2030 – this was based on the oil futures market in 2005.[7] However, the oil futures market only goes five years out. And only three years on, this is much lower than current and futures prices, which are both now around US$90 per barrel.

MED's minority forecast has better predicted oil prices for the last two years than its mainstream forecast. This assumes that oil prices continue to rise steadily to US$120 per barrel in 2010. They stay at this level until 2015, and then decline to US$90 per barrel by

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5 BP. (2007). *BP Statistical Review of World Energy 2007*. BP, London.
6 Samuelson and Taylor. (2005). *Oil Price Assumptions for Energy Outlook*. Discussion Paper for the Ministry of Economic Development.
7 This is measured in 2005$.

2020, remaining there until 2030. The argument for the decline after 2015 is that it should be possible to produce alternative liquid fuels for well under US$90 per barrel, given adequate time to make the necessary investments. But five years does not seem nearly long enough for the kind of investments and technological advancements that would be required.

Economists generally assume that technology will readily be developed when the price is high enough, while scientists generally believe that alternative technology will be much harder to develop. Electronics are a good example of where technology has rapidly developed. However, iron smelting has changed very little since it first began. I think that economists tend to be over-optimistic about substitutability and scientists tend to be over-pessimistic. I was a scientist before I was an economist, and I think that the decline predicted in the minority forecast is too optimistic.

You have a major focus on inflation in your inquiry. A rise in the price of oil certainly increases the transport components of the Consumer Price Index. But it must also feed into virtually all other components of the CPI because most if not all goods and services involve transport in their production. Thus, increasing petrol prices exacerbate the rate at which almost all prices increase.

In its submission, the Reserve Bank acknowledges the effect of oil prices on inflation, but comments that they have been offset by falls in prices of non-oil imports. This is does not appear to be an effect we can rely on in the future.

Land for housing?

There are huge sunk costs associated with infrastructure built around cheap oil and there will be considerable adjustment costs when the end of cheap oil occurs. This suggests we do not want to invest heavily in long-lived oil-dependent infrastructure.

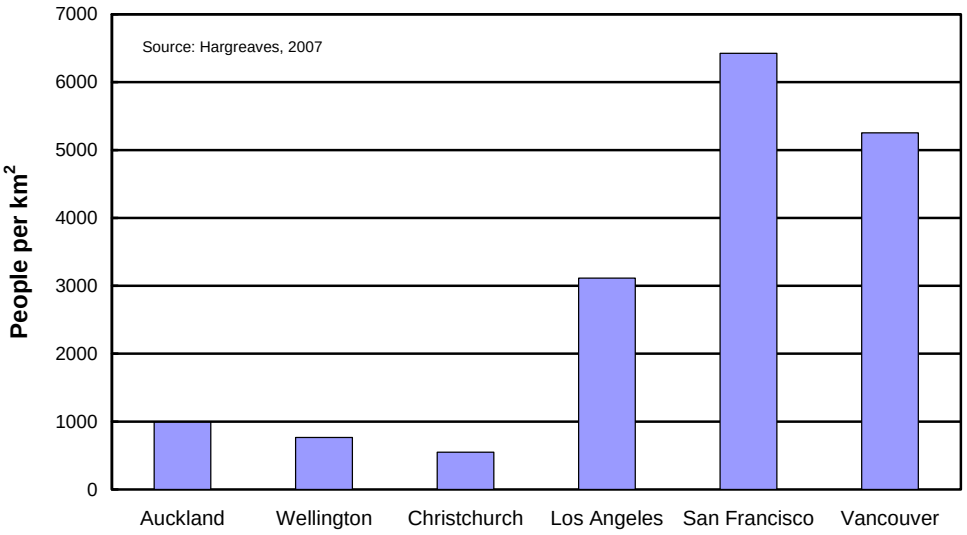
There is considerable risk of oil prices (and in particular transport prices) rising to high levels. We have been building in inflexibility on the demand side and are highly dependent on oil. It is not good risk management to lock in our ability to respond. We

need to minimise our risk by diversifying and reducing dependency on oil-based infrastructure.

Recent inflation has largely been driven by house prices. I understand that many of the submissions to this committee have addressed this issue. I note in particular that the first recommendation from Reserve Bank has been to free up land for developers on the edge of cities. I do not question the validity of the analysis that lies behind this – the large difference in land prices on either side of the Metropolitan Urban Limit in Auckland shows this. However, doing this locks us into more oil dependency. The creation of car-dependent suburbs on the edge of cities goes generally in the wrong direction. If we do create satellite suburbs, they need to have local service centres and good public transport links to city centres.

Freeing up land for urban sprawl is not the only solution to increasing housing supply. In his submission to the Commerce Committee's Affordable Housing Inquiry Professor Bob Hargreaves (2007) showed how our cities are global outliers – they have extremely low population densities. We need to get better at building quality, dense housing in our cities.[8]

[8] Hargreaves. (2007). *A plan to ease rents and house prices*. Submission to the Commerce Committee inquiry into housing affordability in New Zealand.



If oil price rise is a long-term structural issue, then we need to make a long-term structural response, and the structure of our car-dependent cities is an important place to start.

Implications for monetary policy

Increasing scarcity is inflationary. How steeply prices rise depend on our ability to substitute. Some resources can be substituted easily at low cost. Other resources have few substitutes and adjustment will be costly. The impact of increasing scarcity on growth is difficult to predict as it will depend on how the demand and the supply sides respond.

The use of the atmosphere and water bodies as sinks for pollutants has been excessive. This is partly because there have been no prices signalling that their capacity to absorb our wastes has been becoming increasingly scarce. Putting prices on discharges might be inflationary in the short term but can help avoid much more serious economic impacts in the long term.

Our economy is at risk from our high dependency on oil. Oil prices feed into the prices of virtually all goods and services in our economy. We need to reduce our exposure to this risk by investing in infrastructure that is less dependent on oil.