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FROM THE EDITORS

This edition of *EcoNZ@Otago* begins with an emphasis on the family. We look at the effect on young people's earnings of how old they are when they leave the parental home, and at the effect of motherhood on women's lifetime earnings. Also in this edition, we look at the ways in which NZ society might make decisions about priorities in public healthcare, and at the environmental economics of South Canterbury, Otago and Southland through the lens of the traditional land management practices of the southern Ngāi Tahu. As usual, each article is accompanied by further questions to consider. We conclude with our regular piece on the state of the NZ economy.

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ALSO IN THIS ISSUE

The cost of delaying leaving the parental home

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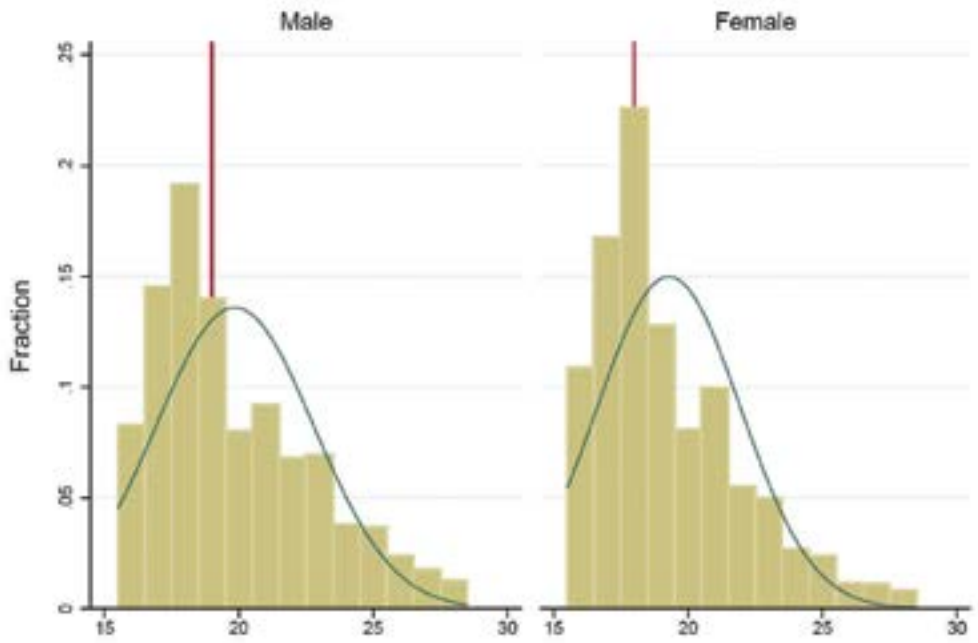
Economics is often described as the study of scarcity and choice. Some of these choices which individuals make require little thought and have very little consequence if the wrong choice is made. An example of such a decision is whether to have a cup of tea or coffee. Some decisions may have a greater impact on an individual's life and so require more thought, such as what car to buy. In this article we discuss some of the costs associated with one of the first large decisions we make as individuals: deciding when to leave the parental home and begin living independently. In this article we present some analysis on whether the age at which an individual decides to leave home has any short-run effects on labour market outcomes.

Studies such as Gutmann et al. (2002), Chiuri and Del Boca (2010), and Blaauboer and Mulder (2010) examine the decision about when to leave home. These papers show that family structure, the number of siblings, the atmosphere of the household, and financial factors are all important. Other studies, such as Billari and Liefbroer (2007), Johnson and DaVanzo, (1998), and Buck and Scott (1993) examine why individuals decide to leave the home. These papers find that there are three main reasons: autonomy or independence, education or employment opportunity, and marriage or cohabitation.

My study complements these papers by looking at how the age at which someone leaves home affects their labour market experiences in later life. The study uses data from the Household Income and Labour Dynamics in Australia (HILDA) survey. This survey is conducted by the Melbourne Institute of Applied Economic and Social Research. The HILDA survey began in 2001, with researchers contacting approximately 12,000 Australian households that were selected to be representative of the whole population. Responses were received from 7,682 of these households, representing 19,914 individuals (Wooden, 2002). Each subsequent wave of the HILDA survey has been conducted annually.

Figure 1: Histograms for the age at which Australian men and women leave home. The red line indicates the median age.



DO I LEAVE OR DO I STAY?

In my statistical analysis, which is designed to quantify the effect of the age of leaving home on labour market outcomes, I use three alternative ways of measuring this age. The first measure is simply the age (in years) at which an individual left home. The second is an indicator variable which distinguishes people who were aged 20 or over when they left home from those who left home at a younger age. The third is a set of three indicator variables for people leaving home at age 15-18 (early leavers), 21-22 (late leavers) and 23-28 (very late leavers); the analysis looks at the outcomes for these groups relative to the average age of 19-20. The labour market outcomes I examine are the likelihood of being in paid employment and the hourly wage rate. The main analysis is based on a sample of individuals who are living in the parental home in the first wave of the HILDA survey and then leave home at some later date. Because moving home can be disruptive in itself (Ribar, 2013), my analysis is based on labour market outcomes reported at least four waves after the individual has left home, so my results cannot be ascribed to any transitional effects.

OUT ON MY OWN

Table 1 presents some results using a sample of individuals aged 25-34. In this table, the numbers in the left-hand panel show the effect of the age of leaving home on the probability of being employed, while the numbers in the right-hand panel show the effect on the hourly wage rate; these numbers are expressed as percentage differences. The results are based on statistical analysis that also allows for the effect on these outcomes of other factors, including marital status, level of education, location, country of birth, parental characteristics and psychometric measures of personality. Each panel includes results for men and women separately. Numbers that are significantly different from zero are indicated by an asterisk. The results in the table show that overall, the age at which an individual leaves has only a moderate effect on labour market outcomes. The only really strong systematic effect is that women who left home at a later age appear to earn significantly less. Those who left home aged 21 or older earn approximately 10% less than others, on average. If we split this group into those leaving home aged 21-22 and those leaving home at an even older age, we see that the significant effect relates to the first of these sub-groups. Those leaving home aged 21-22 earn approximately 17% less than others, on average; for the older group there is no significant effect.[1]

1 There are some other moderately large average estimated effects, e.g. the –19.8% for women who leave home at a very young age. However, these effects are not significantly different from zero. In other words, there is a great deal of heterogeneity in outcomes for this group, so the average effect is not that meaningful.

Table 1: Results for the main sample of individuals observed leaving home

	Average effect on the probability of being employed (in percent)		Average effect on the hourly wage rate (in percent)	
	Women	Men	Women	Men
Effect of one extra year in the age of leaving home	0.0%	0.1%	–1.1%	–1.0%
Effect of being aged 21 or older when leaving home (relative to being younger)	4.3%	5.6%	–10.0%*	6.7%
Effect of being aged 15-18 when leaving home (relative to being 19-20)	–19.8%	3.5%	–7.9%	–8.0%
Effect of being aged 21-22 when leaving home (relative to being 19-20)	0.2%	4.6%	–17.3%*	3.7%
Effect of being aged 23-28 when leaving home (relative to being 19-20)	–9.7%	10.3%	–2.1%	5.9%

Table 2: Results of the robustness checks

	Average effect on the probability of being employed (in percent)		Average effect on the hourly wage rate (in percent)	
	Women	Men	Women	Men
Effect of one extra year in the age of leaving home	0.1%	0.4%	0.1%	–0.7%
Effect of being aged 21 or older when leaving home (relative to being younger)	0.7%	2.0%	–3.50%	–5.5%
Effect of being aged 15-18 when leaving home (relative to being 19-20)	–0.4%	2.7%	–2.2%	–4.1%
Effect of being aged 21-22 when leaving home (relative to being 19-20)	–0.3%	2.3%	–10.4%*	–6.8%
Effect of being aged 23-28 when leaving home (relative to being 19-20)	5.3%	4.7%	2.4%	–9.5%*

The results in Table 1 are based on quite a small sample – fewer than 1,000 men and women combined – so I checked the robustness of these results by enlarging the sample to include individuals who left home before the first wave of the HILDA survey. The enlarged sample includes over 3,000 men and women combined. (The disadvantage of using the larger sample is that there is less background information on the individuals who left home prior to the HILDA survey, so it is not possible to control for as wide a range of individual characteristics.) Results from the enlarged sample, shown in Table 2, confirm that the age at which an individual leaves home does not affect the likelihood of being employed. They also confirm the initial finding that women who leave home at a later age earn significantly lower wages. However, the results in Table 2 regarding the effects of the age at which men leave home conflict with those in Table 1. It is not possible to make any conclusive statement about the effects for men, which require further investigation.

QUESTIONS TO CONSIDER

1. Do these results mean that parents should kick their daughters out of home at younger ages to give them a chance at better labour market outcomes?
2. Do you think that this effect of the age of leaving home on labour market outcomes is also present in countries where on average people live with their parents for longer?

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The motherhood wage gap over the life cycle

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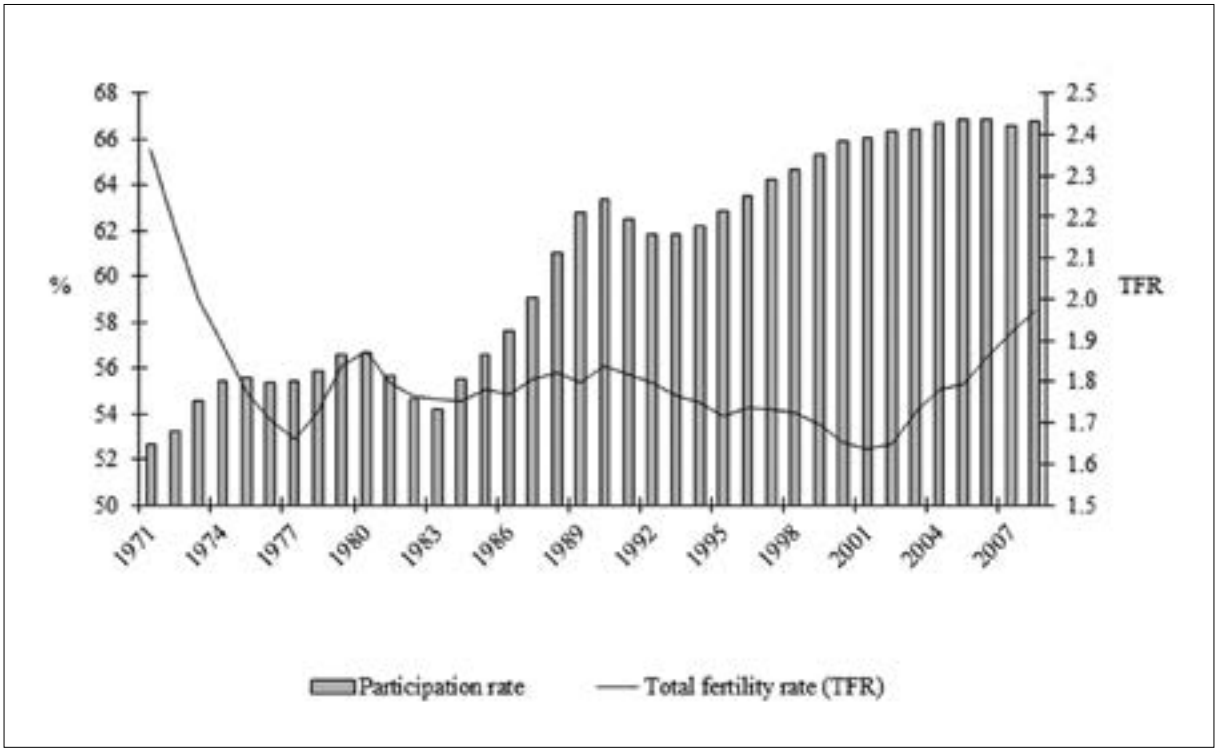
The past 40 years have witnessed an increase in women's labour force participation rates in the United Kingdom from 50% in the early 1970s to over 65% in the late 2000s; along with the increase in participation, the UK has experienced a decrease in the fertility rate during the 1970s, and fertility has now dropped below the replacement rate of 2.1 (Figure 1). Although the two events may be unrelated, it could also indicate that many women find it difficult to combine career and fertility decisions.[1] Therefore, we examine more closely the effect of motherhood on wages in the UK.

Figure 1: Female labour force participation rate and total fertility rate



Note: Labour force participation rate for the UK.
Total fertility rate for England and Wales.
Source: Office for National Statistics

MUMMY PENALTY?

Since 1986 the female labour force has increased by more than 50% internationally, and New Zealand's female labour force participation rate is above the OECD average. According to the September 2014 figures from the New Zealand Household Labour Force Survey, 63.7% of females aged 15 and above are participating in the labour force. However, according to the 2012 New Zealand Income Survey, women earn 9.3% less than men and the gap is larger for Māori, Pasifika and Asian women. Many studies have found that a significant portion of the gender wage gap (that is, the difference between male and female earnings expressed as a percentage of male earnings) can be explained by a "family gap" or "motherhood wage gap", that is, the difference between the earnings of women with children and the earnings of those without children. The estimates for the magnitude of the motherhood wage gap range considerably from 0% for Denmark (Datta Gupta and Smith, 2002; Simonsen and Skipper, 2006) to 33% for the UK (Joshi et al., 1999) with many estimates in between these two extremes. A more recent literature notes the importance of fertility timing (Miller, 2011; Amuedo-Dorantes and Kimmel, 2005). Miller finds that on average more highly educated women delay childbirth, with an increase in earnings of 9% per year of delay. Moreover, having decided to have a child, a woman with a college education benefits from a 4% wage boost compared to college-educated childless women.

Viitanen (2014) extends our understanding of the motherhood wage gap by examining effects over the whole reproductive lifecycle, rather than at one point in time. This study uses the National Child Development Study (NCDS), a longitudinal survey following all individuals born in Britain during the first week of March 1958. Results are based on "propensity score matching", a method that estimates the effects of motherhood by comparing pairs of women who share similar characteristics, except that one woman has a child (or children), and the other woman does not. This is the first study to examine long-term motherhood wage gaps, that is, the effect of motherhood 10, 20 or even 30 years after the birth of the first child.

1 Despite equal opportunities and family friendly policies, females remain primarily responsible for home production and childcare (Blossfeld and Drobnic, 2001).

The study finds that effect of a first child is to reduce the average wage by 8.1% on average at age 23, 22% at age 33, 4.8% at age 42, and 0% at age 51. The effects of a second child are somewhat smaller. The longitudinal nature of the data also allows the estimation of long-run effects. Results indicate that the wage gap persists even 30 years after the birth of the first child. Women who become mothers before the age of 23 have wages that are 16-18% lower after 10 years and 8-9% lower after 20 years, compared with women who are not mothers by that age. These long-term effects are smaller if the woman is older when her first child is born, and there are no significant long-term effects for women who are aged 33 or older at the birth of their first child.

What does this imply for a typical New Zealand woman? In 2012, the median annual income from all sources for women working full-time in New Zealand was $23,400. If this typical woman becomes a mother before the age of 23 then she can be expected to earn about $4,000 per year less at age 33 and nearly $2,000 less at age 43. How can these results be explained? One possible explanation is that women who complete their education and start on the career ladder before having children have higher earnings than those who forgo those things and have children young.

QUESTIONS TO CONSIDER

1. What is a motherhood wage gap?
2. Why might it be a good idea not to rush into having children too soon?

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Diminishing marginal utility

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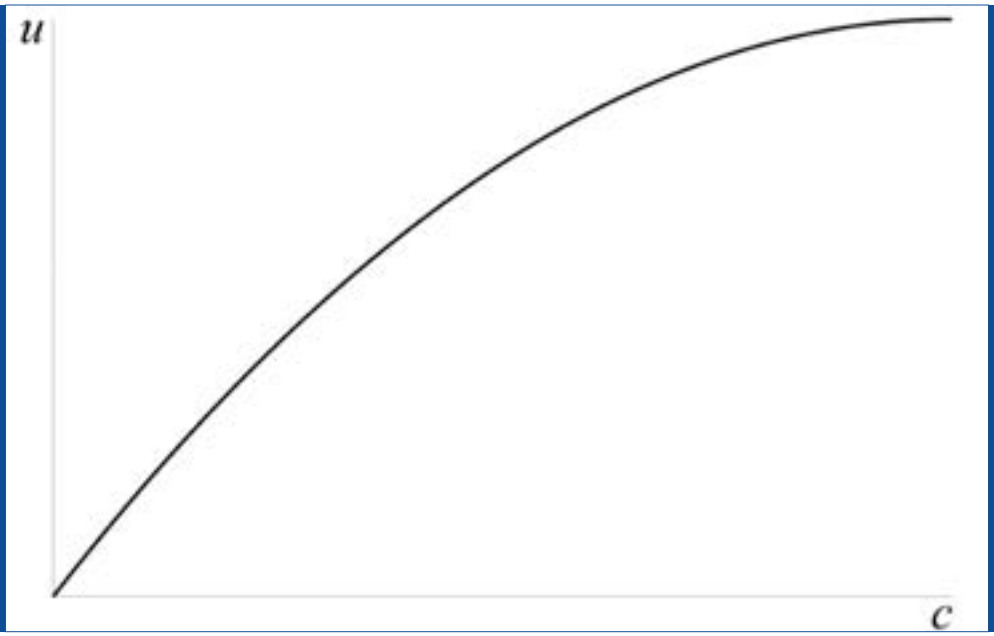

This is the first graph I ever came across in Economics at school, when I was in Year 11. It illustrates the hypothesis that more consumption (c) leads to a higher level of welfare (*u* for utility), but that each incremental unit of consumption has less effect. This hypothesis has its origins in the work of Bentham (1789) and Mill (1863). Bentham and Mill realised that if the hypothesis is correct then it has substantial implications for the way we understand wellbeing in human society. For example, if *u* represents a common measure across all individuals (as Bentham and Mill intended), and if the shape of the function is similar for all individuals, then a transfer from the rich to the poor is likely to increase the total level of utility in society. What I particularly like about the theory of diminishing marginal utility, apart from its clarity and lack of ambiguity, is the fact that it is testable. There are three main ways of testing the theory.

(i) **Statistical analysis of psychometric survey data.** In applied psychology there are now robust ways of measuring individual wellbeing using a battery of survey questions. Observed correlations between these measures and estimates of individual levels of consumption can be used to infer the shape of the function. In fact, even very simple survey questions produce results consistent with the theory. For example, one can ask respondents the question, "Taking all things into account, how happy are you these days?" Then the respondents must choose a point on the following scale.

0	1	2	3	4	5	6	7	8	9	10
extremely unhappy										extremely happy

Layard et al. (2008) show that when responses to this type of question in the US Household Survey are plotted against household income, the points fall on a curve like the one in in the figure, with the line becoming almost completely flat at income levels over $100,000.[1]

(ii) **Behavioural experiments.** The shape of the function can be inferred from the decisions of subjects in laboratory experiments. Experiments involving choice under uncertainty are especially popular in this literature. If someone's utility function is curved, then she ought to choose a 100% chance of earning $1,000 in preference to a 50% chance of earning $2,000 and a 50% chance of earning nothing. If we observe people's choices when they are faced with a range of different probabilities (50-50, 60-40, 70-30, etc.), then we can work out exactly how curved the line is. The value of early experiments of this kind was limited by an assumption that subjects were ultra-efficient and always chose the option that gave them the highest expected utility, but this drawback has been overcome in more recent studies; see for example Fennema and Van Assen (1998).

(iii) **Neurological experiments.** Innovations in neuroscience and in brain scanning techniques have made it possible to examine the correlation between the subjective measures of wellbeing in (i), the experimental behaviour in (ii), and activity in specific parts of the brain. This provides a scientific basis for measuring a person's utility level by scanning her brain.[2] Experimenters such as Pine et al. (2009) have been able to identify certain areas of the brain that are associated with utility from consumption, and show that variations in the intensity of activity in these parts of the brain are consistent with diminishing marginal utility. This type of neurological experiment comes close to fulfilling the expectations of Bentham and Mill that one day it would be possible to analyse human wellbeing using the natural sciences.

Testable theories like this are what make economics a science: if a theory isn't testable then it has little claim to be scientific, however mathematically elegant it is (Popper, 1959), and it adds nothing to our objective understanding of the world around us. The challenge for 21st century economics is to live up to this high standard: to develop testable theories that deepen our understanding of how human society is ordered, and then to test these theories directly.

1 Here there is an assumption that consumption is proportional to income, so that in the figure we can replace consumption with income.
2 This approach can also be used to study utility functions in other primates; see for example Glimcher et al. (2005) and Lee (2009).

QUESTIONS TO CONSIDER

1. Real (1991) shows that experiments of the kind described in (ii) can also be applied to bees (using pollen instead of dollars), and that a bee's utility function is also curved. However, unlike humans, bees seem to be quite good at maximising their expected utility (Dukas and Real, 1993). What might explain this difference? Is there an evolutionary explanation?
2. Bentham and Mill were interested in the idea of utility as a way of rationalising choices about the distribution of wealth. If bees have utility too, should we be concerned about their standard of living?
3. Suppose that it can be proven scientifically that certain types of individual are congenitally happy: it doesn't take very much consumption to give them a high level of utility. Should these people be taxed at a higher rate? Isn't this just like imposing a higher tax rate on people born with the ability to make more money?

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Which drugs, medical procedures and equipment should be funded?[1]

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All health systems must grapple with how best to allocate their limited budgets across the many thousands of health 'technologies' – drugs, medical procedures, equipment, etc. – that are available. This resource-allocation problem is intensifying thanks to advances in medicine, more old people and pressure on government finances in general. And so decisions about which drugs, procedures, equipment, etc. to fund and make available (and which ones not to!) are necessary.

YOU CAN'T ALWAYS GET WHAT YOU WANT

Deciding which technologies to fund – formally known as 'health technology prioritisation' – almost always involves confronting tradeoffs between multiple, conflicting objectives. For example, is it better to fund a drug that will deliver a small health improvement to many people or a medical procedure that will save just a few people's lives? In the last few years prioritisation frameworks based on Multi-Criteria Decision Analysis (MCDA) have become increasingly popular.

In general terms, MCDA is concerned with decision-making situations in which alternatives are ranked based on considering a variety of objectives or criteria simultaneously. For example, if you were looking for a car to buy, you might evaluate the ones you're considering according to criteria such as fuel economy, reliability, age, coolness, safety, etc. and compare their overall 'performance' and ranking on these (multiple) criteria relative to the cars' prices.

Using MCDA to prioritise health technologies is conceptually similar. Not surprisingly, though, the fundamental questions in this case are: What are the appropriate criteria for prioritising health technologies? And, what are the weights for the criteria, reflecting their relative importance to decision-makers and citizens in general?

In this article, we report on our research into developing and pilot-testing a methodology for involving New Zealanders in answering the two questions above. Given that everyone consumes health care and that most people pay taxes to fund the health system, it is appropriate – and a strength of our methodology – that so-called 'every-day' people are asked about their preferred criteria and weights for prioritising technologies.

Understanding people's preferences is important to New Zealand's Pharmaceutical Management Agency (PHARMAC), for example. PHARMAC recently undertook a public consultation exercise, with the aim of, in the words of Chief Executive Steffan Crausaz, ensuring that "the criteria we use to help us make those decisions … mean our funding decisions continue to reflect the things New Zealanders … value." (PHARMAC, 2013, p. 2).

FOCUS ON WHAT MATTERS

To find out what people care about when thinking about health technologies that should be funded, we recruited six focus groups comprising health care consumers, providers and academics: Group (1) 5 general practice staff, (2) 5 nurses, (3) 4 staff from a non-medical health care organisation, (4) 6 public health professionals and academics, (5) 13 staff from a health care provider for Māori, and (6) 7 retirees.

Before attending their group meeting, each person was asked to complete an online 'ranking survey', implemented using 1000Minds software (1000minds.com), that involved ranking short descriptions (or 'vignettes') of the 14 health technologies ((1) Dialysis for end-stage renal disease, (2) Methadone for opioid addiction, (3) Hand sanitiser use in primary schools, (4) Hip replacements, (5) Statins for patients at high risk of cardiovascular disease, (6) Abatacept

1 This article is based on Trudy's research for her PhD degree (supervised by her co-author here and Paul Thorsnes and Rob Lawson). A discussion paper is also available; see Sullivan & Hansen (2014).
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for last-line treatment of rheumatoid arthritis, (7) Antiretroviral drug for HIV, (8) Vaccine for preventing cervical cancer (Gardasil), (9) Growth hormone treatment for Prader-Willi Syndrome, (10) Imatinib mesylate for chronic myeloid leukaemia, (11) IVF treatment, (12) Positron Emission Tomography (PET Scan), (13) Oral drugs for erectile dysfunction (e.g. Viagra, Cialis), and (14) Service for postnatal depression) with respect to their value to society and hence their relative desirability for being available in the health system. Table 1 presents a subset of these vignettes.[4] Participants were instructed: "When ranking this treatment, do not consider its cost – just consider its benefits/value to society."

Table 1. Sample vignettes for health technologies used in the ranking survey

1. Dialysis for end-stage renal disease

- End-stage renal disease is when the kidneys no longer function well enough to keep a person alive and renal replacement therapy (RRT) is required.
- RRT includes kidney transplantation, haemodialysis and peritoneal dialysis.
- Dialysis removes waste and extra fluids from the blood using a special filter (haemodialysis) or a catheter in the abdomen (peritoneal dialysis).
- Dialysis is time-consuming and is done in hospital or at home.
- The major causes of renal failure are diabetes, kidney disease, high blood pressure and genetics.
- The average age of a dialysis patient is 56 yrs, with many patients over 65. Almost 50% of patients are Māori.
- The number of people receiving dialysis could double in the next 5 yrs.
- Approx. 50% of people starting dialysis are still alive after 5 yrs.
- No. of people to start dialysis: 440, for the rest of their lives.

2. Methadone for opioid addiction

- Methadone is used to treat people who have an opioid addiction (e.g. heroin or morphine), by helping them to reduce their use of opioids.
- Methadone reduces the death rate from overdoses and the spread of infectious diseases (hepatitis B, C or HIV from injecting drugs) and improves the health of addicts.
- Opioid addiction is also associated with high cannabis and tobacco use, low health status and low rates of employment.
- Methadone treatment reduces the substantial social and economic costs resulting from drug abuse.
- Alternatives to methadone such as abstinence-based treatments are largely ineffective.
- Relapsing is common with methadone treatment. 98% of addicts stop injecting drugs after an average of 5 years' stabilisation.
- No. of people to receive methadone: 4000 (until they stop their opioid use).

3. Hand sanitiser use in primary schools

- Hand washing helps reduce infectious disease transmission. An alcohol-based no-rinse hand sanitiser is an alternative to using soap, water and drying facilities.
- It helps to reduce the spread of respiratory and gastrointestinal infections by killing various types of bacteria and inactivating different kinds of viruses.
- On average, approx. 11% of children are absent from school each week due to illness.
- In addition to children being ill, spread of the illness harms other pupils, staff and caregivers. Also parents/caregivers may require time off work due to illness or caring for a sick child.
- Alcohol-based hand sanitisers in schools could reduce the rate of absenteeism due to illness by 20%-50%.
- No. of children to use hand sanitisers: 400,000 (for one 4-month period during winter).

4. Hip replacements

- A hip replacement is a surgical procedure in which the damaged hip joint is replaced by a prosthetic implant.
- Hip damage is caused by osteoarthritis, rheumatoid arthritis and hip fractures.
- The most common cause of deterioration of the hip joint is osteoarthritis. As the cartilage lining becomes damaged and wears away, the bones within the joint rub together causing pain and making it difficult to get around.
- It can affect men and women, and is more common over the age of 50.
- A hip replacement relieves pain and restores function to the joint. Patients become mobile again and can lead a normal lifestyle.
- A hip replacement typically lasts 15-20 yrs.
- No. of people to receive a hip replacement: 7000.

5. Statins for patients at high risk of cardiovascular disease

- Cardiovascular disease (heart, stroke and blood vessel disease) is the leading cause of death and hospitalisation in NZ.
- Risk factors are smoking, physical inactivity, an unhealthy diet, high cholesterol, high blood pressure and diabetes.
- Death rates are higher for men than women and are much higher for Māori and Pacific Island people.
- Statins are drugs that reduce the production of cholesterol by the liver, helping to prevent blood vessels becoming blocked with fatty deposits.
- Approx. 20% of people over the age of 35 could benefit from using statins, depending on the threshold for absolute risk.
- Statins reduce the risk of a heart attack or coronary death by about a third.
- No. of people to receive statins: 220,000, for the rest of their lives (potentially preventing 66,000 heart attacks or coronary deaths).

6. Abatacept for last-line treatment of rheumatoid arthritis

- Rheumatoid arthritis (RA) is a chronic and progressive disabling disease that causes pain and joint inflammation and can cause joint damage.
- Onset of RA mainly occurs between 40-70 yrs, affecting 3 times as many women as men.
- Abatacept helps stop the immune system attacking healthy tissues in the body.
- Abatacept is not a cure for RA but when combined with other drugs can significantly improve the quality of life of a person by reducing pain, joint inflammation and damage to bones and cartilage.
- Abatacept is used when treatment with other drugs has been unsuccessful.
- A serious side effect is that it can reduce a person's ability to fight infection.
- No. of people to receive abatacept: 30, for the rest of their lives.

4 To see the full paper which includes all the vignettes, go to otago.ac.nz/Healthsystems/ otago066743.pdf.

FIRST TO LAST

In each of the six focus group meetings, the 14 vignettes were also ranked via discussion and majority consensus. Each group's ranking of the 14 vignettes, as well as mean and median ranks across all groups, are reported in Table 2. As can be seen, 'Statins for patients at high risk of cardiovascular disease' is the highest or second-highest priority for all groups. At the other extreme, 'oral drugs for erectile dysfunction' is ranked last or second-last by five groups and third-last by the remaining group.

HOW IMPORTANT ARE THE CRITERIA?

Based on the focus group discussions, the criteria and the levels within each criterion for ranking technologies presented in Table 2 were specified for use in a discrete choice experiment (DCE) to determine the weights[5] on the criteria, reflecting their relative importance.

The DCE was also implemented using 1000Minds software, which applies the PAPRIKA method (Hansen & Ombler, 2008), in which participants rank pairs of hypothetical patients, defined on the criteria two-at-a-time, with respect to their relative priority for treatment.[6] An example of a pairwise-ranking question appears in Figure 1.[7]

Table 2. Rankings of the 14 health technology vignettes by the six focus groups

	Focus group						Mean rank[a]	Median rank[b]
Health technology vignette	(1)	(2)	(3)	(4)	(5)	(6)		
Statins for patients at high risk of cardiovascular disease	1st	1st	1st	1st	2nd	2nd	1.3	1
Service for postnatal depression	6th	3rd	7th	2nd	1st	4th	3.8	3.5
Hip replacements	2nd	11th	2nd	4th	4th	3rd	4.3	3.5
Methadone for opioid addiction	4th	5th	6th	7th	5th	10th	6.2	5.5
Vaccine for preventing cervical cancer	3rd	13th	5th	5th	3rd	11th	6.7	5
IVF treatment	8th	4th	8th	6th	9th	8th	7.2	8
Positron emission tomography (PET Scan)	11th	12th	4th	10th	6th	1st	7.3	8
Dialysis for end-stage renal disease	7th	7th	10th	8th	7th	7th	7.7	7
Abatacept for last-line treatment of rheumatoid arthritis	9th	6th	12th	12th	8th	5th	8.7	8.5
Antiretroviral drugs for HIV	5th	10th	9th	9th	10th	9th	8.7	9
Imatinib mesylate for chronic myeloid leukaemia	10th	2nd	11th	13th	11th	6th	8.8	10.5
Hand sanitiser use in primary schools	12th	9th	3rd	3rd	12th	14th	8.8	10.5
Growth hormone for Prader-Willi Syndrome	13th	8th	13th	14th	13th	13th	12.3	13
Oral drugs for erectile dysfunction	14th	14th	14th	11th	14th	12th	13.2	14

a Mean ranks are calculated by summing the group ranks for each vignette and dividing by six, the number of groups.
b Median ranks are calculated in the usual way from the group ranks for each vignette.

5 Sometimes referred to as 'part-worth utilities'.
6 Another DCE applying this method featured in an article that appeared in Issue 31 of ***EcoNZ@Otago***; see Kergozou, Hansen & Knowles (2013).
7 Technical details are available from Hansen & Ombler (2008); and for a gentle introduction to the PAPRIKA method, see the Wikipedia article: http://en.wikipedia.org/wiki/PAPRIKA.

Figure 1. Example of a pairwise-ranking question (a screenshot from 1000Minds software)

The DCE was completed by 322 adults randomly selected from the New Zealand electoral roll (a 10% response rate). Their mean weights are reported in Table 3, where the criteria are listed in decreasing order of relative importance. Thus, in summary, the first two criteria (*Patient's health before treatment and Benefit to patient (i.e. length and/or quality of life))* are relatively important, accounting for half of the overall weight between them (i.e. 0.28 + 0.22 = 0.50). Each of the remaining four criteria, which are approximately equally important, are relatively unimportant; though, together they account for half of the overall weight too (0.14 + 0.13 + 0.12 + 0.11 = 0.50).

YOU JUST MIGHT FIND YOU GET WHAT WE CAN AFFORD

Finally, it is worthwhile remembering that the ultimate objective of determining criteria and weights is to be able to use them for prioritising health technologies. In a similar fashion to Golan & Hansen (2012), we demonstrate how the criteria and weights can be applied in an imaginary prioritisation exercise that involves the 14 technologies in Table 1 being rated on the six criteria in Table 3 and then scored using the mean weights (also in the table).

The first author performed this rating task based on her understanding of the technologies and, ultimately, her judgment. Bear in mind that this exercise is intended for illustrative purposes only; were it to be done 'for real' a more exacting process based on experts' judgments and 'hard' evidence would be appropriate. In addition to the criteria, other variables of interest for prioritising technologies include: number of patients affected, cost per patient, total cost and quality of clinical evidence.

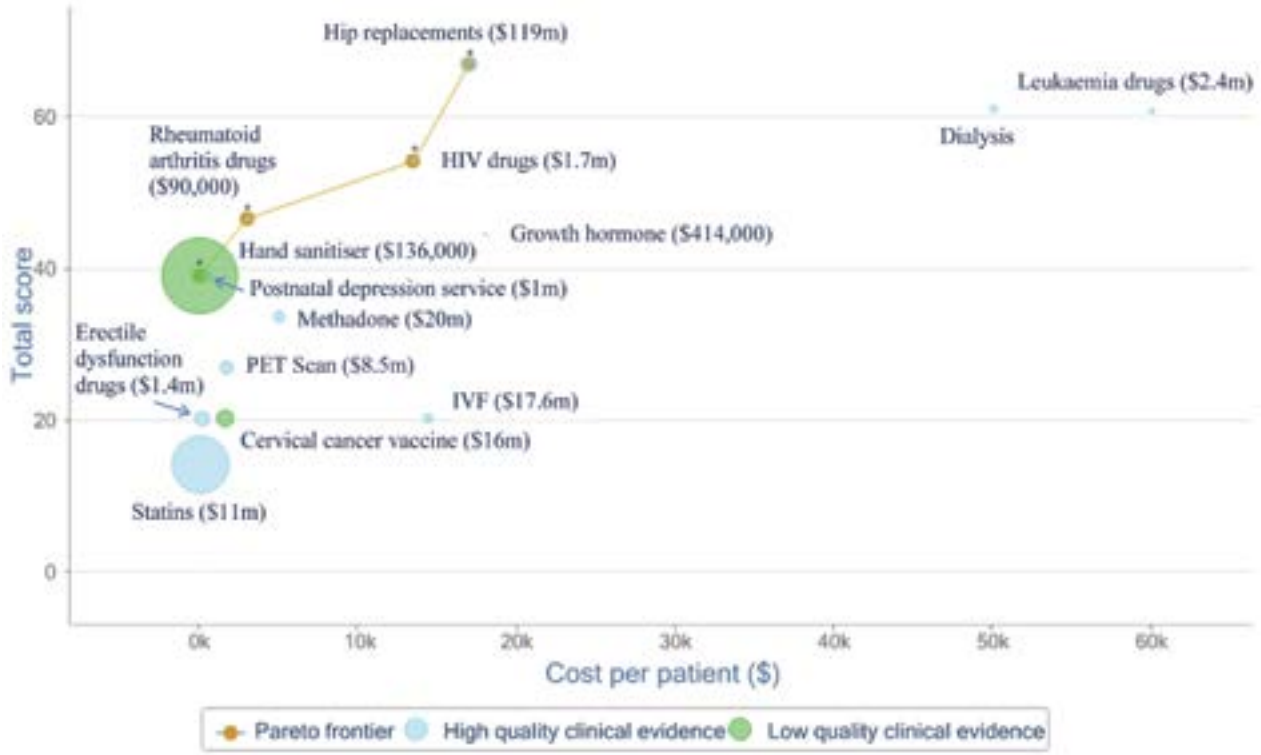
Everything is represented graphically in Figure 2. The chart's vertical axis displays each technology's total score (out of 100), reflecting its aggregate performance on the six criteria (at the individual patient level). The horizontal axis displays each technology's cost per patient. The size of the bubble representing each technology is in proportion to the total number of patients affected, and the total cost for the patient group is reported in parentheses. The colour of the bubbles indicates the quality of the clinical evidence: blue indicates 'high' quality and 'green' indicates 'low'.

Table 3. Criteria included in the DCE and their mean weights (n=322)

Criteria	Mean weights
Patient's health before treatment	
Relatively good (though treatment is still beneficial)	0
Fair (neither good nor bad)	0.07
Poor (but not immediately life threatening)	0.14
Will die soon without treatment	**0.28**[a]
Benefit to patient (i.e. length and/or quality of life)	
Small	0
Medium	0.12
Large	**0.22**
Age of patient	
65+ years	0
15-64 years	0.07
0-14 years	**0.14**
Illness or injury caused mainly by lifestyle choices	
Yes	0
No	**0.13**
Benefit to others (e.g. family or society)	
Small	0
Large	**0.12**
Treatment options for this patient	
This is the best treatment (there are less effective alternatives)	0
This is the **only** treatment available	**0.11**

a Values in bold represent the relative weights of the criteria overall (i.e. bolded values sum to one).

Figure 2. Main prioritisation variables of interest for the 14 illustrative technologies



WHICH TECHNOLOGIES SHOULD BE FUNDED?

Decision-makers should focus their attention first on the technologies in the top-left quadrant of the chart (with high benefits and low cost per patient), while also being mindful of the total number of patients for each technology, the total cost and the quality of clinical evidence. These technologies represent relatively good value for money per patient. In contrast, the technologies in the bottom-right quadrant (low benefits and high cost per patient) represent relatively poor value for money per patient.

The 'Pareto (efficiency) frontier' is the line in the chart connecting hand sanitiser, rheumatoid arthritis drugs, HIV drugs and hip replacements. All else being equal, there are no other technologies that have both a lower cost per patient and a higher total score (benefit) than these 'dominant' technologies. Also relevant is the number of patients, total cost (affordability) and quality of clinical evidence; for example, the effectiveness of hand sanitiser at reducing the spread of germs (compared to using soap and water) is controversial, and therefore decision-makers might be reluctant to invest in this technology, even at a low cost.

By comparing alternative combinations of technologies based on value for money and these other considerations, by a process of 'trial and error', decision-makers can arrive at an 'optimal' portfolio of technologies.

QUESTIONS TO CONSIDER

1. Ignoring cost, how would you rank the vignettes in Table 1 "with respect to their value to society and hence their relative desirability for being available in the health system"?
2. How would *you* answer the question posed in Figure 1?
3. Based on *your* own personal preferences, which of the six criteria included in the study (see Table 3) is the most important? Which is the least important?

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Once we were an ecosystem people: lessons from resource management by indigenous Māori

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Cultural man has been on earth for some 2 million years [and] for over 99% of this period he has lived as a hunter-gatherer ….If economics is the dismal science, the study of hunting and gathering economies must be its most advanced branch." (quoted in Williams, 2004)

The Taieri Scroll Plain, a large wetland in the Maniototo and Styx Basins
Photo courtesy of The Department of Conservation.

The Taieri wetlands near Dunedin were once a "supermarket" for southern Ngāi Tahu, containing hundreds of different indigenous bird and fish species. They have now been drained in order to raise introduced plant and animal species for food. Wetlands act as a large-scale natural water purifier, and their disappearance has decreased water quality due to sewage, storm-water and farmland discharges. The degradation of habitat due to resource use is commonly referred to as an "externality" in environmental economics. Other examples include soil erosion and contamination from mining, and water pollution caused by dairy farming.

Communities, governments and scholars have all come to agree that ecosystem based management (EBM), which focuses on the interconnectedness of ecosystem components, is the only way we can achieve sustainable resource use. But how? The literature on EBM is extensive but real-world application of the ideas is difficult. The biggest problem with EBM is that ecosystems are complex. Policy-makers struggle to translate research about these complex systems into specific policies, and often the data to monitor long-term effects and measure performance are lacking. It is also difficult to reach a consensus between different stakeholders such as iwi, recreational anglers and dairy farmers.

We think that "looking back" to people who have practiced EBM in the past might give some guidance. In particular, most indigenous peoples of the world have been what we now call "ecosystem people," described by ecologist Raymond Dasmann as "members of indigenous cultures who live within a single ecosystem. Since they are dependent upon local ecosystems for their survival, violation of its rules will inevitably result in the scaling-down or disappearance of the culture" (Ulluwishewa et al., 2008). We consider the southern Ngāi Tahu iwi prior to colonisation as an ecosystem people, and we use Ostrom's (1990) eight-principle framework to answer three questions. How did Ngāi Tahu manage the complex linkages, uncertainty and interactions with nature while exploiting their environment? Was resource exploitation sustainable (did Ngāi Tahu practice EBM)? And what implications does their traditional management system have for modern governance structures?

1 This article is based on Kahui and Richards (2014).

WHY SOUTHERN NGĀI TAHU?

Among all the iwi in New Zealand, we needed to identify one that "lived within a single ecosystem" in the sense that they did not primarily rely on agriculture. The iwi's practices also had to fit Ostrom's paradigm of a common property regime, which describes the efforts of communities to regulate access to a common property resource such as fish or ducks. Ngāi Tahu, the dominant tribe of the South Island, fit both criteria. Williams (2004; 2006), our very own Ngāi Tahu expert at Otago, has written extensively about the Ngāi Tahu lifestyle and social structure, and we have drawn extensively on his work. In particular, the Ngāi Tahu south of Banks Peninsula could not rely on agriculture because it was too cold to grow kumara. Seasonal mobility was common, human population density was low and resources included a wide variety of plants, birds and marine species. The access to these resources was controlled through conventions such as birthrights and systems of rules. This fits into the common property paradigm.

OSTROM AND THE COMMONS

Common property resources are defined as a type of good that is non-excludable (i.e. it is costly to exclude individuals from using the good) and rival (the consumption by one individual subtracts from the availability of the resource for other individuals). Such resources are plagued by the Tragedy of the Commons, that is, the overuse and degradation of the resource when it is shared by many individuals and is unmanaged. Economists have long advocated privatisation and regulation as the only way to overcome the Tragedy, but in her famous book based on over hundreds of case studies, Ostrom (1990) criticised the "one size fits all" solution of economists. She found that some common property resource users were able to avoid the Tragedy without any government intervention, and she summarised her findings in eight principles which all successful grass-root management institutions share. Below, we name each of these principles and discuss how southern Ngai Tahu's tribal management satisfied them.

Principle 1: Clearly defined group boundaries

Ngāi Tahu regulated rights to resources based on concepts of *rangatiratanga* (expression of one's chieftainship), *mana whenua* (the right to harvest or make decisions over resources in an area) and *ahikā* ("burning fires", a metaphor for permanent occupation). For example, individuals still travel to the Tītī Islands near Stewart Island during the main periods of harvest for *tītī* (the sooty shearwater or muttonbird). Spatial access on these islands is regulated: the islands are divided into clearly defined family harvesting areas. Customary laws govern the inheritance by children and grandchildren of the family harvesting areas in order to maintain *ahikā* and *mana whenua*.

Principle 2: Rules matching local conditions

For Ngāi Tahu and Māori in general, resource management is based on *kaitiakitanga*, which is a system of beliefs and tools, such as *rāhui, owheo, tapu* and *mauri*, uniquely honed to the local environment. For example, *rāhui*, the ritual setting aside of a resource, was applied to the Tītī Islands between May and March, during which time access to the islands was forbidden in order to protect breeding. *Owheo* was prescribed to important river catchments so that they could not be cleared, burnt for fern root or be used for housing, allowing their ecosystem functions to remain uncompromised. Metaphysical concepts were based on both ecological and spiritual reasoning. For example, shucking *paua* or gutting fish below the high tide mark was inappropriate or *tapu*, both because it encouraged predators and generally showed disrespect for the sea. Descendants of ancestors named after a bird (or fish) were prohibited from eating that particular bird (or fish), in order to restrict localised exploitation over the long run.

The concept of *mauri*, which Māori believed to be "the spark of life kindled at the conception of all living things" (Williams, 2006), lies at the heart of the Māori view of resource management. The overarching goal of *kaitiakitanga* centered on the importance of avoiding radical alteration of the *mauri* of the local ecosystem: harvesting and resource access had to occur in a fashion that did not compromise the integrity of the system.

Principle 3: Collective choice arrangements

People could discuss and debate issues pertaining to resource management on the *marae*. The management of resource use rules was exercised by *kaitiaki* (guardians), including chiefs, elders and resource/ritual specialists. These Māori leaders were accountable to, and kept in check by, the wider kin group.

Principles 4 and 5: Monitoring and graduated sanctions

Ngāi Tahu, and Māori society in general, have solved the problem of mutual monitoring and enforcement by incorporating environmental ethics into the wider social system. For example, the breaking of a *tapu* of low intensity could result in the confiscation of all of the offender's property including that of his family. Punishments for more serious offences included physical retribution and even death at the hands of the chief, but this rarely happened.

Principle 6: Conflict resolution mechanisms

To this date, tribes use the *marae* as a meeting place to communicate, resolve conflicts and impose sanctions. "Emphasis is placed on achieving consensus through a unified, collective agreement. Consensus is achieved through a process that demands goodwill, patience and freedom from time constraints" (NZ Law Commission, 2002).

Principles 7 and 8: Sovereignty and nested enterprises

The concepts of *rangatiratanga* and *mana whenua* imply sovereignty and political authority over a particular area, which is defended against neighbouring tribes. The principle of nested enterprises for Ngāi Tahu, and Māori society in general, was based on a complex network of inter-related hierarchical groups: the *whānau* (extended family) was nestled within a *hapū* (sub-tribe), which in turn was nested within the iwi (tribe). Geographical areas and resources were allocated to particular *hapū* and *whānau*. Each of these groups accessed their apportioned resources, but there was also a system of reciprocal exchange with other areas, which served the survival of the iwi at large.

ANSWERING THE THREE QUESTIONS

The analysis within Ostrom's eight-principle framework shows how early Ngāi Tahu managed the complex linkages, uncertainty and interactions with nature. Ngāi Tahu asserted their right to harvest in areas through *rangatiratanga*. *Kaitiakitanga* embodied all aspects of resource management, and provided indigenous Māori with the tools to control and adapt measures across space and time. Resource exploitation focused on the importance of not altering the *mauri* of an ecosystem: harvesting and resource access had to occur in a fashion that did not compromise the integrity of the system, and thus survival. Resource decisions were executed by chiefs, elders and resource specialists who were accountable to the wider kin group. The problems of mutual monitoring, enforcement and conflict resolution were solved as part of a larger set of societal norms and ethics, and Ngāi Tahu's tribal network of hierarchical groups facilitated a system of reciprocal exchanges between areas that served the survival of the *iwi* at large.

Was it sustainable? That's a difficult question to answer, but what we can say is that broadly speaking all of Ostrom's eight principles for sustainable management were met. So how can we draw on *kaitiakitanga* for effective EBM within modern governance structures?

Kaitiakitanga provides a system that manages the ecosystem as a common property. It combines all aspects of resource management. Currently, resource use and environmental quality in New Zealand are managed separately in the form of private property rights and government regulation (for example, private landowners drain wetlands for food production and the government thereafter imposes regulation to increase water quality). But maybe these could be managed better by a nested stakeholder group. What if we had a group of representatives managing both resource use and environmental quality of the local ecosystem? *Kaitiakitanga* could provide them with a tool kit to do so. This requires legislation and governmental policies to focus on enabling self-determination and self-organisation of communities. This nested stakeholder group has to be able to impose temporary closures (akin to *rāhui*), permanent restrictions on quantity and space, and monitoring and sanctioning suited to local conditions without lengthy processes to get government approval. This would allow communities the flexibility to adapt to changes in social or environmental conditions, and manage complex ecosystems without extensive data availability.

An interesting potential policy change is in the Government's proposal to introduce a collaborative model for freshwater management. This aims to deal with the conflicting demands of recreational users, the dairy industry, iwi and environmental groups with minimal government intervention (Ministry for the Environment, 2013). Would this be a first step towards *kaitiakitanga* and self-determination? Watch this space.

QUESTIONS TO CONSIDER

1. What is the common property resource when private landowners decrease water quality as a byproduct of converting wetlands into agricultural farms?
2. How difficult do you think will it be to create a successful nested stakeholder group for freshwater management?

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Commentary on the New Zealand economy

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	Sep 2014	Jun 2014	Mar 2014	Dec 2013	Sep 2013
GDP (real, annual growth rate, %)	2.9	2.8	2.5	2.2	2.4
Consumption (real, annual growth rate, %)	3.1	3.0	2.8	2.7	2.4
Investment (real, annual growth rate, %)	9.7	12.1	11.1	8.5	8.4
Employment: full-time (000s)	1828	1814	1798	1779	1762
Employment: part-time (000s)	514	517	519	518	509
Unemployment (% of labour force)	5.4	5.6	6.0	6.0	6.1
Consumer Price Inflation (annual rate, %)	1.0	1.6	1.5	1.6	1.4
Food Price Inflation (annual rate, %)	-0.2	1.6	0.8	1.3	0.8
Producer Price Inflation (outputs, annual rate, %)	-1.0	2.5	4.0	3.8	4.1
Producer Price Inflation (inputs, annual rate, %)	-2.2	1.4	3.1	2.8	3.3
Salary and Wage Rates (annual growth rate, %)	1.7	1.6	1.5	1.6	1.6
Narrow Money Supply (M1, annual growth rate, %)	5.9	8.3	7.6	9.5	9.4
Broad Money Supply (M3, annual growth rate, %)	5.3	5.4	5.0	5.8	7.3
Interest rates (90-day bank bills, %)	3.71	3.52	3.05	2.70	2.64
Exchange rate (TWI, June 1979 = 100)	78.2	78.5	81.5	81.3	78.5
Exports (fob, $m, year to date)	51,025	51,161	50,028	48,044	46,005
Imports (cif, $m, year to date)	50,377	49,972	49,230	48,360	47,564
Exports (volume, seas. adj.)	1264	1266	1329	1321	1200
Imports (volume, seas. adj.)	2088	2034	1965	1911	1901
Terms of Trade (June 2002 = 1000)	1352	1415	1414	1389	1355
Current Account Balance (% of GDP, year to date)	-2.6	-2.5	-2.6	-3.3	-3.9

Sources: Statistics New Zealand (stats.govt.nz), Reserve Bank of New Zealand (rbnz.govt.nz)

The major development of the last six months is the substantial fall in the world oil price. At the time of writing, the price of crude oil is just under US$50 per barrel, or less than half its mid-2014 level. Most of this decline has taken place since October – petrol prices have fallen almost 50 cents per litre since then – and so its impact on the New Zealand economy has yet to be seen in the data. Even the just-released CPI figure – which revealed that consumer prices fell by 0.2% in the December quarter – captures only the start of the oil price slide, as it measures prices mid-quarter.

As petrol and diesel accounts for over 5% of household spending, the direct effect of their lower prices will be to take almost a full percent point off the CPI by the March quarter and reduce the annual rate of inflation to around 0%. Petroleum products also account for roughly one-sixth of New Zealand's total import expenditure and so, if the low prices persist, they will go a long way to offsetting the effects of the decline in dairy prices on the terms of trade and the trade and current account balances.

Cheaper petrol should also mean there is less 'cost-push' pressure on the prices of many goods produced within the economy. This effect is reinforced by the fact that an ongoing low rate of 'headline' inflation puts pressure on wage and salary increases to remain near their current low level. This should help keep the rate of non-tradable goods inflation relatively subdued for the time being. Therefore, even though economic growth and falling unemployment is expected to continue through 2015, the relatively benign inflation outlook should allow the RBNZ to refrain from making any further increases in the Official Cash Rate for most of this year.

It might be tempting to think that some interest rate **cuts** may be on the cards if inflation is poised to fall below the RBNZ's 1-3% target band. This is unlikely, however, as the RBNZ is required to largely ignore international price shocks of the type we are currently experiencing when setting monetary policy. This is because monetary policy can only affect inflation with a considerable lag and so the RBNZ focuses on achieving its target over the medium term. Even if oil prices remained low (which is a very big 'if'), their effect on the inflation rate would be only temporary as it is the **change** in the oil price that affects inflation. Hence, this type of event cannot be expected to control inflation over the medium term as oil prices will not keep falling indefinitely.

In fact, it is much more likely that oil prices will rebound at some point over the coming year, as relatively high-cost oil producers suspend production until it is profitable again (as exemplified by Kea Petroleum in Taranaki). So make the most of cheaper petrol while it lasts!

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