Motu Economic and Public Policy Research

Motu RESEARCH UPDATE

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The Role of Technology Policy in Addressing Climate Change

Adam B. Jaffe

Like most economists, I believe that the primary policy response to the climate change challenge must be to raise the price associated with the emission of greenhouse gases ("GHG"), in order to create the appropriate economic incentives to align economic activities – production, consumption, and investment of all kinds – with the social objective. Despite the current political controversies surrounding such policies, and the low prices currently imposed on GHGs in several jurisdictions that have implemented emissions trading systems, I believe we will eventually see significant effective prices on GHG emissions in many countries. In this article, I argue that the implementation of such policies is necessary but not sufficient as a global response to the climate challenge. Emissions policy should be complemented by "technology policy," i.e. a set of actions designed to foster the creation, improvement and diffusion of new low-GHG technologies.

The problem is big. As a thought exercise, consider trying to achieve a 50% reduction in the ratio of world GHG emissions to world GDP (which most models suggest would not avert significant adverse climate impacts) by 2050. Since the "oil crisis" of the early 1970s, the ratio of world oil consumption to world GDP has been reduced by about 40%, as the price of oil has increased by more than a factor of six. Economic theory tells us that the demand for fossil fuels as a group has to be less elastic than the demand for petroleum specifically. This suggests strongly that it would require an enormous increase in the effective price of fossil fuels to reduce the GHG/GDP ratio as needed worldwide. Even assuming the current policy impasses over climate change are eased, effective price increases of the needed magnitude seem very doubtful.

It's not clear what the needed transformation will look like, but history suggests that it won't happen without government support. Given the magnitude of reduction in GHG intensity that is needed, it will only come about through a profound transformation in the social-economic-technological system by which we heat

Measuring greenhouse gas emissions and absorption in a wheat field in Tatura. CSIRO Atmospheric Research. http://scienceimage.csiro.au/image/534/measuring-gas-emissions-and-absorption-from-wheat/

and cool buildings, transport people and goods, and grow and make things. It is not clear that there is a historical analogy for change of this magnitude, but I submit that digital computation and communication have been improved over the last four decades in a way that is qualitatively comparable to the change we need in our carbon system.[1] And I think the analogy is instructive. We do not calculate or communicate today with improved versions of the devices that were available for these purposes in 1970. We use a system whose backbone infrastructure and individual components did not exist, and in important aspects were not even imagined, in 1970. If we are going to meet the climate challenge, we are going to have to effectuate a comparably broad and deep reconstruction of our energy, transport, agricultural and industrial systems.

The information technology and digital communications transformation was fostered in significant ways by public policy around the world. Particularly in the U.S., the government invested in both research and in acquisition of early-stage technology projects related to defense, space, and communications that accelerated technology development significantly. Other, less extensive technological transformations such as nuclear

1Other GHGs such as methane are important, but this does not affect the conclusion that huge reductions in the carbon intensity of human activity will be necessary.

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In this issue

Director's Letter

It has been another busy and productive year at Motu.

- Motu's Environmental Economics Programme, led by Suzi Kerr, developed the modeling of agricultural land use that underpinned an important report, "Water Quality in New Zealand: Land Use and Nutrient Pollution", by the Parliamentary Commissioner for the Environment.
- Arthur Grimes and Suzi Kerr collaborated (along with Corey Allan) on "Value and Culture," a research study summarising how economic value can be appropriately assigned to cultural investments and activities. This work continued to demonstrate one of Motu's key strengths - the collaboration among Senior Fellows with different backgrounds.
- Dave Maré and Richard Fabling continued work on labour market dynamics and productivity, focusing on the incidence and persistence of cyclical job losses in New Zealand.
- Arthur continued his research on infrastructure and housing, and has begun research into his Marsden-funded programme on Wellbeing and Sustainability.
- Isabelle Sin, Dave, Richard, myself and Motu Affiliate Lynda Sanderson have looked at how the characteristics of immigrant and non-immigrant employees relate to firms' international engagement, and how international engagement relates to innovation at the firm level.

In addition to my role as Director, I have started to engage as a Senior Fellow, working on several projects related to my interests in innovation and productivity.

We are very pleased to have launched a major new research programme on the micro-econometrics of productivity in New Zealand, funded by the New Zealand Productivity Hub through the Productivity Commission. This programme focuses on the determinants and effects of productivity at the firm level, and will also seek to increase capability in New Zealand to study issues of this kind using the Longitudinal Business Data of Statistics NZ.

There is no question Motu is highly respected by the governmental and non-governmental bodies we work with, and that our work has added considerable value and impact. I believe that that the kind of high-quality independent research we provide is of great value to New Zealand. Thank you for your ongoing support and interest.

Director and Senior Fellow

Continued from page 1

power, commercial aviation and health care have analogous histories of government research and technology purchase in support of technological development (Henderson and Newell, 2011). Thus, while there may be doubt as to whether any historical precedent for the needed transformation can be found, there is most certainly no historical precedent that did not involve significant explicit government support.

Theory says two market failures require two policy instruments. From the perspective of the theory of welfare economics, the justification for carbon policy is that there is a negative externality associated with GHG emissions. But there are wholly distinct positive externalities associated with technological innovation and diffusion. Carbon policy does not and cannot internalise these, leaving a separate policy gap to be addressed (Popp, et al, 2010).

These externalities flow generally from the fact that knowledge is a public good (Griliches, 1992), leading to the problem of "imperfect appropriability" of the returns to new technology. This appropriability problem is inherent both in research and development, and in the diffusion of new products, because the production and use of new products itself generates knowledge about the production process and the best product designs. This means that in the absence of policy intervention both the research process and the market deployment of new technologies will be suboptimal (Popp et al, 2010).

Evaluation is essential. Theory tells us that government action to spur technology development and deployment is socially desirable, but theory tells us relatively little about which specific policy instruments are most cost-effective. Various governments have engaged, to varying degrees, in regulations, government procurement preferences, targeted development funding, and so on. Careful empirical evaluation of such programmes – which requires attention to the incremental impact of the policy over what would have occurred in the absence of the policy – would tell us which instruments work best under what circumstances (Jaffe, 2002). We are going to be engaging in climate policy for decades. An investment in such evaluation during the first decade could have a large impact on the effectiveness of policy in the following decades.

This article is a condensed version of "Technology Policy and Climate Change," *Climate Change Economics* 3(4), 2012.

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Motu Developments

Te Pūnaha Matatini

Motu will partner with the University of Auckland and other New Zealand and international researchers in a new Centre of Research Excellence ("CoRE") called Te Pūnaha Matatini – The Centre for Complex Systems.

Te Pūnaha Matatini will develop new methods and tools for analysing complex systems, and apply those tools to important problems facing New Zealand. It combines three major Research Themes: Analytic Methods; Ecological Systems; and Economic Systems. Motu Director Adam Jaffe will be the Theme Leader for the Economic Systems Research Theme. Motu Researchers Dave Maré, Isabelle Sin, and Suzi Kerr will form the core of the economics research team.

The research will examine how economic activities in New Zealand – particularly activities related to innovation and economic growth – function within networks that span different technologies and geographic regions, and how these networks compare to and interact with ecological systems. The results of the research will have important implications for New Zealand firms and New Zealand government agencies responsible for innovation and economic growth. The research will be a major part of Motu's Innovation and Productivity research programme.

Thesis Scholarship

Congratulations to Lara Greaves, who was awarded the Motu Thesis Scholarship for 2014. Lara is a Masters student at the University of Auckland's School of Psychology. Her Masters research investigates how different aspects of Māori identity provide a protective buffer for the long-term health and wellbeing of Māori, producing quantitative models of Māori mental, physical and financial health.

Motu awards one Thesis Scholarship per year to a promising university student of Māori descent. Through this scholarship, we hope to enhance Māori research capability and encourage students of Maori descent to develop an interest in researching topics relevant to public policy development.

Low-Emission Future

In 2013 Motu launched a new project, Shaping New Zealand's Low-Emission Future, an extensive multi-disciplinary programme on New Zealand's pathway to a global low-emission future. The project, which runs from 2013 to 2015, will involve significant research, stakeholder dialogue, and international exchanges.

The intention of the programme is to develop new and creative ideas that are well supported by research to progress the issues surrounding emission reduction opportunities, policies and actions where greater positive momentum is needed. To take these from ideas through to viable solutions we will incorporate leading international knowledge and experience, and a range of conceptual and empirical tools. Possible solutions will be thoroughly tested by experts from a range of perspectives and disciplines. Suzi Kerr and Catherine Leining are leading the programme.

Arthur Grimes' UK Lecture Series

Arthur Grimes spent three months in late 2013 as the NZ-UK Link Visiting Professor at the University of London. While in the UK he gave a series of lectures, the text of which is now available from the Motu website, drawing on his ten years' experience as chairman of the board of the Reserve Bank. To download the lectures, visit the Motu website, http://www.motu.org.nz/news-media/detail/arthur_grimes_banking_lectures_available.

Comings and Goings

Motu has recently welcomed three new fellows. Catherine Leining and Anne-Marie Brook join Motu as Policy Fellows. Catherine's work at Motu focuses on the low-emission future project. Anne-Marie is on a part-time secondment to Motu from the New Zealand Treasury; she is working on the development of a global Human Rights Indicator. Trinh Le joins Motu as a Fellow, and is currently working on projects around firm productivity.

Motu has also recently been joined by three new research analysts, Eyal Apatov, Judd Ormsby and Anna Robinson, and farewelled Simon Anastasiadis and Matt Thirkettle. Good luck to Simon and Matt, who are both pursuing PhDs in the United States.

Motu People

Board of Trustees Rob Fenwick, Stephen Goldson, Neil Green, John Hay (chair), Horiana Irwin-Easthope, Peter O'Shea, Bruce Wills

Director and Senior Fellow Adam B. Jaffe

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Value and Culture

Arthur Grimes

A recent Motu working paper, commissioned by the Minstry for Culture and Heritage, outlines the concept of economic value within a cultural context. Culture is taken here to include all goods, services and activities in the broad arts, sports and heritage space. In economic terms the value of any good (including cultural goods) is normally taken to be the addition to wellbeing (or utility) that arises out of the use or existence of that good. This notion of value is much broader than simple market value or national accounts definitions of value. Any direct or indirect benefit to any individual that arises from an activity is a form of value created by that activity.

This broad economic approach to recognising value means that there are several sources of value in the cultural context. These include:

1. The non-monetary return to producers: The difference between what producers could earn in another occupation and the (lower) earnings they receive as producers of cultural goods.

2. Market use value: The value of a cultural good purchased in the market. This may have both a direct component (e.g. concert ticket price) and an indirect component (e.g. subsequent benefits to the individual arising from participation in music lessons as a child).

3. Non-market use value: The value of a cultural good that is not purchased in the market. This may have both a direct component (e.g. sense of wellbeing engendered by viewing a public sculpture or heritage building) and an indirect component (e.g. subsequent benefits to the individual arising from participation in sporting activities as a child).

4. Non-use value: The value that an individual derives from knowing that a certain cultural good (e.g. the Treaty Grounds) is available for others' current use ("existence value") or for future generations' use ("bequest value").

5. Option value: The value created through current support for a certain activity or heritage site that makes it possible for that activity or site to be available in future should some future generation value that activity or site.

6. Instrumental values (externalities): The benefits that accrue to the wider society as a result of cultural activities. These benefits may include greater social cohesion and improvements to the democratic process. They also include benefits to a city that arise from attracting high human capital workers and firms to a city that has vibrant arts, sports and heritage sectors.

The standard economic approach is based on some basic assumptions. These include that individuals know their own preferences, that these preferences are stable over time and that all goods are comparable in terms of their values. Furthermore, in order to arrive at an aggregate value of an activity, some method for aggregating individual outcomes is required.

The metaphor of the "invisible hand" is used in economics to convey the idea that private firms operating in competitive markets will sell the socially optimal quantities of goods and services. But the invisible hand operates reliably only under certain conditions, and these conditions may not apply to cultural goods. As a result, cultural goods may not be optimally provided for a number of reasons:

1. Many cultural goods are public goods (i.e. goods that are non-rival and non-excludable in consumption). In general, public goods suffer from under-provision since each consumer can free-ride off others, resulting in the market value of such a good being less than the combined value to all consumers. An example is a public sculpture that no individual has to pay to see.

2. Consumers may have bounded rationality in relation to some cultural goods, i.e. they do not know their own (current or future) preferences. This may be a particular issue for the avant-garde arts or for aspects of culture from other societal groups that an individual has not yet been exposed to. Deliberate exposure of individuals to new cultural offerings may result in a change in their preferences to include an appreciation of the new offering.

The externality benefits (outlined above) are generally not taken into account when an individual makes a decision to consume (or produce) a particular cultural

Table 3: Information requirements when valuing cultural goods

(A) A clear articulation of the types and amounts of benefits that may accrue as a result of the specific activity, including estimates of:

i. Market value derived by consumers (including the expected number of consumers and their per person expenditures on the cultural good);

ii. Non-market values derived by consumers (including the number of consumers who gain value from the cultural good);

iii. Value gained by producers (over and above their incomes) including the number (and type) of producers;

iv. Other values derived by individuals (option value, existence value, bequest value);

v. Any extra market values derived from outside the cultural sector (which may be relevant for an impact analysis);

vi. Positive externality benefits, including benefits arising from:
- Branding of a locality as a creative city;
- Promotion of democracy and social capital;
- Longer term benefits that may be internalised (but not necessarily recognised) by an individual.

(B) Who these benefits are projected to accrue to (for example, broken down by locality, incomes, ethnicity, gender, age, and/or measures of disadvantage).

(C) What other forms of support are projected for the activity from private, philanthropic and various public sources, with consideration of whether other sources of support may be crowded out if government provides funding.

(D) Whether the funding is being used in part to inform people of new art forms or other cultural opportunities about which current and potential consumers lack information.

good. Society may miss out on the external benefits if an individual chooses not to purchase the good even though total societal benefits warrant the purchase.

There may be unequal access to cultural goods that makes it difficult for certain groups in society to consume certain cultural goods. This issue may be especially concerning where positive externalities exist had there been some consumption of cultural goods by those groups.

A number of techniques can be used to value cultural goods. These techniques, which are summarised in Table 2 of the paper (p. 32), all have certain shortcomings but may assist policy makers in deciding whether a particular cultural activity is worth pursuing. Some techniques (such as hedonic pricing, use of travel costs and contingent valuation) attempt to ascertain the aggregate willingness of individuals to pay for cultural goods; choice modelling provides measures of relative value that can be used for prioritising amongst alternatives. Impact analysis (which attempts to examine the impact of events on economic activity) is the least general of the alternative approaches.

Valuation techniques may be particularly imperfect (and so of less use for prioritisation purposes) where individuals have little knowledge of alternative cultural offerings. In these circumstances, the use of expert opinion within a sector may be useful for prioritising support amongst alternatives.

A problem associated with all methods used to calculate the aggregate value of any cultural activity is that there is no universally acceptable philosophical method for aggregating net benefits across individuals. Thus it is imperative to analyse which groups experience benefits (or costs) rather than just examining aggregate measures of benefit.

All decision-making requires a good fact basis prior to making decisions. A template (see Table 3, p. 35 in the paper and above) designed to gather information on a consistent basis on the types of values, and who they accrue to, arising from various cultural activities could be adopted by potential public (and philanthropic) funders. The information gained from this template could also be used to report information on the cultural sector in such publications as Cultural Indicators for New Zealand.

This article draws on Allan, Corey, Arthur Grimes and Suzi Kerr. 2013. "Value and Culture," *Motu Working Paper* 13-09, available from the Motu website at www.motu.org.nz/publications/detail/value_and_culture. This paper was commissioned and funded by Manatu Taonga - the Ministry for Culture and Heritage, and is available from their website at www.mch.govt.nz/valueandculture.

Motu Publications

For a complete list of publications, visit www.motu.org.nz/publications

Working Papers and Motu Notes

Environmental Regulation

Romanos, Carl, Suzi Kerr and Campbell Will. 2014. "Greenhouse Gas Emissions in New Zealand: A Preliminary Consumption-Based Analysis", *Motu Working Paper* 14-05, Motu Economic and Public Policy Research, Wellington.

This paper explores how the carbon emissions related to the consumption categories of households in New Zealand vary with household characteristics, using data from the 2007 Household Economic Survey.

Timar, Levente, and Suzi Kerr. 2014. "Land-use Intensity and Greenhouse Gas Emissions in the LURNZ Model", *Motu Working Paper* 14-03, Motu Economic and Public Policy Research, Wellington.

This paper documents the development of new land-use intensity and GHG emissions modules for the Land Use in Rural New Zealand model. Simulated land-use outcomes are translated into measures of rural economic activity and GHG emissions for dairy and sheep-beef farming.

Kerr, Suzi. 2013. "Managing Risks and Tradeoffs Using Water Markets", *Motu Working Paper* 13-13, Motu Economic and Public Policy Research, Wellington.

This note creates a framework for synthesising experience with economic instruments for managing risks relating to water quantity and quality and illustrates it with two New Zealand case studies for which detailed information is available. It also explores some linkages between economic instruments that are not primarily directed at water management – for example emissions trading - and water management outcomes.

Anastasiadis, Simon, and Suzi Kerr. 2013. "Mitigation and Heterogeneity in Management Practices on New Zealand Dairy Farms", *Motu Working Paper* 13-11, Motu Economic and Public Policy Research, Wellington.

We use data on dairy farms to estimate a distribution of "farm management" residuals in how efficiently nitrogen leaching and greenhouse gas are used to generate production. We interpret this distribution as a measure of the potential for feasible, relatively low-cost mitigation to take place as less efficient farmers move toward existing best practice.

Economic Geography

Grimes, Arthur, and Nicholas Tarrant. 2013. "A New Zealand Urban Population Database," *Motu Working Paper* 13-07, Motu Economic and Public Policy Research, Wellington.

This paper documents a comprehensive database for the populations of 60 New Zealand towns and cities.

Housing

Grimes, Arthur, and Sean Hyland. 2013. "Housing Market Dynamics and the GFC: The Complex Dynamics of a Credit Shock", *Motu Working Paper* 13-12, Motu Economic and Public Policy Research, Wellington.

We analyse the multiple channels of influence that GFC-induced credit restrictions had on New Zealand's subnational housing markets. We focus on the impacts on two outcome variables: house prices and housing supply; both shocks cause substantial cyclical adjustments in each variable.

Innovation and Productivity

Allan, Corey, Adam B. Jaffe and Isabelle Sin. 2014. "Diffusion of Green Technology: A Survey," *Motu Working Paper* 14-04, Motu Economic and Public Policy Research, Wellington.

This paper surveys the existing literature on diffusion of environmentally beneficial technology. Overall, it confirms many of the lessons of the larger literature on technology diffusion: diffusion often appears slow when viewed from the outside; the flow of information is an important factor in the diffusion process; networks and organisations can matter; behavioural factors such as values and cognitive biases also play a role.

Grimes, Arthur, and Sean Hyland. 2013. "Passing the Buck: Impacts of Commodity Price Shocks on Local Outcomes", *Motu Working Paper* 13-10, Motu Economic and Public Policy Research, Wellington.

We estimate the causal effect of exogenous commodity price innovations on both rural and urban community outcomes. House prices and housing investment are used as quarterly indicators of regional economic and population outcomes. We find that an increase in commodity prices leads to a permanent increase in housing investment and house prices across the country. Rural communities are relatively insulated from commodity price shocks, whereas urban areas are most affected.

Allan, Corey, Arthur Grimes and Suzi Kerr. 2013. "Value and Culture", *Motu Working Paper* 13-09, Motu Economic and Public Policy Research, Wellington.

We develop an economic framework for thinking about value in the cultural context and discuss how well various valuation techniques are able to account for such values. The aim is to outline a framework which can assist policy makers in the cultural sector to intervene more cost-effectively and be more conscious of trade-offs amongst different cultural values.

Labour and Population Economics

Fabling, Richard, Norman Gemmell, Richard Kneller and Lynda Sanderson. 2013. "Estimating Firm-Level Effective Marginal Tax Rates and the User Cost of Capital in New Zealand", *Motu Working Paper* 13-14, Motu Economic and Public Policy Research, Wellington.

We estimate firm-specific EMTRs and related user cost of capital measures allowing for shareholder-level taxation using data from the Longitudinal Business Database. Examining distributions of various UCC measures we find substantial firm-level heterogeneity, systematic changes as a result of tax reforms between 2004 and 2011, and systematic differences between foreign-owned and domestically-owned firms.

Maré, David C., and Richard Fabling. 2013. "The Incidence and Persistence of Cyclical Job Loss in New Zealand," *Motu Working Paper* 13-08, Motu Economic and Public Policy Research, Wellington.

Macroeconomics and Other Topics

Di Tella, Rafael, and Robert MacCulloch. 2014. "Culture, Beliefs and Economic Performance", *Motu Working Paper* 14-06, Motu Economic and Public Policy Research, Wellington.

This paper uses data from the World Values Survey to explore how beliefs concerning meritocracy and poverty vary by and are distributed within countries.

Grimes, Arthur. 2013. "Four Lectures on Central Banking". *Motu Working Paper* 14-02. Wellington: Motu Economic and Public Policy Research.

These four lectures on central banking topics were delivered as part of Arthur Grimes' NZ-UK Link Foundation Visiting Professorship, following his stepping down as Chair of the Reserve Bank of New Zealand in September 2013. A key theme across all four lectures is the importance of ensuring that central bank policies and actions are time consistent.

Fabling, Richard, and Arthur Grimes. 2014. "Over the Hedge: Do Exporters Practice Selective Hedging?" *Motu Working Paper* 14-01, Motu Economic and Public Policy Research, Wellington.

What determines exporters' exchange rate hedging decisions and do exporters attempt to "time the market"? We use a unique unit record longitudinal administrative dataset on firm exports to find the determinants of exporters' currency hedging choices.

External Publications

Allan, Corey, Adam B. Jaffe and Isabelle Sin. 2014. "Diffusion of Green Technology: A Survey", *International Review of Environmental and Resource Economics* 7:1, pp. 1–33. Available online at http://dx.doi.org/10.1561/101.00000055

Anastasiadis, Simon, Suzi Kerr, Marie-Laure Nauleau, Tim Cox and Kit Rutherford. 2014. "Does Complex Hydrology Require Complex Water Quality Policy?" *Australian Journal of Agricultural and Resource Economics* 58:1, pp. 130–45. Available online at http://onlinelibrary.wiley.com/doi/10.1111/1467-8489.12024/abstract.

Bergstrom, Katy, Arthur Grimes and Steve Stillman. 2014. "Does Selling State Silver Generate Private Gold? Neighbourhood Impacts of State Housing Sales," *Urban Studies* 51:6, pp. 1257–73.

Cox, T. J., J.C. Rutherford, Suzi C. Kerr, D.C. Smeaton, C.C. Palliser. 2013. "An Integrated Model for Simulating Nitrogen Trading in an Agricultural Catchment with Complex Hydrology," *Journal of Environmental Management* 127, pp. 268–77.

Fabling, Richard, and Lynda Sanderson. 2013. "Exporting and Firm Performance: Market Entry, Investment and Expansion," *Journal of International Economics* 89:2, pp. 422–31.

Fabling, Richard, and Lynda Sanderson. 2014. "Foreign Acquisition and the Performance of New Zealand Firms," *New Zealand Economic Papers* 48:1, pp. 1–20.

Fabling, Richard, Arthur Grimes & Lynda Sanderson. 2013. "Any Port in a Storm: Impacts of New Port Infrastructure on Exporter Behaviour", *Transportation Research E*, 49:1.

Funk, Jason, Chris Field, Adam Daigneault and Suzi Kerr. 2014. "Modeling the Impact of Carbon Farming on Land Use in a New Zealand Landscape", *Environmental Science and Policy* 37, pp. 1–10.

Grimes, Arthur, and Chris Young. 2013. "Spatial Effects of Urban Rail Upgrades," *Journal of Transport Geography* 30, pp. 1–6.

Grimes, Arthur, Les Oxley & Nicholas Tarrant. 2014. "Does Money Buy Me Love? Testing Alternative Measures of National Wellbeing", in *Economics of Wellbeing*, Volume 5 of *Wellbeing: A Complete Reference Guide* (eds. D. McDaid & C. Cooper), London: Wiley. DOI: 10.1002/9781118539415.

Grimes, Arthur. 2013. "Infrastructure and Regional Growth", Chapter 28 in Handbook of Regional Science (eds. M. Fischer & P. Nijkamp). Berlin: Springer Verlag.

Grimes, Arthur. 2013. "Monetary Policy and Economic Imbalances: An Ethnographic Examination of Central Bank Rituals", *Journal of Economic Surveys* 27:4, pp. 634–640.

Grimes, Arthur. 2014. "Responsibility and Accountability in the Financial Sector", Company Lawyer 35:2, pp. 44–9

Haberl, Helmut, Cheikh Mbow, Xiangzheng Deng, Elena G. Irwin, Suzi Kerr, Tobias Kuemmerle, Ole Mertz, Patrick Meyfroidt, and B.L. Turner. 2014. "Finite Land Resources and Competition." In *Rethinking Global Land Use in an Urban Era*, edited by Karen C. Seto and Anette Reenberg, pp. 35–69. Strüngmann Forum Reports 14, edited by J. Lupp. Cambridge, MA: MIT Press

Keller, E.D., W. T. Baisden, L. Timar, B. Mullan and A. Clark. 2014. "Grassland Production under Global Change Scenarios for New Zealand Pastoral Agriculture." *Geoscientific Model Development Discussions* 7:3, pp. 3307–65.

Kerr, Suzi, and Zachary Dorner. 2013. "Tackling Agricultural Emissions: Potential Leadership from a Small Country," in *Climate Change and Green Growth: Legislative Achievements and Prospects Special Edition*, Seoul: Korea Legislation Research Institute. Vol. II (Korean) pp. 201–238, Vol. IV (English) pp. 387–428.

Kerr, Suzi. 2013. "The Economics of International Policy Agreements to Reduce Emissions from Deforestation and Degradation," *Review of Environmental Economics and Policy* 7:1, pp. 47–66.

Maré, David C., and D. J. Graham. 2013. "Agglomeration Elasticities and Firm Heterogeneity," *Journal of Urban Economics* 75, pp. 44–45.

Maré, David C., and Richard Fabling. 2013. "Productivity and Local Workforce Composition," in *Geography, Institutions and Regional Economic Performance*, R. Crescenzi and M. Percoco, Eds. Berlin and Heidelberg: Springer-Verlag.

Maré, David C., Richard Fabling and Steven Stillman. 2014. "Innovation and the Local Workforce", *Papers in Regional Science* 93:1, pp. 183–201.

OECD. 2013. Water Security for Better Lives, OECD Studies on Water, Paris: OECD Publishing. Contributor to chapters 3 and 4. Available online at http://dx.doi.org/10.1787/9789264202405.

Roskruge, Matthew, Arthur Grimes, Philip McCann and Jacques Poot. 2013. "Homeownership, Social Capital and Satisfaction with Local Government," *Urban Studies* 50(12), pp. 2517–34.

van Benthem, Arthur, and Suzi Kerr. 2013. "Scale and Transfers in International Emissions Offset Programs," *Journal of Public Economics* 107, pp. 31–46.

Public Policy Seminars

Motu's Public Policy Seminar series provides a forum for informed debate on important public policy issues. Through the series, we aim to make the latest economic research more accessible to inform policy debates in New Zealand. Our seminars are accessible to a wide audience, and are attended by people from diverse backgrounds who want to stay informed on economic, social and public policy research. The seminars are presented by the Motu Senior Fellows and Affiliates, as well as other top visiting academics from within New Zealand or around the world. These seminars are free to the public, and there is no need to register to attend.

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Motu Economic and Public Policy Research

The Long and Winding Road to Policy Certainty on Emission Pricing

Catherine Leining and Suzi Kerr

Reports about different aspects of the New Zealand Emissions Trading Scheme have proven wrong the well-worn saying that there's no such thing as bad publicity. The government's international reporting indicated that the scheme has had little effect on domestic emissions. Low and uncertain emission prices have created little incentive for new forest planting and posed little barrier to deforestation in the face of strong drivers. In May, the Iwi Leaders Group announced intentions to file a Treaty of Waitangi claim stemming from low emission prices which have affected the value of Treaty settlements. The public has criticised profits to NZ ETS participants from arbitrage opportunities created by extremely low prices for international units combined with New Zealand's exit from the Kyoto Protocol's second period. In June, the Green Party called for the complete replacement of the NZ ETS with a broad carbon tax whose revenue would be returned to the economy through tax relief to households and businesses. The NZ ETS is not functioning well – but does this mean that ditching it is the best option?

Although all major political parties support emissions pricing, we seem to be missing a common vision for New Zealand's pathway toward a global low-emission future. The NZ ETS was intended to expose the economy to a price on emissions, thereby driving cost-efficient emission reductions, influencing investments in long-lived capital and land use and reducing our future vulnerability to rising international carbon prices. Instead, under weak settings, the emission pricing beacon of the NZ ETS has been obscured in the fog of growing policy uncertainty around whether New Zealand truly intends to reduce its emissions – and who will bear the costs. Until this fog lifts, market players will be hesitant to move ahead with investments that could be placed at risk by future policy changes.

To be successful, a price on emissions needs to be expected to remain high enough for long enough to shift investment decisions. To generate a high emissions price signal in an ETS, participants need to face a limited supply of units and have confidence in the rules governing the use of units. These conditions have not been sustained in New Zealand's carbon market, and the resultant low price signal has not produced much mitigation.

While shifting from a weak ETS to an ambitious carbon tax is one approach for generating a more effective and reliable emission price signal, it would come at a high cost from the design of, and transition to, a new tax regime. A tax would then be subject to the same political uncertainty that has led to problems in the NZ ETS – the Australian experience should offer a salutary lesson here.

The fundamental purpose and architecture of the NZ ETS remain sound. The current problems result largely from failures to adapt the scheme effectively to changing conditions, follow a consultative process when changing government rules impacting on private investments, and above all, demonstrate clear policy commitment to a rising long-term domestic price on emissions. The existing NZ ETS architecture could be adapted to provide both increased price ambition and price certainty under a domestic-only scheme while retaining the option for New Zealand to easily rejoin a future, well-functioning international market. For example, a clearly binding limit on units available to the domestic market between now and 2020 would push prices up toward the current ceiling of $25. Requiring a fixed payment per unit, possibly as well as surrender of units, would push the emission price up, effectively creating a temporary tax within the existing structure. Concerns about the current distributional consequences of an emission price could be addressed without changing the whole policy, imposing huge transitional costs and delay and further undermining confidence in the direction of policy and the value of investments that will shift our economy in fundamental ways.

The suggestion to rethink our approach to emission pricing, increase ambition and improve price certainty is a useful one. But a rough transition between pricing mechanisms could further erode private-sector confidence in government commitment to policy. We could choose to build on the existing foundations of the NZ ETS rather than start from scratch with a new mechanism. Using inclusive consultative processes to shape the country's future climate change mitigation pathway and provide longer-term policy certainty on emission pricing with cross-party support would help to restore public trust and stimulate the kind of investments that will prepare New Zealand to compete effectively in a global low-emission future.

More information on Motu's programme "Shaping New Zealand's Low-Emission Future" is available on the Motu website (www.motu.org.nz) and via the programme's blog (http://low-emission-future.blogspot.co.nz/).