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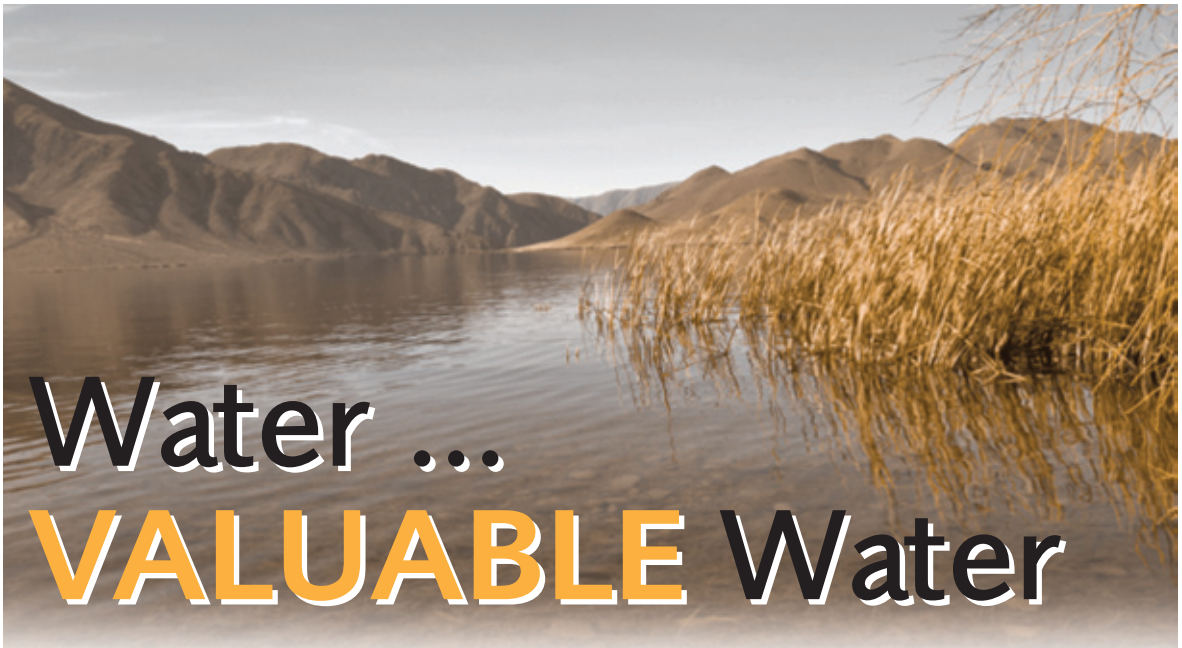

Water … VALUABLE Water

We're well into winter now. Out of the summer drought and back into rainy evenings, turning the lights on earlier and earlier, and switching the heater on. It's a good time to read ISCR's latest monograph, 'Water is Valuable'.[1] Lewis Evans explains the connection between, and roles of, hedge and spot markets in allocating water to its most valued use in electricity.

The value of water is a topic of national importance. There are common misconceptions that water is free and that high spot prices in dry years routinely benefit generators at the expense of electricity users. Neither is true. A key to determining the socially desirable value of water in electricity production and the management of water in dry years is the interaction of many different buyers and sellers in the spot and hedge markets.

'Water is valuable' explains that, just like other commodity markets, the electricity wholesale market consists of spot and hedge markets. These markets must both be present for commodity markets to function well. Hedges are fixed-price long-term agreements at which the bulk of electricity is exchanged. The spot market places a price on electricity that is not hedged. It does so in every half-hour period of the year. It prices exchanges between buyers and sellers of electricity that is not sold under a long-term agreement. It exchanges mismatches of supply and demand. Mismatches must occur[2] under long-term fixed-quantity agreements because supply of electricity must equal demand at every instant in time and forecasts of demand and supply cannot be perfect. Because of variation in rainfall, temperature and any system outages, predictions of demand and supply can vary from outcomes in periods of time that may be very short.

The monograph also explains how the interaction between buyers and sellers produces the value of water in electricity use, and how the spot price of electricity measures this value.[3] Water is scarce. In electricity, it is scarce at any point in time because hydro generators must decide whether to use it then or store it for later use. It is also scarce because water and gas generation substitute for each other in critical peak periods. The value of another unit of water is determined jointly with the cost of additional gas generation.

In addition, mention is made of the obvious additional fact that water is a scarce resource in the wider economy beyond the electricity market, and that its use in electricity is now in competition with other uses. It explains why competition among buyers and sellers in the electricity market is a good framework for water trading that will see water flow to its most socially valued uses.

Who really benefits from dry years?

There is confusion about who benefits and who loses from high spot prices, particularly those prices that are related to dry years in which reservoir inflow levels are low. Commentators such as Wolak[4] have suggested that the prices are due to market power and that generators particularly benefit. In fact these prices represent the socially desirable value of water in allocating scarcity under a workably competitive market. But who really does benefit or lose in these situations?

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The accompanying graph of electricity prices shows these periods well. As the monograph explains, the spot prices in Figure 1 give us the value of water at those points in time.

The 'who' of who benefits from dry years is, in fact, a mix of demand and supply entities (retailers, generators, industrial and large commercial firms) that use electricity intensively and have ability and interest in managing electricity use. Equivalently, in New Zealand they manage hydro water variation. The scarcity of water (and in other periods its plenty) is managed by market participants holding hedge contracts and trading unhedged amounts in the spot market. Let's see how this is done.

Suppose in 1998 generator A (GenA) entered a hedge with a large industrial entity B (IndB) for 100 units of electricity (MWH) at $50 per MWH for each trading period for the years 2000, 2001 and 2003. This hedge is shown in Figure 1 as a straight line.

Typically the hedge would work as follows. GenA receives and IndB pays $50 per MWH for 100 MWH per trading period no matter what the spot price is or how much they supply or use. GenA puts its generation in and IndB takes the electricity it wants out of the spot market, but the spot price of the 100 MWH is not the price of the transaction: it is fixed at $50. If GenA produces 100 MW each trading period then it receives the price of $50 on all units it sells. If it produces less (say, 80 MWH) then it gets its hedge contract of $50 on 100 MWH and will buy 20 MWH at the spot price to meet that quantity of the hedge agreement. If IndB consumes 90 (or 110) MWH then it sells (or buys) 10 MWH from the spot market at the spot market price.

What would have been the effect of the dry year of 2003 on our hypothetical market participants? The hedge is a contract that is present throughout the period of its term. If GenA produces 100 MWH and IndB consumes this, there is no effect at all from the high spot prices of 2003: the transaction price is $50. If GenA is a hydro generator and the low inflows reduce its ability to supply 100 MWH, then it must make up the short fall by buying in the spot market at spot market prices: in this case it would be a loser from the water scarcity. If IndB has the ability to economise on production (for instance by closing plant for maintenance during the dry period and reducing its use of electricity to 30 MWH), then it pays $50 for 100 units and puts 70 back in the spot market for which it gets paid the high spot market price. In this case IndB makes a profit gain. Of

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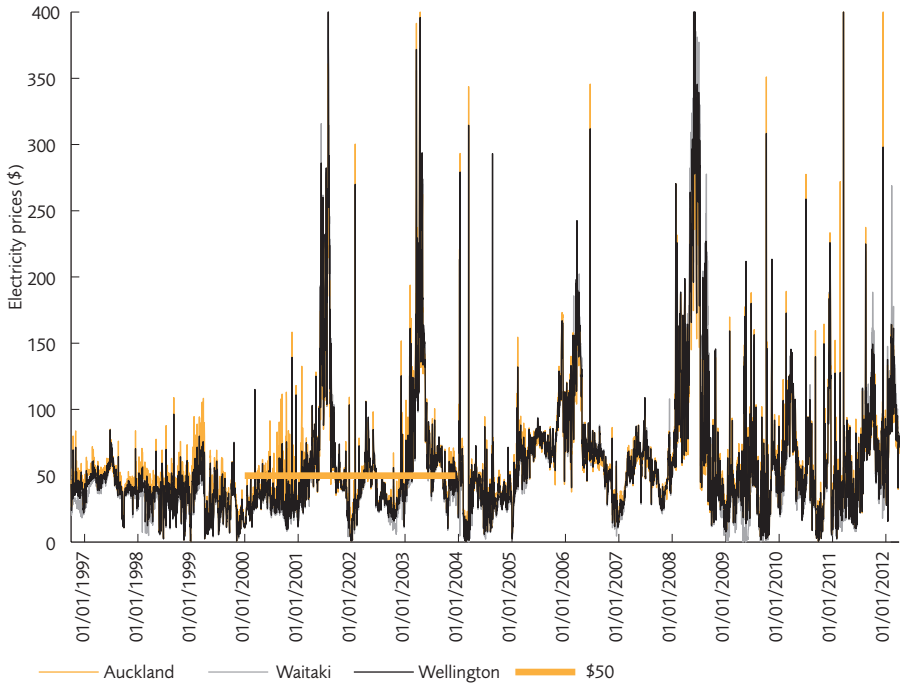
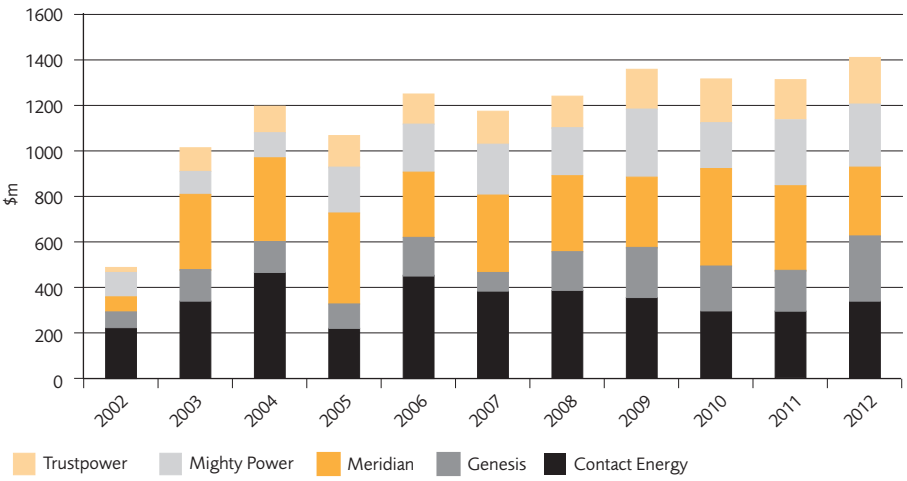
Figure 1: New Zealand electricity prices



Source: Data from Electricity Authority Combined Data Set.

Figure 2: Operating cashflow* of the five major electricity generators



Note: *Operating cashflow excludes interest; is after tax; is before capex, asset and financing transactions; and is in constant (cpi) prices.

Source: Data taken from the companies' reported accounts.

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course, other realistic scenarios include mixes of generators and demand entities benefiting and losing from high price episodes.

To complete the picture we should consider the case when inflows are relatively high (as in 2000). Here GenA still receives, and IndB pays, $50 for 100 units even though the spot price is much lower (see Figure 1). If our hydro generator in this 'year of plenty' produces 130 units of electricity, it will sell 30 units at the low spot price. But it will get $50 for the 100 units.

It is this 'insurance feature' that ensures hedges of various forms will be offered and accepted for a considerable share of electricity traded. The strike price ($50 in our example) will be agreed between seller and buyer and can be expected to be in the vicinity of the expected average spot price looking forward from 1998 to 2000-2004. A hedge may take a contract form or be the result of vertical integration of retail and generation, but the story is the same. The terms and numbers of hedges can be expected to balance these insurance concerns across locations[5] as well as time.

The winners and losers in dry and wet periods are a mix of entities on both the supply and demand sides of the market. Typically these entities have the ability and incentive to actively manage electricity price/quantity fluctuations. The public accounts of all five major generators in the New Zealand market simply do not show that generators make relatively high profits in dry periods. This is illustrated by Figure 2. It shows none of Wolak's monopoly rents, and it is consistent with the balance of hedge and spot markets.

High-price episodes coinciding with dry periods are fully consistent with the New Zealand electricity market being workably competitive and achieving a socially desirable allocation of water, gas and uses to demand. They do not imply profitable periods for generators.

In sum

Most wholesale electricity traded today in New Zealand will be exchanged at hedge prices. The spot prices apply to non-hedged quantities and they are critically important in allocating water to relatively socially beneficial uses in dry, wet and average years. They achieve this because the whole market is not fully hedged – as indeed it cannot be, if it is to serve over- and under-trading and allocate water in socially desirable ways.

It is the interaction among many buyers and sellers in both markets that enables the hedge market to achieve efficient insurance arrangements while New Zealand's fluctuating water supply is applied to socially desirable uses.

1 D Tam & L Evans (2013) 'Water is valuable: the allocation of water and other resources in the New Zealand electricity market' (available at http://www.iscr.org.nz/f882,23080/Monograph_No4_07_13.pdf).

2 Market participants may also choose to buy and sell in the spot market and manage the associated price risk outside the wholesale electricity market. As a point of detail, all electricity traded in New Zealand among market participants must be transacted through the spot market. The hedge arrangements are entered into separately.

3 Strictly, the price of water in electricity is the value of an extra unit of water given the state of demand, storage, current inflows, gas value, etc in the electricity market.

4 Frank Wolak's 2009 report to the New Zealand Commerce Commission is evaluated in a symposium on that subject published in *New Zealand Economic Papers*. See, for example: L Evans, S Hogan & P Jackson (2012) 'A critique of Wolak's evaluation of the NZ electricity market: Introduction and overview' *New Zealand Economic Papers* 46(1) pp1-10.

5 Hydro-water fluctuation in the South Island may well differ from that of the North Island.

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PUBLIC-PRIVATE PARTNERSHIPS:
Building Infrastructure for the Future

Wellington, New Zealand, 27-29 August 2013

Executive Development Workshop 27 & 28 August

Led by Professor Ronald Fischer, University of Chile

Conference 29 August

Co-chairs: Dr Toby Daglish, Research Director, ISCR
Brownyn Howell, General Manager, ISCR

Public-Private Partnerships have proved to be one of the 'bright lights' of infrastructure investment. The PPP model has survived the Global Financial Crisis virtually unscathed and is flourishing internationally, with a record number of deals registered in 2010. Policy-makers, government officials, managers and shareholders of firms in government partnerships will benefit from the shared experiences this conference offers.

New Zealand has been a late adopter of Public-Private Partnerships for the provision of key infrastructure. However, an extensive programme of government investment has been proposed, where many projects have been identified as likely PPP targets. We invite participants from the Asia-Pacific region and beyond to come to Wellington to discuss, debate and share experiences of (and aspirations for) PPPs.

Workshop

9.00am – 5.00pm daily (max 30 participants)

This interactive workshop will cover concepts, combine lectures and both international and national case studies, with specific emphasis on roading, telecommunications and school/hospital building partnerships, culminating in round table discussions.

Participants will be senior level policy, government and industry managers engaged in formulating, negotiating and overseeing the delivery of Public-Private Partnership projects.

Conference Dinner

Workshop attendees and conference attendees have an opportunity to meet and network over cocktails and dinner.

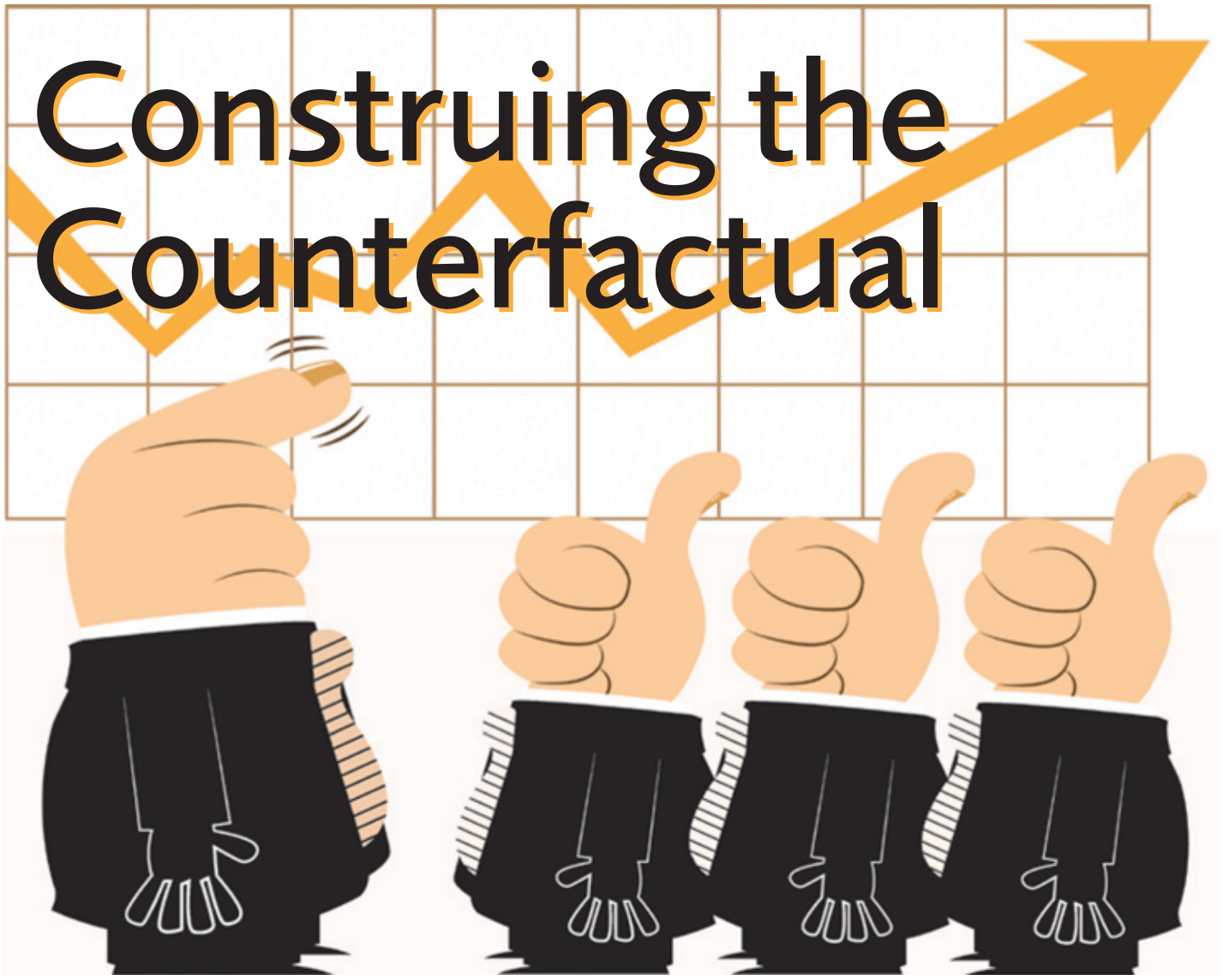
Conference

8.30am – 6.00pm

Following a plenary keynote address by Professor Fischer, the conference will break into parallel streams where a range of academic and practitioner papers and case studies (sought through an open, peer-reviewed submission process) will be presented. The formal conference proceedings will conclude with a plenary forum where all conference participants will be invited to share their thoughts with an expert panel comprised of commentators from each of the academic, policy/government and private partner groups.

For further information and registration details please see:
http://www.iscr.org.nz/n884.html

Construing the Counterfactual



Not quite three years ago, the New Zealand Supreme Court ruled that a firm can only be held to have taken advantage of its market power if a causal connection between the firms' conduct and its market power can be established. The court's decision, which relies on a counterfactual ('but for') test, has proved controversial. Critics claim that it is now easier in New Zealand than in other countries for dominant firms to abuse their market power. However, the counterfactual test may serve other purposes. Kay E Winkler puts the Court's decision into perspective.

The distinction between anti-competitive and pro-competitive behaviour of dominant firms has been subject to debate since the formation of competition law. Some strategies of dominant firms might lead to the exclusion of competitors; but they may also have other less-harmful motivations.

Sorting predators from competitors

The difficulty is to separate exclusionary conduct from 'competition on the merits'. For example, lowering prices is expected from competitive interaction and is good for consumers. But it can have the effect of some firms leaving the market because they cannot compete at that price level. This could distort competition, enhance the market power of the dominant firm, and eventually lead to higher prices in the long run.

The standard competition-law test in many countries is to ask whether the dominant firm can still cover its costs after lowering prices to the observed level. If it can't, then this lowering should be forbidden (as 'predatory pricing').

The problem is that this approach can lead to both false positives and false negatives. Some pricing strategies might effectively hamper competition but still allow the dominant firm to cover its costs. In other situations, a firm might need to price below its high cost of investment in more efficient technology and its competitors would have no problem competing at that price level.

New Zealand case law addresses this dilemma by requiring a counterfactual test.

The aim of the test is to show that the market power of the dominant firm makes it possible for the firm to adopt a strategy that a firm without dominance could not pursue. For a breach of competition law to be found, a causal connection between the market power and its use must be demonstrated.

The counterfactual test poses a hypothetical situation: would the firm have behaved in the same manner if it did not have market power? The counterfactual situation is one where the market has no firms with market power, but rather is in a state of workable competition. The dominant firm's actions are then considered in this context.

Testing, testing ... *0867*

The Supreme Court applied the counterfactual test in the *0867* case,[1] which centred on the 'termination charges' that applied whenever a customer on one telephone network called a customer on a different network. These

charges were part of an industry 'termination agreement' reached between Telecom and new entrant Clear in the early 1990s, before internet connections started being made through dial-up. Once dial-up arrived, problems emerged.

Dial-up internet calls were typically many times longer than voice calls. So an imbalance (exacerbated by 'free' local residential calling) rapidly emerged in the flow of termination revenues from the network operators[2] who supplied residential telephone connections to the network operators[3] who provided connections to internet service providers (ISPs).

Telecom reduced the termination charges it paid to its competitors by introducing 0867 numbers for ISPs who subscribed to Telecom; it also began charging its residential fixed-line telephone customers for calls in excess of 10 hours per month made to ISPs who didn't subscribe to an 0867 number. These arrangements provided a strong incentive for consumers to switch to ISPs using 0867 numbers. The practical effect was to force ISPs to abandon their arrangements with competing network operators, who lost both customers and the termination revenues that the dial-up internet calls to them had generated. Telecom thus eliminated the substantial losses it was incurring.

The Supreme Court held in *0867* that the Commerce Commission had failed to prove Telecom had abused its market power because any firm, whether dominant or not, would have tried to mitigate its losses in circumstances such as Telecom found itself. It ruled that a particular behaviour of a firm enjoying market power is not sufficient for finding a breach of competition law. Rather, there must be a causal connection between the firm's market power and its conduct. The dominant position must have facilitated the behaviour. Otherwise, the market conduct would have to be seen as a regular behaviour of firms in a competitive environment.

Following *0867*, the case law is also clear that the burden of proof is on the plaintiff (or the Commerce Commission) to show that the counterfactual test is fulfilled: that is, the dominant firm would not behave the same way without market power.

Constructive criticism

In reaction to the *0867* case, some commentators expressed disappointment with the Supreme Court's application of the counterfactual. The counterfactual test is accused of being too difficult to apply and is criticised for requiring an unrealistic design of a theoretical market with hypothetical firms. It is further claimed that the test ignores the fact that the conduct of dominant firms may have a different effect on markets than the conduct of non-dominant firms, and therefore the conduct of a firm without dominance cannot be a valid standard for comparison.[4]

These criticisms are consistent with the prevalent thinking in many other jurisdictions. Certain conduct of dominant firms is seen as a violation of competition law regardless of the specific effect in particular cases. In the predatory pricing example, the courts in the United States and in the European Union have developed rules based on certain cost levels, which are aimed at providing a guideline for distinguishing exclusionary conduct from legitimate competition.

However, current discussions in the European Union favour an effects-based approach that focuses on the actual influence of a firm's conduct on the market. Remarkably, this effects-based approach entails using counterfactual elements to test for exclusionary unilateral conduct. Single firm conduct might be assessed by comparing the likely future situation based on that conduct with a counterfactual, such as the absence of the conduct.[5]

Counterfactual analysis is also traditionally used in many areas of the law, such as torts or criminal law, to show a causal connection between an event and its effect. A counterfactual test asks the hypothetical question of what the situation would be like if a certain event did not happen. If, but for the event, the outcome would not have occurred, the causal connection between event and outcome is established.

Moreover, in the field of competition law, the counterfactual test is frequently applied in merger cases to see whether the merger would cause market distortions. In this respect it is asked what the outcome of the merger was, compared to the counterfactual (had the merger not proceeded).

Constructing a causal link

The counterfactual test is indeed a useful tool to establish a causal link between a conduct and its effects, and hence to reduce false positives and false negatives.

Courts have been criticised for posing a static view on competition-law cases and only having regard for the market conditions at the time when the predatory conduct occurred. In so doing, they might exclude many cases of predation that by definition rely on a dynamic progress over time. In this context, the Supreme Court's counterfactual test could be defended as a double-check of whether the firm's dominance actually enables it to exclude competitors in the long run.

A counterfactual analysis may have merit in separating anti-competitive from pro-competitive conduct. It could establish the missing causal link between foreclosure effects (forcing a firm to leave the market) and the incentive for the conduct. The question is whether the conduct would not have been done but for the foreclosure effects. If the conduct is profitable only with the foreclosure effects, it should be held to be anti-competitive. This would be distinct from other suggested profitability tests that ask whether a conduct is more or less profitable compared with other strategies but do not provide a causal connection between profitability and foreclosure.

The counterfactual future

In sum, the counterfactual test might not be as bad as its critics indicate. Because it requires the construction of a causal link between the conduct and the foreclosure effect, it offers a good approach for finding whether the conduct of a dominant firm was motivated by the aim to foreclose the market. Admittedly, the counterfactual test makes it harder to prove anti-competitive conduct. But, in so doing, it preserves incentives for firms to engage in efficient strategies.

1 *Telecom Corporation of New Zealand (0867)* (2011) 1 NZLR 577.

2 Predominantly Telecom.

3 Predominantly Telecom's competitors (these companies had used the termination revenues to subsidise and thereby attract ISPs as customers).

4 For references see: Kay E Winkler *Counterfactual Analysis in Predation Cases* (forthcoming).

5 European Commission (2009) 'Guidance on the Commission's enforcement priorities in applying Article 82 EC Treaty to abusive exclusionary conduct by dominant undertakings' *Official Journal of the European Union* C 45 p11 para21 (available online through OJ C-45/7 or at http://eur-lex.europa.eu/LexUriServ/LexUriServ.do?uri=OJ:C:2009:045:0007:0020:EN:PDF).

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A WILD RIDE FOR small young firms

Young firms usually don't have enough of a track record to allow investors to make an informed decision. In addition, smaller firms tend to be less well known and have less-developed accounting and information systems. So a small young firm tends to be financially constrained and unable to fully fund 'good' projects, especially if its earnings are volatile. Michael Keefe and James Tate report on their recent findings.[1]

In our study, we analyse the extent to which earnings volatility tightens the financial constraints of small and young firms. What do we mean by earnings volatility? Take two otherwise identical firms: both have earnings forecasts of $10, $11, and $12 for the next three years but Firm L's earnings volatility is low and Firm H's is high. Firm L should expect earnings which are close to the forecast (maybe $9.5, $10.75 and $12.25);[2] in contrast, Firm H should expect earnings that depart sharply from the forecast (they may be $12, $7 and $15).[3] Firm H's actual cash flows, in this example, depart from the forecast much more sharply than Firm L's. The size of this deviation is what we mean by 'earnings volatility'.[4]

To understand the relationship between earnings volatility and investment, we built a dataset consisting of 161,630 observations of 16,228 US firms over the period 1965 to 2011 and estimated a measure of earnings volatility for each firm for each year over the sample period. We constructed our measure of earnings to reflect the actual cash flow generated from the operations of the firm, which differs from accounting net income. Using this data set, we investigated the effects of earnings volatility on investment in financially constrained (small and young firms) and financially unconstrained firms (older and larger firms).

We categorised the firms who were in the bottom third of an index based on size and age as being financially constrained. These firms were quite different from the larger and more mature (financially unconstrained) firms in the sample. As examples: the mean ratio

of research and development expenditure to assets ratio was 7.9% for financially constrained versus 2.25% for financially unconstrained firms; and the mean sales growth per year was 27.02% for financially constrained versus 12.10% for financially unconstrained firms. Overall, relative to financially unconstrained firms, financially constrained firms are research and development intensive and they grow faster. In addition, financially constrained firms on average have six times the earnings volatility of unconstrained firms.

The 'rollercoaster' effect on investment

By definition, a financially unconstrained firm should have access to the optimal level of capital to fund investment. So one wouldn't expect to find a relationship between earnings volatility and investment in older and larger (financially unconstrained) firms. Our statistical tests confirm this implication: we find no evidence that earnings volatility affects investment in older and larger firms.

Compare this with a financially constrained firm: because such a firm is unable to gain access to capital in order to fully fund investment, it must rely on cash flows from earnings as the primary source of funding. Returning to our earlier example, suppose both Firm H and Firm L are small and young (financially constrained). We find that on average Firm H invests 5% less than Firm L. In other words, *all else being equal* a high-volatility financially constrained firm invests 5% less on an annual basis than a low-volatility financially constrained firm. Thus, earnings volatility has an important negative economic effect on investment in small and young firms.

Do positive and negative deviations both matter? Our example of Firm H and Firm L provides insight into this question. Suppose that both Firm H and Firm L have investment programmes that require an investment of $10 per year and, further, that this investment is funded by internally generated cash flow. In year two, the cashflow for Firm H is $7, which represents a negative deviation of $4 from the forecast. Firm H simply can't fund a $10 investment with $7 of earnings. In our study, we found that the average 5% reduction in investment due to volatility is entirely driven by these negative deviations. We find some evidence that these negative deviations do affect investment in financially unconstrained firms; but the statistical significance is marginal and, economically, the effect is relatively small.

Interestingly, negative deviations reduce investments but positive deviations do not increase investment. For example, in year three, the cashflow for Firm H is $15 and this represents a positive deviation of $3 from the forecast. According to our evidence, Firm H continues to fund investment at the $10 level despite the positive shock. Overall, these findings suggest negative volatility shocks tighten financial constraints but positive ones don't loosen them. We conjecture that this finding may indicate that loosening of financial constraints takes longer than one year.

Across the entire sample, there is a very strong positive relationship between earnings volatility, cash holdings, and research and development.

Show me the money

Since volatility (and, specifically, negative deviations) affect investments in small and young firms, what policies should management take to hedge away funding risk? The answer is to self-insure by holding cash. Across our entire sample, financially constrained firms *that hold high levels of cash* maintain their investment funding levels after having had a negative deviation from earnings. In contrast, after a negative deviation from earnings, financially constrained firms that hold low levels of cash reduce their investment by 7%.

In the context of our example, this implies Firm H should save cash from earnings during years with positive earnings deviations, allowing it to maintain consistent investment levels. Under this policy, in year three, Firm H would invest $10 and save $5 (out of the $15 of earnings). By saving $5, it will be able to make up possible investment shortfalls in subsequent years.

Our sample statistics suggest a cash-saving policy is followed in many financially constrained firms. Specifically, the cash-to-asset ratio of financially constrained firms is 66.83% versus 15.38% for financially unconstrained firms. Across the entire sample, there is a very strong positive relationship between earnings volatility, cash holdings, and research and development activity. This empirical evidence suggests the financial policies of small and young growth firms include holding relatively high levels of cash.

Cash is king

In closing, our findings show that the financing constraints faced by small and young firms are exacerbated by earnings volatility. These firms, whose investment plans are most affected by earnings volatility, tend to be high growth and research-and-development intensive. Overall, we recommend small and young firms with volatile earnings save cash as a means of funding future investment needs.

In addition, our findings inform policy in two ways. First, these small and young firms grow faster on average than larger firms and are an important source of economic growth. Second, these firms face financing frictions that may prevent them from investing at optimal levels.

1 This article is based on M Keefe & J Tate (2013) 'Is the relationship between conditional cash flow volatility ambiguous, asymmetric, or both?' *Accounting and Finance* (forthcoming) and on related literature cited in that paper.

2 The deviations of Firm L's actual earnings from forecast are -$0.5, -$0.25 and $0.25.

3 The deviations of Firm H's actual earnings from forecast are $2, -$4 and $3.

4 It's worth noting that earnings volatility has increased over the past 30 years, especially in technology-intensive industries.

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I take THEE ... and thy PROPERTY

The recent passing into law of the Marriage (Definition of Marriage) Amendment Act 2013 recognises but one of the many changes in the nature of relationships observed over the past 40 years. Concurrently, there have also been several changes in relationship-property legislation. Using alternative framing of the issues, Stuart Birks speculates on some unanticipated consequences the legislative changes could have on incentives to form relationships and invest in relationship property.

New Zealand's recent history of legislation governing relationship property originates with the 1976 Matrimonial Property Act, which introduced the concept of equal contributions in marriage relationships. A larger unpaid contribution by one spouse was assumed to balance a larger monetary contribution by the other. In the debate leading to the Act there was much discussion as to whether the legislated 'equal sharing' constituted a 'confiscation of property'. This was strongly denied by the Act's proponent, Jim McLay, who stressed that the Act pertained only to property of the 'marriage partnership' and not, for example, 'formal gifts or investments brought to the marriage by one partner or the other, or achieved by incomes ranging well outside normal family needs'.[1] In practice, however, these were frequently included as matrimonial property.

The subsequent Property Relationships Act 1976, despite its date, was the product of parliamentary deliberation between 1998 and 2001. It covers both married and de facto relationships. While claiming to treat de facto relationships in the same way as marriage, this Act actually changed the situation for married couples as it takes the three year 'relationship of short duration' period (where different rules may apply) to run from the start of the relationship, not from the date of marriage. Other clauses allow for unequal division by considering the 'career asset' of the main earner and the division of roles within the relationship. The focus is on both monetary and non-monetary contributions during a relationship, but only on material standards afterwards. Non-monetary post-relationship considerations and considerations of any changes in living standard resulting from entering into the relationship are ignored. The overriding assumptions are that the Act is dealing with a first relationship involving children, with a male income-earner and a female caregiver, and that there are no subsequent relationships.

Relationship 'frames'

The 'framing' governing these Acts was backward- rather than forward-looking. The legislated reallocation of the rights to relationship property was aimed at 'righting' perceived wrongs, which means little consideration was given to the implications for future relationship creation and relationship breakdowns.

The potential created for rapid transfers of funds between people who entered relationships with unequal contributions inevitably leads to some anomalies and possible 'unanticipated' behaviour responses. These can be explored by using alternative frames (see box on the next page) to view the legislation.

For example, the legislation applies to certain relationships lasting over three years between adults. But these are not the only relationships involving property that are subject to breakdown. Relationships between relatives such as siblings, or between parents

Frames as an analytical tool

It has long been recognised[2] that actions can have unanticipated consequences. This applies as much to policy and law changes as it does to individual actions. Any thinking or analysis underpinning the changes involves framing, which has been described as 'selection, emphasis, exclusion and elaboration'.[3] In other words, a particular view (or more than one view) of the issue is used. A simplified representation includes certain aspects and excludes others to tell a story supporting the change. This representation is really an analogy for the real world and, as with any analogy, it is unlikely to suit all (or perhaps even many) circumstances.

and children, are not covered. Perhaps they should not be. But then why should other adults with weaker ties, such as a late-in-life relationship of people who already have children, be automatically subject to the Act's property-division provisions?

A change in the signal(s)

Marriage has been described as a signal[4] that is useful because people may have differing relationship-forming objectives in an environment where information about those objectives is easily concealed. When divorce is uncommon, a willingness to marry indicates a high degree of commitment; and it provides important information to a prospective partner who also wishes to make a heavy commitment.

But changes over the past 40 years make it easier to end a relationship; and the legislation means there can be significant asset transfers when this happens. So risks are increased for those possessing assets and/or earning power and wanting to commit. Risks are further increased because it is not clear when a relationship will be said to commence: the law can apply much sooner than it did previously. The signal has changed, along with the options available to people.

More red lights than green

We can speculate on the consequences of such risks. If the potential exists for rapid transfer of assets in a relationship, weaker incentives are provided for someone to accumulate such assets. Equally, it gives a stronger disincentive against entering into relationships where there are only limited safeguards for holding on to those assets. A possible strategy is to enter only into relationships with people who have similar quantities of assets and earning power. The trend towards two-income and no-income (work-rich and work-poor) households, with consequent enhancement of income inequalities,[5] may in part be explained by incentives that discourage many 'unequal' relationships from forming.

Reduced willingness to commit may also be accompanied by less specialisation within relationships, a shorter planning horizon, reluctance to accumulate assets, and expensive attempts to safeguard existing assets. These effects apply to behaviour in existing relationships as well as to relationship formation. Existing relationships are functioning 'in the shadow of the law': this sets the financial costs and benefits of relationship dissolution, with recent law changes weakening the position of the larger financial contributor.

Women entering 'traditional' male-female relationships will have increased incentives to ensure they can earn in the future. By contrast, their male partners may think that the benefits of higher income are lower than in the past, especially in the event of relationship breakdown.

The presence of young children in a relationship further alters the dynamic. Partnered women (the caregivers) need to ensure that they can cope in the event of a relationship breakdown, while knowing that they can get financial support from a partner in the present and can expect to retain care of the children and receive financial assistance if the relationship ends. Partnered men (the income providers) know that there is a statistically high probability of relationship breakdown, in which case they would have financial obligations and an uncertain relationship with their children.

There are also disincentives for either partner to make the larger contribution to asset accumulation. This is likely to result in a shorter planning horizon and less asset accumulation overall.

Asset accumulation before the relationship is most likely to be relevant for a second or subsequent relationships. When a relationship breaks down, assets are split; but the former partners are at a later stage of their lives than people who are just starting out. Some will therefore have assets, and also obligations, which they may not be willing to put at risk. Alternatively, there may be a change in willingness to accumulate assets for children or for old age, given the legal implications of subsequent relationships. Anecdotally there seems to be less willingness to accumulate family assets for later generations, as indicated by the common reference to SKI ('spending my kids' inheritance') holidays. At the same time, there may be more single-person households among the elderly because of a reluctance to re-partner.

We may not observe these changes through specific individuals changing their viewpoints. Rather, it is likely that each generation will perceive the current environment as the norm and act accordingly. But changes in perceived intergenerational obligations, along with disincentives against planning long-term or accumulating large amounts, do seem to be emerging; and those who are prudent savers may also be more reluctant to risk their savings in new relationships.

Partner in haste, repent at leisure

While this discussion doesn't attempt to conclude that any specific legislation is good or bad, it does suggest that there are important implications from whatever relationship legislation is in place. Many of these implications were given scant consideration by the politicians concerned. The full effects may only be understood in another ten or twenty years. Nevertheless, forecasters may wish to consider them now.

1 *New Zealand Parliamentary Debates* 408 p4722.

2 RK Merton (1936) 'The Unanticipated Consequences of Purposive Social Action' *American Sociological Review* 1(6) pp894-904.

3 WJ Severin & JW Tankard (1997) *Communication theories: origins, methods, and uses in the mass media* (4th ed) Longman. New York.

4 R Rowthorn (2002) 'Marriage as a signal' in A Dnes & R Rowthorn (eds) *The law and economics of marriage and divorce* pp132-156. Cambridge University Press. New York.

5 P Callister (2001) *A Polarisation into Work-rich and Work-poor Households in New Zealand? Trends from 1986 to 2000* (http://www.dol.govt.nz/PDFs/op2001-3.pdf).

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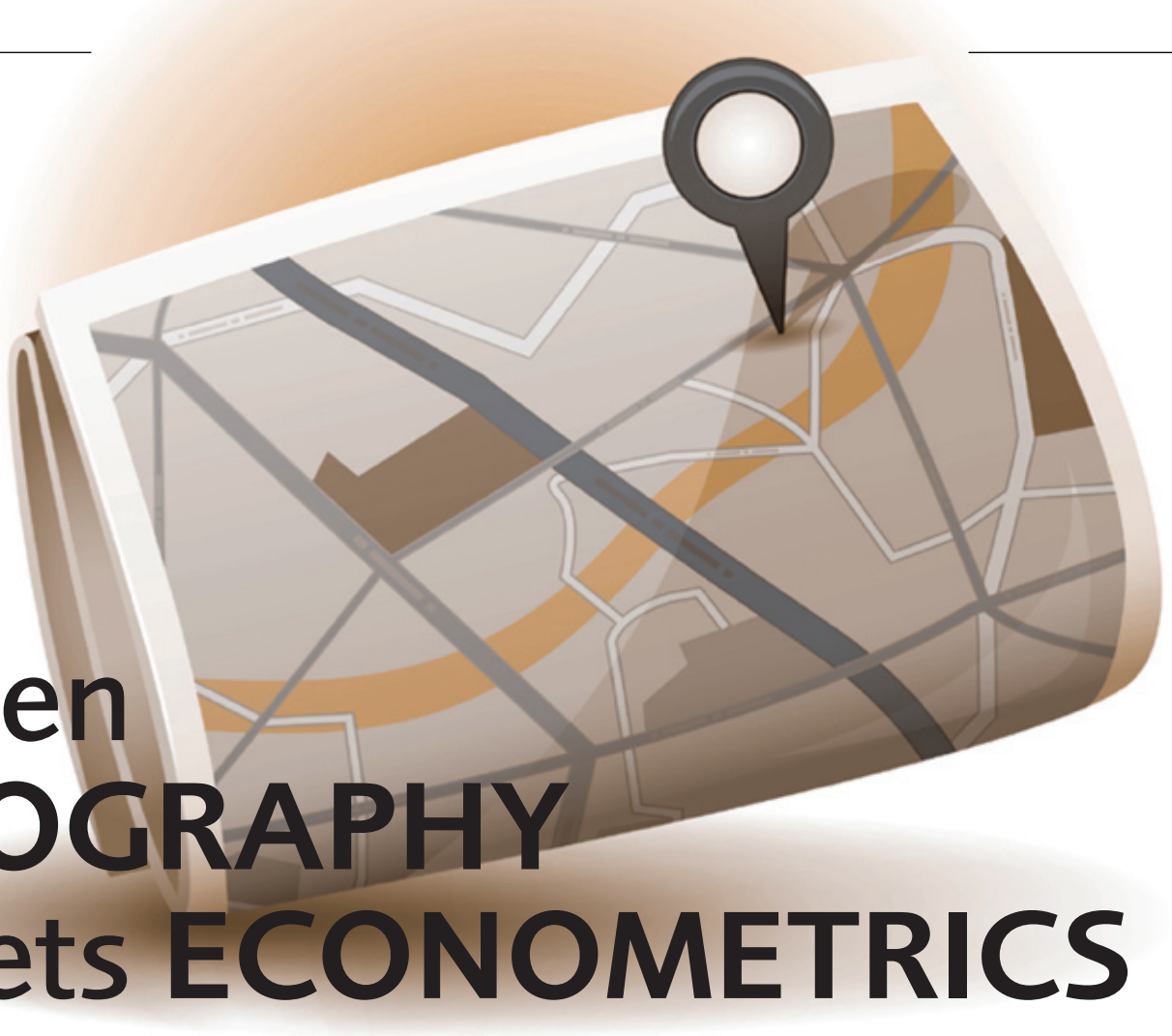


When GEOGRAPHY meets ECONOMETRICS

Tom Pettit and Richard Law combine information from geographic information systems (GIS) and econometric modelling to assess the monetary benefits of neighbourhood greenspace and the commuting mode choices made (via public transit, walking, cycling and driving) by people living in the Greater Wellington region.[1]

Underpinning the analysis was the combination of several years' worth of data from the Ministry of Transport's New Zealand Household Travel Survey (NZHTS) with supplementary data at the individual level: hypothetical public transport travel times, travel costs and neighbourhood greenspace derived from satellite imagery. As these supplementary data were calculated at the census meshblock level, census demographic and dwelling variables could also be integrated.

The GIS foundation

Geographic information systems (GIS) have an important role to play in this area of econometric enquiry.

An accurate and fully customisable computerised representation of the Greater Wellington Region's road and transport networks was made within the ISCR. As it was constructed from the ground up using largely publicly-available data from a variety of sources, the representation is highly customisable for the applications discussed here and any future Wellington transportation projects. The same approach can be used to construct an equivalent model to address the same questions in other parts of New Zealand.

The computerised representation product allows the different network perspectives of drivers, cyclists, pedestrians and public-transport users to be accounted for. It is central to investigating the commuting-mode choices that were made by NZHTS respondents, and for quantifying the time and monetary costs of commuting-mode choices that were not made. This allows us to hypothesise why people make the choices they do, and to understand why alternatives were foregone.

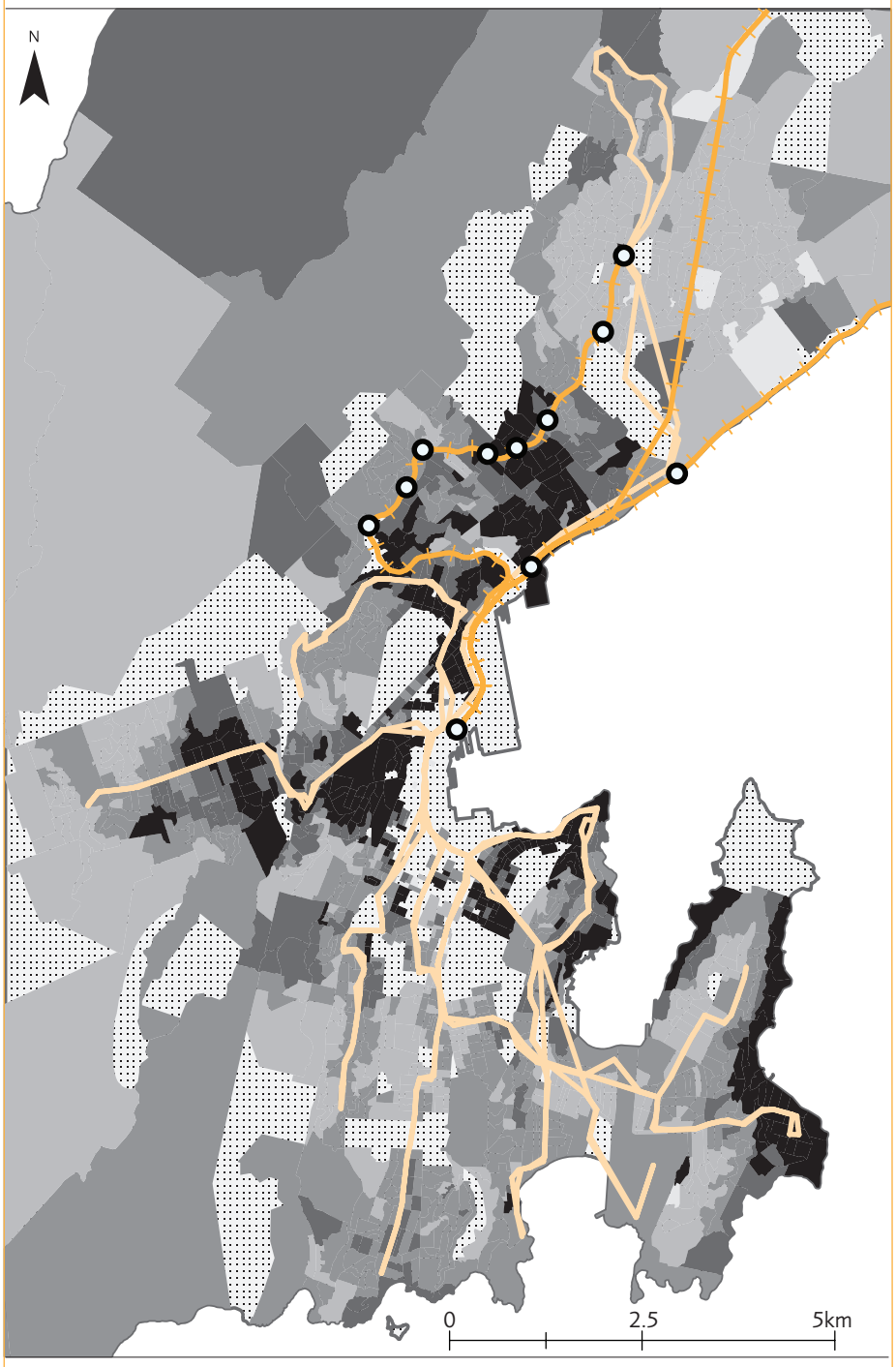
In modelling hypothetical commuting choices, the computerised representation can take account of a variety of characteristics of any route. Three such characteristics are noted immediately below.

First, the average speed of cyclists and pedestrians is influenced by hill slope, with a downhill incline providing for increased average speed up until a certain point. Conversely, travelling uphill is always harder than on the flat. This therefore penalises walking to destinations when the origin or destination is in a hilly neighbourhood, relative to the ease of walking along a valley floor or an isthmus like Rongotai.

Second, when solving for the shortest possible route between places via public transit, restrictions were noted for 'premium' public transit services. An example of this distinction would be comparing the Airport Flyer (a more expensive airport shuttle that stops in residential and commercial areas) to a cheaper, ordinary passenger train. The model can use this information to restrict or allow such 'premium' services and quantify the marginal costs and benefits in terms of both time and money.

Third, it is possible to specify any time penalty to model the waiting for or transferring between public transport services. This can be a static number (five minutes for all modes), be varied by mode (five minutes for buses, seven for trains) or be based on a function (very small for high-frequency, never-late services; very high for those that are low-frequency and unreliable). Quantifying this last parameter is a current goal of the project; it depends on securing suitable data related to service punctuality.

Figure 1: Wellington City property values and transport networks 2011



Sources: Map data from Quotable Value Limited, Wellington City Council and the Greater Wellington Regional Council.

Econometric inquiry

Information derived from the geographic model has been used in econometric analysis to provide insights into a number of important questions. Discrete-choice modelling was used to gain understanding of car ownership levels and commuting choices. Least-squares regressions enabled insights into the relationships between key variables and house values.

The value of neighbourhood greenspace, the frequency and reliability of public transport within walking distance of the meshblock, and other influences on travel time and distance on commuting decisions were assessed.

House values were analysed by taking home valuations in the Wellington region and using a least-squares regression to determine the components. This led us to some interesting conclusions.

In Wellington and Hutt cities, the value of greenspace is approximately an additional $400 for a house valuation per percentage point of a meshblock that contains dense greenspace.

Quality of public transit services is valued at $186 for an additional weekday service accessible within five minutes' walk of the meshblock, and at $6,708 for every minute faster the public transit system can get you to Cuba Mall.

Combined with the value of public transport speed indicated by the regressions, the positive nature of Wellington's public transport system becomes evident.

Some interesting patterns in the commuting decision data were also discovered:

- Most individuals are trading off speed and cost in their commute decision.
- Downtown workers are less inclined to drive, and most people consider a 30-minute walk to work quite acceptable.
- Women have a high incidence of car ownership even though they make heavy use of active and public transport.
- Households with large numbers of driver licences are able to exploit economies of scale with car ownership, and are less likely to have one car available per driver.

Not surprisingly, most individuals are trading-off the cost of commuting against the time taken. Interestingly, however, income has only very weak effects on price sensitivity.

Looking forward

The applications for such work range from growth- and zoning-planning evaluation to cost-benefit analysis, real estate price prediction and transportation-system planning. All of these policy areas can benefit from more rigorous statistical analysis and empirical evaluation.

1 This article is based upon joint work with Toby Daglish, Mairéad de Róiste and Yiğit Sağlam.

Tom Pettit was a recipient of a Summer Research Scholarship sponsored by Wellington City Council and Victoria Business School; he is currently studying toward a Masters in Public Policy. **Richard Law** is a research assistant at the ISCR and is currently in the first year of a Masters in GIS.

Is the 'digital dividend' spectrum OVERPRICED?

In July 2012[1] Toby Daglish, Phuong Ho and Yiğit Sağlam reported on work that the ISCR had undertaken on modelling the auction of the 'digital dividend', the extra frequencies that become available when New Zealand turns off analog television. Here they further refine their thoughts – and look with interest at Australia's very recent experience with the 'digital dividend'.

The market for wireless services can be categorised into two sub-markets. The first is the demand for high-use services that can only be provided by superior bandwidth such as the 700MHz band (the 'digital dividend' spectrum). The second is the demand for low-use services, which are supported by both the 'digital dividend' spectrum and current radio frequencies. The upshot of this market division is that winners of 'digital dividend' spectrum can obtain market power in the high-use market.

Spectrum left on the table

Interestingly, in most scenarios that we ran with our model, there is a high probability of excess supply at the end of the auction. This is because firms can quickly bid prices up to a level where it is no longer optimal for all the units to be held either by a monopolist or an oligopoly of firms. While the prices may be attractive to a government auctioneer, small quantities sold can take the wind out of their sails.

Any place for an entrant?

Table 1 shows the results of two scenarios. One is run with three firms, each of whom has substantial holdings of legacy spectrum. The second has two firms with legacy spectrum and one with no spectrum (the entrant). In this second scenario, the new entrant is unable to win more than one unit of new spectrum. Why does this happen? The two incumbents realise that allowing the entrant to buy units deprives them of potential earnings in the high-use market (either by impeding their ability to produce or by lowering the price they can charge for data plans). The entrant may also use the new spectrum to muscle into the low-use market, further hurting the incumbent's revenue. In effect, the incumbents derive more profits from preventing the entrant winning units than the entrant earns from winning.

The 'benchmark' case shows three identical firms bidding for spectrum, all with equal legacy spectrum. The 'entrant' case shows two firms with equal legacy spectrum bidding against one firm without (Firm 1). For the scenarios, the outcomes are expected results. For the Australian auction, the results are actual observations.

From the Australian 'digital dividend' auction …

The fourth column of Table 1 shows the outcomes of the Australian auction, which took place this May. In this case, TPG could be regarded as an 'entrant' given that it won minimal amounts of 2.5GHz (legacy) spectrum in the parallel auction. The results do not look wildly different from our model's (stylised) outcomes. The auction started with nine units (as in our numerical examples), each of which represents 2x5MHz. Since Vodafone withdrew from the auction, there were only three bidders. As in our numerical example, the Australian auction ended with a low price (equal to the reserve price: $311,067,000). The auction closed after just the first round of bidding. Notice that the result in our entrant scenario implies a low price relative to the price in the benchmark scenario. Despite the low clearing price, the Australian auction outcome exhibits substantial excess supply (3 units), which is also consistent with our outcome. In addition, the entrant (TPG) could not win any spectrum units. This demonstrates our analysis that the disutility for the incumbents (Telstra and Optus in Australia) from the entrant's gaining of market share provides a strong incentive for the incumbents to dominate the auction.

… to the New Zealand 700MHz auction

At the moment, the government has provided temporary licences for mobile operators to test 700MHz band. The 'digital dividend' auction is planned to start in the third quarter of this year so that management rights will commence on 1 January 2014 and expire on 28 November 2031. The auction is expected to apply a clock format with total supply of 9 units (9 lots 2x5MHz). Currently, it appears there will be three bidders in the auction. Though there are likely to be no new entrants to the market, 2 Degrees has a much smaller number of legacy spectrum units than the other bidders. The Australian experience supported our analysis; it will be interesting to see if a similar outcome occurs here.

Table 1: Simulated and real results from spectrum auctions

Variable	Benchmark scenario	Entrant scenario	Australian auction	Firm
Firm 1 winnings	1.3409	1	0	TPG
Firm 2 winnings	1.3409	1.5908	4	Telstra
Firm 3 winnings	1.3409	1.5908	2	Optus
Unpurchased spectrum	4.9773	4.8184	3	
Price	1.5413	1.1008	$311m	

1 *Competition & Regulation Times* issue 38 p1.

Toby Daglish is ISCR's Research Director. **Phuong Ho** is an ISCR research assistant and **Yiğit Sağlam** is a research principal of ISCR.