

The road less travelled

Two roads diverged in a wood, and I—
 I took the one less traveled by,
 And that has made all the difference.

The Road Not Taken, Robert Frost

The announcement that central government is prepared to fund the construction of Auckland's City Rail Link (CRL) has, once again, placed the issue of how to pay for infrastructure onto the public policy agenda.

We don't think that building the CRL should be made conditional on a congestion charge, but there is a place for direct pricing of roads in New Zealand's public finance system.

The building of the CRL is as good a time as any to introduce a better funding system.

Any system should incorporate time-of-use pricing, as that is essential to get congestion off roads during peak periods. Congestion pricing should apply to all roads in a congested area, not just motorways. A uniform congestion charge, rather than fuel taxes, can improve fairness. Remaining equity concerns can be addressed by targeting some of the revenue raised at non-transport activities that benefit low income motorists.

All infrastructure comes at a cost

Infrastructure is vital for economic growth. Without it, good ideas don't get to market; people can't get to where the good jobs are and profitable opportunities won't be financed.

Infrastructure is also costly. Not just because it tends to involve big expensive projects, but because every dollar spent on infrastructure can't be spent on something else (an opportunity cost).

Some types of infrastructure lend themselves to funding via direct charging: electricity is an example.¹ But most of the infrastructure that local government provides is difficult to price via conventional market methods. Even where charging is possible, it often involves high up-front capital costs and radical changes in behaviour on the part of consumers, which can also come at a high cost. Issues of equity naturally arise.

There is therefore, often a good case for local government using taxes on other things (like rates) to fund some of their infrastructure. But advances in technology are reducing the costs of some

charging methods in ways that will make them increasingly viable.

What to tax?

All governments have ample choice when it comes to deciding how to finance their operations.

Through time, governments around the world have tried many different ways to raise revenue, from selling honours, to taxing beards and allowing knights to avoid battle by paying their king a fee. Based on this experience, economists have developed a clear idea of the appropriate contribution that all the various ways of raising revenue should make to funding a modern government. A central focus on this analysis has been to identify tax systems that are "efficient", which is a technical term in economics that means maximising some measure of welfare or well-being given scarce resources that have alternative uses. It has usefully been defined as "an activity is economically efficient if there is no other use of the resources that would yield a higher value or net benefit".²

¹ Although those parts of the electricity system that are natural monopolies also require regulation to protect consumers from the exercise of monopoly power.

² [On efficiency and effectiveness: some definitions](#), Australian Productivity Commission Staff Research Note 2013, p. 4. Note that this definition does not just include money as the measure of value.

Paying for infrastructure in Auckland

The Auckland Council's latest ten-year plan includes a program of spending to improve Auckland's transport system. While the CRL, a \$2.5 billion tunnel below the streets of the CBD to extend Auckland's passenger rail system past Britomart, is the centre-piece, the program involves \$7.9 billion capital and \$14.4 billion operating expenditure.

Auckland Council is proposing a new revenue stream to finance part of this program. It has consulted on proposals for a regional fuel tax or some sort of user toll on roads. Legislation will be required for either option and to date, central government has been cool on the idea.³

In the interim, the Council has levied a special rate, based on property values, to finance a three year Accelerated Transport Program, which includes the initial stages of the CRL.

The Council is to be congratulated for its extensive analysis and open discussion on this issue. A Consensus Working Group provided detailed analysis of the options⁴ and the Council used the consultation process under the Local Government Act in developing its latest 10-year plan to test the options with its rate-payers.⁵ It was refreshing to see a local government saying simply and clearly that it has choices about what it does and all of those choices come with a bill.

Activities that need to be funded by taxes

A tax on one activity can easily be used to finance any other area of government. Economists refer to this as the "fungibility of money". While some governments tie specific funding sources to specific expenditures,⁶ most government revenue is paid into central funds and used to finance a whole range of activities.

There are no hard and fast economic principles that govern what sources of funds should finance what government activities and the criteria traditionally

used are more guidelines and suggestions for good practice.

There are two main options. First, there are general sources of revenue like the income tax and GST, which apply to almost all the population, with the contribution each person makes being based on ability-to-pay (the income tax can be made progressive, so the proportion paid can increase with income, while the GST is a proportional tax on labour income and income from government transfer payments, meaning that it does increase with ability-to-pay measured by those factors).

The second option is to use taxes and charges that are linked to the activity being provided by the government, with a wide range of options from targeted or hypothecated taxes⁷ to price-like fees.

The principal argument for funding from general taxation is that broad-based, low rate taxes can be an efficient (low cost) source of revenue (with costs understood to include administrative, compliance, equity and deadweight costs) and that the contribution an individual makes to the cost of public provision should be based not on the amount of publicly-supplied services consumed, but ability to pay.

The main downside is that goods and services provided in kind without direct payment require some sort of rule to limit supply. There are many alternatives used to achieve this difficult task: population-based funding formulas in health, roll-based funding for school, fixed funding pools for science and innovation funding.

The general argument in favour of "user-pays" is that those that cause an activity should make a direct contribution to the cost (i.e. people who choose to travel overseas should pay for their passports) and that price-like charges can mimic the effect of prices in bringing supply and demand into equilibrium. We will return to this important topic below.

Things like the distribution of income and the quality of the environment can all be included in well-being, although they can be hard to measure accurately.

³ See [Stuff](#). This is despite a study by the Ministry of Transport in 2008 concluding a congestion charge in Auckland would reduce congestion, encourage the growth of public transport and active modes (walking and cycling), improve environmental outcomes throughout the region and yield significant net revenues. See the Ministry's [website](#) for extensive analysis of this issue.

⁴ See the [final report](#) the Consensus Building Group commissioned by the Council to explore options.

⁵ The whole suite of consultation material produced for the 10-year plan is available on the Ministry's [website](#).

The detailed consultation document on transport funding is [here](#).

⁶ New Zealand's road user charges and fuel excise are an example: they are now used exclusively to fund roading.

⁷ Taxes where the revenue is ring-fenced for a particular purpose. For a slightly Anglo-centric, but none-the-less very readable explanation of tied taxes, see the UK House of Commons Library's 2011 Research Note [Hypothecated taxes](#).

Road building

The challenge in building roads is that they are costly, take a long time to build, and can't be readily converted to another use. This means that getting the "right" amount of roads is important. If you don't have "enough" roads, then you get congestion and increased wear and tear. "Too much" means that you have used resources that could have been applied elsewhere.

When it comes to building roads, there are two concepts from engineering and economics that should guide decision-making.

The "depth" of the road (how strong it is), should be determined by the size of vehicles that will use it. All roads wear out from use,⁸ but the amount of wear and tear on a road is proportional to the cube of the axle weight – a truck weighing 10 tonnes creates 1000 times the wear of a 1 tonne car. Thus, suburban roads that are mostly used by light passenger vehicles can be built shallower than a major motorway carrying many articulated lorries.

The "width" of the road (how many lanes) should be determined by the number of passenger vehicles.

The width question is complicated by the general infrastructure problem of having to build to peaks; it's not the average number of users that needs to be accommodated, but the highest number during the day: literally the "peak hour" matters most.

These two characteristics have implications when it comes to deciding how to fund them.

The value of roads

The cost of building a road depends on where it is, how wide it is and how it is constructed. This doesn't vary much once the road is built: maintenance costs are the only factor that will vary with use. But the value that a motorist gets from any piece of road can vary greatly, depending on what they are doing, why and, most importantly, when they are doing it compared to other users.

Roads become congested when demand (those who want to use the road) exceeds supply (the capacity of the road to carry the users).

Equating costs and benefits

In a private transaction, there is an exchange of money, or other valuable consideration, in return for goods or services. Because exchange is voluntary and because the parties usually have other options, economics predicts that there is a clear nexus between what one receives and what one pays: the concept of value and its associated concept willingness-to-pay. Economics predicts that people engage in voluntary exchange because they prefer their post-exchange situation to their pre-exchange circumstances. The reason for that preference is that the exchange is beneficial: you get more than you give up. A further prediction of economics is that exchange will stop – reach an equilibrium, in the jargon – when the benefits of the last item exchanged exactly equal the costs incurred to secure it.

This rationing property is one of the key features of markets and experience has shown that it is much like democracy: a very bad way of organising affairs, except for all the alternatives.

In New Zealand, we ration access to congested roads by queuing: those prepared to wait to get on the road, endure a longer trip and pay the price in terms of the time it takes to get from A to B. We are letting people judge the costs and benefits to them of travelling on a particular route at a particular time. Their contribution to providing the road comes from fuel excise and road-user charges, which don't take time of use into account directly.⁹

An alternative is to raise some or all of the costs of roads by charging directly for using a road based on the time of day, as a proxy for congestion. The idea, called "time-of-use" pricing, is that the cost of using a road should vary depending on how many people are using the road. This sort of pricing is very common with other goods and services, with seats on a plane being one of the more familiar examples. It is scarcity that creates value¹⁰ and so the price that

⁸ The usual practice in New Zealand is that roads are constructed to be maintained frequently, including periodic re-sealing, which reduces the up-front capital cost, but entails higher through-life expenditure. In some overseas countries, like the United States, roads are built to last longer before they need maintenance, but at a higher initial cost.

⁹ If fuel consumption increases per kilometre travelled when roads are congested, then there is a very indirect element of time of use payment. Road user charges, however, are based on vehicle weight

and distance, and so provide no incentive to use roads when they are not congested.

¹⁰ Adam Smith and other classical economists struggled to explain why seemingly trivial things like diamonds were expensive, while water, the stuff of life, was cheap. This "paradox of use" or the "diamond-water paradox" was finally resolved in the 1880s, as part of the "marginal revolution" in economics, which explained that the value that people place on consumption declines with each successive unit. While the minimum amount of water needed to sustain life might be very valuable to a person, if water is overall plentiful and

people are prepared to pay to fly at popular times (the start and end of the business day, during school holidays) is higher. Thus people who do not value flying at a particular time (because they aren't flying for business or don't have school aged children) will pick another flight, so while popular flights are full, there are rarely disappointed people who would have flown. But as every commuter knows, roads just get more and more congested and travel times longer.

London and Singapore are two examples of road use charging at work.¹¹ In both cities, it costs more to drive in otherwise congested zones, which has the effect of reducing demand: only people who value driving over the alternative will pay the charge. There are, however, major differences in the two schemes, which provide interesting experiences for Auckland to draw from.

London

Since 2003, motorists who enter a defined zone around the centre of London between 07:00 and 18:00, Monday to Friday have to have to pay £11.50 per day. The charge has been a success in meeting its objectives of producing a reduction in road congestion in London.¹² However, traffic congestion remains a significant issue in central London.¹³

Litman (2011) observes, however, that the London scheme does not include some of the key features that would make it even more effective: the fee does not vary with distance travelled; the fee is not time-variable and does not increase with congestion; it has relatively high over-heads and alternative modes of transport (the London Underground in particular), are crowded and unreliable, although the buses are improving and revenue from the congestion charge is being used to upgrade public transport.

thus they can consume far more than the minimum, then what they will pay for that last unit, which sets the market price, will be very low. Diamonds, on the other hand are scarce, and while not demanded by many people, those you do want them will be prepared to pay a high price for the few that are available. But a person dying of thirst in a desert would have greater marginal use for water than for diamonds, so would pay more for water and would probably happily exchange diamonds for a drink of water, perhaps up to the point at which they were no longer dying.

¹¹ Variants of time-of-use or congestion charging apply in some other cities around the world, either in specific zones (e.g. Stockholm and Milan) or for specific routes (the toll on the Sydney Harbour Bridge is higher during peak hours to discourage use).

Singapore

Singapore first introduced a congestion charge in 1975, when vehicles entering a two square mile restricted zone in the CBD between 7.30 and 9.30 in the morning were required to display a pre-purchased windshield license, which cost \$S3.00 at the time. Road-side monitoring at 28 entry points enforced the system, with heavy fines for non-compliance.

The charging system has been expanded and automated over time. Currently, an electronic road pricing system applies in the CBD and on a number of points on Singapore's motorways. Charges vary by location, time-of-day and vehicle type and are adjusted regularly to keep traffic flowing freely within the CBD and on the motorway network. The system is fully automated, using vehicle-mounted electronic devices and gantry-mounted monitors. Motorists are required to keep an account in positive balance and can top-up their accounts at ATMs and banks. The public transport system in Singapore provides an attractive alternative to commuting. The Singapore experience has also been highly effective at reducing congestion.¹⁴

Planning is underway to use developments in satellite-based technology to further improve the efficiency of the system.

Equity

Congestion pricing does not take ability-to-pay into account: all users at a particular time pay the same price, regardless of their circumstances. This raises valid and important questions about fairness.

The equity effects of any new congestion charge should be compared with the alternatives. The current system of funding roads in New Zealand also takes no account of ability-to-pay. Indeed, because the fuel excise uses fuel consumption, not distance travelled, as the basis of charging, low income people who tend to drive older, less fuel-

¹² See, for example Transport for London (2008) [Central London Congestion Charging Impacts monitoring, Sixth Annual Report](#); Litman, Todd (2011) [London Congestion Pricing, Implications for Other Cities](#), Victoria Transport Policy Institute and KT Analytics, Inc (2008) [Lessons Learned from International Experience in Congestion Pricing](#), Report prepared for the Federal Highway Administration, U.S. Department of Transportation.

¹³ Inrix (2016) [London Congestion Trends](#).

¹⁴ See van Amelsfort, Dirk (2015) [Introduction to Congestion Charging: A Guide for Practitioners in Developing Cities](#), Asian Development Bank and Deutsche Gesellschaft für Internationale Zusammenarbeit (GIZ) GmbH; and New Zealand Transport Agency (2010) [Road pricing \(congestion charging\). Integrated planning toolkit](#).

efficient cars which might not be serviced regularly, tend to pay disproportionately more per kilometre driven under the status quo. A uniform congestion charge might therefore improve equity.

Designing a congestion charge to directly address concerns about equity is possible, at least in part. Concessions for car-pooling can provide some relief, although it is difficult to target such concessions at specific groups. An automated collection system like that used in Singapore could be combined with provisions like the Community Services Card and the SuperGold Card to allow better targeting.

Another option to address equity concerns is to use part of the revenue raised from any congestion charge for spending outside the transport system that would be of greater benefit to low-income car users.¹⁵ This approach might have lower administration and compliance costs and be less open to abuse. It is also another example of the fungibility of money: a charge on one activity (using a road) can be used to fund programs directed at improving social equity.

Funding the CRL

We are not convinced that proceeding with the CRL requires a congestion charge.

The link between the 3.4 km rail line to Mt Eden that will have a very specific catchment (commuters travelling to and from the downtown CBD) and all users of the motorway system is not strong and may result in some cross-subsidisation. Only a minority of commuters use the motorways to travel to the CBD. Obviously, only people will use the CRL, not freight, while the Council's proposal is that all users, including vehicles carrying freight, should pay a motorway toll.

But in politics, like comedy, timing is everything. It may be that road users in Auckland would be more welcoming of a congestion charge if its introduction were timed to coincide with major new transport projects. Taxpayers from outside Auckland might appreciate seeing a new revenue stream that is clearly paid for by the users of the Auckland roads, not them.

We definitely think that some sort of congestion charging should be part of the suite of methods used to fund roads in New Zealand. If building the CRL meets a robust cost-benefit test and it is the spur to more efficient funding, then we are in favour.

We are not attracted to the option of a motorway toll, as proposed by the Council in its consultation documents. This option involved a charge for using the motorway network at certain times of day, with a slight increase in cost during peak hours.

Any system should incorporate more accurate time-of-use pricing, as that is essential to lessen congestion during peak periods. This is the great advantage of congestion charging over an excise tax and it means that one of the key determinants of the cost of roading – the width of the road – will be influenced by the charge imposed.

Congestion pricing should apply to all roads in a congested area, not just motorways. Technology is making this possible and just increasing the cost of travelling on a motorway will undoubtedly cause some drivers to rationally respond by using other roads, which will see the congestion moved, not addressed.

Finally, concerns about the fairness of a congestion charge are valid, but they don't need to be addressed directly within the scheme design.

Singapore looks like a better model than London.

¹⁵ For an interesting discussion, see the United States Department of Transportation 2008 study [Income-Based Equity Impacts of Congestion Pricing—A Primer](#) and the references it cites.

This Insight was written by Peter Wilson at NZIER, 23 May 2016.

For further information please contact Peter at peter.wilson@NZIER.org.nz or (021) 870928.

NZIER | 0800 220 090 | econ@nzier.org.nz | www.nzier.org.nz

NZIER Insights are short notes designed to stimulate discussion on topical issues or to illustrate frameworks available for analysing economic problems. They are produced by NZIER as part of its self-funded Public Good research programme. NZIER is an independent non-profit organisation, founded in 1958, that uses applied economic analysis to provide business and policy advice to clients in the public and private sectors.

While NZIER will use all reasonable endeavours in undertaking contract research and producing reports to ensure the information is as accurate as practicable, the Institute, its contributors, employees, and Board shall not be liable (whether in contract, tort (including negligence), equity or on any other basis) for any loss or damage sustained by any person relying on such work whatever the cause of such loss or damage.