Environmental and social taxes: Reforming road pricing in Australia

John Stanley and David Hensher
Institute of Transport and Logistics Studies,
The Business School,
The University of Sydney
John.stanley@sydney.edu.au
David.hensher@sydney.edu.au

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Contents

Abstract

Pricing of road use, both in Australia and elsewhere, has long been recognised as an area where current arrangements are economically inefficient but also politically very difficult to change. The 2011 Australian Tax Forum provides an opportunity to revisit this question and lay out a pathway for change. This paper summarises some past analyses of the costs of road use in Australia, to demonstrate the broad extent of under-recovery of costs. The external costs, such as congestion, accidents and greenhouse gas emissions, which are the reason for the cost recovery gap are outlined. International experience with congestion charging, a key component (but not the whole) of road pricing reform is summarised, showing how sustained reductions in congestion levels and associated costs are achievable. That experience also shows the importance of political leadership to achieve implementation, often in the face of minority support pre-implementation. Some illustrative calculations of how Australian road use charges may need to increase, on average, under a reformed road pricing regime are presented. The paper concludes by arguing that an independently run two year community conversation around reforming road pricing, reporting to COAG, is the critical starting point if there is to be a successful implementation program.

1. Context

1.1 The Tax Forum

The Australian Government has announced that a Tax Forum will be held in October. The Treasurer's introduction to a Discussion Paper for the Forum points out that (Commonwealth of Australia 2011, p. vi):

The Tax Forum is an opportunity to hear from all parts of the Australian community about the future of our tax and transfer system.

That paper indicates that the government's approach to tax reform is built around:

1. Reform to make the economy stronger;
2. Reform to make the tax system fairer;
3. Reform to make the tax system simpler.

Session 5 of the Tax Forum is suggested as being concerned with *Environmental and Social Taxes*, the Discussion paper noting that (Commonwealth of Australia, 2011, p, 29):

In some circumstances, specific taxes ... can be used to improve market or social outcomes by addressing spillover costs through appropriate price signalling. User charging can also play a complementary role to signal underlying resource costs of publicly-provided goods and services.

Road transport is mentioned as an example of an area where this approach may be relevant, The Discussion paper reminding readers that (Commonwealth of Australia, 2011, p, 29):

The AFTS review recommended that governments should consider the introduction of variable congestion pricing. Beyond that, the review commented that new technologies may further enable wider application of road pricing if proven cost-effective.

With respect to Environmental and Social taxes, the Discussion paper invites possible discussion on three areas at the Tax Forum (Commonwealth of Australia, 2011, p. 31):

1. *Should Australia consider ways to more closely link road charging to the impact users have on the condition and upkeep of roads?*
2. *Is there a case to more closely link road charging to the impact users have on the level of congestion on particular roads?*
3. *Are there aspects of other tax arrangements that create unintended incentives for adverse environmental outcomes, or ways in which governments could use specific taxes to ensure that people take appropriate account of environmental impacts in their decision making?*

The present paper takes the opportunity to contribute to this discussion.

1.2 Australia's Future Tax System (AFTS)

In May 2010, the Commonwealth Government released the report of the AFTS review (sometimes known as the Henry Tax Review). That review reported[1]:

Current road tax arrangements will not meet Australia's future transport challenges. Poorly functioning road networks harm the amenity, sustainability, liveability and productivity of society. Moving from indiscriminate taxes to efficient prices would allow Australia to leverage the value of its existing transport infrastructure. Less congested roads, shorter travel times and investment in road infrastructure that addresses user demand would provide a foundation for further productivity growth, improved living standards and more sustainable cities.

The AFTS review suggested location-specific congestion charges, removal of cross-subsidies in heavy vehicle charging for road use and regulatory solutions to negative spillovers not currently amenable to pricing, in return for lower taxes on road use (excise) and some other reforms of current road user charges. It argued that investment in roads should be guided by the results of comprehensive and transparent cost benefit analyses. The review expected substantial benefits to flow from these reforms.

1.3 COAG Road Reform Plan (CRRP)

Following a Productivity Commission 2006 inquiry into road and rail freight infrastructure pricing (Productivity Commission 2006), the Council of Australian Governments (COAG) initiated a Road Reform Plan (CRRP), to develop and evaluate options for heavy vehicle pricing reform and road funding and expenditure reform.

CRRP has recently produced a draft report evaluating pricing and funding options (CRRP 2011), in which it proposes a staged move to charging heavy vehicles for their road use based on measures of the static mass of the vehicle, the actual distance travelled and its location on the road network (mass/distance/ location or MDL charging). It is noteworthy that the technology required to implement MDL charging could be extended from the heavy vehicle fleet to all vehicles should a comprehensive road pricing reform program be pursued, as proposed in the present paper.

The CRRP process is very narrow in its focus. It excludes light vehicles (which constitute the majority of the Australian vehicle fleet) and ignores all external costs other than road damage. It would be remarkable and if such a narrowly based terms of reference produced a significant enhancement in the efficiency of the Australian land transport task!

1.4 This Paper

Against the background of the three reports noted above, this paper looks at the external costs of road use in Australia and suggests it is time to commence a more ambitious road pricing reform program. Some illustrative calculations of externality charges are presented, using an optimisation model

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1 http://taxreview.treasury.gov.au/content/FinalReport.aspx?doc=html/publications/papers/Final_Report_Part_1/chapter_8.htm

developed by Dr Ian Parry from Resources for the Future. A version of Dr Parry's model was used by Clarke and Prentice (2009) in providing advice to the Henry Tax Review[2].

2. External Costs of Road Use

Economic theory recognises that, in a competitive market economy, the existence of external costs and benefits creates a situation where the market decisions of individual consumers and producers no longer add up to an efficient outcome for society[3]. Market prices do not reflect these externalities and there will be too much (negative externality) or too little (positive externality) production of the good or service that causes the externality. In general, market pricing on the basis of social costs, not private (or internal) costs, is a requisite for efficient resource allocation[4].

In land transport, most discussion of external costs has focused on the external costs of road use. The typical external costs that are usually considered in this context are:

- congestion
- greenhouse gas emissions
- local air pollution
- noise pollution
- the external cost of accidents
- road damage.

It is also arguable that high community dependence on motor vehicles increases risks of social exclusion for many people, which suggests that there is also a social exclusion external cost of road use (Stanley et al., 2011a,b).

Europe has had an active interest in externality costing of transport for four decades, with this interest increasing over the last two decades. The important ExternE project to cost externalities started in 1991[5], with external costs of road use being one of its major interests. Maddison et al. (1996) brought together much of the international work at the time, with a UK focus.

A major report prepared for the (then) UK Department of the Environment, Transport and the Regions in 2001 suggested that road user charges covered total costs of road use on a fully allocated cost basis, if congestion costs are not included, but that the marginal costs of use (which include congestion costs) were two to three times the relevant marginal revenue levels (Sansom et al., 2001). In terms of the requirements for efficient pricing, this suggested a need for some increases in charges for road use, particularly in peak periods, because of the high levels of congestion costs (even though UK fuel taxes were already far higher than those in Australia). That report estimated total fully allocated road costs for Great Britain of 3.34-7.20 pence/vehicle kilometre and marginal costs of 12.3-16.3p/vkm (Sansom et al., 2001, Table B, page v).

[2] They used the model as set out in Parry and Small (2007).
[3] External costs describe a situation where there are uncompensated costs of transactions that accrue to third parties, who did not agree to whatever caused these costs (conversely for external benefits).
[4] The idea of imposing a tax or charge to correct market prices for negative externalities has a long history in economics, usually associated with the work of Pigou (1920) (hence the term Pigovian tax).
[5] http://www.externe.info/

US interest in externality costing of road use also has a long history. In recent years, Dr Ian Parry and colleagues at Resources for the Future have published extensively in this area, with their main focus being the US (see, for example, Parry and Small 2005; Parry 2008; Parry 2009; Safirova et al. 2007). Parry's work is notable because it examines external costs of transport within the broader context of the taxation system, seeking to optimise road user charges within this broader setting. He draws on Ramsey's (1927) insight that taxes for raising revenue should be higher on goods whose price elasticities are lower. Parry's work suggests a need for substantially increasing taxes on highway fuels in the US (where they are much lower than in Australia) and using the revenues to finance reductions in distortionary income taxes (Parry 2009). He acknowledges, however, that there is still room to sharpen estimates of some external costs and that his estimates of optimal fuel taxes should be treated with some caution.

In terms of quantifying specific external costs in the US context, Parry (2009) produced the figures shown in Table 1. These cost estimates are marginal costs, showing the expected change in the costs in question for a unit change in traffic levels. The way the costs are cited suggests that marginal costs equal average costs.

Table 1: Marginal External Costs

External Costs	Cost (Petrol Cars) (2007)
Air pollution	1c/mile
Accidents (external cost only)	3.5c/mile
Climate change	9c/gallon (at $10/t CO2)
Oil dependency	10c/gallon
Congestion	4.5c/mile

Source: Parry (2009)

The most comprehensive early Australian examination of external costs of road use was probably the Bus Industry Confederation's submission to the 2001 Commonwealth Fuel Tax Inquiry, a submission whose preparation was assisted by ExternE project consultant, Paul Watkiss (BIC 2001), who was also a co-author of Sansom et al. (2001). That submission estimated the total external costs of road transport in Australia at $30.5 billion (Table 2). Revenues collected by governments from road users were estimated at $11.5 billion, well below the total external costs. The CRRP process (see section 1.3 above) is only concerned with less than $2 billion of such expenditure, this being the heavy vehicle part of road costs. Stanley (2010) has updated the costs and revenues shown in Table 2 and estimated the total external costs of road use at over $40b, with revenues at $16 billion, suggesting a wider total deficit than a decade ago.

The 2001 BIC research presented estimates of fuel-based charges that might be used to cover various external costs, with congestion costs excluded – on the argument that this should be charged on a city-specific basis, rather than being recovered through fuel charges. BIC argued that its analysis (Table 3 below) showed that, in addition to road users as a whole not meeting the full external costs of their road use (as per Table 2 above) (BIC 2001, p. 76):

- the current fuel excise (~38c/L) is probably about right as a charge for internalising the costs of urban road use by cars, ignoring congestion costs, but is too high in relation to rural road use by cars;

- the external costs of urban road use by heavy vehicles are probably higher than the current excise rate (ignoring congestion costs) but rural external costs for these vehicles are probably similar to current excise rates.

An implication of this analysis was that heavy vehicles should not receive any rebates of the fuel excise, unless they could demonstrate they create external benefits (as can be shown for buses, which reduce external costs of road use).

Table 2: Total External Costs of Road Transport and Road-Related Revenues (2001)

Cost/Revenue Item	Total ($b)
COSTS	
Road expenditure	4.6
Congestion	12.8
Air pollution	4.3
Climate change	2.4
Noise	1.2
Accidents	5
Total Costs	**30.3**
REVENUES	
Commonwealth excise	12
Less diesel fuel rebate	-2
Less DAFGS	-0.7
Registration fees	2.2
Total Revenues	**11.5**
ROAD "DEFICIT"	**~$20B.**

Source: BIC (2001)

Table 3: Proposed Fuel Based Externality Charges for a range of Road Transport Vehicles (c/L; CNG = c/kg; 2001 prices)

Cost Component	Cars (petrol)		Artic. Trucks		Buses		
	Urban	Rural	Urban	Rural	Urban	Rural	Urban CNG
Infrastructure	8	8	20	20	20	20	16
Congestion	0	0	0	0	0	0	0
Air pollution	2-10	0	7-31	0	6-24	0	5-10
Climate change	9	9	11	11	11	11	11
Noise	7	0	7	7	7	0	7
Accidents	8	8	4	4	4	4	4
Totals	**34-42**	**25**	**49-73**	**35**	**48-66**	**35**	**43-48**

Source: BIC (2001)

Drawing on much of the BIC work, the Victorian Department of Transport subsequently produced external cost estimates for use in project evaluations and this work has now been broadened into Australian Transport Council evaluation guidelines[6], which set out a comprehensive set of external costs and proposed values for use in project/program evaluation. Many other countries have done likewise, with the UK Webtag system[7] and Dutch evaluation handbook notable (Maibach et al. 2007).

More recently, oil dependence has been noted as a possible external cost of road use (Parry and Small 2005), as has obesity from high reliance on motor vehicle travel, with associated diminished physical exercise (Stanley and Barrett 2010).

Clarke and Prentice (2009), in their research paper for the Henry Tax Review (AFTS), discussed the external costs of road use in Australia, drawing particularly on the work of Parry and Small (2007). We draw on some of the Clarke and Prentice analysis below.

The main conclusions the authors draw from this brief overview of research on the external costs oftransport are that:

- there is now a long history of quantifying the external costs of transport;
- the focus of this quantification has been on the external costs of road use;
- Australian road users do not meet the full social costs of their travel choices;
- road damage costs tend to be dwarfed by other external costs of road use, which suggests that road use charging regimes should have a much broader focus than simply seeking to recover only road damage costs and, in Australia's case, explicitly only heavy vehicle road damage costs;
- the gap between the total external costs (and marginal costs) of road use in Australia, and current road user charges, is increasing, suggesting that there is increasing urgency for reform of road pricing;
- the growing international literature on the externalities of road use, and increasing implementation of congestion pricing schemes, suggests that there is likely to be a growing incidence of such initiatives in the coming decade.

3. Changing How Road Use is Priced

3.1 Congestion Pricing

The discussion on the size of external costs ceased to be an abstract intellectual exercise for economists when a number of countries actually implemented explicit road pricing regimes which recognised that externalities are important price setting inclusions for improving resource allocation efficiency. The major externality that has been recognised in terms of transport pricing regimes is congestion, where cities such as Singapore, London, Stockholm and several Norwegian cities have implemented schemes (area or cordon-based charging), places such as Oregon have had trials and the Dutch have gone close to implementing a comprehensive GPS-based pricing scheme.

Professor Tony May from Leeds University has reviewed congestion pricing schemes, Box 1 summarising his main findings. The evidence is compelling that there is no other initiative that can reduce road

[6] http://www.atcouncil.gov.au/documents/files/National_Guidelines_Volume_3.pdf
[7] http://www.dft.gov.uk/webtag/

traffic levels so much, so quickly and in such a sustained manner. UK research suggests that reductions in road traffic levels of 4% can cut congestion costs by about 40% (DfT 2004, Table B). A pricing solution helps to ensure that traffic reductions do not attract additional traffic levels back to fill the void, such that congestion cost savings (benefits) can actually be realised from congestion pricing solutions. In Section 3.2 below, we present some specific impact measures for particular schemes.

Box 1: Impacts of Congestion Pricing Schemes

Traffic reduction
- 14-23% from schemes intended to reduce congestion (e.g. London, Stockholm), often growing over time
- Less from schemes with lower charges, where revenue raising was the main purpose

Impact on travel speeds
- Relatively bigger than traffic reduction

Impact on local business in charge area
- Minimal

Impact on emissions
- Favourable but usually relatively less than congestion impact

Impact on public acceptance
- Usually weak before implementation then majority support

Source: Based on May (2010)

Pricing reform in land transport is also a current concern in the US, where infrastructure backlogs and associated funding flows have been the subject of a major recent review. The US National Surface Transportation Infrastructure Financing Commission report, *Paying Our Way*, proposes shifting from the current US road funding system, based largely on indirect user fees in the form of federal motor taxes, toward a new system built around more direct user charges, in the form of fees for miles driven (NSTIFC 2009). The Commission points out that the current US transport system is underpriced and that a vehicle mile travelled (VMT) charging system is the consensus choice for the future. It proposes that the federal government commit to deploying such a system by 2020, this timeline recognising the difficulties in implementation. Funding shortfalls in the US Highway Trust Fund provide a sharp edge to the consideration of this matter in the US.

The Commission set out six guiding principles for its deliberations (NSTIFC 2009, pp 26-7):

1. The funding and finance framework must *support the overall goal of enhancing mobility* of all users of the transportation system;
2. The funding and financing framework must *generate sufficient funding to meet national investment needs on a sustainable basis...;*
3. The funding and financing framework should *cause users and direct beneficiaries to bear the full cost of using the transportation system to the greatest extent possible*... This will not be possible in all instances, and when it is not, any cross-subsidisation must be intentional, fully

transparent, and designed to meet network goals, equity goals, or other compelling purposes;

4. The funding and financing framework should *encourage investment in the transportation system*...
5. The funding and financing framework should *incorporate equity considerations* – for example, generational equity, equity across income groups, and geographic equity;
6. The funding and financing framework should *support the broad public policy objectives of energy independence and environmental protection*.

These guidelines are useful for any Australian consideration of land transport pricing reform.

Importantly, the Commission found that future US transportation infrastructure financing requirements could be substantially reduced if a congestion charging scheme was in place. The investment needed to maintain existing land transport system performance was estimated at 26% less under a congestion pricing regime. Also, a congestion pricing regime was estimated to reduce future highway improvement costs by 28% but increase public transport investment needs by 28%, with a net reduction of 15% in land transport infrastructure improvement outlays overall (NSTIFC 2009, p. 57).

3.2 Some Case Studies

Li and Hensher (2010) have also reviewed the evidence about congestion charging schemes. Table 4 summarises the real impacts after the first year of permanent implementation of four charging schemes[8]. From the few monitoring studies, evidence shows that the various schemes resulted in significant reductions in traffic during charging hours (over 14 percent), faster speeds (e.g., 14 km/h to 18 km/h for London), and increased public transport mode share (from a 6.2 percent increase for Milan to 21 percent for Singapore). The 70% Singapore reduction in cars entering the charging zone during charge hours is striking but well beyond what might be need to be contemplated for Australia's major cities!

A common experience with implementation of congestion charging schemes, in particular, is minority popular support at time of implementation but subsequent majority support. The Stockholm experience illustrates this phenomenon. Borjesson et al. (2010) report that only 36% supported the Stockholm trial scheme, as it then was, prior to commencement. Support increased to 52% once the trial started. At the subsequent referendum on whether the scheme should continue, 53% voted yes. By 2009, support had increased to about three in four people. Reasons for this increasing support, suggested by Borjesson et al. (2010) are:

- benefits exceeding expectations;
- costs falling short of expectations;
- people accepting what was seen as unavoidable;
- greater familiarity with the scheme.

London's experience in terms of support for congestion charging pre and post implementation also reflects increasing support over time, supporting the arguments for a political approach that involves showing leadership.

[8] Although the primary purpose of Milan's scheme is pollution abatement, it has substantially reduced congestion.

Table 4: Real impacts of congestion pricing schemes

	Congestion charging schemes			
Impacts of the projects	**London**	**Stockholm**	**Milan**	**Singapore**
Reduction in traffic (vehicles with four or more wheels) entering the zone during charging hours	18%	trial: 22%, after permanent implementation:18%	14.2% (23% during the morning peak hours)	40-45% (Area Licensing Scheme), 15% (Electronic road pricing)
Reduction in cars entering the zone during charging hours	33%	Not available	Not available	70%
Change in traffic beyond charging hours	Observed peak traffic after the charging hours in the first year, normalized in the coming years.	Observed peak traffic after the charging hours in the first year, normalized in the coming years.	Observed peak traffic after the charging hours	+23%
Change in traffic round the charging zone	-5%	+10%	-3.6%	Not available
Change in traffic in the inner road	+4%	+5%	Not available	Not available
Increase in speed inside the charging area	30% (from 14 km/h to 18km/h)	30-50% (33% in the morning peak hours)	4%	20%
Change in speed in the inner road	Not available	Not available	Not available	-20%
Increase in bus speed inside the charging area	6%	Not available	7.8% attributed to charging zone in combination with bus lanes.	Not available
Increase in the use of public transport	above 7% totally, 37% in bus passengers entering the zone	9%	6.2% totally, 9.2% in metro passengers	21%

4. Getting the Prices Right

4.1 Clarke and Prentice (2009)

As noted in Section 1.4, Clarke and Prentice (2009) adapted the Parry and Small (2007) model to estimate optimal fuel charges for Australia. As they explain, the Parry and Small model derives an optimal tax which both internalises a range of external costs of road use (local pollution, greenhouse gas emissions, energy security, accidents, congestion) and incorporates the efficiency trade-off between commodity taxation and income taxation, called the Ramsey component (such that the excess burden of different taxes can be included within a welfare optimising framework, along with external costs).[9]

The Clarke and Prentice adaptation of the Parry and Small research led them to conclude that the Australian excise on fuel should be considerably higher than the current rate. As shown in Table 4, their estimates ranged between $0.83c/L and $3.28c/L, well above the excise rate of 38.143c/L. The major source of variability in their estimates is in the Ramsey component, which changes substantially as underlying modelling assumptions are varied (Table 5). However, as Clarke and Prentice (2009) note, all their estimates suggest that simply recovering the external costs of road use through the fuel excise

[9] For a detailed explanation of the model, its derivation and some applications, see Parry and Small (2007) and Parry (2009), while Clarke and Prentice (2009) present a summarised description of the model.

would require an increase of about 10c/L on the current excise rate, the externality component of their optimal fuel tax being relatively stable at just under 50c/L.

Table 5: Clarke and Prentice Fuel Charge Estimates for Australia

Basis of calculation	Externality Component	Ramsey Component	Optimal Tax
Australian estimate	$0.48	$1.51	$1.99
Australian estimate – high elasticity of demand	$0.47	$0.36	$0.83
Australian estimate – low share of government	$0.49	$0.51	$1.00
Australian estimate – higher labour supply elasticity	$0.46	$2.82	$3.28

Source: Clarke and Prentice (2009) Table 6.

4.2 Stanley and Hensher Estimates

4.2.1 Base Estimate

Dr Ian Parry kindly made his optimal fuel tax models available to the current authors, for the purposes of this research paper. To apply the model, we have adopted the assumptions set out in Table 6, in most cases aligning with assumptions adopted by Clarke and Prentice (2009) (who, in turn, frequently adopt the Parry and Small (2007) assumptions). The Parry model uses gallons and miles, rather than litres and kilometres, but our results in Table 6 are expressed in terms of a cents/litre optimal fuel charge. Road damage costs are not included, on the basis that marginal road damage costs relate primarily to heavy vehicle use and should be recovered from heavy vehicles.

Our base optimal fuel (petrol) tax is $0.94/L (Table 7).[10] The externality cost component is 44c/L (Table 6), quite similar to the estimates produced by Clarke and Prentice and again suggesting that the Australian fuel excise is not sufficient to cover the external costs of road use. The Ramsey tax component in the base estimate is $0.50c/L, similar to the Clarke and Prentice "low share of government" estimate, mainly because our base model run uses the 35% government spending share that Clarke and Prentice use as a sensitivity test for their low government spending share scenario. In our base case, revenues to government from the fuel tax are more than double existing revenues but they increase relatively less than the increase in the fuel excise (or tax) rate, because higher fuel prices drive fuel economies.

[10] Ideally, separate calculations would be done for petrol and diesel, covering (broadly) cars and heavy vehicles separately. That is a matter for more detailed analysis, rather than this indicative piece of research.

Table 6: Parameter Assumptions Used for Base Application of Parry Model to Australia

Parameter	Base Value Used	Comments
Initial car fuel efficiency (miles/gallon)	21.5	Authors' estimate
Pollution damage - distance-related (c/ml)	2.4	Clarke and Prentice (2009)
Pollution damage - fuel-related (c/gal)	32	Assumes carbon at $25/t; energy security 10c/gal, as per Parry and Small (2007)
External congestion costs (c/ml)	10.9	Clarke and Prentice (2009) on a mile basis
External accident costs (c/ml)	3.5	Parry (2009)
Fuel price elasticity	-0.21	Parry and Small (2007)
VMT portion of fuel price elasticity	0.4	Clarke and Prentice (2009)
VMT expenditure elasticity	0.6	Parry and Small (2007)
Uncompensated labour supply elasticity	0.2	Parry and Small (2007)
Compensated labour supply elasticity	0.35	Parry and Small (2007)
Government spending/GDP	0.35	Clarke and Prentice (2009) low estimate
Fuel production share	0.0156	Clarke and Prentice (2009)
Producer price of fuel (c/gal)	227	Clarke and Prentice (2009) on gallon basis
Initial tax rate on fuel (c/gal)	144.4	Clarke and Prentice (2009) on gallon basis

Table 7: Stanley and Hensher Fuel Charge Estimates for Australia

Basis of calculation	Externality Component	Ramsey Component	Optimal Tax	Revenue/Base
Base estimate	$0.44	$0.50	$0.94	2.27
Accident costs increased (higher value of life)	$0.57	$0.55	$1.13	2.64
No congestion costs	$0.39	$0.48	$0.87	2.11

4.2.2 Some Sensitivity Tests

Estimating the external part of **accident costs** is a difficult and under-researched area and the AFTS analysis (Henry Tax Review) did not include accident externalities in its discussion of road pricing reform. There are two major issues in the Australian context: first, estimating accident costs; and second, estimating the external part of these costs.

BITRE (2009a) estimated Australian road crash costs at $17.85 billion in 2006. That report used a hybrid human capital approach to valuing life. It is arguable that a willingness-to-pay value for life is more consistent with other values used in transport cost-benefit studies. If the Hensher et al. (2009) value of $6.2 million for life is used, which is now included in the NSW RTA economic evaluation manual, BITRE (2009a) estimates that total accident costs would increase to $27.12 billion.

BIC (2001) cites work that suggests that 20-35% of accident costs might be external, in the sense that they are not covered by private insurances. We use the low end of this range (20%) and apply it to the BITRE base accident cost estimate of $17.85 billion to get an estimate of $3.6 billion for the external costs of accidents. If the total cost of accidents increases by $9.27 billion when a willingness-to-pay value for life is used, the full amount of this increase in total accident costs can be added to the base estimate of accident externalities to re-estimate accident externalities. This gives a value of $12.9 billion. Spread over 224b vkms[11], this suggests accident externalities of about 5.8c/km or 9.2c/ml (in 2006). This is used as a sensitivity test in Table 7, increasing the optimal fuel tax by 19c/L, with the externality component of the tax increasing by 13c/L to 57c/L. Revenues are an estimated 2.64 times current fuel tax revenues under this scenario.

Given our strong belief that a willingness-to-pay approach is the most suitable way to assess the welfare impacts of most public policy, this sensitivity test case is the modelling run on which we would place most weight in terms of optimal fuel charging.

It might be argued that **congestion costs** should only be levied in some locations, rather than recovered through broader charges. If congestion costs are removed from our base case, Table 7 shows that the optimal fuel tax falls from $0.94/L to $0.87/L, with the externality component (39c/L) being almost exactly equal to the current excise rate. This sensitivity test provides a rough basis for identifying which particular external costs of Australian road use might be reasonably considered as being internalised, on average, through the current excise system. In making this point, it needs to be recalled that there are no road damage costs in the analysis reported in Table 7, since marginal road damage costs of light vehicles are negligible and, in a reformed marginal social cost-based road pricing regime, would be primarily recovered from heavy vehicles.

4.2.3 A Vehicle Kilometre Charge

Parry and Small (2007) demonstrate that economic welfare gains are actually higher with a vehicle mile tax (VMT) than with optimal fuel charging, presumably because external costs are more closely driven by distance than by fuel use but also because the elasticity of VMT with respect to fuel cost is quite small, making VMT a more attractive target than fuel for a Ramsey type revenue raising tax. The Parry and Small optimal VMT is close to what they describe as their "naive externality tax" at current fuel economy rates. In our base run, the naive externality charge, at starting fuel economy rates is $3.93 gallon, which converts to a charge of 11.4c/km. In our "Accident costs increased" sensitivity test, the charge increases to 15c/km. In the "No congestion costs" case it falls to 4.6c/km, showing the significance of congestion costs within the total set of external costs that have been included in the analysis.

4.2.4 Distributional Consequences

The equity impact of road pricing reform, and particularly of congestion charging, is a critical issue to be considered. The notion of distributive justice (or equity) is also a complicated concept, which depends substantively on context and circumstance. For example, Santos and Rojey (2004) showed that cordon congestion charging can be regressive, progressive, or neutral, depending on the residential and employment configuration, and modal choice distribution. McMullen et al. (2010), in a broader context than congestion charging, assess the distributional impacts of a switch from a fuel tax (24 cents per mile) to a vehicle miles travelled (VMT) tax (of a flat 1.2 cents per mile) for the state of Oregon, and conclude

[11] BITRE (2009b)

that the VMT tax is found to be only slightly more regressive than an already regressive fuel tax. A particularly interesting finding is that rural households would benefit from a change in tax regimes, primarily because of the fact that, on average, such households own vehicles that lower fuel efficiency even though they drive greater distances than urban households.

5. Pathways

As argued convincingly by SAHA (2010), the level and structure of road user charges that result from a reformed Australian road pricing regime will depend significantly on the approach taken by governments to what is included/excluded, in terms of external costs, and to decisions on cost-recovery targets. International experience with congestion pricing suggests that, if policy makers are serious about implementation of some form of reform program, such decisions should be taken against the background of an open community conversation around questions such as:

- why road pricing needs to change
- the options for change
- how these options will impact on various stakeholders
- what will happen to revenue raised from the charges
- what measures might be implemented to mitigate particular adverse impacts
- how privacy will be protected if comprehensive mass, location, distance charging is adopted.

Such conversation will need about two years and should be managed by eminent independent people, who are committed to the need for open dialogue.

A first step towards implementation may involve changes in way existing toll roads are priced, to incorporate a congestion premium. This will obviously require consideration of existing contractual provisions and decisions about how any additional revenue that might result from such a scheme should be used. Alternatively, it may be that off-peak prices are lowered and peak prices are raised, with a neutral impact on overall toll-road operator cash flow.

A variant of this pricing option is development of priced lane on existing toll roads, to guarantee a faster trip at congested times. This gives users an option of paying a higher price for a faster trip.

Our indicative calculations of externality costs suggest that user charges should increase by 5-10c/L in the near term, which could perhaps be achieved by simply adding a carbon charge to the existing excise rate, even though this option has been ruled out politically. The revenue from such a charge should be hypothecated to improve land transport systems, including public transport.

Long term, we see mass, distance, location charging as the ideal solution, because of the flexibility that it provides to vary charges for road use to reflect (for example):

- road damage that relates to vehicle mass and dimensions
- congestion that is location specific
- air pollution and noise costs that are also location specific
- the distance users travel, which will affect the quantum of their social costs.

An important policy decision concerns the extent to which the charging structure seeks to increase the revenue raised from road users, to enable increased infrastructure spending.

Public transport fare setting should be an integral part of the community conversation about road pricing reform. The current failure to price the external costs of road use is a significant argument in favour of governmental funding support for public transport. If road prices more closely reflect the relevant marginal social costs of the travel in question, the case for funding support to public transport reduces. There will still remain strong social safety net arguments for some governmental funding support of public transport, even in a regime of marginal social costing of road use.

6. Concluding Comments

A growing number of voices are calling for reform of the way road use is priced in Australia, primarily because the current pricing regime provides poor price signals for efficient use of scarce road capacity. Australian road users currently do not pay enough for their road use, in aggregate, once the external costs of road use are recognised. Peak road use should be more expensive. Rural road use on high quality pavements should arguably be cheaper. While much of the focus on reforming road pricing has been on better pricing congested road use, congestion is only one of a number of costs of road use that are inadequately recognised in charging for road use. International experience suggests that implementation of major road pricing reform, particularly involving congestion charging, often starts with only minority support, requiring strong political leadership, but is replaced by majority support once schemes are in place.

International experience also suggests that reforming road pricing is hard work and that an engaged community is a fundamental pre-requisite. The COAG Road Pricing Reform for heavy vehicles has been a positive initiative. However, heavy vehicle pricing has an established set of stakeholder relationships within which to engage and negotiate reform. Extensive road pricing reform, involving light vehicles and additional costs for both heavy and light vehicles, is more complex and must be undertaken in a more open framework. Reformed road pricing typically starts with minority support but this soon changes to majority support, a political context with which Australian politicians are familiar. Instead of continued inter-governmental investigations into road pricing reform, it is time Australia launched an independent inquiry into road pricing reform, run by eminent persons reporting directly to COAG. That inquiry needs a two-year time frame for a serious process of research and community engagement, which should provide the foundation for real reform, rather than simply more talk.

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