Using Measures of Externality Costs to Obtain the Full Costs of Transport Modes

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1 Introduction

Developing measures of the full costs of transportation for various modes and services is an important policy research item in Europe, North America, Australia and several other countries.

The present paper looks beyond the immediate challenging issues in developing estimates of the full costs of transportation, to identify some of the subsequent issues we expect will arise once reliable measures of full costs are obtained. This is necessarily a speculative paper, posing questions and teasing out some implications more than answering them, but it is important that some of these broader and/or longer term issues begin to be addressed.

This paper only briefly addresses the challenges of assembling the financial costs associated with transportation. We focus primarily on the problem of externalities or circumstances where prices and costs diverge in the economy, and consider the implications for the application and implementation of full cost pricing of transport infrastructure and services.

The paper first addresses a few issues concerning the financial costs of transportation, in particular the relationship between full cost pricing and full cost recovery. A related issue is how to treat costs borne directly by users (such as travel and waiting time costs) in comparison with the financial costs. How might differing market structures affect what is and is not internalized and how does this affect pricing? Turning to the challenges of incorporating externality costs such as congestion and environmental externalities, the paper considers what categories of externalities are to be included, whether marginal or average costs are being estimated, and what to do about the inevitably wide range of estimates of environmental costs. This leads to some issues of organisation and governance: what issues need to be addressed and what mechanisms or organisations are needed to implement full cost pricing of transport including externalities. For some modes or infrastructure, the market power of operators can affect the level of congestion charges and revenues collected. Still another issue is under the heading of second best policies: the optimality of full cost pricing policies presumes that prices and costs are equal in other sectors of the economy. But usually this is not true. How are efficient prices and investment policies modified in such circumstances and how will this relate to full cost pricing of transportation? As part of second best we also face setting full prices within a regional trade pact, how do we reconcile micro and macro views? Finally, how do we move from one equilibrium to a new one? There is always a transition and the transition path is strewn with challenges not least of which is how do we get the public to buy into such a regime change?

2 Measuring the Full Costs of Transportation

The underlying purpose of full cost estimates is to provide directional guidance for policies to promote efficiency in the utilisation and mix of transport modes. This reflects the basic microeconomic prescription of linking prices to social (marginal) costs to obtain the most

efficient allocation of resources. Modes of transport and their use have evolved over time with mixes of public and private involvement, and with some differences in levels of taxation and subsidies. This has caused distortions within modes as well as distortions between modes. The first step is to develop accurate and comparable measures of the full costs of the various modes, i.e., not distorted by differences in taxes or subsidies. This gives rise to many specific issues such as measuring and valuing capital inputs in infrastructure, comparing expenditures at different points in time, etc. Various authors and government agencies have addressed these topics, which are not covered in this paper.

To jump ahead a step: measuring the full costs is preliminary to pursuing pricing policies to better reflect the real costs of alternate modes. This raises an issue of the link between full cost prices and cost recovery. One interpretation of full costs is the average full cost calculated by measuring the total costs associated with a mode, divided by traffic volumes. This may be useful for descriptive purposes but it is not necessarily useful as a pricing guideline. If there are decreasing average costs through scale economies then optimal pricing at marginal costs would not result in cost recovery. In countries like Australia and Canada, with large geographic areas with modest population hence modest traffic volumes in many areas, it is very likely that large portions of the transport system would not recover costs under an efficient (marginal cost) pricing regime. On the other hand, where there are rising costs of transport use (decreasing economies), such as in congested urban areas and high density corridors, it is very possible that marginal cost pricing would generate revenues in excess of transportation outlays in those regions.

The foregoing suggests a research agenda of examining the cost/demand characteristics of various sub-networks, regions or markets to assess the financial implications of introducing marginal cost pricing policies. Furthermore, it identifies a critical problem in identifying what is the appropriate geostatistical unit for the application of pricing and indeed for the calculation of social costs; is it link, sub-network, urban plus near urban? The choice of where to apply pricing may exacerbate or even solve the under-recovery financial problem. Given the dividing lines of jurisdictional authority for different modes and components of the networks, it also reinforces the necessity for policy analysis of alternative means of implementing and coordinating efficient pricing practices – including for example proposals for self-funding agencies for roads and urban transit (e.g., see CTAR 2001).

Another issue in measuring the full costs of transportation is recognising that some – potentially substantial – costs are borne directly by transport users and do not involve financial transactions. The obvious example concerns the time costs borne directly by users, whether passengers or freight. In some markets (urban auto use for example) the monetary equivalent of time costs borne by users may exceed the resources provided through financial transactions. Also important, the size of user-borne costs relative to financial costs will differ across modes and markets. Hence a comparison of the full financial costs associated with the different transport modes and markets would not be revealing the true full costs across the modes and markets. But to do the latter requires measuring the monetary magnitudes of user-borne costs. This is done in some contexts, especially for evaluation of specific infrastructure investments, but it is not necessarily pursued in discussions of optimal pricing policies. It is generally (implicitly) assumed that the marketplace reflects this as differences in qualities of service associated with different modes or markets. This assumption is not correct in congested operations where users impose externality delay costs on one another. Hence researchers do attempt to measure these user-borne costs to be included as an externality cost of transportation (see Boardman, Gillen, Waters and Zhang, 2005).

3 Incorporating Externalities in Full Cost Estimates of Transportation

There has been considerable research to identify and estimate the magnitudes of externality costs of transportation (for example, see. Zhang et al., 2005; ECMT, 1998; and Nash, 2005 who draws on the very large scale European research effort including "UNITE" and "INFRAS"; there are many Australian cites including BTE, 2000 and BTRE, 2002a,b,c). This paper builds on these previous works – not to update estimates but rather to think ahead on how to make use of such estimates in moving forward on pricing reform for transportation.

3.1 Categories of Transport Externalities

There are potentially many categories of externality costs. Most research concentrates on the few largest categories such as congestion delays, vehicle crash externalities, noise, air pollution and greenhouse gases. Zhang et al. (2005) and Boardman, et al. (2005) reviewed cost estimates for the latter major externality categories but also identified (but did not review cost estimates for): water pollution, vibration, visual intrusion, 'barrier effects', security risks, as well as situations where market prices in other sectors of the economy do not reflect their underlying full marginal costs and transport activities could exacerbate these economic distortions, i.e., 'second-best' issues.

Research will continue in order to refine estimates of the magnitudes of the major externality categories. But there is also the long run issue about what to do about the other, lesser, externality categories. They can be important in particular contexts or localities, e.g., the impact of vibrations from heavy vehicles, or the community disruption from expansion of infrastructure capacity through established local communities. Can one contemplate imposing Pigouvian taxes say along specific corridors to incorporate externalities of local importance? Presumably yes but this gives rise to a research need to explore various externality categories, estimates of their costs and factors affecting them, and the need for ideas about what mechanisms and/or formulae would be used to specify such taxes.

3.2 Alternatives of Regulation and Pricing

An alternative to Pigovian taxes in those conditions might be a regulation restricting traffic to the optimum. In practice, that is often the solution chosen by governments, and indeed there is a large body of rules and regulations on land use practices and traffic control, which are practical solutions to the implementation of expressed collective or community opinions. In concept, such rules and regulations could be based on the same economic reasoning as marginal social cost pricing. If it is possible to recognise the community's monetary valuation of the harmful external effects of traffic, and also to predict the costs of measures to restrict traffic, restrictions could be imposed up to the point at which the marginal benefit just exceeds the marginal cost. The use of standards rather than effluent charges to control water pollution is a good example of this point. This presupposes a knowledge and foresight of the valuations and cost conditions that is very unlikely in practice (though those same valuations and cost conditions would have to be known to set Pigouvian prices). But even approximate cost-benefit analysis might still be able to show with confidence that some forms of land-use or traffic regulations are justified on grounds of reducing externalities – just as the marginal social cost pricing rules are justified. And such regulations would be compatible with pricing remaining externalities. Indeed, it is the case that transport externalities of all kinds are regulated substantially at present – as well as land-use and traffic rules, regulation of vehicles and operators is common for safety, emissions and noise – and any proposed marginal cost pricing rule would in fact be pricing the remaining externality costs after the regulations have had their effects. Whether existing regulations are efficient alternatives to pricing is a subject for discussion and research, and reconsideration of the government processes for assessing proposed regulations.

3.3 Issues in Determining Externality Tax Levels

Looking at implementation issues, one challenge to be faced is how to arrive at specific proposals for environmental taxes to be levied to make various transport modes and services better reflect true marginal social costs. While we hope that accuracy of cost estimates will improve with time, it is very likely that there will continue to be large differences in estimates of various externality costs. The question arises: what would be an appropriate level of a Pigouvian tax when there is substantial uncertainty about the magnitude of the externality cost? And how might we resolve such an issue?

Faced with a wide range of estimates from different research studies of an externality cost category, what specific value should be chosen to adjust transport prices? A mean or median valuation is a candidate, but note that these will change as research continues and additional estimates are always forthcoming. In calculating a mean, would one give equal weight to all research studies or put higher weight on those deemed to be more reliable? Also, there might be an upward bias in the average as the number of studies increase. Estimates of environmental costs have a higher upside than downside. More studies may produce both higher and lower new estimates, but being unbounded in an upward direction will tend to raise the calculated average. Perhaps some measure below the mean might be advocated, especially since one would be introducing a charge where none exists at present. Is it appropriate to error in a downward direction in imposing a new tax? This would be a cautious approach, although it ignores the question of how much below a mean estimate one should adopt. It does draw attention to the importance of understanding the sources of error. Differences in the estimates occur for a number of reasons and we need to better understand the source of much of the variation using, for example, a meta-analysis. The problem also is that the estimates are not estimates of the same things, but differ in specifications and may also differ fundamentally in methodologies. One example is that stated preference (SP) estimates have been shown to be systematically higher than revealed preference (RP) estimates. Nonetheless, we are accepting more and more SP studies into valuation studies as they are so much easier to carry out and they provide estimates of issues that are not available via RP data. A real problem is the difficulty of discriminating between valid and invalid studies. And even if this is solved, while we have methods to combine results of the same thing statistically, combining estimates of different things and/or estimates using different methods is difficult, requiring some basis for weighting the various studies. Finally, the relative modal price level and mix is of great importance since it matters how sensitive the marketplace is to any new tax.

3.4 Organizational and Financial Issues with Externality Taxes

What mechanisms or organisational structures might help resolve these questions? Are they to be purely an outcome of a political process? At present it will most likely be a recommendation forthcoming by a government department such as a Department of Transport to the Government of the day (or the state/provincial equivalent). A more neutral organisational structure might be an independent commission who would compile and review evidence, and bring forth recommendations for Parliament or state/provincial legislatures. Such a commission could be headed either by appointed experts or more or less random appointments of citizens to reflect diverse backgrounds of citizens. As scientists it is our job to identify trade-offs and costs and benefits but these costs and benefits are not purely objective; communities can decide what they deem as an acceptable level of pollution or congestion, as an example, the ratification of the Kyoto target is a political decision not a product of scientific inquiry.

Another set of issues concern the financial implications of the introduction of externality-based Pigouvian taxes? The economic rationale for externality-based taxes is to improve efficiency in resource use within transportation as well as by transport users. That is,

behavioural responses are the goal. But introduction of such taxes will be accompanied by tax revenues. In principle, such taxes are not necessarily intended to produce a financial windfall to the government overseeing the environmental charges. Indeed, people can be highly suspicious that such efficient pricing proposals are really pursued as a "tax grab." In some cases this might be deliberate, but it is possible that there would be far less resistance to externality taxes if they were to be implemented in a revenue-neutral fashion, i.e., their introduction would be accompanied by reductions in other taxes to result in no net change in overall government revenues. For example, implementation of road pricing could be accompanied by reduction or even elimination of fuel taxes. Air pollution taxes might be accompanied by reductions in income and/or property taxes. Hence, an important research agenda is to explore revenue-neutral tax adjustments to accompany proposals to implement transport externality taxes. An obvious complication here is that existing and prospective charges could be associated with different levels of government. Congestion taxes would be levied in an urban region, but the fuel taxes are collected by the Province *and* the Federal Government. This raises numerous complications of jurisdiction and governance structures.

There is the slightly broader issue of how to combine and coordinate new charges for the marginal costs of infrastructure (e.g. axle-weight-distance charges) with those for externalities. Presumably the former should go to infrastructure construction and expansion. The congestion externality components might be used for infrastructure expansion so as to reduce users' congestion costs as well, but rising marginal congestion costs might result in revenues in excess of investment requirements. In that case, the base-level infrastructure charge might be reduced so that it is coordinated with the congestion tolls. And the emission, noise, accident externality components might legitimately be used to compensate those affected, or just used for anything else, if the affected population is indistinguishable from the whole population. In brief, there are financial accounting issues in addition to the behavioural modification and efficiency goals associated with full marginal social cost pricing.

Another challenge is the choice of 'instrument(s)' to bring prices up to full social costs. For roadways, we could levy a toll for a congestion charge, a distance-location based fee for noise charge, a vehicle type-distance charge for air pollution and a vehicle-type distance-location based charge for safety. For aviation something different and something different again for rail. Should we impose these externality charges on public transit, as buses are noisy whether they are public or private? It seems on the one hand that we subsidize public transit because we underprice auto and for other equity reasons; yet none of the literature in pricing noise and pollution externalities considers public transportation.

The full social cost pricing regime must fit into a regional trade pact such as NAFTA (North American Free Trade Agreement). There are both micro and macro views on this. If the U.S. subsidizes its transport system, from a micro perspective Canadians could benefit from the U.S. subsidy by shipping containers through U.S. rather than Canadian ports. We can export our externalities to some degree and perhaps do even now. However, from a macro perspective as income, jobs and tax revenue are lost Canadians would take the opposite perspective.

The transition or phase-in period and mechanism are a serious challenge. How do we 'bribe' the public to accept such a pricing philosophy? Lindsey (2005) describes some successes in Canada and the US. We want to move from one equilibrium to another; how do we do it? Substantial compensation packages might be necessary to get interest groups to accept a new regime.

Still another issue concerns the base case from which we measure the externality. Is it some year, some acceptable level of pollution? In setting noise charges for example, the optimal amount of noise is that which is worth what it costs, but its costs are generally measured by

some property value depreciation which may be affected by time period and a number of other factors.

In providing the arguments to the public as to the logic of a move to full cost pricing, do we consider all the additional cost savings from excess capital and operating costs generated by congestion? Congestion requires transit, police and other public services to invest in excess capital costs caused by congestion. For example once we set standards for fire, ambulance and police responses, more stations and vehicles must be provided to meet that standard as congestion rises. Similarly, firms must increase inventories as congestion increases or delivery firms use less capacity and more vehicles to meet customer needs. Once we 'price' congestion the private sector has every incentive to reduce the extra capacity that was required to meet customer demands; but is the same true of the public sector?

Finally, the foregoing assumes at least implicitly that the magnitude of externality costs are sufficiently large to justify implementing taxes and/or regulations to deal with the externality. In some cases, perhaps externality pricing would introduce other costs that would offset any efficiency gains. Arnott (2005) raised the possibility that congestion pricing might not reduce congestion very much, that tolling may exacerbate other distortions, and that implementation will be impeded by political barriers and high infrastructure and administration costs.

4 Full Cost Pricing and Full Cost Recovery when Carriers have Market Power

The economic literature has advocated congestion pricing because it will make the use of scarce resources at a congested transport infrastructure (road, airport, port, etc.) socially efficient, in the sense that the user will pay the full cost of his consumption of the services provided by the infrastructure. The resulting congestion toll would thus curtail demand and help relieve congestion.

However, if the infrastructure is used by only one carrier or a few oligopolistic carriers, although the additional delay costs imposed by one vehicle/flight are external to that vehicle/flight, these costs would become internal to the company if other vehicles/flights also belong to the same carrier. If so, the carrier will internalize these costs and raise prices to reflect the congestion costs. Concerning airports, several papers have recently considered whether airlines with large shares of airport traffic face incentives to internalize congestion costs (e.g., Daniel 1995, Brueckner 2002, Pels and Verhoef 2004, Basso 2005). Brueckner (2002) showed that the standard rule of congestion pricing only applies to an airport servicing competitive (atomistic) carriers and that there is no room left for the airport to levy congestion tolls if all the flights belong to a single carrier (the monopolist), or only partial room if some flights belong to the same carrier (the oligopolists). This implies that carriers themselves will be effective in curtailing excess demand by making their passengers pay the social congestion cost, fully so for a monopolist and partially so for oligopolists. Note that these social congestion costs are not only those of the carriers, i.e., the higher operating costs that congestion would bring, but also those of passenger time costs. The airlines do consider the passenger time costs in their own internalization calculations, as congestion delay costs would, other things being equal, reduce passengers' willingness to pay, reducing the airlines' ability to charge higher fares. (However, this does not necessarily mean that quality/delay decisions are socially optimal, this raises additional market structure issues).

These studies on airport pricing and congestion with non-atomistic carriers have also raised a new issue regarding capacity financing at airports. Apart from demand management, congestion tolls may also serve a second purpose, namely providing funds to finance capacity expansion by an airport. Literature on congestion pricing and airport capacity

financing is extensive. However, almost all of the existing literature assumes, explicitly or implicitly, that the airport is served by competitive (atomistic) carriers. If carriers have market power at a congested airport and therefore are able to internalize congestion costs, the airport may lose all or part of congestion tolls to the airlines and hence the funds to finance its capacity expansion. Zhang and Zhang (2006) investigate the relation between the optimal transport infrastructure cost and the revenues from optimal congestion pricing, recognizing that carriers may have market power and therefore internalize part of the congestion externality. The self-internalization of congestion costs calls for a downward adjustment of the airport congestion charge compared to the conventional "full cost" charge based on marginal external congestion costs. Under atomistic competition, revenues from the conventional congestion charge – under certain conditions – would exactly cover the capacity cost at the optimal level of capacity (see, e.g., Mohring and Harwitz 1962, Mohring 1970, 1976, Morrison 1983). However, airport congestion charging under imperfect competition yields revenues that fall short of the optimal capacity cost, and thus resulting in a *financial deficit* for the public infrastructure (Brueckner 2002, Zhang and Zhang 2006).

There are other market structure effects that should be but heretofore have not been considered. Introducing congestion prices, for example, may affect downstream firms' profitability. In the absence of congestion tolls, willingness to pay may be higher than in the case where congestion is reduced as a result of congestion tolls. Less demand downstream may have market structure effects including exit by marginal firms. Such exit may increase the market power of remaining firms, reducing social welfare. Therefore, we may face a trade-off of improving economic efficiency with congestion pricing and reducing economic efficiency from impacts on downstream markets. The congestion toll, which considers these downstream impacts, could be lower than one that does not.

5 Second Best Pricing Policies

A persistent nagging issue in applying welfare economic principles is the problem of 'second best.' One of the basic tenets of microeconomic policy is the importance of prices reflecting costs to foster an efficient allocation of resources. This recommendation is derived from a model that assumes that elsewhere in the economy there is efficient (marginal cost) pricing.

But what if prices do not equal costs in many sectors of an economy? Do the policy principles of marginal cost pricing still apply where it is possible to do so? To be more specific, is full-cost pricing of transport services the optimal policy in a world with various price/cost distortions?

Lipsey and Lancaster (1956) formally investigated the second best problem. Mathematically, in an idealized competitive market economy, they introduce a constraint to set one or more prices to deviate from marginal costs and then solve for the optimal conditions for prices. It turns out that marginal cost pricing is not necessarily the optimal policy. Unfortunately, the optimizing conditions are complex, requiring extensive knowledge of all the relevant costs and elasticities.

There are some pragmatic although complex guidelines for optimal second best pricing (e.g., Turvey, 1974). The optimal deviation of a particular sector's price from its marginal costs depends on (1) the size and direction of price/cost divergences in other sectors of the economy, and (2) the cross-elasticity of demand between the sector being priced and the other sectors of the economy. For example, if a substitute sector has a price below costs, the second best policy calls for price to be set below marginal costs although the exact divergence of price from marginal costs depends on the aggregate of price/cost divergences and cross-elasticities of all interrelated sectors. A potential example is the common practice of subsidizing public transit to combat peak auto travel. The first best policy would be to introduce congestion pricing on auto use. But given the inability or unwillingness of

governments to impose unpopular congestion taxes, a second best policy is to subsidize urban transit to at least partially counter the effect of an uneconomically low price of auto use.

Another example is the subsidization of public airports when there is market power at the airline level. The first best policy would be to make the airline market competitive and then impose the social marginal cost charge. Given the presence of market power by carriers, however, the monopolistic mark-up calls for a downward adjustment of the second-best charge, compared to the conventional social marginal cost charge. The latter charge would be 'third-best' under conditions of market power.

There are troublesome features of second best policies. The complexity of accurate calculations is one. Another is that it involves accepting the other distortions from first-best policies rather than working to correct them. Third, second best pricing is a piecemeal approach, pricing one sector given the price structure of other sectors. But over time many sectors could be evaluated and reformed. This raises how to coordinate a sequence of second best pricing policies.

Lindsey (2005) in a recent paper discusses the problems of implementing road pricing. He notes issues of phase-in or transition (timing, number of steps, design, form and extent, and one needs to include an adjustment mechanism), should they be facility-based, area-based or network-based? Many of these same concerns can be raised in implementing 'full social cost' pricing with pricing noise, air pollution and safety.

Second best pricing and its associated difficulties have been discussed and debated at length in the literature. Implementation means dealing with the numerous distortions that exist. Full cost pricing means setting prices equal to marginal social costs requiring knowledge of all the costs of externalities and demand sensitivities. Failing this how does one proceed? Do we minimize congestion, or noise or air pollution? Some have argued that autos are significantly under-priced at the margin (since their marginal running costs are low) thus raising taxes on use is reasonable since it moves us in the right direction and there is 'little risk of making matters worse'. This is a vague recipe for sound transport pricing policy.

Earmarking toll revenues (generally second best) opens up a host of issues. In many cases public support is garnered by earmarking for specific modes (public transit) or sectors (transportation). This puts us into the realm of second best investment policy. The first and second best investment rules are decreasing in price but follow different paths. In particular if the output price is below the optimum, e.g. a toll is set too low, then capacity should be expanded to accommodate the greater traffic but it should *not* be expanded by as much as the first best investment rule suggests. Similarly, if the toll is set too high, capacity should be curtailed but not by as much as would occur with a first best rule. In effect, if there are pricing distortions and a first rather than second best investment policy is followed, an underpriced road will be overbuilt and an overpriced road will be underbuilt. If road prices are set below the optimal level, social costs will be greater than otherwise. Second best policy therefore calls for a reduction in investment in capacity relative to the level which would equate incremental benefits and costs of capacity. The reduction in investment will increase congestion and thereby discourage road use which has been 'synthetically' induced due to underpricing. However, second best policy does not say to build fewer roads since excessive congestion would result. Rather the policy simply requires that less of the induced demand be accommodated.

In sum, recognising the second best problem weakens the rationale for full cost pricing in transport, although more accurately, it calls for a more complex calculation of optimal prices explicitly taking into account the price/cost relationships and substitutability for other modes as well as other sectors of the economy. Second but related: in addition to identifying the

extent to which environmental concerns result in market prices not reflecting true costs, we also have to also investigate the extent to which there are any manner of price/cost divergences in various sectors of the economy, not just those associated with externalities. An already formidable task is made all the more ambitious and difficult.

6 Conclusion

It is easy to be overwhelmed with the many complications and challenges in developing measures of the full costs of transport and how they would influence transport pricing. First of all are the financial and accounting issues in determining the relevant measure of the financial outlays associated with infrastructure costs including measuring capital costs and cost assignment among multiple users. Then there are the even more tenuous estimates of environmental and other externality costs and how to interpret them: are they marginal or average cost estimates, do they vary substantially from place to place, which level of government would implement them and rebalance overall tax revenues?

There are important conclusions that transcend the myriad of difficulties of measurement and implementation. The key point is that full cost measurement is a needed and crucial first step. The external costs of transport are real, even if difficult to measure. And they likely differ among modes and regions. "Making the best use of all modes of transport at lowest total costs…" should include externality costs.

Measures of externality costs exist and have been reviewed by various groups. Considerable uncertainty remains, but there are sufficient estimates to be exploring the next step of what type and level of charges (or regulations) would be appropriate to improve efficiency both within and among the transport modes. These explorations need to be accompanied by studies of the implications for overall tax revenues and sharing among levels of government, including governance and accountability structures. Finally, progress can be made on second best implications. It is possible to identify price/cost differences among modes and the sectors that are substitutes or complements to the various modes. This would shed light on the extent to which full cost pricing is appropriate given the constellation of price/cost differences that exist in the economy.

Our record is weak in introducing or even moving in the direction of full marginal social cost pricing. Certainly Europe has moved much farther than North America. Australia is probably in between. In North America, the US seemingly -- and surprisingly -- embraced externality pricing more than Canada. However, North America might be regarded better once the impact of regulations is recognised. As noted earlier, in many cases regulations have been introduced to reduce the impact of externalities, e.g. fuel economy requirements, emission standards and catalytic converters for automobiles, also Stage III noise regulations for aircraft. Nonetheless, externality costs remain important in many transport markets. Progress is being made in monetising externality costs. This must continue as an important research agenda. But it is also time for more research on implementation issues.

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