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The NZ Transport Agency's Transport Appraisal Framework

Introduction

In a recent article in *Policy Quarterly* (August 2013) Michael Pickford claimed that economic efficiency (as determined by social cost-benefit analysis) has declined in importance as a factor in determining investment in state highways. He claims that this has led to the NZ Transport Agency investing in state highway projects with low benefit-cost ratios, such as the roads of national significance. This reply explains why Pickford's assertions are not correct.

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Standard cost-benefit analysis theory

A conceptually correct transport cost-benefit analysis is very demanding: it requires a travel demand curve derived to incorporate the reorganisation and output effects as travel costs change. This implies that it requires knowledge of the relevant conditions in all markets likely to be affected by a transport scheme, so that the required demand curve can be correctly estimated and equilibrated with transport supply. In practice, simplifying assumptions are made, the most significant of which is that there is perfect competition in all transport-using markets (Vickerman, 2007).

This assumption implies that in all transport-using markets price equals marginal social costs, such that the demand curve completely measures all the benefits associated with the use of transport. Thus, any change in the perceived price of transport will be completely and directly reflected in decisions concerning the activities using transport. Hence, a transport cost-benefit analysis is a partial equilibrium method. Prices are taken to equal or at least broadly approximate marginal social costs in secondary markets (labour, land, etc).

The implication is that surpluses occurring in the secondary market double count surpluses in the primary transport market. Such secondary markets are therefore excluded from the cost-benefit analysis. However, if prices do not equal marginal social costs in the secondary markets, the primary transport market surpluses do not capture all the benefits of the project. This shortcoming of standard cost-benefit analysis has long been understood. Much progress has been made with conceptualising and quantifying the impacts ignored or not taken into account by standard cost-benefit analysis.

Table 1: NZ Transport Agency scheme benefit matrix

	Road	Demand management	Services	Walking and cycling	Education,promotion and marketing	Parking and land use	Private sector financing and road tolls
Travel time and cost savings	•	•	•	•	•	•	
Vehicle operating cost savings	•	•	•	•	•	•	
Accident cost savings	•	•		•	•	•	
Seal extension benefits	•						
Driver frustration benefits	•						
Risk reduction benefits	•	•	•		•		•
Vehicle emission benefits	•					•	
Other external benefits	•	•	•	•	•	•	•
Mode change benefits		•	•	•			
Walking and cycling health benefits		•		•	•		
Transport service user benefits			•			•	
Parking user cost savings		•			•	•	
National strategic factors	•	•	•		•		

Source: NZTA (2010)

Approach adopted by the NZ Transport Agency

The Transport Agency methodology for standard cost-benefit analysis accords with best international practice. It also assumes perfect competition. The standard appraisal methodology, as set out in the Transport Agency's *Economic Evaluation Manual*, focuses on savings in travel time, operating costs, accident costs, and some external costs such as pollution and health effects.

Table 1 shows the Transport Agency's existing scheme benefit matrix, including the different types of benefits attributable to each scheme type. These costs and benefits are valued using shadow pricing to adjust for the differences in the perceived market price and the true resource costs. The latter often diverges because of taxes and subsidies. For example, when an individual purchases a good in New Zealand they perceive the price as the resource cost plus goods and services tax (GST); however, when the government purchases a good the price is merely the resource cost, because indirect taxes are ultimately returned to its pocket.

The approach used by the NZ Transport Agency provides valuation of the main impacts of transport in a comprehensive way. However, in recognition that the standard cost-benefit approach has limitations (as discussed), it includes additional criteria, such as strategic fit and effectiveness.

The standard cost-benefit approach also fails to account for some of the developments in economic theory and evidence over the past 10 years. These have significantly improved understanding of the interactions between transport and the economy. These interactions are referred to as the wider economic benefits or wider economic impacts of transport.

Limitations of standard cost-benefit analysis

In line with overseas agencies, the NZ Transport Agency recognises that there are limitations to standard cost-benefit analysis, as not all positive and negative impacts are captured. These limitations include difficulties in assessing the land-use changes and traffic changes that can occur as the result of transformational transport projects. Grimes (2011) used the example of the Auckland Harbour Bridge to show how significant changes in land-use activities are often not captured in conventional cost-benefit analysis. He states that the royal commission report to Parliament which recommended the construction of a harbour bridge was very conservative in its estimates of traffic build-up and the population growth of the North Shore. A truly accurate estimate was difficult. While a bridge itself would be the biggest incentive for population growth on the North Shore, nobody could quantify the incentive. The (tolled) bridge opened in May 1959 and its effects were immediate. In McLauchlan (1989) it is stated:

> The rate of traffic vastly exceeded forecasts. In the first ten months, 4,092,307 vehicles used the bridge. The total was 5, 543,973 in the year to 31 March 1961, 15, 153,659 in the year to 31 March 1970 and exceeded 32 million by the mid-1980s … The bridge triggered an explosion of development on the North Shore and the early traffic growth at more than 13 percent led to the decision in 1964 to add two more lanes on each side of the bridge.

More recently, the New Zealand Institute of Economic Research raised concern that current conventional cost-benefit analysis generally ignores any induced changes to transport demand that occurs over a period of time. It states that:

> the assumption seems to be that transport-induced land-use change in the longer term either does not happen, or if it does happen, it is immaterial to the CBA result. This is in stark contrast to the discussion

> in the previous section, showing that transport can have a large effect on long-term land use development, which makes it a strong assumption. (NZIER, 2013)

A more balanced approach

Large transport schemes can have a marked impact on land-use development in the long term. Furthermore, induced traffic effects can be a primary long-term characteristic of major transport schemes (such as the roads of national significance). For these reasons the Transport Agency has incorporated two other criteria – strategic fit and effectiveness – into its project selection process. Investment proposals are assessed as 'high', 'medium' or 'low' against three criteria:

- strategic fit: how policies align with the government policy statement priorities (economic growth and productivity, value for money and road safety);
- effectiveness criteria: ensuring that whole-of-system options have been considered and have been given appropriate considerations;
- efficiency criteria: the value of the solution in relation to the resources used (based on cost-benefit analysis calculation in the Transport Agency's *Economic Evaluation Manual*).

Michael Pickford (2013) takes issue with the use of strategic fit and effectiveness, and claims that the matters listed are already incorporated in the efficiency criteria using cost-benefit analysis. This assertion is not correct. Standard cost-benefit analysis adopts a restrictive assumption that there is little or no impact of a scheme on the distribution and growth of population and employment, or on the sectoral make-up of employment. Rather, it assumes that population and employment are static between the do-minimum option and the proposed activity, and that economic gains arise mainly because of increased efficiency from travel time savings.

Transport investments which are focused principally on securing economic development through supporting and facilitating structural changes in the make-up of population and employment do not necessarily deliver a strong benefit stream in the standard framework. By incorporating two additional criteria in its assessment framework, the Transport Agency has adopted a more balanced approach. This ensures that the appraisals of transport schemes (including non-road alternatives) do not over- or underestimate the total economic impact of the proposed activity.

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Similar approaches are adopted by transport agencies overseas. For example, the UK Department for Transport also recognises the shortcomings of standard cost-benefit analysis. Its multi-criteria framework, the New Approach to Appraisal (NATA), allows qualitative and non-monetised quantitative impacts of a scheme to be captured. Projects are also considered using the UK Treasury's five-case model:

- strategic fit;
- value for money;
- ability of the promoter to deliver the project;
- project affordability and financial stability;
- evidence that the project can be satisfactorily procured.

Likewise, Australia's Austroads cost-benefit analysis manual requires other criteria to be taken into account, including a strategic alignment assessment. This requires assessments against broader strategies, policies and plans. Many Australian states have adopted this approach by including multi-criteria analysis in their transport assessment framework.

The NZ Transport Agency also recognises that transport schemes cannot be considered in isolation. A package approach should be used which takes into account the relevant regional land transport strategies, regional land transport programmes and long-term council community plans. Guidance is provided in the Transport Agency's *Economic Evaluation Manual* to encourage approved organisations (where appropriate) to develop packages of interrelated and complementary activities, either individually or in association with other approved organisations. An example of a package approach would be where a major state highway upgrade is combined with traffic calming on adjacent local roads to improve safety on the adjacent local road network. When considered individually, neither activity may represent an efficient use of resources. Travel time and capacity issues may reduce the benefits of the traffic calming when considered as an isolated activity. Similarly, main road traffic volumes may not be sufficient to warrant the highway upgrade as an isolated activity. However, the combined activity will benefit from the complementary nature of the two activities.

To manage the investigation, design and construction of the roads of national significance effectively, the total corridors have been split into smaller projects. However, the benefit-cost ratios of each of the smaller projects cannot be considered in isolation. The most appropriate measure is the package cost-benefit ratio. This is because the benefits of and the synergies between complementary activities cannot be fully realised without each component being implemented. Pickford's claim that each individual component of the corridor, developed solely for administrative and

construction management purposes, should be taken into account is contrary to good project appraisal practice.

Like other road projects, the individual segments which comprise the Wellington Northern Corridor are designed to work as a whole corridor. To selectively examine benefit-cost ratios for individual segments of the corridor in isolation – such as the Otaki expressway – does not tell the whole story, as people's journeys are seldom limited to the arbitrary boundaries of single sections chosen for management purposes. Collectively, the improvements to individual sections will unlock benefits along the whole corridor. This is in accordance with best practice.

The Transport Agency is in the process of incorporating aspects of the Treasury's Better Business Case framework into its decision-making process. The Treasury's framework is based on the UK Treasury framework, but also takes into account some elements from the Investment Management Standard produced by the State of Victoria Department of Treasury and Finance (Mackie and Worsley, 2013). Under the Treasury's Better Business Case framework, a project is assessed on the following matters:

- is it supported by a robust case for change – the strategic case;
- does it maximise value for money – the economic case;
- is it commercially viable – the commercial case;
- is it financially affordable – the financial case;
- is it achievable – the management case.

The Treasury's Better Business Case framework is being adapted to ensure that it is fit for purpose when evaluating transport projects. This will require some minor changes to existing Transport Agency procedures, including developing a strategic case for change first, followed by a detailed economic appraisal.

Wider economic impacts

In line with international best practice, the Transport Agency has also strengthened the way it evaluates economic efficiency by including agglomeration impacts in its *Economic Evaluation Manual*. Agglomeration economies describe the productive advantages that arise from the close spatial concentration of economic activity. The *Economic Evaluation Manual* operates with two types of agglomeration economies:

- Localisation economies: the efficiency gains that arise from the increased scale of a particular industry operating in close proximity. These economies are external to organisations but internal to the industry.
- Urbanisation economies: the productive advantages that accrue to organisations by being located in large population centres. These economies are external to the organisation and the industry but internal to large population centres. Organisations derive benefits from the scale of markets (including labour markets), from the proximity of market areas for inputs and outputs, and from good infrastructure and public service.

The Transport Agency has a continuous improvement programme for its *Economic Evaluation Manual* and an active programme to research such matters.

Pickford claims that the Transport Agency was quick to embrace the concept of agglomeration benefits despite the concept not being free from controversy. The concept of agglomeration is not new. Economic literature has identified a range of possible sources for higher productivity in densely populated areas. Marshall (1920), for example, discussed the advantages of thick labour markets, ease of linkages to input and output markets, and knowledge spill-overs arising from proximity to others in the same industry (localisation). Each of these potential sources is consistent with agglomeration effects – the observed positive relationship between agglomeration and productivity (Maré and Graham, 2009).

In 2008 the Transport Agency commissioned David Maré and Daniel Graham to carry out research to derive agglomeration elasticity estimates on an aggregate, one-digit industry and on a regional level. Prior to this, considerable research had been carried out overseas, such as that by Graham (2006a, 2006b, 2007; Graham, Gibbons and Martin, 2009), Venables (2007) and Ciccone and Hall (1996). The UK Department for Transport had also carried out development and testing work on the agglomeration methodology (Department for Transport, 2005).

In a paper published in the *Journal of Urban Economics*, Maré and Graham concluded that:

- Our preferred overall agglomeration elasticity estimate of 0.066 indicates that a 10% increase in effective density is associated with a 0.66% increase in firm productivity. The overall estimate is well within the consensus range of 0.01–0.10 identified by Graham (2005) though slightly above the median estimate of 0.041 documented by Melo et al. (2009).
- The preference for this estimate reflects a tradeoff between reducing the upward bias due to sorting of high-productivity firms into dense areas, and the downward attenuation bias due to limited within-enterprise variation in effective density when we control for firm heterogeneity using enterprise fixed effects. (Maré and Graham, 2013).

The Transport Agency is satisfied that the agglomeration estimates derived accord with studies carried out and that the methodology adopted in its *Economic Evaluation Manual* is line with best practice adopted overseas.

Pickford's comment that the agglomeration concept and methodology

is far from settled could apply to many economic theories and concepts, including those used in standard cost-benefit analysis such as travel time, travel time reliability and safety impacts. The Transport Agency has a continuous improvement programme for its *Economic Evaluation Manual* and an active programme to research such matters.

Summary and conclusions

The Transport Agency's review of the Pickford article concludes that the article fails to take into account the limitations of standard cost-benefit analysis and the development of cost-benefit theory and practice. The criteria of strategic fit and effectiveness seek to ensure that a more balances approach is achieved and that appraisals of transport schemes do not over- or underestimate the total economic impact of the proposed activity.

The Transport Agency has also adopted a package approach when assessing transport schemes to ensure that benefits of and synergies between complementary activities are fully realised. Rigorous cost-benefit analysis is the cornerstone of our economic appraisal for investment, but it is not the only aspect relevant to the decision-making process for transport projects and programmes.

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