Identifying preferences for public transport investments under a constrained budget

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ABSTRACT

As urban areas face increasing demands for new transport infrastructure to promote a sustainable future with an increasing reality of constrained government budgets, the debate on whether we should focus on rail or bus-based investments continues unabated in many jurisdictions. Associated with the debate is an emotional (or ideological) bias by communities in favour of one mode, especially rail, which carries much sway at the political level as if there is no budget constraint. This paper presents a stated choice experiment to investigate this context as two unlabelled options described by 20 potential drivers of community preferences for improved public transport, where each choice scenario is conditioned on an estimated construction cost and a total annual transport infrastructure budget for the relevant geographical jurisdiction. This is followed by a labelling of each alternative to reveal whether the option is bus rapid transit (BRT) or light rail (LRT) and to establish whether this additional information influences preference revision. Data is collected in all eight capital cities of Australia in mid 2014. Mixed logit models with heteroscedastic conditioning in terms of the cost of the project infrastructure and whether the alternative is labelled BRT or LRT, provide new evidence on the nature and extent of community modal bias in a budget-constrained choice setting. The conclusions are twofold. On the one hand, if a fully compensatory choice rule is assumed (as is common in all previous modal comparison studies), LRT is predominantly preferred over BRT despite budgetary constraints, similarities in quality of service attributes and the opportunity to choose a greater network coverage for a given construction cost. However, when we allow for attribute non-attendance (a semi-compensatory choice rule), the modal bias is no longer a significant driver of preferences.

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1. Introduction

There is growing pressure on many governments to provide improved public transport as a sustainable alternative to the car. In many industrialised societies where the car dominates the modal share, the amount of public transport investment required to make a significant switch from the car is substantial. However budget constraints mean that governments are unable to focus on the many corridors required to have a significant impact on traffic congestion. With tight budgets, the choice is of rather limited geographical investment using a rail solution or the delivery of a more system-wide investment using bus based technology, as illustrated by the number of developing economies where budgets are significantly more

restricted and where bus-based systems (e.g., Curitiba and Bogota) have shown the great advantage of serving a much larger catchment area than rail systems for the given budget.

Whilst buses often have a major role to play in the public transport task (e.g., carrying more passengers per year than rail in Sydney, for example), the incremental investment in additional bus services in most western economies has shown some, albeit limited success, in getting car users to switch. What is clearly needed (especially where governments are not supportive of road pricing reform for cars) is to find a way to grow public transport throughout a metropolitan area to such an extent that a non-marginal switch to public transport can occur. With a fixed budget, one might suggest that this can be most economically achieved through a bus-based plan in which corridors are dedicated to bus rapid transit (or where there is a significant increase in frequency and coverage in mixed traffic[1]).

Government budgets are under pressure not only from the transport sector but also from competing sectors such as health, education and law and order (including security[2]). It is therefore particularly important to identify and promote public transport investments that are able to deliver real societal benefits in respect of outcomes related to improved accessibility, safety, and environmental sustainability, serving a larger number of current and potential public transport users for a given budget outlay. This means that the observed preference by governments for rail-based solutions as the only (or dominating) way to deliver these benefits has to be questioned. In turn this opens up the relevance of at least assessing other options such as bus-based solutions. This is a challenge in many cities where emotional ideology in support of rail-based solutions (without question) dominates the debate and political decision making (see Hensher and Waters, 1994).

The issue of public preference of rail over bus has been investigated in a number of earlier studies, some of which found a significant preference of rail over bus, whilst others found no evidence of such a bias towards rail service. For example, Ben-Akiva and Morrikawa (2002) found no evidence of such a bias towards rail services when both services had equivalent travel times and fares. However, the same study found that a bias existed when rail offered a higher quality of service. Yannes et al. (2012) also found no significant public preference for rail service over bus service. However, these studies did not consider the reality facing many cities today, of limited budgets and a pressing need for public transport investments. In these circumstances, two issues are important to understand. First, how the majority of society would temper their preference for a new modern light rail system if its geographical scope were to be limited by budget considerations? Second, and alongside this, how society would view a bus based system giving greater network coverage for the same budget outlay as a proposed modern rail system?

This paper investigates these key questions using a stated choice experiment. Each experiment begins with a binary choice set of unlabelled options described by 20 potential drivers of community preferences for improved public transport, where each choice scenario is conditioned on an estimated common construction cost and a total annual transport infrastructure budget for the relevant geographical jurisdiction. This is followed by a labelling of each alternative to reveal whether the option is bus rapid transit (BRT) or light rail transit (LRT); and in the light of this additional information, individuals can review their preferences and revise them if they wish. Data were collected in eight capital cities of Australia in 2014. The empirical evidence is derived from mixed logit models with heteroscedastic conditioning, the latter defined in terms of the construction cost of the new transport infrastructure relative to the annual infrastructure budget and whether the alternative is labelled BRT or LRT, assuming in one model that all attributes are relevant as well as allowing for attribute non-attendance in a separate model. This analysis identifies the main influences on the preferences of the sample of 1018 residents, including the role of the *ex post* modal naming in revised preferences for each investment option and the influence of the budget commitment, and permits commentary on the two issues identified above which motivate the paper in the conclusions and synthesis section.

2. Drivers of community preferences for public transport

The challenge in selecting the factors that could influence individual's choice in the experiment was to create an experiment which included relevant attributes, but not too many as this is known to influence the ability of respondents to complete the experiment effectively (see Hensher, 2010). The selection of the key factors that influence individuals when asked about the preferences for various public transport investments has been informed by the broader literature and especially our own investigations (see Hensher et al., 2015b) into candidate attributes, particularly relating to voting choices which are of great interest to policy makers.

In broad terms, the choice of attributes centred on two main sources of literature; the literature relating to the aspects of different public transport modes which appeal to users and which are important in determining the mode choice of travellers; and the literature which focuses on the potential of modal image to influence mode preferences. The former body of literature was used to inform, in detail, a phase one part of this study which developed best–worst preference experiments, one associated with design characteristics, one with service descriptions associated with BRT and LRT, and another related to

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[1] As an example, if in Sydney we had not proceeded with the 23 km North–West rail project (costed at approximately $500 m per km), we could increase the number of buses threefold. Even in mixed traffic this would deliver significant improvements in frequency and connectivity. If this did not deliver a non-marginal switch to public transport, then it is doubtful that any single corridor investment where car is 80% of modal share, is likely to have little chance of effecting noticeable change,

[2] See http://sydney.edu.au/business/itls/tops as one example of such evidence.